INFORMATION TO OFFERORS OR QUOTERS

OMB Control No.: 2700-0042 Exp. Date: N/A

Solicitation Number: NNA057682R

☐ Sealed Bid (IFB) ☐ MidRange (RFO)

☐ Negotiated (RFQ) ☐ Negotiated (NRA)

X Negotiated (RFP)

Issuing Office:

NASA Ames Research Center
Acquisition Division
Moffett Field, CA 94035-1000

Point of Contact: **NO COLLECT CALLS ACCEPTED**

Name: Ameka Chapman
Mail Stop: 213-13
Telephone: (650) 604-0976
Fax: (650) 604-4984

Item(s) to Be Acquired:

N202 Seismic Rehabilitation Phase II at NASA Ames Research Center

This Solicitation Is:

☐ Unrestricted--Full and Open Competition

X Set-Aside 100% for X HUBZone ☐ Labor Surplus Area Concerns

☐ a combination Small Business/Labor Surplus Area Set-Aside

☐ Intended for award with Other than Full and Open Competition pursuant to FAR 6.302-
To:

Potential offerors are invited to submit a proposal to demonstrate their capability to meet the requirements of this solicitation.

☐ For planning/informational purposes only and will not result directly in a contract award. See Section L.

All Ames Research Center procurements (other than Simplified Acquisitions) are published on the Internet. Offerors/quoters may access the Internet via a worldwide web browser such as Mosaic, Netscape, or other similar application. The ARC Procurement Site URL is: **http://procure.arc.nasa.gov**

CRITICAL ELEMENTS OF INFORMATION: *Your attention is invited to the following:*

☒ Section K. You **MUST** complete the "Representations, Certifications, and Other Statements" included here.

X Sections L and M. Note the instructions contained therein, with particular attention to the Section L provision, "Late Submissions, Modifications, and Withdrawal of Bids," or "Late Submissions, Modifications, and Withdrawal of Proposals." Section M sets forth evaluation information.

X Section L, NFS 1852.215-77. A pre-bid/proposal conference has been scheduled.

☐ It is the policy of the United States that competitive procedures be used to the maximum practical extent in the awarding of subcontracts by prime contractors. This policy is endorsed and fully supported by NASA and Ames Research Center. See Section L, FAR 52.244-5. Note NASA Small Disadvantaged Business Goal (NFS 1852.219-76).

☐ Other:

OTHER IMPORTANT INSTRUCTIONS:

1. The envelope(s) used to submit your reply must be plainly marked with the solicitation number (as shown above), and the date and local time set forth in the solicitation document for bid opening or receipt of proposal/price quotation.
2. You **MUST** acknowledge in your bid or proposal/quotation your receipt of any and all amendments to this solicitation.
3. **If no offer or price quotation is to be submitted, detach this sheet, complete the information requested on the reverse, and return it to the issuing office noted above.**
4. **IN THE EVENT OF A CONFLICT BETWEEN THIS COVER SHEET AND THE SOLICITATION, THE SOLICITATION TAKES PRECEDENCE.**

NO OFFER/PRICE QUOTATION SUBMITTED FOR REASONS CHECKED

INSTRUCTIONS: Solicitees that choose not to respond with a bid or proposal/price quotation are requested to provide the following information. Please be specific and thorough in your response, as it will help us to identify and overcome barriers to competition in future acquisitions. Your cooperation is greatly appreciated.

☐ SPECIFICATIONS/SCOPE OF WORK APPEAR TO BE RESTRICTIVE. *Please explain.*

☐ INSUFFICIENT TIME TO PREPARE AN OFFER/PRICE QUOTATION.

☐ CANNOT MEET REQUIRED DELIVERY SCHEDULE. *Please explain.*

☐ CANNOT BE PRICE COMPETITIVE. *Please explain.*

☐ UNABLE TO UNDERSTAND THE REQUIREMENT. *Please explain.*

☐ DO NOT REGULARLY MANUFACTURE OR SELL THE SPECIFIC TYPE(S) OF ITEM(S) INVOLVED.

☐ OTHER. *Please specify.*

☒ WHAT WOULD HAVE ENABLED YOU TO RESPOND? *Please explain.*

We ☐ do ☐ do not desire to be retained on the mailing list for future acquisitions of the type(s) of item(s) involved.

NAME AND ADDRESS OF SOLICITEE:
(INCLUDE ZIP CODE)

SIGNATURE:

_____
Name

_____
Title/Position of Signer

_____
Telephone Number

OMB APPROVAL NO. 2700-0042

SOLICITATION, OFFER, AND AWARD (Construction, Alteration, or Repair)	1. SOLICITATION NO.	2. TYPE OF SOLICITATION	3. DATE ISSUED	PAGE OF PAGES
	NNA057682R	☐ SEALED BID ☒ NEGOTIATED (BVS)	06-DEC-04	1 of 3

IMPORTANT - The "offer" section on the reverse must be fully completed by offeror.

4. CONTRACT NO.	5. REQUISITION/PURCHASE REQUEST NO.	6. PROJECT NO.

7. ISSUED BY CODE	8. ADDRESS OFFER TO
National Aeronautics and Space Administration Ames Research Center Attn: M/S 213-13 Moffett Field, CA 94035-1000	National Aeronautics and Space Administration Attn: Ameka Chapman Ames Research Center Attn: M/S 213-13, Room 216A Moffett Field, CA 94035-1000

9. FOR INFORMATION CALL:	A. NAME	B. TELEPHONE NO. *(Include area code)* ***(NO COLLECT CALLS)***
	Ameka Chapman	(650)-604-0976 EMAIL ADDRESS: Ameka.A.Chapman@nasa.gov

SOLICITATION

NOTE: In sealed bid solicitations "offer" and "offeror" mean "bid" and "bidder."

10. THE GOVERNMENT REQUIRES PERFORMANCE OF THE WORK DESCRIBED IN THESE DOCUMENTS *(Title, identifying no., date)*:

TITLE: **Seismic Rehabilitation of Building N202**

Section A. Solicitation/Contract Form	SF 1442: Solicitation, Offer, and Award (this form)
Section B. Supplies or Services and Prices/Costs	Page B1
Section C. Description/Specs./Work Statement	Page C1
Section E. Inspection and Acceptance	Pages E1 – E2
Section F. Deliveries or Performance	Pages F1 – F2
Section G. Contract Administration Data	Page G1
Section H. Special Contract Requirements	Pages H1 – H3
Section I. Contract Clauses	Pages I1 – I11
Section J. List of Attachments	Page J1
Section K. Representations, Certifications, and Other Statements of Offerors	Pages K1 – K11
Section L. Instrs., Conds., and Notices to Offerors	Pages L1 – L12
Section M. Evaluation Factors for Award	Page M1 – M2

A PRE-BID CONFERENCE & CONDUCTED SITE TOUR IS SCHEDULED FOR 10:00 A.M. on MAY 21, 2003 AT AMES RESEARCH CENTER, BUILDING N213, ROOM 261. THE ESTIMATED MAGNITUDE OF THIS PROJECT IS BETWEEN $500,000 AND $1,000,000.

11. The Contractor shall begin performance within 0 calendar days and complete it within 150 calendar days after receiving ☐ award, ☒ notice to proceed. This performance period is ☒ mandatory, ☐ negotiable. *(See Clause 52.211-10.)*

12A. THE CONTRACTOR MUST FURNISH ANY REQUIRED PERFORMANCE AND PAYMENT BONDS? *(If "YES," indicate within how many calendar days after award in Item 12B.)* ☒ YES ☐ NO	12B. CALENDAR DAYS
	Ten

13. ADDITIONAL SOLICITATION REQUIREMENTS:

A. Sealed offers in original and 2 copies to perform the work required are due at the place specified in Item 8 by 2:00 PM *(hour)* local time January 12, 2005. If this is a sealed bid solicitation, offers must be publicly opened at that time. Sealed envelopes containing offers shall be marked to show the offeror's name and address, the solicitation number, and the date and time offers are due.

B. An offer guarantee ☒ is, ☐ is not required.

C. All offers are subject to the (1) work requirements, and (2) other provisions and clauses incorporated in the solicitation in full text or by reference.

D. Offers providing less than 90 calendar days for Government acceptance after the date offers are due will not be considered and will be rejected.

NSN 7540-01-155-3212
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1442-101

STANDARD FORM 1442 (REV. 4-85)
Prescribed by GSA
FAR (48 CFR) 53.236-1(e)

OFFER *(Must be fully completed by offeror)*

14. NAME AND ADDRESS OF OFFEROR *(Include ZIP Code)*	15. TELEPHONE NO. *(Include area code)*
	16. REMITTANCE ADDRESS *(Include only if different than Item 14)*
CODE FACILITY CODE	

17. The offeror agrees to perform the work at the prices specified below in strict accordance with the terms of this solicitation, if this offer is accepted by the Government within ____ calendar days after the date offers are due. *(Insert any number equal to or greater than the minimum requirement stated in Item 13D. Failure to insert any number means the offeror accepts the minimum in Item 13D.*

AMOUNTS	BASE OFFER $_____
	OPTION 1 $

18. The offeror agrees to furnish any required performance and payment bonds.

19. ACKNOWLEDGMENT OF AMENDMENTS

The offeror acknowledges receipt of amendments to the solicitation -- give number and date of each

AMENDMENT NO.										
DATE										

20A. NAME AND TITLE OF PERSON AUTHORIZED TO SIGN OFFER *(Type or print)*	20B. SIGNATURE	20C. OFFER DATE

AWARD *(To be completed by Government)*

21. ITEMS ACCEPTED:

22. AMOUNT	23. ACCOUNTING AND APPROPRIATION DATA

24. SUBMIT INVOICES TO ADDRESS SHOWN IN *(4 copies unless otherwise specified)*	ITEM 7	25. OTHER THAN FULL AND OPEN COMPETITION PURSUANT TO ☐ 10 U.S.C. 2304(c)( ) ☐ 41 U.S.C. 253(c)( )
26. ADMINISTERED BY CODE Refer to Block 7.		27. PAYMENT WILL BE MADE BY Financial Management and Payments Branch NASA-Ames Research Center Moffett Field, CA 94035-1000

CONTRACTING OFFICER WILL COMPLETE ITEM 28 OR 29 AS APPLICABLE

☐ 28. NEGOTIATED AGREEMENT *(Contractor is required to sign this document and return ____ copies to issuing office.)* Contractor agrees to furnish and deliver all items or perform all work, requisitions identified on this form and any continuation sheets for the consideration slated in this contract. The rights and obligations of the parties to this contract shall be governed by (a) this contract award, (b) the solicitation, and (c) the clauses, representations, certifications, and specifications or incorporated by reference in or attached to this	☐ 29. AWARD *(Contractor is not required to sign this document.)* Your offer on this solicitation is hereby accepted as to the items listed. This award consummates the contract, which consists of (a) the Government solicitation and your offer, and (b) this contract award. No further contractual document is necessary.
30A. NAME AND TITLE OF CONTRACTOR OR PERSON AUTHORIZED TO SIGN *(Type or print)*	31A. NAME OF CONTRACTING OFFICER *(Type or print)*

30B. SIGNATURE	30C. DATE	31B. UNITED STATES OF AMERICA BY	31C. AWARD DATE

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STANDARD FORM 1442 BACK (REV. 4-85)

1. THE CONTRACTING OFFICER MAY EXERCISE THE OPTION AT TIME OF AWARD. A FIRM FIXED OFFER PRICE IS REQUIRED FOR THE OPTION. NO PROVISION IS MADE FOR AN ECONOMIC PRICE ADJUSTMENT. IF THE OPTION IS EXERCISED, THE PERIOD OF PERFORMANCE REMAINS UNCHANGED. THE OPTION WILL BE EVALUATED IN ACCORDANCE WITH FAR CLAUSE 52.217-5, EVALUATION OF OPTION.

2. OFFERS MUST BE SUBMITTED ON ALL ITEMS. FAILURE TO PROPOSE ON ALL ITEMS MAY RESULT IN THE OFFER BEING NON RESPONSIVE.

3. THIS IS A NEGOTIATED BEST VALUE PROCUREMENT. NO PUBLIC BID OPENING WILL BE HELD. PLEASE SEE SECTION M FOR EVALUATION FACTORS AND SECTION L FOR PROPOSAL SUBMITTAL REQUIREMENTS. A TECHNICAL PROPOSAL IS REQUIRED FOR THIS PROCUREMENT.

PART 1 - THE SCHEDULE

SECTION B - SUPPLIES OR SERVICES AND PRICE/COSTS

B.1 SUPPLIES/SERVICES TO BE PROVIDED (ARC 52.211-94) (FEB 1997)

The contractor shall provide all resources (except as may be expressly stated in this contract as furnished by the Government) necessary to furnish the items below in accordance with the Description/Specification/Work Statement set forth in Section C.

Item No.	Description	Quantity	Unit
Base Option	N202 Seismic Rehabilitation, Phase II in accordance with the drawings and specification	JB	1
Option 1	Stair front entry system at the east entry in accordance with the drawings and specifications.	JB	1

(End of clause)

B.2 FIRM FIXED PRICE (NASA 1852.216-78) (DEC 1988)

The total firm fixed price of this contract is (See Standard Form 1442 Back, Block No. 22).

(End of clause)

[END OF SECTION]

SECTION C - DESCRIPTION/SPECIFICATION /WORK STATEMENT

C.1 SPECIFICATION (ARC 52.211-93) (FEB 1997)

(a) In accordance with the contract's terms and conditions, the Contractor shall furnish all personnel, services, equipment, materials, and facilities and do all other things necessary for, or incidental to performance of the requirements set forth herein.

(b) Work shall be accomplished in accordance with the Specification/Work Statement incorporated in Section J.

(End of clause)

[END OF SECTION]

SECTION E - INSPECTION AND ACCEPTANCE

E.1 INSPECTION OF CONSTRUCTION (FAR 52.246-12) (AUG 1996)

(a) Definition. "Work" includes, but is not limited to, materials, workmanship, and manufacture and fabrication of components.

(b) The Contractor shall maintain an adequate inspection system and perform such inspections as will ensure that the work performed under the contract conforms to contract requirements. The Contractor shall maintain complete inspection records and make them available to the Government. All work shall be conducted under the general direction of the Contracting Officer and is subject to Government inspection and test at all places and at all reasonable times before acceptance to ensure strict compliance with the terms to the contract.

(c) Government inspections and tests are for the sole benefit of the Government and do not—

(l) Relieve the Contractor of responsibility for providing adequate quality control measures;

(2) Relieve the Contractor of responsibility for damage to or loss of the material before acceptance;

(3) Constitute or imply acceptance; or

(4) Affect the continuing rights of the Government after acceptance of the completed work under paragraph (i) below.

(d) The presence or absence of a Government inspector does not relieve the Contractor from any contract requirement, nor is the inspector authorized to change any term or condition of the specification without the Contracting Officer's written authorization.

(e) The Contractor shall promptly furnish, at no increase in contract price, all facilities, labor, and material reasonably needed for performing such safe and convenient inspections and tests as may be required by the Contracting Officer. The Government may charge to the Contractor any additional cost of inspection or test when work is not ready at the time specified by the Contractor for inspection or test, or when prior rejection makes re-inspection or retest necessary. The Government shall perform all inspections and tests in a manner that will not unnecessarily delay the work. Special, full size, and performance tests shall be performed as described in the contract.

(f) The Contractor shall, without charge, replace or correct work found by the Government not to conform to contract requirements, unless in the public interest the Government consents to accept the work with an appropriate adjustment in contract price. The Contractor shall promptly segregate and remove rejected material from the premises.

(g) If the Contractor does not promptly replace or correct rejected work, the Government may (l) by contract or otherwise, replace or correct the work and charge the cost to the Contractor or (2) terminate for default the Contractor's right to proceed.

(h) If, before acceptance of the entire work, the Government decides to examine already completed work by removing it or tearing it out, the Contractor, on request, shall promptly furnish all necessary facilities, labor, and material. If the work is found to be defective or nonconforming in any material respect due to the fault of

the Contractor or its subcontractors, the Contractor shall defray the expenses of the examination and of satisfactory reconstruction. However, if the work is found to meet contract requirements, the Contracting Officer shall make an equitable adjustment for the additional services involved in the examination and reconstruction, including, if completion of the work was thereby delayed, an extension of time.

(i) Unless otherwise specified in the contract, the Government shall accept, as promptly as practicable after completion and inspection, all work required by the contract or that portion of the work the Contracting Officer determines can be accepted separately. Acceptance shall be final and conclusive except for latent defects, fraud, gross mistakes amounting to fraud, or the Government's rights under any warranty or guarantee.

(End of clause)

[END OF SECTION]

SECTION F - DELIVERIES OR PERFORMANCE

F.1 LISTING OF CLAUSES INCORPORATED BY REFERENCE

NOTICE: The following solicitation provisions and/or contract clauses pertinent to this section are hereby incorporated by reference:

I. FEDERAL ACQUISITION REGULATION (48 CFR CHAPTER 1)

CLAUSE NUMBER	DATE	TITLE
52.211-15	SEP 1990	DEFENSE PRIORITY AND ALLOCATION REQUIREMENTS
52.242-14	APR 1984	SUSPENSION OF WORK

F.2 COMMENCEMENT. PROSECUTION, AND COMPLETION OF WORK (FAR 52.211-10) (APR 1984)

The Contractor shall be required to (a) commence work under this contract within 10 calendar days after the date the Contractor receives the notice to proceed, (b) prosecute the work diligently, and (c) complete the entire work ready for use not later than 150 calendar days after the effective date of the Notice to Proceed. The time stated for completion shall include final cleanup of the premises.

(End of clause)

F.3 LIQUIDATED DAMAGES-CONSTRUCTION (FAR 52.211-12) (SEP 2000)

(a) If the Contractor fails to complete the work within the time specified in the contract, the Contractor shall pay liquidated damages to the Government in the amount of $570 for each calendar day of delay until the work is completed or accepted.

(b) If the Government terminates the Contractor's right to proceed, liquidated damages will continue to accrue until the work is completed. These liquidated damages are in addition to excess costs of repurchase under the Termination clause.

(End of clause)

F.4 DELIVERY OF REPORTS (ARC 52.211-92) (FEB 1997)

Unless otherwise specified, all reports shall be addressed to NASA-Ames Research Center, Moffett Field, CA 94035-1000, marked with the contract number, to the attention of the listed recipients, and in accordance with the following delivery schedule. A copy of the transmittal letter for each report shall be forwarded to the Contracting Officer.

Item/Report	Delivery Date	Qty	Recipient

Please refer to the Specification for all required submittals.

(End of clause)

[END OF SECTION]

SECTION G - CONTRACT ADMINISTRATION DATA

G.1 LISTING OF CLAUSES INCORPORATED BY REFERENCE

NOTICE: The following solicitation provisions and/or contract clauses pertinent to this section are hereby incorporated by reference:

I. FEDERAL ACQUISITION REGULATION (48 CFR CHAPTER 1)

CLAUSE NUMBER	DATE	TITLE

No FAR By-reference clauses in Section G.

II. NASA FAR SUPPLEMENT (48 CFR CHAPTER 18) CLAUSES

1852.245-70	JUL 1997	CONTRACTOR REQUESTS FOR GOVERNMENT-OWNED EQUIPMENT

(End of clause)

G.2 SUBMISSION OF INVOICES--FIXED PRICE (ARC 52.232-93) (MAR 2001) *Alternate I* (FEB 1998)

(a) Invoices shall be submitted to the attention of the Contracting Officer, M/S 213-13, Ames Research Center, Moffett Field, CA 94035-1000, in quadruplicate (an original and three copies), shall reference the contract number, Taxpayer Identification Number (TIN#), Banking Information for Electronic Funds Transfer (EFT), and be identified by denoting the numerical sequence of the invoice.

(b) Reporting Requirements under Taxpayer Relief Act of 1997

(1) The Taxpayer Relief Act of 1997, enacted August 5, 1997, requires Federal executive agencies to file information returns (i.e., Form 1099-MISC) for payment of $600 or more to corporations for services. Payments for services under certain confidential or classified contracts that meet the requirements of Internal Revenue Code Section 6050M(e) are excluded from the reporting requirements. This change became effective as of January 1, 1997.

(2) In order to comply with the Act, the contractor shall separately subtotal taxable services and nontaxable materials and supplies on each invoice. If subtotals are not specified on the invoices, the Government will presume that the entire invoice amount is reportable and will be shown on the Form 1099-MISC generated by NASA and provided to the contractor and the Internal Revenue Service.

[END OF SECTION]

SECTION H - SPECIAL CONTRACT REQUIREMENTS

H.1 LISTING OF CLAUSES INCORPORATED BY REFERENCE

NOTICE: The following solicitation provisions and/or contract clauses pertinent to this section are hereby incorporated by reference:

I. FEDERAL ACQUISITION REGULATION (48 CFR CHAPTER 1)

CLAUSE NUMBER	DATE	TITLE
52.236-2	APR 1984	DIFFERING SITE CONDITIONS
52.236-3	APR 1984	SITE INVESTIGATION AND CONDITIONS AFFECTING THE WORK
52.236-5	APR 1984	MATERIAL AND WORKMANSHIP
52.236-6	APR 1984	SUPERINTENDENCE BY THE CONTRACTOR
52.236-7	NOV 1991	PERMITS AND RESPONSIBILITIES
52.236-8	APR 1984	OTHER CONTRACTS
52.236-9	APR 1984	PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES, AND IMPROVEMENTS
52.236-10	APR 1984	OPERATIONS AND STORAGE AREAS
52.236-11	APR 1984	USE AND POSSESSION PRIOR TO COMPLETION
52.236-12	APR 1984	CLEANING UP
52.236-13	NOV 1991	ACCIDENT PREVENTION
52.236-14	APR 1984	AVAILABILITY AND USE OF UTILITY SERVICES
52.236-15	APR 1984	SCHEDULES FOR CONSTRUCTION CONTRACTS
52.236-17	APR 1984	LAYOUT OF WORK
52.236-21	FEB 1997	SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION

II. NASA FAR SUPPLEMENT (48 CFR CHAPTER 18) CLAUSES

1852.223-70	APR 2002	SAFETY AND HEALTH
1852.242-72	AUG 1992	OBSERVANCE OF LEGAL HOLIDAYS

H.2 PERFORMANCE OF WORK BY THE CONTRACTOR (FAR 52.236-1) (APR 1984)

The Contractor shall perform on the site, and with its own organization, work equivalent to at least 20% percent of the total amount of work to be performed under the contract. This percentage may be reduced by a supplemental agreement to this contract if, during performing the work, the Contractor requests a reduction and the Contracting Officer determines that the reduction would be to the advantage of the Government.

(End of clause)

H.3 SECURITY REGISTRATION AND IDENTIFICATION BADGES-- CONSTRUCTION CONTRACTS (ARC 52.204-92) (FEB 1997)

(a) All persons engaged in work at Ames Research Center are required to be registered and badged by Protective Services.

(b) The Contractor is responsible for assuring that each employee or company representative wears his/her issued identification badge at all times while they are within the boundaries of Moffett Field. Badges shall be worn above the waist in such a manner as to be clearly visible.

(c) The Contractor shall ensure that all employees who are terminated or who are no longer connected with the work being performed under this contract are processed out through Protective Services. Badges, keys, and other Government property must be accounted for and returned. If a computer account has been established, the account must be deactivated.

(d) Only U.S. Citizens and Permanent Resident Aliens will be badged by Protective Services. Foreign Nationals (non-immigrant aliens) WILL NOT be badged or permitted to perform on-site work on the project (other than to be escorted) until a National Agency Check has been completed.

(e) After badging, contractor and subcontractor employees will be permitted to enter the Center and to drive by direct route from that gate to the parking area assigned to the Contractor by the Contracting Officer.

(f) Employees of construction contractors shall turn in their badges to the Visitor Badging Office, Building 26, when they complete working on-site.

(End of clause)

H.4 1852.243-72 EQUITABLE ADJUSTMENTS (APRIL 1998)

(a) The provisions of all other clauses contained in this contract which provide for an equitable adjustment, including those clauses incorporated by reference with the exception of the "Suspension of Work" clause (FAR 52.242-14), are supplemented as follows:

Upon written request, the Contractor shall submit a proposal for review by the Government. The proposal shall be submitted to the contracting officer within the time limit indicated in the request or any extension thereto subsequently granted. The proposal shall provide an itemized breakdown of all increases and decreases in the contract for the Contractor and each subcontractor in at least the following detail: material quantities and costs; direct labor hours and rates for each trade; the associated FICA, FUTA, SUTA, and Workmen's Compensation Insurance; and equipment hours and rates.

(b) The overhead percentage cited below shall be considered to include all indirect costs including, but not limited to, field and office supervisors and assistants, incidental job burdens, small tools, and general overhead allocations. "Commission" is defined as profit on work performed by others. The percentages for overhead, profit, and commission are negotiable according to the nature,

extent, and complexity of the work involved, but in no case shall they exceed the following ceilings:

	Overhead (Percent)	Profit (Percent)	Commission
To Contractor on work performed by other than its own forces	-----	-----	10 percent
To first tier subcontractor on work performed by its subcontractors	-----	-----	10 percent
To Contractor and/or subcontractors on work performed with their own forces	10 percent	10 percent	-----

(c) Not more than four percentages for overhead, profit, and commission shall be allowed regardless of the number of subcontractor tiers.
(d) The Contractor or subcontractor shall not be allowed overhead or commission on the overhead, profit, and/or commission received by its subcontractors.
(e) Equitable adjustments for deleted work shall include credits, limited to the same percentages for overhead, profit, and commission in paragraph (b) of this clause.
(f) On proposals covering both increases and decreases in the amount of the contract, the application of the overhead, profit, and commission shall be on the net change in direct costs for the Contractor or the subcontractor performing the work.
(g) After receipt of the Contractor's proposal, the contracting officer shall act within a reasonable period, provided that when the necessity to proceed with a change does not permit time to properly check the proposal, or in the event of a failure to reach an agreement on a proposal, the contracting officer may order the Contractor to proceed on the basis of the price being determined at the earliest practicable date. In such a case, the price shall not be more than the increase or less than the decrease proposed.

(End of clause)

[END OF SECTION]

PART II - CONTRACT CLAUSES

SECTION I - CONTRACT CLAUSES

I.1 LISTING OF CLAUSES INCORPORATED BY REFERENCE

NOTICE: The following solicitation provisions and/or contract clauses pertinent to this section are hereby incorporated by reference:

I. FEDERAL ACQUISITION REGULATION (48 CFR CHAPTER 1)

CLAUSE NUMBER	DATE	TITLE
52.202-1	JUL 2004	DEFINITIONS
52.203-3	APR 1984	GRATUITIES
52.203-7	JUL 1995	ANTI-KICKBACK PROCEDURES
52.203-8	JAN 1997	CANCELLATION, RECISSION, AND RECOVERY OF FUNDS FOR ILLEGAL OR IMPROPER ACTIVITY
52.203-10	JAN 1997	PRICE OR FEE ADJUSTMENT FOR ILLEGAL OR IMPROPER ACTIVITY
52.203-12	JUN 2003	LIMITATION ON PAYMENTS TO INFLUENCE CERTAIN FEDERAL TRANSACTIONS
52.204-4	AUG 2000	PRINTING/COPYING DOUBLE-SIDED ON RECYCLED PAPER
52.209-6	JUL 1995	PROTECTING THE GOVERNMENT'S INTEREST WHEN SUBCONTRACTING WITH CONTRACTORS DEBARRED, SUSPENDED, OR PROPOSED FOR DEBARMENT
52.219-3	JAN 1999	NOTICE OF TOTAL HUBZONE SET-ASIDE
52.219-8	MAY 2004	UTILIZATION OF SMALL BUSINESS CONCERNS
52.222-3	JUN 2003	CONVICT LABOR
52.222-4	SEP 2000	CONTRACT WORK HOURS AND SAFETY STANDARD ACT—OVERTIME COMPENSATION
52.222-6	FEB 1995	DAVIS-BACON ACT
52.222-7	FEB 1988	WITHHOLDING OF FUNDS
52.222-8	FEB 1988	PAYROLLS AND BASIC RECORDS
52.222-9	FEB 1988	APPRENTICES AND TRAINEES
52.222-10	FEB 1988	COMPLIANCE WITH COPELAND ACT REQUIREMENTS
52.222-11	FEB 1988	SUBCONTRACTS (LABOR STANDARDS)
52.222-12	FEB 1988	CONTRACT TERMINATION—DEBARMENT
52.222-13	FEB 1988	COMPLIANCE WITH DAVIS-BACON AND RELATED ACT REQUIREMENTS
52.222-14	FEB 1988	DISPUTES CONCERNING LABOR STANDARDS
52.222-15	FEB 1988	CERTIFICATION OF ELIGIBILITY
52.222-26	APR 2002	EQUAL OPPORTUNITY

52.222-27	FEB 1999	AFFIRMATIVE ACTION COMPLIANCE REQUIREMENTS FOR CONSTRUCTION
52.222-35	DEC 2001	AFFIRMATIVE ACTION FOR DISABLED VETERANS AND VETERANS OF THE VIETNAM ERA
52.222-36	JUN 1998	AFFIRMATIVE ACTION FOR WORKERS WITH DISABILITIES
52.222-37	DEC 2001	EMPLOYMENT REPORTS ON DISABLED VETERANS AND VETERANS OF THE VIETNAM ERA
52.223-3	JAN 1997	HAZARDOUS MATERIAL IDENTIFICATION & MATERIAL SAFETY DATA (ALTERNATE 1) (JUL 1995)
52.223-5	AUG 2003	POLLUTION PREVENTION AND RIGHT-TO-KNOW INFORMATION
52.223-6	MAY 2001	DRUG-FREE WORKPLACE
52.223-14	AUG 2003	TOXIC CHEMICAL RELEASE REPORTING
52.225-13	DEC 2003	RESTRICTIONS ON CERTAIN FOREIGN PURCHASES
52.227-1	JUL 1995	AUTHORIZATION AND CONSENT
52.227-2	AUG 1996	NOTICE AND ASSISTANCE REGARDING PATENT AND COPYRIGHT INFRINGEMENT
52.227-4	APR 1984	PATENT INDEMNITY--CONSTRUCTION CONTRACTS
52.228-1	SEP 1996	BID GUARANTEE
52.228-2	OCT 1997	ADDITIONAL BOND SECURITY
52.228-5	JAN 1997	INSURANCE--WORK ON A GOVERNMENT INSTALLATION
52.228-11	FEB 1992	PLEDGES OF ASSETS
52.228-12	OCT 1995	PROSPECTIVE SUBCONTRACTOR REQUESTS FOR BONDS
52.228-14	DEC 1999	IRREVOCABLE LETTER OF CREDIT
52.229-3	APR 2003	FEDERAL, STATE, AND LOCAL TAXES
52.232-5	SEP 2002	PAYMENTS UNDER FIXED-PRICE CONSTRUCTION CONTRACTS
52.232-17	JUN 1996	INTEREST
52.232-18	APR 1984	AVAILABILITY OF FUNDS
52.232-23	JAN 1986	ASSIGNMENT OF CLAIMS
52.232-27	OCT 2003	PROMPT PAYMENT FOR CONSTRUCTION CONTRACTS
52.232-34	MAY 1999	PAYMENT BY ELECTRONIC FUNDS TRANSFER-OTHER THAN CENTRAL CONTRACTOR REGISTRATION
52.233-1	JUL 2002	DISPUTES (ALTERNATE I) (DEC 1991)
52.233-3	AUG 1996	PROTEST AFTER AWARD
52.236-26	FEB 1995	PRECONSTRUCTION CONFERENCE
52.242-13	JUL 1995	BANKRUPTCY
52.243-4	AUG 1987	CHANGES
52.246-21	MAR 1994	WARRANTY OF CONSTRUCTION (ALTERNATE I) (APR 1984)

52.248-3	FEB 2000	VALUE ENGINEERING--CONSTRUCTION
52.249-2	MAY 2004	TERMINATION FOR CONVENIENCE OF THE GOVERNMENT (FIXED-PRICE) (ALTERNATE I) (SEP 1996)
52.249-10	APR 1984	DEFAULT (FIXED-PRICE CONSTRUCTION)

II. NASA FAR SUPPLEMENT (48 CFR CHAPTER 18) CLAUSES

1852.209-72	DEC 1988	COMPOSITION OF THE CONTRACTOR
1852.219-76	JUL 1997	NASA 8 PERCENT GOAL
1852.232-79	SEP 1987	PAYMENT FOR ON-SITE PREPARATORY COSTS
52.252-4	APR 1984	ALTERATIONS IN CONTRACT

Portions of this contract are altered as follows:

(a) FAR Clause 52.223-3. The successful bidder will be required to provide a list of hazardous materials prior to award, if applicable. Otherwise, paragraph (b) of the clause is completed by the insertion of "NONE".

(End of clause)

I.2 CLAUSES INCORPORATED BY REFERENCE (FAR 52.252-2) (FEB 1998)

This contract incorporates one or more clauses by reference, with the same force and effect as if they were given in full text. Upon request, the Contracting Officer will make their full text available. Also, the full text of a clause may be accessed electronically at this/these address(es): http://procure.arc.nasa.gov/.

(End of clause)

1.3 NOTICE TO THE GOVERNMENT OF LABOR DISPUTES (FAR 52.222-1) (FEB 1997)

If the Contractor has knowledge that any actual or potential labor dispute is delaying or threatens to delay the timely performance of this contract, the Contractor shall immediately give notice, including all relevant information, to the Contracting Officer.

(End of clause)

I.4 NOTICE OF REQUIREMENT FOR AFFIRMATIVE ACTION TO ENSURE EQUAL EMPLOYMENT OPPORTUNITY FOR CONSTRUCTION (FAR 52.222-23) (FEB 1999)

(a) The offeror's attention is called to the Equal Opportunity clause and the Affirmative Action Compliance Requirements for Construction clause of this solicitation.

(b) The goals for minority and female participation, expressed in percentage terms for the Contractor's aggregate workforce in each trade on all construction work in the covered area, are as follows:

Goals for Minority Participation for Each Trade	Goals for Female Participation for Each Trade
19.6%	6.9%

These goals are applicable to all the Contractor's construction work performed in the covered area. If the Contractor performs construction work in a geographical area located outside of the covered area, the Contractor shall apply the goals established for the geographical area where the work is actually performed. Goals are published periodically in the Federal Register in notice form, and these notices may be obtained from any Office of Federal Contract Compliance Programs office.

(c) The Contractor's compliance with Executive Order 11246, as amended, and the regulations in 41 CFR 60-4 shall be based on (1) its implementation of the Equal Opportunity clause, (2) specific affirmative action obligations required by the clause entitled "Affirmative Action Compliance Requirements for Construction," and (3) its efforts to meet the goals. The hours of minority and female employment and training must be substantially uniform throughout the length of the contract, and in each trade. The Contractor shall make a good faith effort to employ minorities and women evenly on each of its projects. The transfer of minority or female employees or trainees from Contractor to Contractor, or from project to project, for the sole purpose of meeting the
Contractor's goals shall be a violation of the contract, Executive Order 11246, as amended, and the regulations in 41 CFR 60-4. Compliance with the goals will be measured against the total work hours performed.

(d) The Contractor shall provide written notification to the Deputy Assistant Secretary for Federal Contract Compliance, U.S. Department of Labor, within 10 working days following award of any construction subcontract in excess of $10,000 at any tier for construction work under the contract resulting from this solicitation. The notification shall list the--

(1) Name, address, and telephone number of the subcontractor;

(2) Employer's identification number of the subcontractor;

(3) Estimated dollar amount of the subcontract;

(4) Estimated starting and completion dates of the subcontract; and

(5) Geographical area in which the subcontract is to be performed.

(e) As used in this Notice, and in any contract resulting from this solicitation, the "covered area" is California, Santa Clara County, Moffett Field.

(End of provision)

I.5 ESTIMATE OF PERCENTAGE OF RECOVERED MATERIAL CONTENT FOR EPA- DESIGNATED PRODUCTS (FAR 52.223.9) (AUG 2000)

(a) *Definitions.* As used in this clause-

"Postconsumer material" means a material or finished product that has served its intended use and has been discarded for disposal or recovery, having completed its life as a consumer item. Postconsumer material is a part of the broader category of "recovered material."

"Recovered material" means waste materials and by-products recovered or diverted from solid waste, but the term does not include those materials and by-products generated from, and commonly reused within, an original manufacturing process.

(b) The Contractor, on completion of this contract, shall-
(1) Estimate the percentage of the total recovered material used in contract performance, including, if applicable, the percentage of postconsumer material content; and
(2) Submit this estimate to _____ [*Contracting Officer complete in accordance with agency procedures*].

(End of clause)

Alternate I (Aug 2000). As prescribed in 23.406(b), redesignate paragraph (b) of the basic clause as paragraph (c) and add the following paragraph (b) to the basic clause:

(b) The Contractor shall execute the following certification required by the Resource Conservation and Recovery Act of 1976 (42 U.S.C. 6962(i)(2)(C)):

Certification

I, _____ (name of certifier), am an officer or employee responsible for the performance of this contract and hereby certify that the percentage of recovered material content for EPA-designated products met the applicable contract specifications.

_____

[*Signature of the Officer or Employee*]

_____

[*Typed Name of the Officer or Employee*]

_____

[*Title*]

_____

[*Name of Company, Firm, or Organization]*

_____

[*Date*]

(End of certification)

I.6 BUY AMERICAN ACT-CONSTRUCTION MATERIALS 52.225-9 (JUN 2003)

(a) Definitions. As used in this clause-

"Component" means an article, material, or supply incorporated directly into a construction material.

"Construction material" means an article, material, or supply brought to the construction site by the Contractor or a subcontractor for incorporation into the building or work. The term also includes an item brought to the site preassembled from articles, materials, or supplies. However, emergency life safety systems, such as emergency lighting, fire alarm, and audio evacuation systems, that are discrete systems incorporated into a public building or work and that are produced as complete systems, are evaluated as a single and distinct construction material regardless of when or how the individual parts or components of those systems are delivered to the construction site. Materials purchased directly by the Government are supplies, not construction material.

"Cost of components" means-

(1) For components purchased by the Contractor, the acquisition cost, including transportation costs to the place of incorporation into the construction material (whether or not such costs are paid to a domestic firm), and any applicable duty (whether or not a duty-free entry certificate is issued); or

(2) For components manufactured by the Contractor, all costs associated with the manufacture of the component, including transportation costs as described in paragraph (1) of this definition, plus allocable overhead costs, but excluding profit. Cost of components does not include any costs associated with the manufacture of the end product.

"Domestic construction material" means-

(1) An unmanufactured construction material mined or produced in the United States; or

(2) A construction material manufactured in the United States, if the cost of its components mined, produced, or manufactured in the United States exceeds 50 percent of the cost of all its components. Components of foreign origin of the same class or kind for which nonavailability determinations have been made are treated as domestic.

"Foreign construction material" means a construction material other than a domestic construction material.

"United States" means the 50 States and the District of Columbia, U.S. territories and possessions, Puerto Rico, the Northern Mariana Islands, and any other place subject to U.S. jurisdiction, but does not include leased bases.

(b) Domestic preference.

(1) This clause implements the Buy American Act (41 U.S.C. 10a - 10d) by providing a preference for domestic construction material. The Contractor shall use only domestic construction material in performing this contract, except as provided in paragraphs (b)(2) and (b)(3) of this clause.

(2) This requirement does not apply to the construction material or components listed by the Government as follows:

_____

[Contracting Officer to list applicable excepted materials or indicate "none"]

(3) The Contracting Officer may add other foreign construction material to the list in paragraph (b)(2) of this clause if the Government determines that-

(i) The cost of domestic construction material would be unreasonable. The cost of a particular domestic construction material subject to the requirements of the Buy American Act is unreasonable when the cost of such material exceeds the cost of foreign material by more than 6 percent;

(ii) The application of the restriction of the Buy American Act to a particular construction material would be impracticable or inconsistent with the public interest; or

(iii) The construction material is not mined, produced, or manufactured in the United States in sufficient and reasonably available commercial quantities of a satisfactory quality.

(c) Request for determination of inapplicability of the Buy American Act.

(1)(i) Any Contractor request to use foreign construction material in accordance with paragraph (b)(3) of this clause shall include adequate information for Government evaluation of the request, including-

(A) A description of the foreign and domestic construction materials;

(B) Unit of measure;

(C) Quantity;
(D) Price;
(E) Time of delivery or availability;
(F) Location of the construction project;
(G) Name and address of the proposed supplier; and
(H) A detailed justification of the reason for use of foreign construction materials cited in accordance with paragraph (b)(3) of this clause.

(ii) A request based on unreasonable cost shall include a reasonable survey of the market and a completed price comparison table in the format in paragraph (d) of this clause.

(iii) The price of construction material shall include all delivery costs to the construction site and any applicable duty (whether or not a duty-free certificate may be issued).

(iv) Any Contractor request for a determination submitted after contract award shall explain why the Contractor could not reasonably foresee the need for such determination and could not have requested the determination before contract award. If the Contractor does not submit a satisfactory explanation, the Contracting Officer need not make a determination.

(2) If the Government determines after contract award that an exception to the Buy American Act applies and the Contracting Officer and the Contractor negotiate adequate consideration, the Contracting Officer will modify the contract to allow use of the foreign construction material. However, when the basis for the exception is the unreasonable price of a domestic construction material, adequate consideration is not less than the differential established in paragraph (b)(3)(i) of this clause.

(3) Unless the Government determines that an exception to the Buy American Act applies, use of foreign construction material is noncompliant with the Buy American Act.

(d) Data. To permit evaluation of requests under paragraph (c) of this clause based on unreasonable cost, the Contractor shall include the following information and any applicable supporting data based on the survey of suppliers:

Foreign And Domestic Construction Materials Price Comparison

Construction Material Description	Unit of Measure	Quantity	Price (Dollars)*
Item 1:			
Foreign construction material	_____	_____	_____
Domestic construction material	_____	_____	_____
Item 2:			
Foreign construction material	_____	_____	_____
Domestic construction material	_____	_____	_____

[List name, address, telephone number, and contact for suppliers surveyed. Attach copy of response; if oral, attach summary.]
[Include other applicable supporting information.]
[* Include all delivery costs to the construction site and any applicable duty (whether or not a duty-free entry certificate is issued).

I.7 PERFORMANCE AND PAYMENT BONDS-CONSTRUCTION (FAR 52.228-15) (JULY 2000)

(a) Definitions. As used in this clause--

"Original contract price" means the award price of the contract; or, for requirements contracts, the price payable for the estimated total quantity; or, for indefinite-quantity contracts, the price payable for the specified minimum quantity. Original contract price does not include the price of any options, except those options exercised at the time of contract award.

(b) Amount of required bonds. Unless the resulting contract price is $100,000 or less, the successful offeror shall furnish performance and payment bonds to the Contracting Officer as follows:

(1) Performance bonds (Standard Form 25). The penal amount of performance bonds at the time of contract award shall be 100 percent of the original contract price.

(2) Payment Bonds (Standard Form 25-A). The penal amount of payment bonds at the time of contract award shall be 100 percent of the original contract price.

(3) Additional bond protection. (i) The Government may require additional performance and payment bond protection if the contract price is increased. The increase in protection generally will equal 100 percent of the increase in contract price.

(ii) The Government may secure the additional protection by directing the Contractor to increase the penal amount of the existing bond or to obtain an additional bond.

(c) Furnishing executed bonds. The Contractor shall furnish all executed bonds, including any necessary reinsurance agreements, to the Contracting Officer, within the time period specified in the Bid Guarantee provision of the solicitation, or otherwise specified by the Contracting Officer, but in any event, before starting work.

(d) Surety or other security for bonds. The bonds shall be in the form of firm commitment, supported by corporate sureties whose names appear on the list contained in Treasury Department Circular 570, individual sureties, or by other acceptable security such as postal money order, certified check, cashier's check, irrevocable letter of credit, or, in accordance with Treasury Department regulations, certain bonds or notes of the United States. Treasury Circular 570 is published in the Federal Register or may be obtained from the:

U.S. Department of Treasury

Financial Management Service

Surety Bond Branch

401 14th Street, NW, 2nd Floor, West Wing

Washington, DC 20227.

(e) Notice of subcontractor waiver of protection (40 U.S.C. 270b(c). Any waiver of the right to sue on the payment bond is void unless it is in writing, signed by the person whose right is waived, and executed after such person has first furnished labor or material for use in the performance of the contract.

(End of clause)

I.8 Option for Increased Quantity-Separately Priced Line Item (FAR 52.217-7) (Mar 1989)

The Government may require the delivery of the numbered line item, identified in the Schedule as an option item, in the quantity and at the price stated in the Schedule. The Contracting Officer may exercise the option by written notice to the Contractor within 60 calendar days from award of contract. Delivery of added items shall continue at the same rate that like items are called for under the contract, unless the parties otherwise agree.

(End of clause)

(END OF SECTION)

PART III - LIST OF DOCUMENTS, EXHIBITS AND OTHER ATTACHMENTS

SECTION J - LIST OF ATTACHMENTS

J.1 LIST OF DOCUMENTS. EXHIBITS. AND ATTACHMENTS (ARC 52.211-90) (FEB 1997)

(a) The following documents, exhibits, and attachments are included in the solicitation and resulting contract. Representations and certifications completed by the contractor in response to this solicitation are incorporated by reference in the resulting contract at time of award.

Title

1. Solicitation Number NNA057682R
2. General Wage Decision No. CA20030029with Modifications 1 through 12.
3. Standard Form 24; Bid Bond

(b) The following documents and attachments are included only in the solicitation:

1. Experience Questionnaire
2. DD Form 2051; Request for Assignment of a Commercial and Government Entity (CAGE) Code.

(End of clause)

(END OF SECTION)

PART IV - REPRESENTATIONS AND INSTRUCTIONS

SECTION K - REPRESENTATIONS, CERTIFICATIONS, AND OTHER STATEMENTS OF OFFERORS

RFP NNA057682R

NAME OF OFFEROR: _____

K.1 CERTIFICATE OF INDEPENDENT PRICE DETERMINATION (FAR 52.203-2) (APR 1985)

(a) The offeror certifies that:

(l) The prices in this offer have been arrived at independently, without, for the purpose of restricting competition, any consultation, communication, or agreement with any other offeror or competitor relating to (i) those prices, (ii) the intention to submit an offer, or (iii) the methods or factors used to calculate the prices offered;

(2) The prices in this offer have not been and will not be knowingly disclosed by the offeror, directly or indirectly, to any other offeror or competitor before bid opening (in the case of a sealed bid solicitation) or contract award (in the case of a negotiated solicitation) unless otherwise required by law; and

(3) No attempt has been made or will be made by the offeror to induce any other concern to submit or not to submit an offer for the purpose of restricting competition.

(b) Each signature on the offer is considered to be a certification by the signatory that the signatory:

(l) Is the person in the offeror's organization responsible for determining the prices being offered in this bid or proposal, and that the signatory has not participated and will not participate in any action contrary to subparagraphs (a)(l) through (a)(3) above; or

(2)(i) Has been authorized, in writing, to act as agent for the following principals in certifying that those principals have not participated, and will not participate in any action contrary to subparagraphs (a)(l) through (a)(3) above

_____
_____
_____

(Insert full name of person(s) in the offeror's organization responsible for determining the prices offered in this bid or proposal, and the title of his or her position in the offeror's organization)

(ii) As an authorized agent, does certify that the principals named in subdivision (b)(2)(i) above have not participated and will not participate, in any action contrary to subparagraphs (a)(I) through (a)(3) above; and

(iii) As an agent, has not personally participated, and will not participate, in any action contrary to subparagraph (a)(I) through (a)(3) above.

(c) If the offeror deletes or modifies subparagraph (a)(2) above, the offeror must furnish with its offer a signed statement setting forth in detail the circumstances of the disclosure.

(End of provision)

K.2 COVENANT AGAINST CONTINGENT FEES (FAR 52.203-5) (APR 1984)

(a) The Contractor warrants that no person or agency has been employed or retained to solicit or obtain this contract upon an agreement or understanding for a contingent fee, except a bona fide employee or agency. For breach or violation of this warranty, the Government shall have the right to annul this contract without liability or, in its discretion, to deduct from the contract price or consideration, or otherwise recover, the full amount of the contingent fee.

(b) "Bona fide agency," as used in this clause, means an established commercial or selling agency, maintained by a contractor for the purpose of securing business, that neither exerts nor proposes to exert improper influence to solicit or obtain Government contracts nor holds itself out as being able to obtain any Government contract or contracts through improper influence.

"Bona fide employee," as used in this clause, means a person, employed by a contractor and subject to the contractor's supervision and control as to time, place, and manner of performance, who neither exerts nor proposes to exert improper influence to solicit or obtain Government contracts nor holds out as being able to obtain any Government contract or contracts through improper influence.

"Contingent fee," as used in this clause, means any commission, percentage, brokerage, or other fee that is contingent upon the success that a person or concern has in securing a Government contract.

"Improper influence," as used in this clause, means any influence that induces or tends to induce a Government employee or officer to give consideration or to act regarding a Government contract on any basis other than the merits of the matter.

(End of clause)

K.3 CERTIFICATION AND DISCLOSURE REGARDING PAYMENTS TO INFLUENCE CERTAIN FEDERAL TRANSACTIONS (FAR 52.203-11) (APR 1991)

(a) The definitions and prohibitions contained in the clause, at FAR 52.203-12, Limitation on Payments to Influence Certain Federal Transactions, included in this solicitation, are hereby incorporated by reference in paragraph (b) of this certification.

(b) The offeror, by signing its offer, hereby certifies to the best of his or her knowledge and belief as of December 23, 1989, that—

(l) No Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress on his or her behalf in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment or modification of any Federal contract, grant, loan, or cooperative agreement;

(2) If any funds other than Federal appropriated funds (including profit or fee received under a covered Federal transaction) have been paid, or will be paid, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress on his or her behalf in connection with this solicitation, the offeror shall complete and submit, with its offer, OMB Standard Form LLL, Disclosure of Lobbying Activities, to the Contracting Officer; and

(3) He or she will include the language of this certification in all subcontract awards at any tier and require that all recipients of subcontract awards in excess of $100,000 shall certify and disclose accordingly.

(c) Submission of this certification and disclosure is a prerequisite for making or entering into this contract imposed by Section 1352, Title 31, United States Code. Any person who makes an expenditure prohibited under this provision or who fails to file or amend the disclosure form to be filed or amended by this provision, shall be subject to a civil penalty of not less than $10,000, and not more than $100,000, for each such failure.

(End of provision)

K.4 TAXPAYER IDENTIFICATION (FAR 52.204-3) (OCT 1998)

(a) Definitions.

"Common parent," as used in this provision, means that corporate entity that owns or controls an affiliated group of corporations that files its Federal income tax returns on a consolidated basis, and of which the offeror is a member.

"Taxpayer Identification Number (TIN)," as used in this provision, means the number required by the Internal Revenue Service (IRS) to be used by the offeror in reporting income tax and other returns. The TIN may either be a Social Security Number or an Employer Identification Number.

(b) All offerors must submit the information required in paragraphs (d) through (f) of this provision to comply with debt collection requirements of 31 U.S.C. 7701(c) and 3325(d), reporting requirements of 26 U.S.C. 6041, 6041A, and 6050M, and implementing regulations issued by the IRS. If the resulting contract is subject to the payment reporting requirements described in Federal Acquisition Regulation (FAR) 4.904, the failure or refusal by the offeror to furnish the information may result in a 31 percent reduction of payments otherwise due under the contract.

(c) The TIN may be used by the Government to collect and report on any delinquent amounts arising out of the offeror's relationship with the Government (31 U.S.C. 7701(c)(3)). If the resulting contract is subject to the payment reporting

requirements described in FAR 4.904, the TIN provided hereunder may be matched with IRS records to verify the accuracy of the offeror's TIN.

(d) Taxpayer Identification Number (TIN).

[ ] TIN: _____.
[ ] TIN has been applied for.
[ ] TIN is not required because:
[ ] Offeror is a nonresident alien, foreign corporation, or foreign partnership that does not have income effectively connected with the conduct of a trade or business in the United States and does not have an office or place of business or a fiscal paying agent in the United States;
[ ] Offeror is an agency or instrumentality of a foreign government;
[ ] Offeror is an agency or instrumentality of the Federal Government.

(e) Type of organization.
[ ] Sole proprietorship;
[ ] Partnership;
[ ] Corporate entity (not tax-exempt);
[ ] Corporate entity (tax-exempt);
[ ] Government entity (Federal, State, or local);
[ ] Foreign government;
[ ] International organization per 26 CFP 1.6049-4;
[ ] Other;

(f) Common Parent.
[ ] Offeror is not owned or controlled by a common parent as defined in paragraph (a) of this provision.
[ ] Name and TIN of common parent:

Name _____

TIN _____

(End of provision)

K.5 WOMEN-OWNED BUSINESS (OTHER THAN SMALL BUSINESS) (FAR 52.204-5) (MAY 1999)

(a) Definition. "Women-owned business concern," as used in this provision, means a concern that is at least 51 percent owned by one or more women; or in the case of any publicly owned business, at least 51 percent of its stock is owned by one or more women; and whose management and daily business operations are controlled by one or more women.

(b) Representation. [Complete only if the offeror is a women-owned business concern and has not represented itself as a small business concern in paragraph (b)(1) of FAR 52.219-1, Small Business Program Representations, of this solicitation.] The offeror represents that it
( ) is a women-owned business concern.

(End of provision)

K.6 CERTIFICATION REGARDING DEBARMENT, SUSPENSION, PROPOSED DEBARMENT, AND OTHER RESPONSIBILITY MATTERS (FAR 52.209-5) (DEC 2001)

(a)(l) The Offeror certifies, to the best of its knowledge and belief, that—

(i) The Offeror and/or any of its Principals—

(A) Are [ ] are not [ ] presently debarred, suspended, proposed for debarment, or declared ineligible for the award of contracts by any Federal agency;

(B) Have [ ] have not [ ], within a three year period preceding this offer, been convicted of or had a civil judgment rendered against them for: commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, state, or local) contract or subcontract; violation of Federal or state antitrust statues relating to the submission of offers; or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, tax evasion, or receiving stolen property; and

(C) Are [ ] are not [ ] presently indicted for, or otherwise criminally or civilly charged by a governmental entity with, commission of any of the offenses enumerated in subdivision (a)(l)(i)(B) of this provision.

(ii) The Offeror has [ ] has not [ ], within a three-year period preceding this offer, had one or more contracts terminated for default by any Federal agency.

(2) "Principals," for the purposes of this certification, means officers; directors; owners; partners; and, persons having primary management or supervisory responsibilities within a business entity (e.g., general manager, plant manager; head of a subsidiary, division, or business segment, and similar positions).

THIS CERTIFICATION CONCERNS A MATTER WITHIN THE JURISDICTION OF AN AGENCY OF THE UNITED STATES AND THE MAKING OF A FALSE, FICTITIOUS, OR FRAUDULENT CERTIFICATION MAY RENDER THE MAKER SUBJECT TO PROSECUTION UNDER SECTION 1001, TITLE 18, UNITED STATES CODE.

(b) The Offeror shall provide immediate written notice to the Contracting Officer if, at any time prior to contract award, the Offeror learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances.

(c) A certification that any of the items in paragraph (a) of this provision exists will not necessarily result in withholding of an award under this solicitation. However, the certification will be considered in connection with a determination of the Offeror's responsibility. Failure of the Offeror to furnish a certification or provide such additional information as requested by the Contracting Officer may render the Offeror nonresponsible.

(d) Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render, in good faith, the certification required by paragraph (a) of this provision. The knowledge and information of an Offeror is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

(e) The certification in paragraph (a) of this provision is a material representation of fact upon which reliance was placed when making award. If it is later determined that the Offeror knowingly rendered an erroneous certification, in addition to other remedies available to the Government, the Contracting Officer may terminate the contract resulting from this solicitation for default.

(End of provision)

K.7 SMALL BUSINESS PROGRAM REPRESENTATIONS (FAR 52.219-1) (MAY 2004)

(a)(1) The North American Industry Classification System (NAICS) code for this acquisition is_____ [insert NAICS code].

(2) The small business size standard is _____ [insert size standard].

(3) The small business size standard for a concern which submits an offer in its own name, other than on a construction or service contract, but which proposes to furnish a product which it did not itself manufacture, is 500 employees.

(b) Representations.

(1) The offeror represents as part of its offer that it o is, o is not a small business concern.

(2) [Complete only if the offeror represented itself as a small business concern in paragraph (b)(1) of this provision.] The offeror represents, for general statistical purposes, that it [ ] is, [ ] is not, a small disadvantaged business concern as defined in 13 CFR 124.1002.

(3) [Complete only if the offeror represented itself as a small business concern in paragraph (b)(1) of this provision.] The offeror represents as part of its offer that it [ ] is, [ ] is not a women-owned small business concern.

(4) [Complete only if the offeror represented itself as a small business concern in paragraph (b)(1) of this provision.] The offeror represents as part of its offer that it [ ] is, [ ] is not a veteran-owned small business concern.

(5) [Complete only if the offeror represented itself as a veteran-owned small business concern in paragraph (b)(4) of this provision.] The offeror represents as part of its offer that it [ ] is, [ ] is not a service-disabled veteran-owned small business concern.

(6) [Complete only if the offeror represented itself as a small business concern in paragraph (b)(1) of this provision.] The offeror represents, as part of its offer, that- (i) It [ ] is, [ ] is not a HUBZone small business concern listed, on the date of this representation, on the List of Qualified HUBZone Small Business Concerns maintained by the Small Business Administration, and no material change in ownership and control, principal office, or HUBZone employee percentage has occurred since it was certified by the Small Business Administration in accordance with 13 CFR part 126; and

(ii) It o is, o is not a joint venture that complies with the requirements of 13 CFR part 126, and the representation in paragraph (b)(6)(i) of this provision is accurate for the HUBZone small business concern or concerns that are participating in the joint venture. [The offeror shall enter the name or names of the HUBZone small business concern or concerns that are participating in the joint venture:_____.] Each HUBZone small business concern participating in the joint venture shall submit a separate signed copy of the HUBZone representation.

(c) Definitions. As used in this provision-

"Service-disabled veteran-owned small business concern"-

(1) Means a small business concern-

(i) Not less than 51 percent of which is owned by one or more service-disabled veterans or, in the case of any publicly owned business, not less than 51 percent of the stock of which is owned by one or more service-disabled veterans; and
(ii) The management and daily business operations of which are controlled by one or more service-disabled veterans or, in the case of a service-disabled veteran with permanent and severe disability, the spouse or permanent caregiver of such veteran.
(2) Service-disabled veteran means a veteran, as defined in 38 U.S.C. 101(2), with a disability that is service-connected, as defined in 38 U.S.C. 101(16).

"Small business concern" means a concern, including its affiliates, that is independently owned and operated, not dominant in the field of operation in which it is bidding on Government contracts, and qualified as a small business under the criteria in 13 CFR part 121 and the size standard in paragraph
(a) of this provision.

"Veteran-owned small business concern" means a small business concern-

(1) Not less than 51 percent of which is owned by one or more veterans (as defined at 38 U.S.C. 101(2)) or, in the case of any publicly owned business, not less than 51 percent of the stock of which is owned by one or more veterans; and
(2) The management and daily business operations of which are controlled by one or more veterans.

"Women-owned small business concern" means a small business concern-

(1) That is at least 51 percent owned by one or more women; or, in the case of any publicly owned business, at least 51 percent of the stock of which is owned by one or more women; and
(2) Whose management and daily business operations are controlled by one or more women.
(d) Notice.
(1) If this solicitation is for supplies and has been set aside, in whole or in part, for small business concerns, then the clause in this solicitation providing notice of the set-aside contains restrictions on the source of the end items to be furnished.
(2) Under 15 U.S.C. 645(d), any person who misrepresents a firm's status as a small, HUBZone small, small disadvantaged, or women-owned small business concern in order to obtain a contract to be awarded under the preference programs established pursuant to section 8(a), 8(d), 9, or 15 of the Small Business Act or any other provision of Federal law that specifically references section 8(d) for a definition of program eligibility, shall-
(i) Be punished by imposition of fine, imprisonment, or both;
(ii) Be subject to administrative remedies, including suspension and debarment; and
(iii) Be ineligible for participation in programs conducted under the authority of the Act.

(End of provision)

Alternate I (Apr 2002). As prescribed in 19.308(a)(2), add the following paragraph (b)(7) to the basic provision:

(7) [Complete if offeror represented itself as disadvantaged in paragraph (b)(2) of this provision.] The offeror shall check the category in which its ownership falls:
_____ Black American.
_____ Hispanic American.

_____ Native American (American Indians, Eskimos, Aleuts, or Native Hawaiians).
_____ Asian-Pacific American (persons with origins from Burma, Thailand, Malaysia, Indonesia, Singapore, Brunei, Japan, China, Taiwan, Laos, Cambodia (Kampuchea), Vietnam, Korea, The Philippines, U.S. Trust Territory of the Pacific Islands (Republic of Palau), Republic of the Marshall Islands, Federated States of Micronesia, the Commonwealth of the Northern Mariana Islands, Guam, Samoa, Macao, Hong Kong, Fiji, Tonga, Kiribati, Tuvalu, or Nauru).
_____ Subcontinent Asian (Asian-Indian) American (persons with origins from India, Pakistan, Bangladesh, Sri Lanka, Bhutan, the Maldives Islands, or Nepal).
_____ Individual/concern, other than one of the preceding.

(End of provision)

K.8 SMALL BUSINESS CONCERN REPRESENTATION FOR THE SMALL BUSINESS COMPETITIVENESS DEMONSTRATION PROGRAM (FAR 52.219-19) (OCT 2000)

(a) Definition. "Emerging small business" as used in this solicitation, means a small business concern whose size is no greater than 50 percent of the numerical size standard applicable to the North American Industry Classification System (NAICS) code assigned to a contracting opportunity.

(b) [Complete only if the Offeror has represented itself under the provision at 52.219-1 as a small business concern under the size standards of this solicitation.] The Offeror [ ] is, [ ] is not an emerging small business.

(c) [Complete only if the Offeror is a small business or an emerging small business, indicating its size range.] Offeror's number of employees for the past 12 months [check this column if size standard stated in solicitation is expressed in terms of number of employees] or Offeror's average annual gross revenue for the last 3 fiscal years [check this column if size standard stated in solicitation is expressed in terms of annual receipts]. [Check one of the following.]

No. of Employees	Avg. Annual Gross Revenues
____ 50 or fewer	____ $1 million or less
____ 51 – 100	____ $1,000,001 - $2 million
____ 101 – 250	____ $2,000,001 - $3.5 million
____ 251 – 500	____ $3,500,001 - $5 million
____ 501 – 750	____ $5,000,001 - $10 million
____ 751 - 1,000	____ $10,000,001 - $17 million
____ Over 1,000	____ Over $17 million

(End of provision)

K.9 PROHIBITION OF SEGREGATED FACILITIES (FAR 52.222-21) (FEB 1999)

(a) "Segregated facilities," as used in this clause, means any waiting rooms, work areas, rest rooms and wash rooms, restaurants and other eating areas, time clocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees, that are segregated by explicit directive or are in fact segregated on the basis of race, color, religion, or national origin because of written or oral policies or employee custom. The term does not include separate or single-user rest rooms or necessary dressing or sleeping areas provided to assure privacy between the sexes.

(b) The Contractor agrees that it does not and will not maintain or provide for its employees any segregated facilities at any of its establishments, and that it does not and will not permit its employees to perform their services at any location under its control where segregated facilities are maintained. The Contractor agrees that a breach of this clause is a violation of the Equal Opportunity clause in this contract.

(c) The Contractor shall include this clause in every subcontract and purchase order that is subject to the Equal Opportunity clause of this contract.

(End of clause)

K.10 PREVIOUS CONTRACTS AND COMPLIANCE REPORTS (FAR 52.222-22) (FEB 1999)

The offeror represents that—

(a) It [ ] has, [ ] has not participated in a previous contract or subcontract subject to the Equal Opportunity clause of this solicitation;

(b) It [ ] has, [ ] has not, filed all required compliance reports; and

(c) Representations indicating submission of required compliance reports, signed by proposed subcontractors, will be obtained before subcontract awards.

(End of provision)

K.11 COMPLIANCE WITH VETERANS' EMPLOYMENT REPORTING REQUIREMENTS (52.222-38) (DEC 2001)

By submission of its offer, the offeror represents that, if it is subject to the reporting requirements of 38 U.S.C. (d) (i.e., if it has any contract containing Federal Acquisition Regulation clause 52.222-37, Employment Reports on Special Disabled Veterans, Veterans of the Vietnam Era, and Other Eligible Veterans), it has submitted the most recent VETS-100 Report required by that clause.

(End of provision)

K.12 RECOVERED MATERIAL CERTIFICATION (FAR 52.223-4) (Oct 1997)

As required by the Resource Conservation and Recovery Act of 1976 (42 U.S.C. 6962(c)(3)(A)(i)), the offeror certifies, by signing this offer, that the percentage of recovered materials to be used in the performance of the contract will be at least the amount required by the applicable contract specifications.

(End of provision)

K.13 CERTIFICATION OF TOXIC CHEMICAL RELEASE REPORTING (FAR 52.223-13) (AUG 2003) (required if contract is over $100,000)

(a) Executive Order 13148, of April 21, 2000, Greening the Government through Leadership in Environmental Management, requires submission of this certification as a prerequisite for contract award.

(b) By signing this offer, the offeror certifies that-

(1) As the owner or operator of facilities that will be used in the performance of this contract that are subject to the filing and reporting requirements described in section 313 of the Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA) (42 U.S.C. 11023) and section 6607 of the Pollution Prevention Act of 1990 (PPA) (42 U.S.C. 13106), the offeror will file and continue to file for such facilities for the life of the contract the Toxic Chemical Release Inventory Form (Form R) as described in sections 313(a) and (g) of EPCRA and section 6607 of PPA; or

(2) None of its owned or operated facilities to be used in the performance of this contract is subject to the Form R filing and reporting requirements because each such facility is exempt for at least one of the following reasons: [Check each block that is applicable.]

[ ] (i) The facility does not manufacture, process, or otherwise use any toxic chemicals listed in 40 CFR 372.65;

[ ] (ii) The facility does not have 10 or more full-time employees as specified in section 313(b)(1)(A) of EPCRA, 42 U.S.C. 11023(b)(1)(A);

[ ] (iii) The facility does not meet the reporting thresholds of toxic chemicals established under section 313(f) of EPCRA, 42 U.S.C. 11023(f) (including the alternate thresholds at 40 CFR 372.27, provided an appropriate certification form has been filed with EPA);

[ ] (iv) The facility does not fall within the following Standard Industrial Classification (SIC) codes or their corresponding North American Industry Classification System sectors:

(A) Major group code 10 (except 1011, 1081, and 1094.
(B) Major group code 12 (except 1241).
(C) Major group codes 20 through 39.
(D) Industry code 4911, 4931, or 4939 (limited to facilities that combust coal and/or oil for the purpose of generating power for distribution in commerce).
(E) Industry code 4953 (limited to facilities regulated under the Resource Conservation and Recovery Act, Subtitle C (42 U.S.C. 6921, et seq.), or 5169, or 5171, or 7389 (limited to facilities primarily engaged in solvent recovery services on a contract or fee basis); or

[ ] (v) The facility is not located in the United States or its outlying areas..

(End of provision)

(END OF SECTION)

SECTION L - INSTRUCTIONS, CONDITIONS, AND NOTICES TO OFFERORS

L.1 DATA UNIVERSAL NUMBERING SYSTEM (DUNS) NUMBER (FAR 52.204-6) (OCT 2003)

(a) The offeror shall enter, in the block with its name and address on the cover page of its offer, the annotation "DUNS" or "DUNS+4" followed by the DUNS number or "DUNS+4" that identifies the offeror's name and address exactly as stated in the offer. The DUNS number is a nine-digit number assigned by Dun and Bradstreet, Inc. The DUNS+4 is the DUNS number plus a 4-character suffix that may be assigned at the discretion of the offeror to establish additional CCR records for identifying alternative Electronic Funds Transfer (EFT) accounts (see Subpart 32.11) for the same parent concern.

(b) If the offeror does not have a DUNS number, it should contact Dun and Bradstreet directly to obtain one.

(1) An offeror may obtain a DUNS number-
- (i) If located within the United States, by calling Dun and Bradstreet at 1-866-705-5711 or via the Internet at http://www.dnb.com; or
- (ii) If located outside the United States, by contacting the local Dun and Bradstreet office.

(2) The offeror should be prepared to provide the following information:
- (i) Company legal business name.
- (ii) Tradestyle, doing business, or other name by which your entity is commonly recognized.
- (iii) Company physical street address, city, state and Zip Code.
- (iv) Company mailing address, city, state and Zip Code (if separate from physical).
- (v) Company telephone number.
- (vi) Date the company was started.
- (vii) Number of employees at your location.
- (viii) Chief executive officer/key manager.
- (ix) Line of business (industry).
- (x) Company Headquarters name and address (reporting relationship within your entity).

(End of provision)

L.2 AVAILABILITY OF SPECIFICATIONS LISTED IN THE GSA INDEX OF FEDERAL SPECIFICATIONS, STANDARDS AND COMMERCIAL ITEM DESCRIPTIONS, FPMR Part 101-29 (FAR 52.211-1) (AUG 1998)

(a) The GSA Index of Federal Specifications, Standards and Commercial Item Descriptions, FPMR Part 101-29, and copies of specifications standards, and commercial item descriptions cited in this solicitation may be obtained for a fee by submitting a request to--

GSA Federal Supply Service

Specifications Section, Suite 8100

470 East L'Enfant Plaza, S.W

Washington, D. C. 20407

Telephone (202) 619-8925

Facsimile (202) 619-8978.

(b) If the General Services Administration, Department of Agriculture, or Department of Veterans Affairs issued this solicitation, a single copy of specifications, standards, and commercial item descriptions cited in this solicitation may be obtained free of charge by submitting a request to the addressee in paragraph (a) of this provision. Additional copies will be issued for a fee.

(End of provision)

L.3 AVAILABILITY FOR EXAMINATION OF SPECIFICATIONS NOT LISTED IN THE GSA INDEX OF FEDERAL SPECIFICATIONS, STANDARDS AND COMMERCIAL ITEM DESCRIPTIONS (FAR 52.211-4) (JUN 1988)

The specifications cited in this solicitation are not available for distribution. However, they may be examined at the following location(s):

NASA-Ames Research Center
Moffett Field, CA 94035-1000
Reliability and Quality Assurance Office
Trailer Area TA 3, Building T-041, Room 129
Mail Stop T-041-1
Telephone 415-604-4901

(End of provision)

L.4 NOTICE OF PRIORITY RATING FOR NATIONAL DEFENSE USE (FAR 52.211-14) (SEP 1990)

Any contract awarded as a result of this solicitation will be [ ] DX rated order; [X] DO rated order certified for national defense use under the Defense Priorities and Allocations System (DPAS) (15 CFR 700), and the Contractor will be required to follow all of the requirements of this regulation.

(End of provision)

L.5 NOTICE OF BUY AMERICAN ACT REQUIREMENT-CONSTRUCTION MATERIALS (FAR 52.225-10) (MAY 2002)

(a) Definitions. "Construction material," "domestic construction material," and "foreign construction material," as used in this provision, are defined in the clause of this solicitation entitled "Buy American Act-Construction Materials" (Federal Acquisition Regulation (FAR) clause 52.225-9).
(b) Requests for determinations of inapplicability. An offeror requesting a determination regarding the inapplicability of the Buy

American Act should submit the request to the Contracting Officer in time to allow a determination before submission of offers. The offeror shall include the information and applicable supporting data required by paragraphs (c) and (d) of the clause at FAR 52.225-9 in the request. If an offeror has not requested a determination regarding the inapplicability of the Buy American Act before submitting its offer, or has not received a response to a previous request, the offeror shall include the information and supporting data in the offer.

(c) Evaluation of offers.

(1) The Government will evaluate an offer requesting exception to the requirements of the Buy American Act, based on claimed unreasonable cost of domestic construction material, by adding to the offered price the appropriate percentage of the cost of such foreign construction material, as specified in paragraph (b)(3)(i) of the clause at FAR 52.225-9.

(2) If evaluation results in a tie between an offeror that requested the substitution of foreign construction material based on unreasonable cost and an offeror that did not request an exception, the Contracting Officer will award to the offeror that did not request an exception based on unreasonable cost.

(d) Alternate offers.

(1) When an offer includes foreign construction material not listed by the Government in this solicitation in paragraph (b)(2) of the clause at FAR 52.225-9, the offeror also may submit an alternate offer based on use of equivalent domestic construction material.

(2) If an alternate offer is submitted, the offeror shall submit a separate Standard Form 1442 for the alternate offer, and a separate price comparison table prepared in accordance with paragraphs (c) and (d) of the clause at FAR 52.225-9 for the offer that is based on the use of any foreign construction material for which the Government has not yet determined an exception applies.

(3) If the Government determines that a particular exception requested in accordance with paragraph (c) of the clause at FAR 52.225-9 does not apply, the Government will evaluate only those offers based on use of the equivalent domestic construction material, and the offeror shall be required to furnish such domestic construction material. An offer based on use of the foreign construction material for which an exception was requested-

(i) Will be rejected as non responsive if this acquisition is conducted by sealed bidding; or

(ii) May be accepted if revised during negotiations.

(End of provision)

Alternate I (May 2002). As prescribed in 25.1102(b)(2), substitute the following paragraph (b) for paragraph (b) of the basic provision:

(b) Requests for determinations of inapplicability. An offeror requesting a determination regarding the inapplicability of the Buy American Act shall submit the request with its offer, including the information and applicable supporting data required by paragraphs (c) and (d) of the clause at FAR 52.225-9.

of the Buy American Act.

(1)(i) Any Contractor request to use foreign construction material in accordance with paragraph (b)(4) of this clause shall include adequate information for Government evaluation of the request, including-
(A) A description of the foreign and domestic construction materials;
(B) Unit of measure;

THE SUCCESSFUL OFFEROR WILL BE REQUIRED TO FURNISH THE FOLLOWING INFORMATION AS REQUIRED IN FAR CLAUSE 52.232.38:

L.6 SUBMISSION OF ELECTRONIC FUNDS TRANSFER INFORMATION WITH OFFER (FAR 52.232.38) (MAY 1999)

The offeror shall provide, with its offer, the following information that is required to make payment by electronic funds transfer (EFT) under any contract that results from this solicitation. This submission satisfies
the requirement to provide EFT information under paragraphs (b)(1) and (j) of the clause at 52.232-34, Payment by Electronic Funds Transfer--Other than Central Contractor Registration.

(1) The solicitation number (or other procurement identification number).

(2) The offeror's name and remittance address, as stated in the offer.

(3) The signature (manual or electronic, as appropriate), title, and telephone number of the offeror's official authorized to provide this information.

(4) The name, address, and 9-digit Routing Transit Number of the offeror's financial agent.

(5) The offeror's account number and the type of account (checking, savings, or lockbox).

(6) If applicable, the Fedwire Transfer System telegraphic abbreviation of the offeror's financial agent.

(7) If applicable, the offeror shall also provide the name, address, telegraphic abbreviation, and 9-digit Routing Transit Number of the correspondent financial institution receiving the wire transfer payment if the offeror's financial agent is not directly on-line to the Fedwire and, therefore, not the receiver of the wire transfer payment.

(End of provision)

L.7 SERVICE OF PROTEST (FAR 52.233-2) (AUG 1996)

(a) Protests, as defined in section 33.101 of the Federal Acquisition Regulation, that are filed directly with an agency, and copies of any protests that are filed with the General Accounting Office (GAO), shall be served on the Contracting Officer (addressed as follows) by obtaining written and dated acknowledgment of receipt from NASA-Ames Research Center, Moffett Field, CA 94035-1000.

(b) The copy of any protest shall be received in the office designated above within one day of filing a protest with the GAO.

(End of provision)

L.8 SITE VISIT (CONSTRUCTION) (FAR 52.236-27) (FEB 1995) ALT 1 (FEB 1995)

(a) The clauses at 52.236-2, Differing Site Conditions, and 52.236-3, Site Investigations and Conditions Affecting the Work, will be included in any contract awarded as a result of this solicitation. Accordingly, offerors or quoters are urged and expected to inspect the site where the work will be performed.
(b) An organized site visit has been scheduled for:

Date: December 9, 2004

Time: 10:00 AM

Location: Building N213, Conference Room 204A
Ames Research Center
Moffett Field, CA 94035-1000

(End of provision)

L.9 OMBUDSMAN (NFS 1852.215-84) (OCTOBER 2003)

(a) An ombudsman has been appointed to hear and facilitate the resolution of concerns from offerors, potential offerors, and contractors during the preaward and postaward phases of this acquisition. When requested, the ombudsman will maintain strict confidentiality as to the source of the concern. The existence of the ombudsman is not to diminish the authority of the contracting officer, the Source Evaluation Board, or the selection official. Further, the ombudsman does not participate in the evaluation of proposals, the source selection process, or the adjudication of formal contract disputes. Therefore, before consulting with an ombudsman, interested parties must first address their concerns, issues, disagreements, and/or recommendations to the contracting officer for resolution.
(b) If resolution cannot be made by the contracting officer, interested parties may contact the installation ombudsman, Mr. Lewis Braxton III, M/S 200-9, NASA/Ames Research Center, Moffett Field, CA 94035-1000, Telephone (650) 604-5068, FAX (650) 1668, e-mail Lewis.S.Braxton@nasa.gov. Concerns, issues, disagreements, and recommendations which cannot be resolved at the installation may be referred to the NASA ombudsman, the Director of the Contract Management Division, at 202-358-0445, facsimile 202-358-3083, e-mail james.a.balinskas@nasa.gov. Please do not contact the ombudsman to request copies of the solicitation, verify offer due date, or clarify technical requirements. Such inquiries shall be directed to the Contracting Officer or as specified elsewhere in this document.

(End of clause)

L.10 BID BOND (NASA 1852.228-73) (OCT 1988)

(a) Each bidder shall submit with its bid a bid bond (Standard Form 24) with good and sufficient surety or sureties acceptable to the Government, or other security as provided in Federal Acquisition Regulation clause 52.228-1, in the amount of twenty percent (20%) of the bid price, or $3 million, whichever is the lower amount.

(b) Bid bonds shall be dated the same date as the bid or earlier.

(End of provision)

L.11 PROTESTS TO NASA (NASA1852.233-70) (OCT 2002)

Potential bidders or offerors may submit a protest under 48 CFR Part 33 (FAR Part 33) directly to the Contracting Officer. As an alternative to the Contracting Officer's consideration of a protest, a potential bidder or offeror may submit the protest to the Assistant Administrator for Procurement, who will serve as or designate the official responsible for conducting an independent review. Protests requesting an independent review shall be addressed to Assistant Administrator for Procurement, NASA Code H, Washington, DC 20546-0001.

(End of provision)

L.12 MAGNITUDE OF REQUIREMENT (NASA 1852.236-74) (DEC 1988)

The Government estimated price range of this project is between $250,000 and $500,000.

(End of provision)

L.13 INSTRUCTIONS TO OFFERORS-COMPETITIVE ACQUISITION (FAR 52.215-1) (JAN 2004)

"Discussions" are negotiations that occur after establishment of the competitive range that may, at the Contracting Officer's discretion, result in the offeror being allowed to revise its proposal.

"In writing," "writing," or "written" means any worded or numbered expression that can be read, reproduced, and later communicated, and includes electronically transmitted and stored information.

"Proposal modification" is a change made to a proposal before the solicitation's closing date and time, or made in response to an amendment, or made to correct a mistake at any time before award.

"Proposal revision" is a change to a proposal made after the solicitation closing date, at the request of or as allowed by a Contracting Officer as the result of negotiations.

"Time," if stated as a number of days, is calculated using calendar days, unless otherwise specified, and will include Saturdays, Sundays, and legal holidays. However, if the last day falls on a Saturday, Sunday, or legal holiday, then the period shall include the next working day.

(b) Amendments to solicitations. If this solicitation is amended, all terms and conditions that are not amended remain unchanged. Offerors shall acknowledge receipt of any amendment to this solicitation by the date and time specified in the amendment(s).

(c) Submission, modification, revision, and withdrawal of proposals.

(1) Unless other methods (e.g., electronic commerce or facsimile) are permitted in the solicitation, proposals and modifications to proposals shall be submitted in paper media in sealed or packages (i) addressed to the office specified in the solicitation, and (ii) showing time and date specified for receipt, the solicitation number, and the name and address of the

offeror. Offerors using commercial carriers should ensure that the proposal is marked on the wrapper with the information in paragraphs (c)(1)(i) and (c)(1)(ii) of this provision.

(2) The first page of the proposal must show-

(i) The solicitation number;

(ii)The name, address, and telephone and facsimile numbers of the offeror (and electronic address if available);

(iii) A statement specifying the extent of agreement with all terms, conditions, and provisions included in the solicitation and agreement to furnish any or all items upon which prices are offered at the price set opposite each item;

(iv) Names, titles, and telephone and facsimile numbers (and electronic addresses if available) of persons authorized to negotiate on the offeror's behalf with the Government in connection with this solicitation; and

(v) Name, title, and signature of person authorized to sign the proposal. Proposals signed by an agent shall be accompanied by evidence of that agent's authority, unless that evidence has been previously furnished to the issuing office.

(3) Submission, modification, revision, and withdrawal of proposals.

(i) Offerors are responsible for submitting proposals, and any modifications or revisions, so as to reach the Government office designated in the solicitation by the time specified in the solicitation. If no time is specified in the solicitation, the time for receipt is 4:30 p.m., local time, for the designated Government office on the date that proposal or revision is due.

(ii)(A) Any proposal, modification, or revision received at the Government office designated in the solicitation after the exact time specified for receipt of offers is "late" and will not be considered unless it is received before award is made, the Contracting Officer determines that accepting the late offer would not unduly delay the acquisition; and-

(1) If it was transmitted through an electronic commerce method authorizedby the solicitation, it was received at the initial point of entry to the Government infrastructure not later than 5:00 p.m. one working day prior to the date specified for receipt of proposals; or

(2) There is acceptable evidence to establish that it was received at the Government installation designated for receipt of offers and was under the Government's control prior to the time set for receipt of offers; or

(3) It is the only proposal received.

(B) However, a late modification of an otherwise successful proposal that makes its terms more favorable to the Government, will be considered at any time it is received and may be accepted.

(iii) Acceptable evidence to establish the time of receipt at the Government installation includes the time/date stamp of that installation on the proposal wrapper, other documentary evidence of receipt maintained by the installation, or oral testimony or statements of Government personnel.

(iv) If an emergency or unanticipated event interrupts normal Government processes so that proposals cannot be received at the office designated for receipt of proposals by the exact time specified in the solicitation, and urgent Government requirements preclude amendment of the solicitation, the time specified for receipt of proposals will be deemed to be extended to the same time of day specified in the solicitation on the first work day on which normal Government processes resume.

(v) Proposals may be withdrawn by written notice received at any time before award. Oral proposals in response to oral solicitations may be withdrawn orally. If the solicitation authorizes facsimile proposals, proposals may be withdrawn via facsimile received at any time before award, subject to the conditions specified in the provision at 52.215-5,

Facsimile Proposals. Proposals may be withdrawn in person by an offeror or an authorized representative, if the identity of the person requesting withdrawal is established and the person signs a receipt for the proposal before award.

(4) Unless otherwise specified in the solicitation, the offeror may propose to provide any item or combination of items.

(5) Offerors shall submit proposals in response to this solicitation in English, unless otherwise permitted by the solicitation, and in U.S. dollars, unless the provision at FAR 52.225-17, Evaluation of Foreign Currency Offers, is included in the solicitation.

(6) Offerors may submit modifications to their proposals at any time before the solicitation closing date and time, and may submit modifications in response to an amendment, or to correct a mistake at any time before award.

(7) Offerors may submit revised proposals only if requested or allowed by the Contracting Officer.

(8) Proposals may be withdrawn at any time before award. Withdrawals are effective upon receipt of notice by the Contracting Officer.

(d) Offer expiration date. Proposals in response to this solicitation will be valid for the number of days specified on the solicitation cover sheet (unless a different period is proposed by the offeror).

(e) Restriction on disclosure and use of data. Offerors that include in their proposals data that they do not want disclosed to the public for any purpose, or used by the Government except for evaluation purposes, shall-

(1) Mark the title page with the following legend:

This proposal includes data that shall not be disclosed outside the Government and shall not be duplicated, used, or disclosed-in whole or in part-for any purpose other than to evaluate this proposal. If, however, a contract is awarded to this offeror as a result of-or in connection with-the submission of this data, the Government shall have the right to duplicate, use, or disclose the data to the extent provided in the resulting contract. This restriction does not limit the Government's right to use information contained in this data if it is obtained from another source without restriction. The data subject to this restriction are contained in sheets [insert numbers or other identification of sheets]; and

(2) Mark each sheet of data it wishes to restrict with the following legend:

Use or disclosure of data contained on this sheet is subject to the restriction on the title page of this proposal.

(f) Contract award.

(1) The Government intends to award a contract or contracts resulting from this solicitation to the responsible offeror(s) whose proposal(s) represents the best value after evaluation in accordance with the factors and subfactors in the solicitation.

(2) The Government may reject any or all proposals if such action is in the Government's interest.

(3) The Government may waive informalities and minor irregularities in proposals received.

(4) The Government intends to evaluate proposals and award a contract without discussions with offerors (except clarifications as described in FAR 15.306(a)). Therefore, the offeror's initial proposal should contain the offeror's best terms from a cost or price and technical standpoint. The Government reserves the right to conduct discussions if the Contracting Officer later determines them to be necessary. If the Contracting Officer determines that the number of proposals that would otherwise be in the competitive range exceeds the number at which an

efficient competition can be conducted, the Contracting Officer may limit the number of proposals in the competitive range to the greatest number that will permit an efficient competition among the most highly rated proposals.

(5) The Government reserves the right to make an award on any item for a quantity less than the quantity offered, at the unit cost or prices offered, unless the offeror specifies otherwise in the proposal.

(6) The Government reserves the right to make multiple awards if, after considering the additional administrative costs, it is in the Government's best interest to do so.

(7) Exchanges with offerors after receipt of a proposal do not constitute a rejection or counteroffer by the Government.

(8) The Government may determine that a proposal is unacceptable if the prices proposed are materially unbalanced between line items or subline items. Unbalanced pricing exists when, despite an acceptable total evaluated price, the price of one or more contract line items is significantly overstated or understated as indicated by the application of cost or price analysis techniques. A proposal may be rejected if the Contracting Officer determines that the lack of balance poses an unacceptable risk to the Government.

(9) If a cost realism analysis is performed, cost realism may be considered by the source selection authority in evaluating performance or schedule risk.

(10) A written award or acceptance of proposal mailed or otherwise furnished to the successful offeror within the time specified in the proposal shall result in a binding contract without further action by either party.

(11) If a post-award debriefing is given to requesting offerors, the Government shall disclose the following information, if applicable:

(i) The agency's evaluation of the significant weak or deficient factors in the debriefed offeror's offer.

(ii) The overall evaluated cost or price and technical rating of the successful and the debriefed offeror and past performance information on the debriefed offeror.

(iii) The overall ranking of all offerors, when any ranking was developed by the agency during source selection.

(iv) A summary of the rationale for award.

(v) For acquisitions of commercial items, the make and model of the item to be delivered by the successful offeror.

(vi) Reasonable responses to relevant questions posed by the debriefed offeror as to whether source-selection procedures set forth in the solicitation, applicable regulations, and other applicable authorities were followed by the agency.

(End of provision)

Alternate I (Oct 1997). As prescribed in 15.209(a)(1), substitute the following paragraph (f)(4) for paragraph (f)(4) of the basic provision:

(f)(4) The Government intends to evaluate proposals and award a contract after conducting discussions with offerors whose proposals have been determined to be within the competitive range. If the Contracting Officer determines that the number of proposals that would otherwise be in the competitive range exceeds the number at which an efficient competition can be conducted, the Contracting Officer may limit the number of proposals in the competitive range to the greatest number that will permit an efficient competition among the most highly rated proposals. Therefore, the offeror's initial proposal should contain the offeror's best terms from a price and technical standpoint.

Alternate II (Oct 1997). As prescribed in 15.209(a)(2), add a paragraph (c)(9) substantially the same
as the following to the basic clause:

(c)(9) Offerors may submit proposals that depart from stated requirements. Such proposals shall clearly identify why the acceptance of the proposal would be advantageous to the Government. Any deviations from the terms and conditions of the solicitation, as well as the comparative advantage to the Government, shall be clearly identified and explicitly defined. The Government reserves the right to amend the solicitation to allow all offerors an opportunity to submit revised proposals based on the revised requirements.

L.14 SUBMITTAL REQUIREMENTS

a. Technical Submittal Requirements: The offeror's technical proposal shall be limited to 20 single sided, 8-1/2 by 11 inch pages of text with 10 point font or larger. The page limitation does not include the Standard Form 1442, Solicitation, Offer, and Award, and construction schedule. If the technical proposal exceeds the stated page limitation, only the first 20 pages will be evaluated. The technical proposal shall be presented in three ring binders with dividers separating each evaluation factor. Offerors are advised that the required data listed below will be utilized for technical review and evaluation and for determination of a "rating" by a Technical Evaluation Team. The proposal shall address the BVS value characteristics in the following format:

(1) PAST PERFORMANCE:

(a) Provide specific examples that demonstrate successful past performance on similar projects within the last three (3) years. Provide up to six (6) project examples in the following format:

Contract Number:

Project Title, Location and Description:

Owner and Point of Contact – Agency:
Contact Name:
Address:
Phone:
E-mail Address:

Contract Award Date and Price:

Original Contract Completion Date:

Current or Actual Completion Date:

Provide explanation if actual completion date exceeded or exceeds original contract completion date:

Percentage of Completion and Current Price:

Performance Evaluation Rating Received:

Involvement of Proposed Key Personnel:

Description of Requirements and/or Complexity of the Project:

Briefly describe the similarities between this project and the scope of work described in this solicitation:

Discuss any major problems encountered and how they were resolved

Awards/Recommendations Received:
(b) Provide up to five (5) letters of commendation and /or recommendation. Annotate the contract description, contract amount, and completion date on each letter.

(2) PROJECT TEAM AND ORGANIZATION

(a) **Provide the following information for the offeror (prime contractor) and each proposed subcontractor performing 25% or greater of the work including-mechanical, electrical, structural, and roofing and control systems.**

Company name

Company's principal officer:

Company address:

Company phone number:

Company E-mail address:

Company's principal business (mechanical, electrical, roofing, etc.)

Number of years the company has been in business:

Supplemental Business Qualifications (contractors license in principal trade, organizational memberships, etc.):

Experience the offeror (prime contractor) has working with their proposed subcontractors:

(b) Offeror (prime contractor) shall provide an organizational chart defining relationships and responsibilities of all project team members.

(c) Provide resumes for the key personnel who will be assigned to work on this project for the offeror. At a minimum, resumes for the project manager and project site superintendent that will be assigned to work on this project by the offeror should be provided. Each persons resume should completely address all the elements listed below and be provided in the following format:

Key personnel name:

Proposed position/responsibility:

Years experience working in the proposed position:

Years employed by this company:

Years working with this company in the proposed position:

Years of experience in the construction industry:

Education/Licenses:

General resume experience (list dates and projects worked on along with the complexity and magnitude of the project):

Describe how this individual contributed to the successful performance of the projects described in Factor 1:

(3) CONSTRUCTION SCHEDULE

(a) Provide a network schedule based on the critical path method. Submission may be either a bar chart or a network diagram. The project schedule shall include timelines for submittal preparation and approvals, material delivery, demolition and new construction work for each of the major trades (e.g. mechanical, electrical, structural, roofing, control systems) as outlined in Specification Section 01000, Paragraph 1.7 Work Scheduling. The schedule duration shall be for the full specified contract performance period and be sufficiently detailed to show how the offeror will accomplish the work.

(4) UTILIZATION OF SMALL BUSINESS

(a) Indicate your goal for subcontracting to Small Disadvantaged Businesses (SDBs), both as a percentage of the total offer and dollar amount.

b. Price Submittal Requirements:

(1) PRICE PROPOSAL REQUIREMENTS: The price proposal shall include all labor and material costs to accomplish the work shown in the contract documents.
(2) PRICE PROPOSAL: The price proposal shall include costs on the Standard Form 1442; Solicitation, Offer, and Award, for the following:

(a) Lump Sum Price for Base Item
(b) Lump Sum Price for Options

L.15 1852.223-73 SAFETY AND HEALTH PLAN (APRIL 2002)

(a) The offeror shall submit a detailed safety and occupational health plan as part of its proposal (see NPG 8715.3, NASA Safety Manual, Appendices). The plan shall include a detailed discussion of the policies, procedures, and techniques that will be used to ensure the safety and occupational health of Contractor employees and to ensure the safety of all working conditions throughout the performance of the contract.
(b) When applicable, the plan shall address the policies, procedures, and techniques that will be used to ensure the safety and occupational health of the public, astronauts and pilots, the NASA workforce (including Contractor employees working on NASA contracts), and high-value equipment and property.
(c) The plan shall similarly address subcontractor employee safety and occupational health for those proposed subcontracts that contain one or more of the following conditions:
(1) The work will be conducted completely or partly on premises owned or controlled by the government.
(2) The work includes construction, alteration, or repair of facilities in excess of the simplified acquisition threshold.
(3) The work, regardless of place of performance, involves hazards that could endanger the public, astronauts and pilots, the NASA workforce (including Contractor employees working on NASA contracts), or high value equipment or property, and the hazards are not adequately addressed by Occupational Safety and Health Administration (OSHA) or Department of Transportation (DOT) regulations (if applicable).
(4) When the assessed risk and consequences of a failure to properly manage and control the hazards warrants use of the clause.
(d) This plan, as approved by the Contracting Officer, will be included in any resulting contract.

(End of provision) (END OF SECTION)

SECTION M - EVALUATION FACTORS FOR AWARD

M.1 COMPETITIVE NEGOTIATED PROCUREMENT USING QUALITATIVE CRITERIA

This solicitation shall be conducted utilizing Best Value Selection (BVS) procedures, which seeks to select an offer based on the best combination of price and qualitative merit of the offers submitted. BVS predefines the value characteristics which will serve as the discriminators among offers.

BVS evaluation is based on the premise that, if all offers are of approximately equal qualitative merit, award will be made to the offeror with the lowest evaluated price (fixed-price contracts) or the Government-determined most probable cost (cost type contracts). However, the Government will consider awarding to an offeror with higher qualitative (technical) merit if the difference in price is commensurate with added value. Conversely, the Government will consider making award to an offeror whose offer has lower qualitative merit if the price (or cost) differential between it and other offers warrant doing so.

The specifications/statement of work included in the solicitation serves as the Government's baseline requirements. The following value characteristics establish what the Government considers to be valuable in an offer. These value characteristics are performance based and permit selection of the offer which provides better results for a reasonable marginal increase in price. All offers will be judged against these value characteristics. Cost and technical will be considered equal in importance and will not be assigned weights. On those value characteristics the offeror chooses to provide, adequate information should be submitted to permit proper evaluation.

The following value characteristics are applicable to this procurement:

(1) PAST PERFORMANCE: This BVS value characteristic evaluates the record of performance on recent projects of similar scope and complexity. Recent projects are defined as current projects and projects completed within the last three (3) years. Offerors are encouraged to provide information on any problems encountered during performance of these contracts and any corrective actions taken by the offeror. In evaluating past performance, the Government will consider information in the offeror's proposal and information from other sources including references, customers, Government agencies, and other sources deemed appropriate.

(2) PROJECT TEAM AND ORGANIZATION: This BVS value characteristic evaluates the experience and qualifications of the offeror and their proposed project team (project manager, superintendent, and any subcontractor performing 25% or more of the work) and their proposed organization,

relationship, and responsibilities. The proposed key personnel and subcontractors shall be required to perform on the contract in their proposed roles.

(3) CONSTRUCTION SCHEDULE: This BVS value characteristic evaluates the proposed scheduled and whether it demonstrates a clear understanding of the requirements and is considered realistic, logical, and shows a minimal disruption to adjacent ongoing operations. The work must be planned and performed to allow ongoing activities by Government personnel and minimize utility system shutdowns, interferences, closures of portions of the facility, and activities which may generate excessive noise, dust, and other disturbances (see Project Note 8 on Drawing A202-0401-G1).

(4) UTILIZATION OF SMALL DISADVANTAGED BUSINESS: This BVS value characteristic evaluates the extent of the offeror's proposed utilization of Small Disadvantaged Business (SDB). Factor includes work to be performed by the prime contractor.

b. PRICE EVALUATION FACTOR:

(1) The Government will evaluate the proposed price of the base and option requirements. The option prices will be evaluated in accordance with FAR Clause 52.217-5, EVALUATION OF OPTIONS.

(2) Price evaluation will not be based upon absolute standards or given an adjectival rating, but will be an assessment of the reasonableness of the proposed price.

(3) The Government will evaluate the fairness and reasonableness of the proposed price using one or more of the following price analysis techniques:

(a) Comparison of proposed price with the independent Government estimate;

(b) Comparison of proposed price to all other proposed prices; and

(c) Analysis of price for unbalanced items.

M.2 EVALUATION OF OPTION (FAR 52.217-5) (JUL 1990)

Except when it is determined in accordance with FAR 17.206(b) not to be in the Government's best interest, the Government will evaluate offers for award purposes by adding the total price for all options to the total price for the basic requirement. Evaluation of options will not obligate the Government to exercise the option.
(End of provision) (END OF SECTION)

SECTION 01000

GENERAL REQUIREMENTS
12/01

PART 1 GENERAL

1.1 SCOPE

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

1.2 FURNISHED DRAWINGS AND SPECIFICATIONS

Five sets of full-size contract drawings and specifications will be furnished without charge. Other reference publications will not be furnished.

Immediately check furnished drawings and specifications, and notify COTR of any discrepancies. Commencement of work shall constitute acceptance of drawings. Field check dimensions of existing facilities on drawings for accuracy and determine exact dimensions for proper fit.

Drawings and specifications are in metric units. Construction shall be in metric units with dimensions as shown on the drawings. Materials and products are to be metric units unless specifically noted otherwise. Inspections will take place using metric units. Contractor drawings shall be submitted using metric units.

1.3 SUBMITTALS

Submit the following per Section 01300, "Submittals":

SD-09, Reports

Submit progress reportsper Paragraph 3.5.B.

SD-20, Work Plan

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

1.4 HOURS OF WORK

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

1.5 OCCUPANCY OF PREMISES

The Government may occupy and use the facilities within and/or adjacent to the areas of Work during the entire construction period.

Provide and coordinate controls for the abatement of dust, noise, and inconvenience to Government personnel during the Work. Arrange with COTR

(before work is started) a sequence of Work, means of access, space for material and equipment storage, and use of approaches, corridors, and stairways. Obtain COTR approval at least three (3) days in advance of starting any activity that will interfere with accessibility or normal work activities of occupants.

Occupancy of building during construction, alteration or demolition shall comply with Article 87 of the 1998 California Fire Code (CFC) for fire safety requirements.

PART 2 PRODUCTS

2.1 OPTIONS

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

2.2 SUBSTITUTIONS

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

Performance type, type of construction, capacity, rating, and materials of manufacture, acceptance listing by industry standards organizations and/or national laboratories, and compatibility with existing systems equal to or exceeding those of the specified product.

Size, mounting, appearance, and finish must be comparable to those of the specified model.

Record of performance, ease of maintenance, manufacturer's warranty provisions, interchangeability of parts, and provision for modification or extension must equal or exceed those of the specified product, unless a request by the Contractor is approved by COTR for the reduction in these characteristics.

If a substitute product is approved by COTR, the Contractor shall be responsible for modifying the design (approved by the COTR) of the system and/or supporting structure as required to accommodate the change, and for executing these modifications at Contractor's expense. Any difficulty or issue arising from the use of an approved substitution shall be resolved by the Contractor to the satisfaction of COTR, at Contractor's expense.

PART 3 EXECUTION

3.1 TEMPORARY FACILITIES

Install and maintain temporary utilities required for construction, and remove them upon completion of the Work. Materials, new or used, shall be adequate for their intended usage, and shall not create unsafe conditions nor violate applicable codes and standards. The Government will furnish required water and electricity (120 V/1 Ph and 208 V/3 Ph). Connections, distribution, and lighting shall be furnished by the Contractor. Connections may only be made at methods and locations must be and in the

manner approved in advance by the COTR.

Provide and maintain temporary sanitary facilities, and remove them at the completion of the Work. Construction personnel shall not use existing facilities without COTR approval.

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

Provide signs necessary to expedite deliveries, maintain traffic flow, promote safety, and prevent interference with Government operations. Advertisement signs shall not be erected. Contractor shall obtain COTR approval of locations for placement of Contractor-owned or leased trailers and sheds, which shall be at least from existing structures, unless they are of non-combustible construction.

3.2 TRAFFIC PROVISIONS

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

3.3 PROTECTION OF EXISTING SYSTEMS

Provide a clear record of existing conditions before starting work. This may include photographs or videotape.

Provide temporary coverings to protect existing surfaces and equipment when Work is being done performed in adjacent areas. Damaged surfaces and equipment shall be repaired or replaced, to the satisfaction of COTR and the Government, at the Contractor's expense.

Protect existing utilities and safety systems from damage. Repair at Contractor's expense utilities and safety systems damaged by the Contractor.

Immediately report to Inspector immediately any utilities not previously identified to the Contractor and which it when encountered in the field. The size, type, location, depth, and direction of these utilities shall be recorded on the as-built drawings, and approved by Inspector prior to covering them.

Structural members shall not be altered unless approved by COTR.

Photograph existing conditions before start of work.

3.4 UTILITY OUTAGES AND CONNECTIONS

Schedule utility outages and connections required during the construction process at the convenience of the Government. Schedule Work to hold outages to a minimum. Submit a request to interrupt existing systems to COTR at least seven (7) days in advance.

Take all reasonable steps to minimize the effect and duration of such interruptions.

3.5 PROGRESS CONTROLS

A. Project Meetings

1. Attend with all first tier subcontractors performing work on-site a pre-construction conference, if scheduled by the COTR. On-site work shall not commence prior to the conference. Discussion shall include introductions, project orientation, quality control, safety, administration and temporary utilities and facilities.

2. Participate in progress meetings, as scheduled by COTR. Discussion shall include submittals, progress, material delivery, potential delays, interfaces, problems, quality control, and safety.

3. Promptly report construction problems or design deficiencies encountered to COTR. Solutions will be determined by COTR.

B. Construction Schedule and Progress Reports

1. Contractor shall submit an original and subsequently updated schedule of Contractor activities and sequence of operations needed for the orderly performance and completion of the work.

2. Contractor shall adhere to the schedule, and shall submit periodic progress reports and proposed schedule changes in the form and manner directed by COTR.

C. Project Closeout

1. Complete all required submittals and restore the site as required, including final cleaning.

2. Notify COTR in writing when Work is complete and ready for acceptance.

3. The COTR and Government will conduct reviews, inspections, and tests as needed to satisfy the COTR and Government that the Work conforms to requirements. The COTR will notify Contractor of any nonconformances.

4. Correct any nonconformances and then repeat the above acceptance procedure as required by the COTR and Government until the work is accepted.

5. Neither notice of acceptance nor final payment shall constitute waiver of Contractor's guarantee or warranty.

SECTION 01100

SAFETY AND HEALTH
12/01

PART 1 GENERAL

1.1 SCOPE

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

1.2 REFERENCES

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

CODE OF FEDERAL REGULATIONS (CFR)

29 CFR PART 1926	Safety and Health Standards for the Construction Industry
29 CFR PART 1910	General Industry Safety and Health Standards
Title 40	Protection of Environment, EPA

BAY AREA AIR QUALITY MANAGEMENT DISTRICT (BAAQMD)

Regulation 11, Rule 1	Lead

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(1993) National Electrical Code

CALIFORNIA OCCUPATIONAL SAFETY & HEALTH ADMINISTRATION (CAL-OSHA)

Title 8, Div. 1, Ch. 4	Construction Safety Orders (Division of Industrial Safety)

CODE OF CALIFORNIA REGULATIONS (CCR)

Title 26	Toxins

SANTA CLARA COUNTY HEALTH DEPARTMENT (SCCHD)

Hazardous Materials Storage Ordinance

CITY OF MOUNTAIN VIEW

Industrial Waste Ordinance, Provision Pertaining to Sewer Service and Sewage Disposal

CITY OF SUNNYVALE

Title 12	Water and Sewers

NASA POLICY AND PLANS

AHB 1700-1	(1988) Ames Health and Safety Manual

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z359.1	(1992) Safety Requirements for Personal Fall Arrest Systems
ANSI A90.1	Safety Standard for Manlifts
ANSI A92.2	Standard for Vehicle Mounted Elevating and Rotating Work Platforms
ANSI B30.5	Safety Code for Crawler, Locomotive, and Truck Cranes

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

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

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION AMES HANDBOOK (AHB)

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

1.3 SUBMITTALS

Submit the following per Section 01300, "Submittals":

SD-06, Instructions

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

SD-09, Reports

Safety Clearance Permit Requests, submit at least 24 hours in advance of covered work.

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

Accident Reports and Records, as required.

Crane Inspection Reports, submit daily when operated.

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

Crane Compliance Certification; submit for each crane 24 hours prior to bringing crane to Ames.

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

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

SD-20, Work Plan Safety Plan

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

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

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

A. Definitions

1. Competent person. One who is capable of identifying existing and predictable hazards in the surroundings or working conditions that are unsanitary, hazardous, or dangerous to employees and who has authorization to take prompt corrective measures to eliminate them.

2. Safety plan. The safety plan is one distinct part of the work plan. It includes hazard control details required by this section. An IIPP complying with 8 CCR 3202 is an acceptable equivalent, however the requirements in this section for a job-specific safety plan and site specific Activity Hazard Analyses must be provided additionally, prior to start of work.

3. Job-specific safety plan. A detailed plan that describes anticipated potential hazards and planned controls for this particular project. It comprises the bulk of the safety plan and its specific contents are described in this section.

4. Activity hazard analysis. A detailed analysis of potential hazards and planned controls for distinct phases of the work. These details are generally beyond the scope of the Job-specific safety plan but are necessary due to potential for significant mishap. Specific contents are described in this section.

1.4 GENERAL RESPONSIBILITIES

Provide safety and health measures to insure a safe, healthy environment for employees, including those of subcontractors, and for other workers, bystanders and visitors in area of Contractor's operations.

Comply with procedures prescribed by the Government for control and safety of visitors to the site.

Familiarize employees and subcontractors with all safety requirements and enforce them.

Advise COTR of any special safety restrictions established, so that Government personnel can be made aware of them.

Require that superintendent give personal, on site attention to the Safety Plan while any work is in progress.

New Employee Indoctrination. New employees shall be informed of specific site hazards before they begin work. Document in daily log.

Training Certificates: Contractor shall maintain a file of certificates for all training required by 29 CFR 1926 and 1910 as applicable for each person engaged in hazardous work. File shall be accessible and upon request made available to the Contracting Officer or appointed representative for review and verification for quality control purposes.

Contractor shall avail Contracting Officer or appointed representative access to contractor's activities to determine adequacy of hazard prevention measures. Contractor shall also provide access for NASA Headquarters and Center safety program review teams to conduct selected announced and unannounced reviews of contract operations.

Contractor is responsible for safety requirements compliance by all subcontractors at every tier. All subcontracts pursuant to this contract shall include safety requirements of this section.

Work requiring confined space entry shall be performed only by contractor's having one year or more experience in similar work. Contractor shall have an implemented confined space program based on a written procedures and responsibilities for testing, entry, permitting, evaluating, hazard control, rescue, qualifications and training.

Notify the COTR and Ames Safety Office immediately upon discovery that OSHA or other regulatory agency is conducting an inspection of the job site.

1.5 EMERGENCY PHONES

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

1.6 FIRST AID FACILITIES

Post emergency phone numbers at the jobsite. Report all emergencies by dialing 911 on Government phones, or 604-5555 on other phones. Ambulance, fire, and police services are available through this number, 24 hours a day. The AMES Health Unit is located on the West end of building N215, on Durand Road, across the street from the north side of the cafeteria. It is open Monday through Friday, between 7:30 a.m. and 4:30 p.m., for emergency care.

1.7 NON-COMPLIANCE

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

completed.

PART 2 SPECIFIC REQUIREMENTS

2.1 SAFETY PLAN

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

A. Code of safe practices, complying with 8 CCR 1509. This must be posted at job site.

B. Identify detailed contractual and supervisory means for controlling and coordinating safety responsibilities and activities of subcontractors and suppliers in accordance with this section.

C. Job-Specific Safety Plan. Address each of the following. Indicate for each item 4 through 10 if separate AHA will be provided.

1. Designated responsibilities of contractor's key personnel. Include names, safety qualifications and assignment details for controlling hazards on job site. Indicate name and professional certifications of the point of contact person responsible for safety on the site. This person must have adequate control of resources to abate hazards or stop work. Other key functions requiring responsible persons include reports and logs, exposure data monitoring, accident investigator and reporting. List training certifications required by 29 CFR 1926 and 1910 as applicable for designated key site personnel.

2. Include a list of safety clearance permits that will be required and a simple table listing anticipated hazards and control measures.

3. Safety meetings, inspections, and reports to be conducted or made.

4. Demolition plan.

5. Excavation plan.

6. Hazardous energy control plan.

7. Material and personnel lifting plan.

8. Fall protection plan.

9. Confined space plan. Identify the qualified person(s), training and experience. Delineate authority to direct work stoppage. Include procedure for rescue.

10. Asbestos and lead control plan. Incorporate by reference other specialized job specific safety plans required by this contract such as asbestos removal if applicable.

11. Other potentially hazardous tasks related to scaffolding, machinery, operational equipment, or electrical hazards.

12. Hazardous materials use. Provision for secondary containment of any hazardous material that will be brought on site. Inventory

or materials to be introduced to site. Plan for personnel protection during transport, storage and use including MSDS, labeling and hazard communications plan. Emergency spill plan.

13. Emergency response plan. Location, telephone numbers of emergency services and location of their posting on the job site. Procedures for securing an accident site until investigation by the government is complete. Procedures for securing work areas and protecting personnel in event of an accident or emergency. Accident reporting procedures.

14. Alcohol and drug control plan.

15. Unusual conditions. Power outage and weather contingencies.

16. Identify AHA's anticipated in course of work.

D. Safety meetings, inspections, and reports to be conducted or made.

E. Location/telephone numbers of emergency services and location of their posting on the job site.

F. Accident reporting procedures.

G. Procedures for securing an accident site until investigation by the government is complete.

H. Procedures for securing work areas and protecting personnel in event of an accident or emergency.

I. Provision for secondary containment of any hazardous materials that will be brought on site.

J. Job-specific safety plans shall include a list of safety clearances that will be required, and a tabulation of anticipated hazards and measures to be used to control the respective risks to acceptable levels.

K. Activity Hazard Analysis for each major phase of work. Submit as modification to safety plan prior to start of work sequence. As a minimum these shall include: preparatory, excavation, erection and roof work phases of construction.

2.2 SAFETY CLEARANCE PERMITS

A. A specific, written permit is required before conducting operations involving any of the dangerous operations listed below. Contractor shall insure that no such work is conducted prior to obtaining the permit, and that all provisions of the permit requirements are met. Contact COTR at least 24 hours in advance to obtain the required permit. Ensure person(s) is named and designated as competent person(s) and that qualifications and training are included in the Job-specific safety plan or AHA.

B. The granting of a permit in no way relieves the Contractor of responsibility for any injury or damage that might result from his operation. The granting of these permits may be contingent upon restricted areas or hours of operation or special safety requirements. Contractor shall comply with these requirements at

Contractor's expense. Contractor shall comply with these requirements and with the fire protection, electrical and construction site safeguarding requirements of NFPA 241, sections 5 to 11 at contractor's expense.

1. OPEN FLAME HEATING DEVICES or OPEN FIRES. Use of these devices requires a permit. Burning of trash, brush, or wood is prohibited.

2. EXCAVATION. Excavation or more beneath the surface requires a permit. Underground high voltage must be de-energized prior to pneumatic or machine powered excavation or subsurface demolition activities in vicinity. Obtain underground x-ray type survey to locate and mark ground for all buried electrical conduits whenever high voltage is suspected to be near planned digging.

3. CONFINED SPACE ENTRY. Entry or work in confined spaces, including but not limited to manholes and vaults, requires a permit. Provide training certificates for attendant, entrant(s) and rescue personnel at time of request for safety clearance permit.

4. FACILITY CLOSURE OR OBSTRUCTION. Obstruction of streets, walks, and parking areas, and other facilities occupied and used by the government Government requires a permit.

5. ELECTRICAL WORK. Work on electrical circuits or equipment of greater than 480 V requires a permit, and compliance with special provisions of AHB 1700.1. Work on live 480 V. parts is generally prohibited. When impractical to de-energize, work on electrical circuits or equipment of 480 V. or greater requires a safety clearance permit and compliance with special provisions of AHB 1700.1, Section 11.

6. WELDING, FLAME CUTTING, AND MELTING. These operations, when performed in an existing or occupied facility, require a permit.

7. CRANE LIFTS. Permits are required for lifting loads greater that 75% of rated capacity. Provide a lift plan at time of request for safety clearance permit.

C. Crane Compliance Certification. Provide for each crane entering Ames under this contract. Provide statement on company letterhead indicating that crane and rigging gear meet 29 CFR 1926.555, 952(c), and 406(a) requirements as applicable. Include operator training and qualification data.

2.3 HOLD OFF AND SPECIAL CONDITIONS TAGS

HOLD OFF and SPECIAL CONDITIONS tags are in general use on the site. They are used whenever equipment lockout or use only under specific, limited conditions is required to insure for a safe working environment. Contractor is required to ALWAYS HONOR THESE TAGS. If Contractor needs to have a tag removed or believes that one should be applied, it shall coordinate with the person who originally signed the tag to effect the application or removal.

A HOLD OFF tag constitutes an order not to operate a piece of equipment.

A SPECIAL CONDITIONS tag specifies the conditions or circumstances under

which the equipment may be operated. It constitutes an order not to operate the equipment except under the conditions or circumstances specified.

2.4 REPORTS AND RECORDS

Require superintendent to conduct weekly toolbox safety meetings with all Contractor and Subcontractor employees, and maintain copy of the minutes of these meetings in the project file.

Immediately make an oral report to COTR of any accident that results in one of the following: fatality; disabling or lost-time injury; injury requiring medical treatment; property contamination; or property loss of $10,000 or more. Submit a completed NASA Form 1627 within 24 hours of any accident. Submit a written report to COTR within 5 days of each incident, including investigative findings (but is not required to include an expression of opinion as to the negligence or fault of any employee) and proposed or completed corrective actions.

Maintain a log of safety inspections conducted, employee requests for inspections and verbal reprimands made to employees for safety violations.

2.5 SAFETY INSPECTION

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

2.6 FALL PROTECTION ANCHORAGE

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

2.7 PERMANENT SIGNAGE

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

2.8 CHEMICALS AND HAZARDOUS MATERIALS

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

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

2.9 LIFTING DEVICES

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

2.10 DUCT SYSTEMS

Interior of all ducting systems shall be free of insulating materials. Duct insulation, if needed, shall be installed on the duct exterior only.

PART 3 EXECUTION

3.1 GENERAL SAFETY RULES

Follow the following safety rules in addition to the requirements of federal OSHA, Cal/OSHA, and other laws and regulations.

Maintain the work area in a clean and tidy condition at all times. Remove debris and rubbish from the site daily or place in an approved dumpster, provided by the Contractor and removed as required. Keep emergency access and egress routes clear at all times.

Tie off and/or brace ladders to prevent movement. Do not permit workers to stand on any of the top three rungs of a stepladder.

Require employees to wear approved hard hats at all times in designated hard hat areas.

Raise and lower all tools and equipment by means of a bucket and/or rope. Do not permit employees to throw or drop items from one level to another.

Require all employees to use safety clothing and equipment appropriate to the work they are performing. Provide all necessary safety clothing and equipment, including: goggles or face shields, protective garments, ear protection, safety shoes, and safety belts. Train all employees in the proper use of these items. Insure that persons employed in cutting, chipping, burning, and similar operations use proper eye protection.

3.2 FIRE PREVENTION AND PROTECTION

Store and handle flammable liquids per NFPA 30, Flammable and Combustible Liquids Code.

Prohibit smoking in buildings and in dangerous areas, such as paint storage, fuel storage, confined space, and posted "No Smoking" areas.

Provide obstruction-free routing for persons carrying hot substances. Hot substances shall not be carried up or down ladders.

Store gas bottles upright and secured to prevent accidental tipping.

Provide, maintain, and make available at the site, a minimum of two portable fire extinguishers. For welding and torch-cutting work, these shall be in the immediate vicinity of the work.

Prohibit open fires or salamanders in construction areas.

3.3 EXCAVATION

Obtain from COTR prior to any excavation the locations of the underground utilities in the area and mark these locations on the ground surface. The elevations and exact locations of all utilities are not known; therefore, exercise caution in all excavation work to avoid damaging existing utilities.

Conduct all excavation under the direct, on-site supervision of a qualified, person with experience in earthwork and knowledgeable of the requirements of Article 6 of the California Construction Safety Orders. This person shall be named on the Excavation Permit Request. The competent person shall inspect the excavation daily and after every rainstorm or other hazard-increasing occurrence, before any person is allowed to enter the excavation. If inspection reveals a potential hazard, it shall be mitigated before any person is allowed to enter the excavation. Keep a log of these inspections and submit a copy to COTR with each weekly tool-box meeting minutes.

Shore all excavations or more in depth. Shoring shall meet the requirements of OSHA (29 CFR 1926.652(c)). Shoring for excavations over in depth shall be designed by a California registered Civil Engineer, and design shall be submitted to COTR for approval.

When work is being done in trenches deeper than , provide ladders or other safe means of egress in the trench, so as to require no more than of lateral travel for employees; and provide at least one Contractor employee to stand by above ground, ready to give assistance in an emergency.

Barricade open trenches and excavations to comply with regulations and to the satisfaction of COTR. "Sawhorse" barricades and warning tape do NOT constitute an acceptable barricade. Provide and maintain warning lights at night, and signs. In addition, use safety cones and warning flags to direct traffic around such openings.

3.4 CONFINED SPACE WORK

A. If entry into confined space(s) is required, implement a confined space entry program compliant with applicable regulations (the federal OSHA confined spaces standard applies in areas of federal jurisdiction, which is most of the Center; the CAL-OSHA confined spaces standard applies for spaces north of Hunsaker Road and west of Lindbergh Road).

B. Confined spaces are those that have extremely limited provisions for entry and exit, have poor natural ventilation, or contain or may contain hazardous atmosphere.

C. Blind, block or disconnect all pipelines that may contain flammable or hazardous substances and that enter a confined space, before entry.

D. If tests determine that hazardous conditions exist, remove all hazardous substances, and/or provide ventilation to the satisfaction of Safety Engineer prior to entry.

E. When oxygen-consuming or hazardous-substance-producing procedures are to be employed in the confined space, or when the Safety Engineer

determines that a hazardous atmosphere may develop during work, provide a qualified person and adequate testing devices to monitor air quality during the entire work period, at Contractor's expense.

F. Provide at least one employee to stand by outside of the confined space, ready to give assistance in an emergency. When open manholes or vaults are barricaded, provide warning lights at night, and signs. Place rescue and retrieval body lifting device in a ready position above spaces greater than 5 feet in depth.

G. Whenever it is necessary to work in an area equipped with an automatic CO_2discharge system, lock closed and tag the CO_2 isolation valve before entering the area. An audible alarm shall precede the activation of the CO_2 discharge system. When the alarm sounds, all personnel shall leave the area immediately. Do not re-enter the area without proper breathing apparatus unless gas detection tests have been made and the area declared safe.

H. Other specific requirements for confined space work include:

1. Use manhole cover hooks, cover lifters, or recessed handles for removing or replacing manhole covers.

2. Enter and exit manholes by means of a ladder whenever possible. Manhole covers and gratings shall be properly seated when replaced.

3. Use only NEC-approved lighting units for illumination when working in confined spaces.

4. Prohibit matches or and smoking in confined spaces.

5. Ground all air-driven tools used around energized cables.

6. Return expired entry permits and exit evaluations to Contracting Officer, Ames Safety Office, M/S 218-1.

3.5 FACILITY CLOSURE OR OBSTRUCTION

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

3.6 ELECTRICAL SAFETY

Properly ground any electrical equipment or circuit before working on it. Unless prior approval has been given by COTR, it shall be disconnected from the power source.

Protect portable electric tools with standard 3-prong grounding plugs or use double-insulated tools. Unplug tools when not in use.

Use ground fault interrupters on all temporary electrical lines and cables. Route temporary wiring and cables to prevent tripping hazards.

When permanently removing equipment or circuits, the wiring, conduit, and boxes shall be removed back to the source, unless otherwise specified.

3.7 WELDING, FLAME CUTTING, AND MELTING

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

3.8 RADIATION FOR NONDESTRUCTIVE TESTING

Use of radioactive materials, radiation producing machines, or particle accelerator equipment is not allowed on-site, UNLESS written authorization has been obtained from the NASA Radiation Safety Officer. Ames Research Center is a federal site under the jurisdiction of the Nuclear Regulatory Commission (NRC).

All non-NRC licensed radiographers shall obtain a reciprocity agreement with the NRC prior to bringing sources on site. A copy of the radiography contractor's license to conduct radiography and its company safety manual shall be kept on file with the NASA Radiation Safety Officer.

Conduct permitted radiation operations only under the surveillance of a NASA representative. Conspicuously post the area and erect barriers, as required by Title 10, Code of Federal Regulations, Part 34.42. During hours of darkness, the signs shall be conspicuously illuminated with an amber or white light. Maintain direct surveillance of the area to protect against unauthorized entry. Maintain a properly calibrated survey meter on site and conduct periodic monitoring.

Unless otherwise specified, non-destructive testing shall be in accordance with MIL-STD-271, modified by deletion of all reference to Bureau of Ships and other Navy agencies and substitution of NASA therefore. Radiographs shall be performed in a manner consistent with Title 10, CFR and approved by the COTR, and in the presence of an approved radiographer. Radiography shall normally be required to be performed outside of normal working hours. Immediately report to the RSO any loss of radioactive material or any radiological health hazard or emergency. Upon completion of radiological operations, notify the RSO and remove warning signs and ropes.

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

3.9 EXPLOSIVES

Explosives shall not be used or stored on site.

3.10 ASBESTOS

Unless otherwise specified, no asbestos-containing materials are to be used by the Contractor.

All materials to be encountered on the site may contain asbestos unless specifically identified otherwise. Except as specified, no asbestos-containing material is expected to be encountered on the site. If such unspecified material is encountered, immediately inform the COTR.

Unless otherwise instructed, do not break, burn, or disturb any materials containing asbestos. If COTR determines it necessary, arrange for removal, disposal, and/or isolation of the material. Perform such work for the lowest cost while meeting regulatory requirements.

Handle asbestos-containing materials as specified in Section 02080, Asbestos Abatement.

Specifically address asbestos in Safety Plan and discuss the operations and precautions planned to mitigate worker exposure to the fibers.

3.11 LEAD

Existing painted structural and miscellaneous steel and steel pipe shall be assumed to be coated with lead-based material, unless otherwise specified. All requirements for lead-containing materials and lead-producing operations, contained in the referenced regulations shall be met, as shall the additional requirements below.

Demolition and abatement of lead-based paint shall be performed as specified in Section 02090.

Burning or welding through lead-based paint will not be permitted is prohibited. Vacuum-blasting operations is permitted, provided that the operator wears approved respiratory protection. General blasting shall be contained to prevent lead levels in excess of the General Industry standard outside of the containment. Ground level concentrations of lead outside of the immediate work area shall not exceed the limit specified by the Bay Area Air Quality Management District (BAAQMD) in Regulation 11, Publication 1, Lead.

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

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

3.12 PRESSURE SYSTEMS

Work on systems designed for gas pressures above , or liquid pressures above , is subject to special provisions of AHB 1700-1, in addition to those of this section.

3.13 POLLUTION PREVENTION

A. Contractor shall ensure that construction, demolition, and excavation practices do not cause pollutant discharges on Ames Research Center and Moffett Federal Airfield.

1. Staging Area - The Staging Area, to the maximum extent practicable, shall not be located near catch basins, gutters, drainage ditches, and creeks. Routine inspection of the jobsites shall be performed periodically to ensure that construction, demolition, and excavation materials (liquid or solid) are not entering the storm drain system or causing pollution. The jobsite shall be kept orderly. Storm drain catch basins shall be covered to prevent pollutants and sediments from entering the storm drain system. Scrap, debris, and nonhazardous waste material shall be collected and disposed of properly.

2. Street Sweeping/Catchbasins - Roadways and on-site paved areas involved in or impacted by the project shall be cleaned and swept periodically. Use of water to flush down streets in place of street sweeping is prohibited. Catch basins impacted by the project shall be inspected and vacuumed, if necessary, at project completion.

3. Dumpsters/Bin - Dumpsters shall be periodically inspected for leaks. Leaking dumpsters shall be replaced or repaired. Discharging water on-site from cleaning dumpsters is prohibited. Waste collection shall be scheduled before the dumpster overflows.

4. Hazardous Material/Waste Storage - Hazardous materials such as pesticides, paints, thinners, solvents, and fuels; and hazardous wastes such as waste oil and antifreeze; shall be labeled and stored in secondary containment in accordance with the Santa Clara County Hazardous Materials Storage Ordinance and applicable State and Federal regulations. These hazardous materials and hazardous wastes shall be covered wherever practicable.

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

1. Usage - The manufacturer's instructions regarding uses, application, protective equipment, ventilation, safety precautions, and mixing of chemicals shall be followed.

2. Disposal - Hazardous wastes generated by the project, including light ballasts, shall be handled, and managed properly. Contractor shall transfer hazardous wastes to a designated location at the Center for disposal by the Government.

3. Spill Prevention and Control - Spill cleanup materials (such as rags or absorbents) shall be maintained and be readily accessible. Releases shall be immediately contained and measures implemented to prevent leaks and spills from entering storm drains. Releases are prohibited from being washed into streets, gutters, and storm drains. Releases shall be reported to COTR and Ames Code DQH.

4. Contractor Training and Awareness - Employees/subcontractors shall be trained on the pollution prevention requirements contained in these specifications. The Contractor shall inform subcontractors of the pollution prevention contract requirements, and shall include appropriate subcontract provisions to ensure

that these requirements are met.

5. Painting - Painting products shall conform to Regional Air District (BAAQMD) Rule 8 for VOC contents. Before project commencement, Material Safety Data Sheets shall be submitted to Ames Code DQH for review and approval of the products to be used. Solvent usage shall be monitored, and the amounts used shall be reported to Ames Code DQH.

   Water-Based Paint - Remove as much excess paint as possible from brushes, rollers, and equipment before starting cleanup. To the maximum extent practicable, measures shall be implemented to dispose of wash water from aqueous cleaning of equipment and tools to the sanitary sewer. Otherwise, cleaning of painting equipment and tools shall be conducted in a designated area that will not allow run-on of stormwater or runoff of spills. The rinsate shall be containerized for subsequent discharge. Cleaning equipment, vehicles, or tools over catch basins, into streets, gutters, storm drains, or creeks is prohibited. Dispose of dry, empty paint cans/buckets, old dry brushes, dry rollers, dry rags, and dry drop cloths in the trash.

   Oil-Based Paint - Remove as much excess paint as possible from brushes, rollers, and equipment before starting cleanup. To the maximum extent practicable, filter paint thinner and solvents for reuse. Dispose of waste thinner and solvent, and sludge from cleaning of equipment and tools. Dispose of dry, empty paint cans/buckets in the trash. Discarded items including material containers, old brushes, rollers, rags, and drop cloths shall be disposed of as a hazardous waste if they are heavily contaminated.

3.14 LIFTING

Personnel Lifts. Occupied scissor lifts shall be lowered prior to horizontal relocation. Hard hats shall be worn while in lifts. Personal fall restraint devices shall be utilized. Personnel lifting shall comply with ANSI A90.1 and A92.2.

Materials Lifting. Comply with rigging requirements of ANSI B30.5 and AHB 1700.1 sections 17.4.5 to 17.8. Tandem lifting is prohibited. Each load shall be rigged and attached independently to the hook or master-link in such a fashion that the load cannot slide or otherwise become detached. Lifting of multiple rigged materials on a single hook or master-link, also known as Christmas-tree lifting or tandem lifting is prohibited.

3.15 DEMOLITION

Avoid production of dust during concreted demolition. Wet concrete before demolition. If dust is visible from concrete demolition, provide additional wetting of concrete.

-- End of Section --

SECTION 01300

SUBMITTALS
12/01

PART 1 GENERAL

1.1 SCOPE

This Section applies to all Work done under this Contract.

Submittals (SD) are drawings, diagrams, schematics, descriptive literature, illustrations, schedules, performance and test data, samples, and similar materials that are to be furnished by the Contractor. Submittals explain in detail the manner in which the Contractor will conduct specific portions of the Work.

1.2 SUBMITTALS

A. At or before the preconstruction conference, or as requested by the COTR, Contractor shall provide a list of required submittals, including for each submittal the "SD" number and identifying title of the submittal, the Contractor's scheduled date of submittal, and need date for any related COTR approval to proceed.

B. Submittals shall use SI units except for generic data that are not project-specific.

C. Submittals shall be provided by the Contractor, and shall not be submitted directly by lower-tier subcontractors.

D. The following are descriptions of submittals.

1. Those marked with a plus (+) are required; those marked with an additional plus (++) require COTR's approval to proceed prior to ordering affected product(s) or proceeding with the affected work, unless specified otherwise on the drawings or in the design package.

2. Those marked with an asterisk (*) are required only if specifically requested on the project drawings, materials/products to which they the required submittals apply. Those marked with an additional asterisk (**) require COTR's approval to proceed prior to ordering the affected product(s) or proceeding with the affected work described., unless specified otherwise.

3. Others shall be submitted only if they are pertinent to the scope of the Work (per the technical sections of these specifications), and COTR's approval to proceed is not required for these, unless specified otherwise.

**SD-01, Data

Calculations, descriptions, or other documentation regarding the work.

**SD-02, Manufacturer's Catalog Data

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

SD-04, Drawings

**Shop Drawings - Scaled drawings, schematics, and diagrams illustrating details, configuration, components, or function of a part of the work and/or connections or relationships among various parts of the work.

+As-Built Drawings - Complete set of contract and shop drawings that provide current factual information including deviations from, and amendments to the drawings and changes in the Work, concealed and visible. Lines, letters, and details shall be sharp, clear, legible, and drawn to the original scale. Submit one set of full size prints with alterations shown in red. Submit circuit panel schedules and one-line electrical drawings according to Section 16000, PART 1, 1.3 SD-04, As-Built Drawings.

SD-05, Design Analysis and Calculations

**Engineering analyses and calculations that verify that the individual end items meet contract requirements. Unless otherwise specified, these shall be performed and stamped by a Professional Engineer licensed in California.

**Mix designs for each type of concrete, grout, asphalt concrete, or blended material including a complete list of ingredients and admixtures; and applicable test reports verifying that the mix meets contract requirements.

**Equipment Performance Data providing information on use life, system functional flows, safety features, mechanical automated details, automatic interlocks, and such features as electrical system protective device ratings. Curves indicating tested and certified equipment response and performance characteristics.

*SD-06, Instructions

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

*SD-07, Schedules

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

**SD-08, Records

A document required of the Contractor, or the manufacturer of a

product, documenting procedures, qualifications, or other verification of quality.

SD-09, Reports

+Progress Reports, per Section 01000

+Safety Reports, per Section 01100

SD-10, Test Reports

Certified reports of inspections and tests, including analysis and interpretation of test results, test methods used, and compliance with recognized test standards.

SD-13, Certificates of Compliance

Supplier's or manufacturer's statement that the supplied product meets specified requirements, signed by an official authorized to certify in behalf of supplier or manufacturer, and identifying quantity and date of shipment to which the certificates apply. Certificates are not required if the submitted Catalog Data certifies the material as meeting the specification, or if the manufacturer affixes a label or other marking to the product that certifies this.

SD-14, Samples

**Product samples - Full-sized, complete examples of the manufactured product proposed for use, fully fabricated, with the specified finish. Provide the full set of available choices for selection of color, finish, and texture.

**Material samples - Representative samples of construction materials proposed for use on the project, in quantities sufficient to perform the specified laboratory tests.

+SD-18, Record of Existing Conditions

Record of Contractor's survey of work area conditions and features of existing structures and facilities within and adjacent to the jobsite; including the location and extent of any cracks or other damage and a description of surface conditions existing prior to start of Work. This may take the form of photographs or videotape. It shall be made by the Contractor and submitted before beginning on-site work.

*SD-19, Operation and Maintenance Manuals

Bound sets of instructions and data, grouped by technical sections, including manufacturer's brochures, schematics, operating instructions and procedures, operating limits, safety precautions, preventive maintenance requirements and procedures, repair procedures, special tools list, and repair parts list.

SD-20, Work Plan

++Safety Plan - Detailed procedures defining the Contractor's provisions for accident prevention and health protection of its

workers, subcontractors, and government workers, and describing actions taken in case of accident. Per Section 01100, Part 2.1, job-specific safety plans shall include a list of required safety clearance permits and a tabulation of anticipated hazards and mitigation methods, and all of these materials shall be submitted with the Construction Plan.

++Construction Plan - Detailed procedures defining the precise manner in which the Contractor intends to perform construction activity, including equipment and techniques used and protection and controls.

++Quality Control Plan - Contractor's detailed procedures, instructions, and reports to be used to assure compliance with the contract, including a listing of outside testing agencies and engineers to be employed by the Contractor. This plan must include provision for: purchase control and receiving inspections, control/disposition of non-conforming work, inspection/test plans and procedures, calibration control, and training and qualification programs. If Contractor has submitted a General Quality Control Plan, only revisions to address the unique aspects of the Work are required to be submitted for a specific project.

++Project Schedule - Contractor's schedule to perform the work as described in Section 01000.

**Welding Procedures and Qualifications - Contractor prepared welding procedures and procedures for and records of the qualification of operators for each type weld to be used.

SD-21, Delivery Docket

Bill of lading for construction materials, giving supplier's mix number, time of batching, quantity delivered, Contractor's name, and time clear.

1.3 PREPARATION AND DISPOSITION

A. Identification - Mark each drawing sheet, data set, and sample to identify it by Project name and Contract number; Contractor name, address, telephone number; Subcontractor/supplier's name, address, telephone number; specification or drawing reference; submittal name and date.

B. Drawings

1. Drawings shall be prepared on translucent, reproducible sheets, between x and x in size; to accurate scale, with scale indicated.

2. Submit one reproducible and four prints of each drawing. Two marked prints will be returned to the Contractor.

C. Data

1. Data submittals for each specific material, product, unit of work, or system shall be collected into a single submittal and marked for choices, options. Marking of each copy submitted

shall be identical.

2. Submit one original and four copied, indexed, and bound sets of all data. Two marked copies will be returned to the Contractor.

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

1.4 REVIEW AND DISPOSITION

A. Contractor shall review submittals from subcontractors and suppliers to ensure compliance prior to submittal to the Contracting Officer. Contractor shall return any unsatisfactory submittals to the subcontractor for timely correction prior to submittal.

B. Contractor shall furnish submittals to the Contracting Officer for COTR disposition.

C. COTR will review submittals and provide pertinent notation within 10 calendar days after receipt. Failure by COTR to complete the review within this time may be grounds for a time extension, but not for a change in contract price, unless the delay is over 30 days.

D. COTR will return submittals with one of the following dispositions:

1. "APPROVED" authorizes the Contractor to proceed with the work in accordance with the associated submittal.

2. "APPROVED AS CORRECTED" authorizes the Contractor to proceed with the work in accordance with the associated submittal, provided no exceptions are taken to the indicated corrections. If Contractor takes exception to indicated corrections, resubmittal is required prior to proceeding with affected work.

3. "RESUBMIT" requires the Contractor to make required additions and to resubmit for approval before proceeding with the work.

4. "DISAPPROVED" indicates noncompliance with the contract requirements and requires the Contractor to make the necessary corrections and to resubmit for approval, prior to proceeding with the work.

E. Approval to proceed does not constitute acceptance or approval of the submittal, and does not relieve Contractor from full compliance with contractual obligations. Contractor's failure to point out deviations from the contractual requirements may result in COTR requiring removal and replacement of such work at Contractor's expense.

F. If Contractor considers any correction or disposition to constitute a contractual change, it shall immediately notify the Contracting Officer.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

-- End of Section --

SECTION 01400

QUALITY CONTROL
12/01

PART 1 GENERAL

1.1 SCOPE

This section applies to, and is a component part of, each section of the specifications.

The work to be performed under this specification shall be accomplished in strict accordance with professionally recognized standards for building construction. The Contractor is solely responsible for the quality of construction and for making those submittals, inspections, and tests specified by the technical sections of this specification as the Contractor's responsibility. Contractor is also responsible for documentation and notifying COTR of the results of tests required.

Contractor's in-house Quality Control program shall be used to the maximum extent possible, subject to meeting the requirements of this specification.

1.2 SUBMITTALS

The following shall be submitted per Section 01300, Submittals:

SD-05, Mix Designs

At least 14 days before commencement of concrete, pavement, or masonry work, mix designs for concrete asphalt concrete and/or mortar shall be submitted. Use of a mix shall not begin before COTR's approval to proceed.

SD-10, Test Reports

Test reports for Contractor-conducted tests will be submitted within one working day of completion of the test. Test reports for construction materials will be submitted at least 14 days prior to inclusion of the materials in the work. Reports are required for imported fill, asphalt concrete materials, masonry units, structural steel, and reinforcing steel.

SD-13, Certificates of Compliance

Certificates of Compliance for each item of mechanical or electrical equipment shall be submitted prior to incorporating that piece of equipment into the work.

SD-20, Quality Control Plan

Quality Control Plan, within 7 days of the Notice to Proceed. No production or on-site work shall begin before COTR's approval to proceed.

SD-20, Welding Procedures and Qualifications

Welding Procedures and Qualifications, 2 complete sets. Production welding shall not begin until COTR's approval to proceed. Each weld shall be stamped with the identification number of operator making that weld.

SD-21, Delivery Certificates

Delivery Certificates, shall be submitted within one working day of delivery of materials to the site. Certificates are required for imported fill, ready-mixed asphalt concrete, asphalt concrete materials, ready-mixed concrete, concrete materials, metal decking, and roofing materials.

1.3 DEFINITIONS

Inspection - Examination and test of supplies, services, materials, components, or assemblies to determine contract performance.

Testing - Element of inspection that determines the properties or functional operation of materials or components, by the application of established scientific principles and procedures.

Independent Testing Agency - An organization, approved by COTR, engaged to perform specific inspections or tests of work, either at the construction site, or elsewhere, and report the results.

1.4 METRIC EDUCATION

The Contractor shall provide its employees with training guides and measuring tools to assist them in using the SI metric system of measurement. SI units shall be used in correspondence.

PART 2 PRODUCTS

2.1 MANUFACTURE

Materials, equipment, and fixtures to be provided shall be the standard catalog products of manufacturers regularly engaged in their manufacture; shall meet the specified and the detailed requirements; shall be suitable for the installation shown, and shall represent products that have been in satisfactory use for at least 2 years.

Where two or more units of the same class are furnished, the units shall be from the same manufacturer and shall be interchangeable. Products shall be new, free from defects, and of the size, make, type, and quality specified and indicated in the manufacturer's catalog data.

2.2 DELIVERY AND STORAGE

Materials, equipment, and fixtures shall be delivered to the site in their original, unopened containers, bearing labels identifying the manufacturer's name, brand name, and material, and while stored at the site, shall be fully protected from damage, dirt, debris, and weather.

Products provided with a factory finish shall be fully protected during construction and shall be maintained free of dust, dirt, and other foreign matter. Dents, marred finishes, and other damage shall be repaired to the satisfaction of COTR, or the product shall be replaced at Contractor's

expense.

PART 3 EXECUTION

3.1 GENERAL

Conduct all inspections and tests, required by the specifications, on material and equipment fabricated off-site. Submit records of such tests and inspections to COTR at least 24 hours before incorporating the materials/equipment in the project.

Unless otherwise specified, inspections and tests of on-site work, required by the specifications, of on-site work, shall be made by the Government inspector, who will provide a copy of the report to the Contractor.

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

3.2 DAILY INSPECTION

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

3.3 SCHEDULED INSPECTIONS/TESTS

A. Inspections and tests, other than day-to-day monitoring of field work, whether conducted by the Contractor or the Government, will be scheduled by the Contractor, with designated inspector, at least 24 hours in advance. Contractor shall provide time and access to conduct the inspection/test. Contractor shall not cover any work requiring inspection/test before that work has been approved by the Inspector. Failure to comply with this requirement may require the re-exposure of such work and recovering and repair, all at Contractor's expense.

B. Scheduled Inspections - The following scheduled inspections are required, and will be performed by the Government. These are in addition to any required by other sections of this specification:

1. Site utilities - Performed after piping, conduit, etc. is in place and bedded, but before it is encased or backfilled.

2. Formwork/reinforcement - Performed after excavations, forms and reinforcement are complete, and before any concrete is placed.

3. Underfloor - Performed after all in-slab or under-floor building service equipment, conduit, piping, accessories, and other ancillary items are in place, and before any concrete is placed or floor sheathing installed.

4. Bolting/welding - Performed after all bolting/welding has been completed, but before it is covered by other work.

5. Rough-out - Performed after light framing, rough plumbing, rough electrical, and ductwork is complete, and before sheathing, lath and drywall are applied.

6. Sheathing - Performed after all sheathing, wallboard and lath are in place, but before roofing, taping, or other finishes are applied.

C. Tests - The following tests are required, in addition to any required by other sections of the specification.

1. Hydraulic testing of piping - Performed after piping is in place, but before it is covered. Hydraulic testing shall be performed by the Contractor.

2. Grounding/meggering - Required of all circuits designed for 480 V or more. Performed after all conductors are in place, but before final connection to the power source.

3. Slump test - Required of each load of concrete, prior to and during placement in the forms. In addition, sampling for compressive testing will be conducted when specified 28-day compressive strength is 20 MPa or more.

4. Density test - Required of each lift of backfill.

3.4 REPORTING

Inspection/Test reports for Contractor-conducted tests shall be submitted within one working day of completion of the test.

Inspection/Test reports for Government conducted tests will be transmitted to Contractor within one working day of completion of the test.

Contractor shall not cover any item of work subject to inspection/test before results of inspection are satisfactory.

3.5 CORRECTIVE ACTION

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

3.6 GOVERNMENT INSPECTION AT SUBCONTRACTOR OR VENDOR FACILITIES

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

-- End of Section --

SECTION 01500

ENVIRONMENTAL COMPLIANCE AND POLLUTION PREVENTION
12/01

PART 1 GENERAL

1.1 SUMMARY

The pollution prevention, environmental compliance, and sustainability provisions described in this section apply to all work conducted on Ames Research Center and Moffett Federal Airfield under this contract.

The information in this section is in addition to the requirements provided in the detailed sections.

1.2 REFERENCES

Bay Area Air Quality Management District (BAAQMD)

BAAQMD Rules and Regulations	Air Quality
BAAQMD Regulation 8, Rule 3	VOC Content, Architectural Coating Limits
BAAQMD Regulation 8, Rule 49	VOC Content, Aerosol Coatings
BAAQMD Regulation 8, Rule 51	Volatile Organic Compounds, Adhesives and Sealants
BAAQMD Regulation 8, Rule 29	Aerospace Coating Operations
BAAQMD Regulation 2	Permit Requirements
BAAQMD Regulation 11	Hazardous Air Pollutants

Code of Federal Regulations (CFR)

29 CFR 1910.120	Emergency Response Awareness Level/Operators Training
29 CFR 1910.1200	Hazard Communication Training
40 CFR 82	Protection of Stratospheric Ozone
40 CFR 112	Oil Pollution Prevention
40 CFR 1500	National Environmental Policy Act
40 CFR 260	Proper Management of Hazardous Waste
40 CFR 66265.16	Generator Training
49 CFR	Transportation
50 CFR 402	Endangered Species Act Regulations
40 CFR Part 247	Comprehensive Procurement Guidelines

10 CFR Part 435	Energy Conservation
California Code of Regulations (CCR)	
CCR Title 22 Section 66260, etal	Hazardous Waste Management
CCR Title 22 Division 19	State Fire Marshal
CCR Title 22 Division 19.1	Office of Emergency Services
CCR Title 23	Waters
CCR Title 24, Part 6	California's Energy Efficiency Standard
United States Codes (USC)	
16 USC 703	Migratory Bird Treaty
42 USC 6901	Resource Conservation and Recovery Act
42 USC 8251	Federal Energy Management
42 USC 13101- 13109	Pollution Prevention Act of 1990
NASA Policy and Plans and Executive Orders	
* AHB 8800.3	Ames Environmental Handbook
* SWPP	Ames Storm Water Pollution Prevention Plan
* SPCC	Ames Spill Control and Countermeasures Plan
* June 20, 1990	NASA Policy on CFC and Halon Compounds
* EO 13101	Greening the Government through Waste Prevention
* EO 13123	Greening the Government through Energy Efficiency
* EO 13148	Greening the Government through Leadership
* EO 13150	Federal Workforce Transportation
Santa Clara County	
* NS-517.31	Santa Clara County Hazardous Materials Storage Permit Ordinance
* Sunnyvale Municipal Code 12	City of Sunnyvale Waters and Sewer Ordinance
* Palo Alto Chapter 16	City of Palo Alto Sewer Use Ordinance
* CAG6 12001 General	Industrial Storm Water Discharge Permit
* SCC NS-517.44	Santa Clara County Toxic Gas Ordinance

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

1.3 SUBMITTALS

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

SD-01, Data

Site Inspection Checklists, every week for projects handling hazardous materials.

Request for Industrial Wastewater discharge form , at least 7 working days before commencement of discharge.

Hazardous Materials Inventories Statement (HMIS) and Material Safety Data Sheets (MSDS), at project commencement and as necessary to reflect changes in materials stored.

SDSs of proposed coating and/or adhesive materials, before bringing these materials on-site.

SD-08, Statements

Hazardous Waste Disposal Subcontractors before project proposed commencement.

Hazardous Waste Profiles, and supporting analytical data before disposal.

SD-18, Records

Training records, before project commencement and personnel changes.

Records of wastewater discharges, including dates and quantities of water discharged, weekly.

Spill Cleanup Records, as necessary.

Records of solvent (paints and other organic coatings) usage, monthly.

1.4 GENERAL RESPONSIBILITIES

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

1.5 DEFINITIONS

Hazardous Material - As defined by Chapter 6.95 of the State of California Health and Safety Code, any material that poses a significant present or potential hazard to human health and safety or to the environment if released into the workplace or the environment. Common examples are oil, fuel, caustic and acid cleaners, mineral spirits, petroleum distillate based solvents, oil based paints, aerosol spray paints, coolants and

antifreeze, and solvents/cleaners containing chlorinated compounds.

Solid Waste - Includes rubbish, debris, garbage, and other discarded solid materials resulting from industrial, commercial, construction, and agricultural operations, and from community activities.

Reclamation - As defined by California Code of Regulations, Title 22, Section 66260.10 means that a material is processed to recover a usable product, or that it is regenerated. Examples are recovery of lead from spent batteries and regeneration of spent solvents.

Hazardous Waste - As defined in California Code of Regulation Title 22, Section 66261.3. Hazardous Waste, includes extremely hazardous waste, acutely hazardous waste, RCRA hazardous waste, non-RCRA hazardous waste and special waste. Examples include waste paint, solvents, PCB transformers, contaminated soil, and oil.

Non-Sewerable - Wastewater that contains at least one contaminant above the allowable discharge limit set by the Publicly Owned Treatment Works (POTWs) for discharge to the sanitary sewer.

Recycle - to take something that would otherwise be thrown away and make it into something that can be used again. Examples include fluorescent light tubes and cardboard boxes.

Sustainability - design and green building principles, which call for buildings that are designed, constructed, renovated, and reused in a resource and energy efficient manner.

PART 2 MATERIALS

2.1 AIR QUALITY

A. Construction operations and materials used on the project shall be in compliance with the Rules and Regulations for Air Quality of the Bay Area Air Quality Management District (BAAQMD).

B. Adhesives and Sealants - Adhesive and sealant products shall conform to Bay Area Air Quality Management District (BAAQMD) Regulation 8, Rule 51 for Volatile Organic Compound (VOC) content - Adhesives and Sealants.

C. Architectural Coatings - Architectural coatings and paints shall conform to BAAQMD Regulation 8, Rule 3 for VOC content - Architectural Coating Limits.

D. Spray Paints - Spray paints shall conform to BAAQMD Regulation 8, Rule 49 for VOC content - Aerosol Coatings.

E. Chlorofluorocarbons (CFCs) and Other Class I Ozone Depleting Substances.

1. Class I Ozone Depleting Substances (ODS) as defined and identified herein shall not be used in the performance of this contract, nor be provided as part of the equipment. This prohibition shall prevail over any other provision, specification, drawing, or referenced documents.

2. Class I ODS is defined in Section 602(a) of the Clean Air Act and

includes the following chemicals:

a. Chlorofluorocarbon-11 (CFC-11)
b. Chlorofluorocarbon-12 (CFC-12)
c. Chlorofluorocarbon-13 (CFC-13)
d. Chlorofluorocarbon-111 (CFC-111)
e. Chlorofluorocarbon-112 (CFC-112)
f. Chlorofluorocarbon-113 (CFC-113)
g. Chlorofluorocarbon-114 (CFC-114)
h. Chlorofluorocarbon-115 (CFC-115)
i. Chlorofluorocarbon-211 (CFC-211)
j. Chlorofluorocarbon-212 (CFC-212)
k. Chlorofluorocarbon-213 (CFC-213)
l. Chlorofluorocarbon-214 (CFC-214)
m. Chlorofluorocarbon-215 (CFC-215)
n. Chlorofluorocarbon-216 (CFC-216)
o. Chlorofluorocarbon-217 (CFC-217)
p. Halon-1211
q. Halon-1301
r. Halon-2402
s. Carbon tetrachloride
t. Methyl chloroform.

3. Service, maintain, renovate, and demolish ODS containing equipment in accordance with 40 CFR 82. Prevent a discharge of ODS to the atmosphere. ODS recovery equipment shall meet applicable EPA requirements. Place recovered ODS in cylinders suitable for the type ODS (filled to no more than 80 percent capacity) and provide appropriate labeling. For new ODS added to existing equipment, provide the following data to Code QE, mail stop 19-21, within 48 hours of adding the new ODS: Type of ODS, quantity added, and date the work was performed.

4. The Contractor shall ensure that CFC refrigerants are recovered by a certified technician in accordance with the Final Rule of the Clean Air Act of 1990, Section 608, before the equipment is removed from Government property.

5. Aerospace Paints - All paints used on aerospace projects shall conform to BAAQMD Regulation 8, Rule 29 for VOC limits.

6. Reduce indoor levels of radon gas and formaldehyde emissions by following industry and USEPA guidelines on indoor environmental quality (see http://www.epa.gov/iaq for more information).

2.2 STORAGE AREAS

A. Hazardous Materials Storage

1. Hazardous materials storage shall be in accordance with Santa Clara County Hazardous Materials Storage Ordinance No. NS-517.31, and the General Storm Water Permit. Hazardous materials shall be handled in manner that minimizes the potential for releases. All liquid hazardous materials must be secondarily contained. Adequate spill response equipment shall be readily available.

2. Hazardous materials and hazardous wastes shall be labeled, handled properly, and stored in secondary containment at the end of each work day. Secondary containment shall be of adequate

size and compatible with the materials stored. Storage areas shall be properly labeled and secured.

3. At the beginning of the project, an accurate inventory of hazardous materials and hazardous wastes to be generated including the estimated maximum quantity of each hazardous material to be brought on-site shall be provided to the COTR. Material Safety Data Sheets (MSDSs) for hazardous materials shall be maintained by the Contractor so they are immediately available to assist emergency response personnel in the event of a hazardous materials incident.

B. Staging Area - In accordance with the Clean Water Act and Ames Storm Water Pollution Prevention Plan (SWPP), to the maximum extent practicable, the staging area must be located away from storm drain inlets, gutters, drainage ditches, and creeks.

C. Granular Material Storage - In accordance with the Clean Water Act and Ames SWPP, granular material shall be stored at least 3 meters from drainage ditches, catch basins, and curbs.

D. Refuse Bins - Refuse bins shall not be overloaded. Liquid materials shall not be placed in dumpsters or bins. Leaking dumpsters shall be replaced. Dumpsters and bins shall not be cleaned on-site. Dumpsters shall remain covered except when in use.

E. Landscaping - The Contractor shall control soil erosion and storm run-off to protect natural habitat from the project site to the satisfaction of the COTR.

F. Site Inspections - In accordance with Santa Clara County Hazardous Materials Storage Permit Ordinance No. NS-517.31 and Ames Industrial Storm Water Discharge Permit, the project site and storage areas shall be inspected weekly to ensure compliance. Compliance status shall be verified by the Contractor using the applicable portion of the checklist in Attachment A, or equal. The checklists shall be submitted to Code QE, mail stop 19-21, within 48 hours following the inspection.

2.3 CHEMICAL USAGE AND HANDLING

A. Hazardous material shall be used only as described on the Material Safety Data Sheet. The Contractor shall wear the protective equipment recommended by the manufacturer. Containers of hazardous materials and hazardous wastes shall be kept closed except when in use. Containers of liquid hazardous materials shall be stored in secondary containment at the end of each work shift.

B. Reclamation of Equipment Containing Hazardous Material Residues - The Contractor shall disclose to COTR the facility to which equipment containing hazardous material residues are shipped for reclamation, such as electrical wire wrapped with asbestos and electrical panels containing asbestos. The disclosure shall be documented on the Bill of Lading or by other written means.

C. Disposal of Non-Hazardous Waste Containing Hazardous Material Residue - The Contractor shall disclose to COTR the facility to which equipment containing hazardous material residues are shipped for disposal, such as steel coated with lead paint. The disclosure shall

be documented on the Bill of Lading or by other written means. Supporting analytical data shall be included to document the equipment is not hazardous waste.

D. Labeling

1. Containers, drums, vessels, tanks, and associated piping containing hazardous materials shall be labeled in accordance with California Code of Regulations Title 8 Section 5194 and the most recent edition of the Uniform Fire Code.

2. Label containers with description of contents, percentages of components (if not pure), hazardous properties, name of contact person or waste generator, phone number, and date. If material is a waste, container shall have a hazardous waste accumulation label.

2.4 SUSTAINABILITY

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

Minimize the amount of energy required during construction and operation by using resource efficient construction techniques, building systems (including HVAC, heating, electrical, water, lighting, heat-pumps and boilers), insulation, fixtures, appliances, and controls.

Whenever possible, utilize energy efficient office equipment through the Environmental Protection Agency's Energy Star labeling program (@ http://www.epa.gov/energystar/).

Use automated monitors and controls for energy, water, waste, temperature, moisture, and ventilation.

Conserve water with systems that reduce consumption and recycle water through reclamation and treatment systems.

Maximize the reduction, reuse, recycling or composting of waste and scrap materials.

Minimize waste, spillage, pilferage, spoil, and misuse of building materials.

Consider adaptive reuse, rather than demolition whenever possible.

Follow federal Comprehensive Procurement Guidelines (@ http://www.epa.gov/epaoswer/non-hw/procure/) for building materials and products, and select materials that have a long-life cycle; select least toxic materials; select recyclable materials; select materials that are resource-efficient; select materials with the maximum recycled content; select materials harvested on a sustained yield basis; select products causing the least pollution during their manufacture, use and reuse.

Reduce, reuse, and recycle to minimize consumption and waste in business operations.

Utilize life cycle cost analysis in the development process.

Utilize LEEDS (Leadership in Energy and Environmental Design Green Building System) in building design and construction. LEEDS, developed by the U.S. Green Building Council, evaluates a building's environmental performance over its life cycle, and assigns credits to projects for satisfying a list of criteria. The System provides a definitive standard for what constitutes a "green building" by awarding different levels of green building certification based on the total credits earned. Strive for the highest possible LEEDS rating in building design, and meet at least the minimum required score to achieve LEEDS Certification.

PART 3 OPERATIONS

3.1 WASTEWATER DISCHARGE PERMITS

A. In accordance with the Clean Water Act, the City of Sunnyvale Water and Sewers Ordinance, and the City of Palo Alto Sewer Use Ordinance, a specific written Incidental Sewer Discharge permit is required before discharging wastewaters to the sanitary sewer system from project activities such as excavation dewatering, saw cutting coolant water, cleaning operations, and decontamination water.

B. The Contractor shall complete and submit a Request for Incidental Sewer Discharge form to the COTR at least 7 work days before the planned discharged of groundwater or other wastewater. The request shall include the estimated discharge volume, discharge rate, source of the wastewater and the duration of discharge. The Government will sample the wastewater and obtain the discharge approval.

C. Wastewater Discharge

1. With the exception of groundwater from excavation, wastewater from Contractor operations shall be containerized by the Contractor until the Contractor is notified a discharge permit has been obtained.

2. The Contractor shall record and submit information specified in the discharge permit issued to the project including, but not limited to, the dates of discharge, quantity of water discharged, source of the wastewater, dates wastewater was sampled and analyzed (if required), and filtering method (if required).

3. Non-sewerable wastewater shall be disposed of by the Government in accordance with Paragraph 3.9, Government Disposal.

4. Non-sewerable wastewater shall be treated, managed, and disposed of properly by the Contractor in accordance with Paragraph 3.10, Contractor Disposal.

D. Groundwater Discharge - Groundwater from excavations shall be discharged in accordance with Section 02200, Site Preparation and Earthwork.

3.2 TRAINING REQUIREMENTS

A. All personnel shall be trained in the hazards and safe work practices for their tasks.

B. Personnel performing hazardous operations shall receive training as specified in applicable regulations.

1. Personnel handling hazardous materials shall have received Hazard Communication Training per 29 CFR 1910.1200 and CCR Title 8 Section 5194 and Emergency Response Awareness Level training per 29 CFR 1910.120. Employee training documents shall be kept at the jobsite.

2. Personnel containing spills or conducting cleanup of small spills shall have received First Responder Operators level training per 29 CFR 1910.120.

3. Personnel generating hazardous waste shall receive training on the proper management of hazardous waste per 40 CFR 66265.16 and CFR Title 22 Section 66265.16.

4. Personnel using personal protective equipment (PPE) shall receive training on its proper use per 29 CFR 1910.132.

C. Personnel handling hazardous materials shall have received Hazard Communication Training per 29 CFR 1910.1200 and CCR Title 8 Section 5194and Emergency Response Awareness Level training per 29 CFR 1910.120. Employee training documents shall be kept at the jobsite.

D. Personnel containing spills or conducting cleanup of small spills shall have received First Responder Operators level training per 29 CFR 1910.120.

E. Personnel generating hazardous waste shall have receive training on the proper management of hazardous waste per 40 CFR 66265.16 and CFR Title 22 Section 66265.16.

3.3 SITE OPERATIONS AND MAINTENANCE

A. Site Operations shall be conducted in accordance with the Clean Water Act and Ames Storm Water Pollution Prevention Plan.

B. Equipment Fueling and Maintenance - Equipment fluid changes and fueling shall be conducted over drip pans to prevent spilled materials from contacting the ground surface. The operator of leaking equipment shall contain and control the leak. All other maintenance and repairs of Contractor equipment is prohibited on-site.

C. Paint Clean-up

1. Painting operations must be conducted in accordance with Ames Storm Water Pollution Prevention Plan and applicable BAAQMD requirements.

2. Water Based Paints

a. The Contractor shall paint out as much excess paint as possible from brushes, rollers, and equipment before starting clean up.

Rinse brushes, rollers, and other tools over a sink that drains to the sanitary sewer using water only. Tools and equipment shall not be cleaned into streets, gutters, storm drains, or creeks. Dispose of dry brushes, rollers, rags, and drop cloths as solid waste.

b. Disposal of containers with any liquids as a solid waste is prohibited. These materials must be used elsewhere or handled as a hazardous waste and disposed of in accordance with Paragraph 3.10, Contractor Disposal.

3. Oil Based Paints

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

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

D. Paving Operations

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

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

E. Concrete/Asphalt Cutting and Core Drilling - The Contractor shall not allow slurry run-off from saw cutting or core drilling to enter the storm or sanitary sewer collection systems. Catch basins and drains shall be protected. The Contractor shall sweep/shovel up slurry cutting waste from work areas before leaving an area or at the end of each work day, whichever is sooner. If saw-cut slurry enters a drain, the Contractor shall remove the slurry and notify the COTR immediately.

F. Concrete Truck/Wash Out - Washing out concrete trucks or equipment into streets, gutters, storm drains, or creeks is prohibited. Trucks may be washed out on the ground surface in a location approved by the COTR.

G. Sweeping - Roadways and on-site paved areas impacted by the project shall be cleaned to the satisfaction of the COTR and swept at the end of each phase or at project completion. Hosing down paved areas and streets is prohibited.

H. Reclaimed Water - The Contractor shall use reclaimed water for dust control and other construction site operations unless an exception is

granted by the COTR. Reclaimed water is available at no cost from a hydrant located on Moffett Federal Airfield approximately 100 m west of the intersection of Macon Road and Fifth Avenue.

I. Storm Drain Management

1. Catch basins near the project shall be protected to prevent debris, pollutants, sediments and releases from entering the storm drain system. Catch basins shall be inspected and cleaned out to the satisfaction of the COTR at the end of each phase or at project completion.

2. The Contractor shall control soil erosion and storm runoff from the Contractor's site to the satisfaction of the COTR.

J. Broken/Ruptured Pipes - If the Contractor breaks a utility pipe, or observes any broken or leaking pipes, it shall immediately notify the COTR. The Contractor shall immediately notify Ames Environmental Office if the pipe contained any liquid except potable water. The Contractor shall berm the area to prevent run-off from releases of non-potable water from entering the storm drain.

K. Draining, Tanks, Piping, and Equipment

1. Tanks, piping, and equipment shall be drained as required. Devices to properly contain the product shall be provided by the Contractor. Storm drains in the vicinity shall be covered during drainage operations.

2. The Government will conduct the sampling of drained fluid in order to determine disposal options unless there is sufficient generator knowledge to determine disposal options.

3. The Government will obtain the necessary sanitary sewer discharge permits if the discharge is sewerable. Non-sewerable water shall be treated to a level to allow discharge to the sanitary sewer or managed and disposed of properly.

4. Disposal of drained fluid and associated costs shall be by the Government in accordance with Paragraph 3.9, Disposal.

L. Contaminated Soil Management

1. The Contractor shall notify the COTR immediately if soil appears discolored or has an odor. The Contractor shall place suspect soil on plastic sheeting and cover with a plastic tarpaulin. The suspect soil will be tested by the Government for contamination.

2. Contaminated soil shall be transferred to a designated on-site location for disposal by the Government in accordance with Paragraph 3.9, Disposal or properly disposed of by the contractor in accordance with paragraph 3.10.

3.4 ELECTRICAL PCB SPILL CLEAN UP

As specified in Section 16000, "Electrical".

3.5 SPILL PREVENTION, CONTROL, AND REPORTING

All liquid petroleum products must be secondarily contained in accordance with Ames Spill Prevention Control and Countermeasures Plan and 40 CFR 112, spill clean-up materials (such as rags, absorbent booms/pads), and tools (such as shovels and brooms) shall be maintained at the project site and be readily accessible. Releases of hazardous materials to the environment shall be contained and measures implemented to prevent leaks and spills from entering storm drains. Spills of hazardous materials to unpaved surfaces in excess of shall immediately be reported to Ames Environmental Office.

Dial 911 from any NASA phone or 650-604-5555 from an outside phone to request assistance of any spill by the Contractor.

3.6 BURROWING OWL HABITAT

The Contractor shall conduct its activities in a manner that does not negatively impact fauna or flora, in accordance with 40 CFR 1500, 50 CFR 402, and Ames Environmental Handbook AHB 8800.3.

The Contractor shall comply with the "Burrowing Owl Management Policy for Ames Research Center".

3.7 LEAD ABATEMENT

As specified in Section 02090, "Lead Abatement/Demolition".

3.8 ASBESTOS ABATEMENT

As specified in Section 02080, "Asbestos Abatement/Demolition".

3.9 GOVERNMENT DISPOSAL

A. The Contractor shall label, package, and secondarily contain hazardous wastes before submitting the hazardous wastes to the Government for subsequent disposal.

B. Hazardous Waste Manifest

1. NASA Ames Research Center shall be designated as the generator on the manifest and only approved Ames Environmental Office personnel shall sign the Uniform Hazardous Waste Manifests. Contractors shall not sign hazardous waste manifests.

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

3.10 CONTRACTOR DISPOSAL

A. Hazardous wastes generated by materials brought on site by the Contractor shall be properly handled, shipped, and disposed of as required by federal, state, and local regulations. No hazardous materials shall remain at the worksite upon completion of the project unless specified otherwise. The Government shall sample waste streams for purposes of waste characterization. Waste Profiles shall be submitted to the COTR. Hazardous wastes shall be disposed of at a permitted Treatment, Storage, and Disposal Facility (TSDF) authorized to accept the specific waste to be shipped. Use of deep well

injection as a treatment or disposal method is prohibited.

B. Hazardous Waste Manifest

1. NASA Ames Research Center shall be designated as the generator on the manifest and only approved Ames Environmental Office personnel shall sign the Uniform Hazardous Waste Manifests. Contractors shall not sign hazardous waste manifests.

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

3. The Contractor shall perform disposal services in compliance with 49 CFR. The Contractor shall meet the removal and disposal time frames established by law.

4. The Contractor shall use only disposal facilities that have a valid permit to manage hazardous waste, and shall be responsible for determining that permit allows for the type of management and disposal intended for that waste. The Contractor shall be responsible for ensuring that any party handling hazardous waste, including subcontractors, transporters, and TSDFs are in compliance with applicable federal, state, and local regulations.

C. Treatment, Storage, And Disposal Facility List - The Contractor shall provide a list of storage and disposal facilities (TSDF) that perform treatment, storage, or disposal services under this contract. Each facility shall have, as a minimum, EPA RCRA interim status or state approval as a treatment or disposal facility and be in good standing with the regulatory community. Recycling facilities shall meet applicable federal, state, and local regulations. The Contractor agrees that no facility other than those initially approved for use under this contract will be used, without first obtaining the written approval of the COTR.

D. Hazardous Waste Liability - For the purpose of this contract, the Contractor shall be responsible for any release or threatened release of the materials or substances handled under this contract, as well as any liabilities resulting or arising from or related to this contract, and shall bear all costs pertaining to such releases including, but not limited to, responses, remediation, testing, or disposal costs, and further shall defend and indemnify the Government for any costs including, but not limited to, any judgments, penalties, assessments, litigation, or attorney fees.

E. Hazardous Waste Transportation - Certified Waste Haulers shall be utilized. Government directed waste shall be transported to the disposal facility or interim storage facility without delay, in accordance with Department of Transportation (DOT) manifest regulations. The Contractor shall notify the Government if 10 days or more have a elapsed during shipment.

F. Containerized Hazardous Waste - Hazardous wastes and other materials picked up by the Contractor from other facilities may not be added to any container of Government hazardous waste.

G. Bulk Hazardous Waste - Bulk hazardous waste shipments shall be weighed to confirm shipping weight.

H. Fluorescent Light Tubes - Fluorescent light tubes removed by the Contractor shall be turned over to the Government for recycling.

-- End of Section --

SECTION 02050

ALTERATIONS AND DEMOLITION
12/01

PART 1 GENERAL

1.1 SUMMARY

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

1.2 SUBMITTALS

Submit the following per Section 01300, Submittals:

SD-18, Record of Existing Conditions

SD-20, Work Plan

1.3 TEMPORARY PROTECTION

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

PART 2 PRODUCTS

Products are not required for this section.

PART 3 EXECUTION

3.1 DISCONNECTING EXISTING UTILITIES

Install temporary utility services before disconnecting existing utilities. Maintain temporary services during period of construction, and remove them only after permanent utilities have been installed, tested, and are in operation.

3.2 PRECAUTION AGAINST MOVEMENT

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

3.3 SALVAGE AND REUSE

The Government will designate materials and equipment to be salvaged.

Remove salvageable materials and equipment so as to cause the least possible damage thereto. Handle, sort by type and size, store off ground, and protect salvaged items that will be reused in Work or will be retained by the Government. Provide identification tags indicating type, size, and quantity of materials for items boxed or placed in containers.

Recondition salvaged materials and equipment required for reuse in areas

of new construction before installation. Repair or replace, as necessary, items damaged during removal and salvage operations.

3.4 CONCRETE DEMOLITION

Perform concrete demolition using wet methods to eliminate visible dust, which can result in excessive silica inhalation. If visible dust occurs, perform silica dust personal air monitoring to confirm the adequacy of controls.

3.5 DISPOSAL

Debris, rubbish, scrap, and other materials not designated to be salvaged or reused in Work become Contractor's property. Remove such materials and dispose of them legally off worksite.

Burning of materials is prohibited on Government property.

3.6 ALTERATION

Where required to patch or extend existing construction, match existing materials and exposed surfaces. Employ experienced mechanics for cutting, patching, repairing and other alteration work.

SECTION 02080

ASBESTOS ABATEMENT
12/01

PART 1 GENERAL

1.1 SUMMARY

The Contractor shall furnish labor, materials, services, and equipment necessary for the complete enclosure, encapsulation, removal, and approved disposal of asbestos located at the jobsite and asbestos-contaminated materials resulting from the work performed.

Work shall be performed per documents referenced herein, and per applicable federal, state, and local regulations. Nothing specified herein shall be construed as waiving any legal requirements.

All High Efficiency Particulate Air (HEPA) filtered air pressure differential machines and vacuums shall be DOP certified. This certification must accompany all High Efficiency Particulate Air Filtration Systems (negative air machines and vacuums) brought onto NASA property. The DOP test must have been conducted within the last 30 days, and must be re-tested every 30 calendar days. Copies of all DOP certifications shall be submitted to the NASA ARC asbestos representative.

1.2 REFERENCES

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

NASA POLICY AND PROCEDURES

AHB 1700.1	NASA Ames Safety and Health Manual
Chapter 30	Asbestos Management Plan

Code of Federal Regulations (CFR)

29 CFR Part 1910	General Industry Safety and Health Standards
29 CFR Part 1926	Safety and Health Standards for the Construction Industry
40 CFR Part 61, Subpart M	National Emission Standards for Asbestos (NESHAP)
49 CFR Part 262	Hazardous Wastes

Notwithstanding the "start-up dates" given in 29 CFR Parts 1926.134 and 1926.1101, all methods of compliance, respiratory protection, hygiene facilities and practices, communications of hazardous, housekeeping, and designation and training requirements are a part of this specification and must be followed.

California Department of Toxic Substance Control

Title 26, Sections 22-66261 et esq Hazardous Waste

California Health and Welfare Agency

Title 26, Division 21.5 Proposition 65

American National Standards Institute (ANSI)

National Institute of Occupational Safety and Health (NIOSH)

Bay Area Air Quality Management District (BAAQMD)

Regulation 11, Rule 2 Asbestos

California Department of Health Services (DHS)

Regional Water Quality Control Board

Underwriters Laboratories Inc. (UL)

586 High-Efficiency Particulate Air Filter Units

1.3 SUBMITTALS

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

SD-04, Shop Drawings

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

SD-06, Instructions

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

Copy of respirator program complying with 29 CFR Part 1910.134.

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

SD-08, Records

Documented proof that the employees have successfully completed the required training.

Documented proof that the workers have been recently fit tested for respirators.

Documented proof that the on-site supervisor meets the criteria for a "competent person" as set forth in 29 CFR Part 1926.1101.

Copy of notification (per Section entitled "Notice").

Copy of all applicable permits and licenses (per paragraph entitled "Permits & Licenses").

Copy of medical certification of physical examination on all employees engaged in the operation clearly showing medical qualification for asbestos-related work and ability to wear a respirator.

Documented proof that the laboratory analyzing the asbestos air samples meets the requirements of the American Industrial Hygiene Association (AIHA) and participates in the Proficiency Analytical Testing (PAT) program.

SD-20, Work Plan

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

a. Written plan for containment and waste removal, including the number and location of negative air machines, and quantity and location of on-site waste storage containers.

b. Copy of initial exposure assessment, if required to support the work plan.

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

SD-01, Data

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

SD-08, Records

Copies of Contractor-performed air monitoring tests to be submitted within 24 hours of the sampling.

Original records of "negative-air pressure" measurements in containments from circular chart-recording manometers to be submitted within five days of completion of work.

Upon completion, copies of all manifests for asbestos containing waste to be submitted within five days of completion of work.

All updated training, medical, and fit-test documents to be submitted within 24 hours of expiration.

Within five days of completion, a copy of all manifests for asbestos-containing waste shall be submitted. Each manifest shall be accompanied by a certified weight slip.

1.4 NOTICE

Contractor shall make the following written notifications at least 14 days prior to starting work.

A. California Occupational Safety and Health Administration
1900 S. Norfolk, Suite 215
San Mateo, CA 94403

B. Bay Area Air Quality Management District (BAAQMD)
939 Ellis Street
San Francisco, CA 94109

1.5 PERMITS AND LICENSES

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

INDUSTRIAL WASTE HAULER PERMIT, specifically for asbestos materials or LICENSED HAZARDOUS WASTE HAULER PERMIT (required for actual hauler)

CALIFORNIA ASBESTOS CONTRACTOR'S LICENSE

CALIFORNIA GENERAL CONTRACTOR'S LICENSE or CALIFORNIA SPECIALTY CONTRACTOR'S LICENSE

1.6 SIGNS AND LABELS

Provide and post adequate warning signs at designated entrances to the regulated area, as required by Cal/OSHA, Proposition 65 (Title 26, Division 21.5), and the EPA.

Provide and post, in the clean room and the equipment room (if applicable), the decontamination and work procedures to be used by all workers and visitors.

Provide appropriate warning labels and Class 9 placards pre-printed on all asbestos waste bags, and affix the same labels on other types of waste containers immediately after asbestos waste is placed in the containers.

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

PART 2 PRODUCTS

2.1 WORK CLOTHING

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

2.2 MISCELLANEOUS EQUIPMENT

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

All equipment brought onto NASA property must be free of visible dust and

debris.

All vacuums and negative air machines shall pass DOP certification per Section 1.1C.

All negative air machine exhaust duct shall be wire reinforced.

PART 3 EXECUTION

3.1 REQUIREMENTS BY TYPE OF OPERATION

Perform operations using the work practices and controls specified by 29 CFR Part 1926.1101 (g), Methods of Compliance. If alternative control methods are proposed, these must be submitted to and be approved by the COTR and the NASA Safety Office prior to beginning work.

Use respiratory protection at least as stringent as specified by 29 CFR Part 1926.1101 (h). As a minimum, a powered air purifying respirator (PARR) shall be used for all Class I removal and bagging operations. As a minimum, half-mask respirator shall be used by employees engaged in Class II removal, bagging, waste-handling, and cleanup operations, and those engaged in all waste-handling and cleanup operations, shall wear half-mask respirators.

3.2 PREPARATION

A. Prior to beginning work, remove all furniture and equipment from the work area. Any equipment or furniture that cannot be removed shall be completely enclosed with 6 mil thick fire-retardant polyethylene sheeting, securely taped in place with duct tape. Draping and taping of piping is also required.

B. If a negative-pressure enclosure (NPE) or critical barrier is required per 29 CFR Part 1926.1101(g), the Contractor shall thoroughly seal all openings and fixtures including, but not limited to, heating and ventilating ducts, skylights, doors, windows, and lighting with polyethylene taped securely in place.

1. All critical barriers shall be sealed using, as a minimum, (6 mil) thick fire-retardant polyethylene sheeting taped securely in place. Care must be taken in sealing off lighting fixtures/transformers to avoid burning or melting the plastic sheeting.

2. All air handling systems affecting the regulated area shall be turned off and tagged out during the abatement operation (where feasible).

C. All electrical power in the work area shall be disconnected and tagged out, unless a GFCI-protected circuit is used at the point of connection to the electrical systems.

3.3 WORK AREA ISOLATION

A. Regulated Area

1. Establish the work area as a regulated area either by use of an NPE or by other means of acceptable demarcation.

2. Remove all PPE (suits, footwear, gloves, eye protection, etc.), except respirators, prior to departure from the regulated work area.

3. No smoking, eating, or drinking etc. shall take place in the regulated area.

B. Negative Pressure Enclosure

1. Clearly mark exits and emergency exits from the enclosure.

2. Maintain a minimum negative pressure differential of (-0.03 inches of water) inside the containment. At no time shall the negative pressure differential fall below (-0.02 inches of water). If the negative pressure differential falls below (-0.02 inches of water), work shall be stopped and corrective action taken.

3. Use an electronic pressure differential circular chart-recording manometer to record the negative pressure differential in the containment. The manufacturer shall have serviced the manometer within the last 365 days. The circular charts shall be signed and dated by the supervisor daily. The recorder shall function continuously throughout the abatement operation. All manometer charts are to be set on single day recording; if work continues over a weekend, any "unmanned" manometer can be set to print on a three or five day record. The Government may check the negative pressure with a calibrated magnehelic.

4. Submit copies of all charts within two days of recording.

3.4 DECONTAMINATION

Perform decontamination of personnel in accordance with 29 CFR Part 1926.1101 (j).

Prepare and distribute procedures for evacuation of injured workers. Aid for a seriously injured worker will not be delayed for reasons of decontamination. Submit the procedure to the COTR and Safety office for approval.

Seal, label, and clean the outside of containers prior to removing from the work area.

3.5 AIR MONITORING

The Contractor shall be fully responsible for personal air monitoring needed to demonstrate compliance with OSHA and Cal/OSHA regulations and standards of good practice in worker protection.

For Class I abatement jobs involving more than or of material, provide perimeter air monitoring as required by 29 CFR Part 1926.1101, (g). (4) (ii) (B). All air sampling results must be less than by PCM or by TEM (AHERA). Engineering controls must be instituted to achieve this criterion.

If, at any time, the air samples collected inside the work area exceed the PEL, all active abatement work shall stop immediately. The Contractor shall re-evaluate existing engineering controls and implement new,

COTR-approved engineering controls in conjunction with cleaning the work area.. If the PEL is exceeded three times on the same contracted project work, the Contractor shall implement the use of Type C respirators (air supplied) for all workers entering the work area.

For Class I abatement jobs involving more than or of material, the Government may provide clearance air sampling as required by 29 CFR Part 1926.1101, g. (4) (ii) (B). TEM air samples shall be used to confirm decontamination of work area and will be collected within 48 hours after completion of the work. The Certified Asbestos Consultant (CAC) will determine the number and location of samples to be taken.

3.6 REMOVAL

Remove asbestos-containing material as specified by 29 CFR Part 1926.1101 (g).

If pipes, valves, or structural members are covered with and/or contain asbestos, remove them as units where feasible. Wet and double wrap these units with two layers of 0.15 mm (6 mil) thick polyethylene sheeting. Securely seal polyethylene sheeting along all seams and "candy stripe" with duct tape and affix labels.

3.7 CLEANUP/CLEARANCE

A. Properly package, label, and remove all waste containing asbestos from the work area to the holding area or hazardous waste container. Remove all unnecessary equipment and materials from the work area. Wet-clean or HEPA vacuum the entire area. Notify the COTR that the work area is ready for inspection. Utilize secondary hard shell containers when transferring poly waste bags through public use areas.

B. Upon approval of the visual/tactile inspection by the COTR and a CAL-OSHA-certified consultant, the Contractor may apply a fine spray of lock-down encapsulant. Any secondary barriers or protective coverings will be removed prior to clearance testing. The encapsulant shall meet the requirements of ASTM for life (C732), flame (E84), and bonding (E736).

C. At the discretion of the CAL-OSHA-certified consultant, the use of fans and leaf blowers may be used to disturb the vertical and horizontal surfaces within the work area as described in 40 CFR 763.

D. The placement and number of air samples to be collected in a work area are at the sole discretion of a CAL-OSHA-certified inspector.

E. All Transmission Electron Microscopy (TEM, AHERA) clearance air samples collected in the work area must be less than . If Phase Contrast Microscopy (PCM) is the method of clearance, then all air samples must be less than or equal to . When the work area meets one of these criteria, the Contractor can remove all remaining barriers, enclosures, and equipment. All barriers and enclosures shall be packaged and disposed of as hazardous asbestos-containing waste.

1. The method for analysis of PCM air samples shall be NIOSH 7400, A Rules.

2. The method for analysis of TEM air samples shall be AHERA as described in 40 CFR 763, Final Rule and Notice.

F. After all barriers/enclosures have been removed, the surfaces/areas that were covered shall be wet cleaned and HEPA vacuumed.

G. If all clearance air samples collected in the work area do not meet the established clearance criteria, the Contractor shall wet wipe and HEPA vacuum the entire work area again. A new set of clearance air samples shall be collected.

3.8 DISPOSAL

Asbestos-containing waste, friable and non-friable, containing more than 1 percent asbestos shall be handled as hazardous waste and transferred to a designated on-site location.

Asbestos-containing materials and all materials contaminated during operations shall be sealed in double-containers. The inner container shall be a (6 mil) thick polyethylene bag (or wrapping). The outer container may be an additional (6 mil) thick bag or wrapping, or a sealed drum. The outer container must be cleaned and labeled (per 40 CFR Part 262, Title 26, Sections 22-66262 et seq., and other applicable regulations) before removal from the equipment room or work area.

Clean, sealed bags/containers may be stored in a holding area adjacent to the work area until a sufficient volume has accumulated for disposal, but not for longer than 30 days. The holding area will be prominently marked, and waste containers will be covered with plastic sheeting and protected from damage.

Asbestos wastes will be carefully handled to prevent container rupture and release of asbestos fibers. Workers loading or unloading asbestos waste shall wear approved respirators.

The performing Contractor shall be fully responsible for hauling asbestos wastes to a designated on-site location for Government disposal.the disposal of waste in an approved landfill in accordance with the rules and regulations of the California Department of Health Services, the Regional Water Quality Control Board, and any other applicable agency. Removal from the site shall be by a licensed hazardous waste hauler, and the manifest shall be signed by a civil servant representative of NASA's Safety, Environmental, and Mission Assurance Directorate (Code Q).the Government. All asbestos materials and miscellaneous debris in sealed drums shall be transported to the designated site per EPA 40 CFR Part 61, Subpart M guidelines. Labels and all necessary signs shall be in accordance with EPA 40 CFR Part 61, Subpart M, OSHA 29 CFR Part 1910.100, Asbestos.

SECTION 02090

LEAD PAINT ABATEMENT/DEMOLITION
12/01

PART 1 GENERAL

1.1 SUMMARY

Contractor shall furnish all labor, materials, services, and equipment necessary for the removal and approved disposal of lead-based paint and/or items covered with lead-based paint located at the jobsite and lead-contaminated materials resulting from the work performed.

This work includes manual demolition, saw-cutting, manual scraping, hand-tool cleaning, sanding, use of heat guns, caustic strippers, and power-tool cleaning with dust collection systems. Abrasive blasting, water blasting, and power-tool cleaning without high efficiency particulate air (HEPA) dust collection systems shall not be used, unless pre-approved. Torch-cutting, burning, and welding within 150 mm of a material containing lead is prohibited.

Work shall be performed per documents referenced herein, and with all applicable federal, state, and local regulations. Nothing specified herein shall be construed as waiving any legal requirements. All painted surfaces at NASA Ames Research Center are assumed to contain lead unless specified otherwise. Disturbance of any painted surface must comply with this specification and AHB 1700.1, Chapter 35.

All HEPA-filtered air pressure differential machines and vacuums shall be DOP certified. This certification must accompany all HEPA filtration systems (negative air machines and vacuums) brought onto NASA property. The DOP test must have been conducted within the last 30 days, and must be retested every 30 calendar days. Copies of all DOP certifications shall be submitted to the COTR.

All workers disturbing lead covered by this specification shall wear, at a minimum, half face, HEPA-filtered, negative pressure respirators.

1.2 REFERENCES

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

NASA POLICIES AND PROCEDURES

AHB 1700.1 NASA Ames Safety and Health Manual
Chapter 35, Lead Management Plan

California Code of Regulations (CCR)

Title 8, Div 1, Ch 4, Subchapter 4
Construction Safety Orders

US Department of Labor, Occupational Safety and Health Administration (OSHA)

29 CFR Part 1910	General Industry Safety and Health Standards
29 CFR Part 1926	Safety and Health Standards for the Construction Industry
8CCR 1532.1	OSHA Lead Standard
Title 17	California Department of Health Services

California Health and Welfare Agency

Title 26, Division 21.5	Proposition 65

Bay Area Quality Management District (BAAQMD)

Regulation 11, Publication 1	Lead

American National Standards Institute (ANSI)

ANSI Z9.2	Fundamentals Covering the Design and Operations of Local Exhaust Systems
ANSI Z88.2	Respiratory Protection

Underwriters Laboratory, Inc. (UL)

UL 586	High-Efficiency Particulate Air Filter Units

1.3 SUBMITTALS

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

SD-04, Shop Drawings

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

SD-06, Instructions

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

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

Decontamination and work procedures to be used by all workers and visitors.

Copy of respirator program complying with 29 CFR Part 1910.134.

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

decontamination).

SD-08, Records

Documented proof that the employees have successfully completed the required training.

Documented proof that the workers have been recently fit tested for respirators.

Copy of results of blood tests for lead taken within the past 6 months.

Documented proof that the on-site supervisor meets the criteria for a "competent person" as set forth in 29 CFR Part 1926.1101.

Copy of all applicable permits and licenses (per paragraph entitled "Permits & Licenses").

Copy of medical certification of physical examination on all employees engaged in the operation clearly showing medical qualification for lead-related work and ability to wear a respirator.

SD-20, Work Plan

Written plan for containment and waste removal, including the number and location of negative air machines, and quantity and location of on-site waste storage containers.

Written compliance program per 29 CFR Part 1926.62.

Copy of initial exposure assessment per 29 CFR Part 1926.62, if required to support the work plan.

Description of the proposed waste disposal site (name, location, and phone number).

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

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

SD-01, Data

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

SD-08, Records

Copies of Contractor-performed air monitoring tests to be submitted within 24 hours of the sampling.

Original records of "negative-air pressure" measurements in containments from circular chart-recording manometers to be submitted daily and final paper work within five days of completion of work.

Copies of all manifests for lead containing waste to be submitted within five days of completion of work. All waste shall be accompanied by certified weight slips.

All updated training, medical, and fit-test documents to be submitted within 24 hours of expiration.

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

1.4 QUALIFICATIONS AND TRAINING

The supervisor for the Contractor actually performing the work must be a "competent person", as defined by 29 CFR Part 1926.62 (b).

Each worker must have received training per 29 CFR Part 1926.62 (l), including the wearing and fitting of respirators.

The Contractor's supervisor must complete the required DHS-approved lead training course and be DHS certified. A certified supervisor must remain at the work location when work is being performed with asbestos-containing material. The DHS certification must remain valid for the duration of such work.

Contractor's workers must complete the required DHS approved lead training course and be DHS certified. This certification must remain valid for the duration of the project.

Necessary and proper licensing and training per the requirements and regulations of the State of California shall be a minimum requirement for workers and supervisors on this job.

1.5 SIGNS AND LABELS

Provide and post adequate warning signs at designated entrances to the regulated area, as required by Cal/OSHA, Proposition 65 (Title 26, Division 21.5), and the EPA.

Provide appropriate warning labels and placards pre-printed on all lead waste bags, and affix the same labels on other types of waste containers immediately after lead waste is placed in the containers.

PART 2 PRODUCTS

2.1 WORK CLOTHING

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

2.2 MISCELLANEOUS EQUIPMENT

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

All equipment brought onto NASA property must be free of visible dust and

debris.

All negative air machine exhaust ducting shall be wire reinforced.

PART 3 EXECUTION

3.1 REQUIREMENTS BY TYPE OF OPERATION

Use caustic strippers in strict accordance with the approved manufacturer's instructions, including all recommended precautions. Caustic strippers shall not be used in occupied areas. If used, provide ventilation to remove all fumes and odors from the work area until the project is complete. Use of strippers containing volatile organic compounds shall be in accordance with BAAQMD Regulation 11, Rule 1. Use of caustic strippers containing chlorinated products is prohibited.

Use respiratory protection at least as stringent as specified by 29 CFR Part 1926.62(d)(2) "Protection of Employees during assessment of exposure," until and unless a risk assessment demonstrating a lower hazard is approved by COTR and a DHS certified inspector.

3.2 WORK AREA ISOLATION

A. A work area is defined as the room, corridor, or other space in which the work is being performed, from floor to ceiling, and between walls or other full-height partitions. The work area specifically includes the dumpster or other container in which unwrapped debris is to be placed and the path to that container.

B. Establish the work area as a regulated area, with signage per 29 CFR 1926.62(m), 8CCR 1532.1, and Proposition 65. In addition to isolation required by OSHA, use the procedures specified in the following paragraphs.

C. Preparation

1. Seal all critical barriers using, as a minimum, (6 mil) think fire-retardant polyethylene sheeting taped securely in place. Take care in sealing off lighting fixtures to avoid burning or melting the plastic sheeting.

2. Turn off and tag out all air handling systems affecting the regulated area during the abatement operation (where feasible).

3. Disconnect and tag out all electrical power in the work area, unless a GFCI-protected circuit is used at the point of connection to the electrical systems.

4. Secure all openings into the work area to separate the work area from other occupied spaces and prevent unauthorized entry, and post proper signs at the openings.

5. Seal HVAC ducts into the work area with at least one layer of (6 mil) thick fire-rated plastic.

6. Remove all furniture and equipment from the area as feasible, and cover any furniture or equipment left in the work area with two layers of (6 mil) thick fire-retardant plastic taped securely in place.

D. Clean all work areas at the end of each work day.

3.3 DECONTAMINATION

Provide protective clothing in accordance with 29 CFR Part 1926.62 (g) for all workers and visitors, including NASA lead consultant.

Decontaminate personnel in accordance with 29 CFR Part 1926.62 (i).

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

Prepare and distribute procedures for evacuation of injured workers. Aid for seriously injured worker will not be delayed for reasons of decontamination. The procedure shall be submitted to the COTR for approval.

Seal and clean the outside of containers so they are free of all visible dust, dirt, or debris prior to removing from the work area.

3.4 AIR MONITORING

The Contractor shall be fully responsible for personal air monitoring needed to demonstrate compliance with DHS, OSHA, and CAL-OSHA regulations and standards of good practice in worker protection. The Contractor will be required to collect air samples on its work force for the duration of the project, and must obtain written approval from the COTR and the onsite Lead Professional prior to discontinuing personal air monitoring.

If, at any time, the personal air samples collected inside the work area exceed the Action Level, all active abatement work shall stop immediately. The Contractor shall re-evaluate existing engineering controls and implement new, COTR-approved engineering controls in conjunction with cleaning the work area. If the Action Level is exceeded three times on the same contracted project, the Contractor shall implement the use of Type C respirators (air supplied) for all workers entering the work area.

The Government may conduct area air monitoring, at its sole discretion. The techniques employed will be consistent with regulatory requirements. The number and location of air samples will be at the sole discretion of the onsite Lead Professional.

3.5 CLEANUP/CLEARANCE

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

B. Upon approval of the visual/tactile inspection by the Lead Professional, apply a fine spray of lock-down encapsulant and remove any secondary barriers or protective coverings prior to clearance testing.

C. A DHS-certified inspector will collect wipe samples in accordance

with Title 17. Required clearance levels for work performed at the Center are as follows:

1. Floors must be less that

2. Horizontal window surfaces must be less than

3. Exterior floors and horizontal surfaces must be less than (excluding soil)

4. Soil must be less than 400 ppm where children may be present

5. Soil must be less than 1,000 ppm in other areas

D. After all barriers/enclosures have been removed, wet clean and HEPA vacuum the surfaces/areas that were covered.

E If clearance samples collected in the work area do not meet the established clearance criteria, the contractor shall wet wipe and HEPA vacuum the entire work area again. A new set of clearance samples will be collected.

3.6 DISPOSAL

Contain, remove from the surroundings, and properly handle dust, chips, and abrasive as hazardous waste. Note: if all such is contained in the HEPA vacuums, it may be removed still in the vacuums and disposed of later by the Contractor.

Other debris is unlikely to be considered as hazardous, and may be disposed as construction debris, transported in a covered container. Plastic, suits, and other protective material must be HEPA vacuumed prior to disposal.

Clean, sealed bags/containers may be stored in a holding area adjacent to the work area until a sufficient volume has accumulated for disposal, but not longer than 30 days. The holding area shall be prominently marked, and waste containers shall be covered with plastic sheeting and protected from damage.

Carefully handle lead waste containers to prevent rupture and release. Workers loading or unloading the waste shall wear approved respirators.

Contractor shall be fully responsible for all costs for lead waste characterization, profiling, and testing, and for hauling lead wastes to a designated on-site location for Government disposal. The disposal of waste in an approved landfill, in accordance with the rules and regulations of the California Department of Health Services, the Regional Water Quality Control Board, and any other applicable agencies. Removal from the site shall be by a licensed hazardous waste hauler, and the manifest shall be signed by a civil servant representative of NASA's Safety, Environmental, and Mission Assurance Directorate (Code Q).

SECTION 02200

SITE PREPARATION AND EARTHWORK
12/01

PART 1 GENERAL

1.1 SUMMARY

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

1.2 REFERENCES

American Association of State Highway and Transportation Officials (AASHTO)

AASHTO T2	Sampling of Aggregates

American Society for Testing and Materials (ASTM)

ASTM D1557	Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft or 2700 kN m/m)
ASTM D2487	Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D2922	Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D3017	Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)

U.S. Department of Labor, Occupational Safety and Health Administration (OSHA)

OSHA 29 CFR 1926	Safety and Health Standards for the Construction Industry

1.3 SUBMITTALS

Submit the following per Section 01300, Submittals:

SD-13, Certificates

Certificates, for manufactured materials

SD-14, Material Samples

Material Samples, of soil materials. Two 13.6 kg sacks of each material, submitted at least 10 days in advance of intended use.

SD-18, Record of Existing Conditions

SD-18, Records

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

1.4 QUALITY CONTROL

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

B. Testing Requirements

MATERIAL	REQUIREMENT	TEST METHOD	NUMBER OF TESTS
Soil materials	Sampling	AASHTO T2	One per type and source, and whenever there is any apparent change.
	Classification	ASTM D2487	
	Moisture-density relations	ASTM D1557, Method D	
Fill and back fill	Density	ASTM D2922	Three per lift in-place or layer
	Moisture Content	ASTM D3017	
Spoil contamination	Fuel/solvent contamination	EPA Methods	One per 76 m3, at least one per ite, whenever is known or suspected.

C. Evaluation of Test Results

1. Test spoil. Consider spoil a satisfactory fill/backfill material unless otherwise determined by COTR. If COTR determines that spoil is unsuitable because of contamination by fuel or solvents, use borrow material and haul unsatisfactory spoil to a designated site on Ames Research Center; the cost thereof will be borne by the Government.

2. Results of soil-in-place tests are considered satisfactory if:

a. Average density equals or exceeds that specified

b. No density test is less than 2 percent below specified density

c. Moisture content tests are within 2 percent of optimum

1.5 DEFINITIONS

Subgrade - Top surface of a backfill or fill, or uppermost surface of an excavation, graded to conform to required subgrade elevation, and compacted.

Suitable Topsoil - Friable clay loam surface soil to be used as a base for grass planting. Occurs as a thin soil layer covering naturally well-drained land covered by a heavy growth of grass, or which has been covered with a heavy growth of grass during the latest growing period

before start of construction. Free of subsoil, clay lumps, brush, weeds, and other litter, and free of stones, stumps, objects larger than in any dimension, roots, and other objectionable material.

Degree of Compaction - Expressed as a percentage of maximum density obtained by test procedure in ASTM D1557, Methods B or D.

Satisfactory Soil Materials - Those meeting classification for intended use; are uncontaminated by fuel and solvents; and are free of organic matter, trash, stones greater than in any dimension, and any other deleterious substances.

Spoil - Material, below level of topsoil, removed from excavations on jobsite.

PART 2 PRODUCTS

2.1 SOIL MATERIALS

Conform to following designation:

MATERIAL DESIGNATION	MAXIMUM PARTICLE SIZE, mm	UNIFIED SOIL CLASSIFICATION
Borrow	75	SW, SW-SM, SW-SC, SM, SC, GW-GM, GW-GC, GM, GC
Sub-base	37.5	SW, SW-SM, SW-SC, GW, GW-GM, GW-GC
Base	37.5	GW-GM, GW-GC
Sand, bedding material	4.75	SP
Gravel, filter material	12.5	GP (less than 5% passing sieve)
Clay, impervious fill	0.45	CL, CM

2.2 USE OF SOIL MATERIALS

AREA CLASSIFICATION	SOIL MATERIALS	PERCENT COMPACTION COHESIVE NON-COHESIVE
Fill and backfill, unless otherwise specified	Clean spoil or borrow	90
Within below structures, steps, walks, or pavement	Clean spoil or borrow	95
Against face of structures, where drains are specified, to a distance equal to three drain diameters	Filter material	N/A

In foundation subdrain trenches	Filter material	N/A
Against surfaces having applied waterproofing, for a minimum distance of	Sand	N/A
Within below building slabs	Sand	N/A
Within below walks and steps	Subbase	100
Within below slabs and paving	Base	N/A
Below subdrains	Impervious fill	100

PART 3 EXECUTION

3.1 GENERAL

Before earthwork is started, carefully verify location of underground utilities by hand methods. Protect from damage utilities to be left in place.

All earth disturbance shall be done with sufficient wetting of the soil to prevent visible airborne dust, thereby controlling silica dust inhalation.

Where excavations cut through paved areas, saw-cut pavement to provide a clean edge. Pavement removed from excavation site is classified as debris - dispose of this pavement legally. Patch resulting cut with similar material in accordance with Section 02500, Asphalt-Concrete Paving and Markings, or Section 03300, Cast-in-Place Concrete, as applicable.

Pile spoil backfill in an orderly manner, shape to drain, and place at minimum from excavations to prevent overloading, slides, and cave-ins.

Protect trenches and excavations from inflow of surface water. Prevent flooding of jobsite and surrounding area.

Keep contaminated soil segregated from uncontaminated soil throughout course of Work.

3.2 SURFACE PREPARATION

Remove trees, stumps, roots, brush, and other vegetation in areas to be cleared, except those indicated or directed to be left standing. Trees to be left standing - Trim of dead branches diameter or larger and of live branches to indicated height; neatly cut close to bole of tree or main branches. Paint cuts with tree-wound paint. Protect trees and vegetation to be left standing by erecting barriers or by other means as required.

Remove stumps, roots, and organic or other debris to a minimum depth of below surface level of original ground. Do not use mechanical grubbing equipment inside drip lines of trees indicated to remain standing.

Strip topsoil from surface of areas to receive fills or embankments, or to

be excavated. Transport topsoil to, and stockpile in, designated storage areas.

Fill depressions resulting from grubbing operations with acceptable backfilling material, unless further excavation is required. Before filling, ensure that subgrade surfaces of depressions are free of standing water, frost, or frozen material. Remove unsatisfactory soil materials.

3.3 EXCAVATION

A. Shoring and Bracing

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

2. Trench shields and backsloping are not acceptable in any developed area of Ames Research Center.

3. Wherever subsequent removal of sheet piling would permit lateral movement of soil under adjacent structures, use and permanently leave in place steel sheet piling or pressure-treated timber sheet piling, cut off as required.

B. Dewatering

1. Do not allow water to accumulate in excavations. Provide a dewatering system, as required, to convey water to approved disposal areas. Provide and maintain temporary drainage ditches and other diversions as necessary outside of excavation limits. Dewatering system and method of disposal requires approval by NASA Safety Office. Continue dewatering until construction subjected to water pressure has obtained full-specified strength and backfill is completed.

2. Groundwater in area of work may be contaminated with petroleum products. Provide a sample of groundwater for analysis by the Government at least 10 days before starting dewatering operations. Depending on results of this analysis, groundwater may be disposed of into sanitary sewer or into Government-provided decontamination equipment. In either case, keep detailed records of quantity, by date, of groundwater removed, and provide a copy of these records to the Government with each payment request.

3. Groundwater may be encountered at approximately to below surface in developed areas of Ames-Moffett, and to below surface in undeveloped areas, unless otherwise indicated.

4. Do not use trench excavations for utilities as temporary drainage ditches.

C. Excavation for Structures

1. Conform to dimensions and elevations indicated within a tolerance of , and extend a sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services and other construction indicated, and for inspection.

2. In excavating for footings and foundations, do not disturb bottom of excavation.

3. For pile foundations, stop excavation at an elevation to above bottom of footing before piles are driven. After pile driving has been completed, remove loose and displaced material and perform excavation to final grade, leaving a solid bed to receive concrete.

D. Excavation of Ditches, Gutters, and Channels - Accomplish excavation by cutting accurately to cross sections, grades, and elevations indicated. Backfill excessive open-ditch or gutter excavation with approved materials to grade at no additional cost.

E. Trench Excavation

1. Provide side slopes of trenches as nearly vertical as practicable. Grade bottoms of trenches accurately, at an elevation allowing for specified bedding or filter material. Dig bell holes and depressions for joints after trench bottom has been graded, and only to length, depth, and width required to make joint. Except as specified for wet or otherwise unstable material, backfill overdepths with materials specified for backfilling lower portion of trenches.

2. Sequence trenching for underground utilities to minimize time a trench is open. If any area of trench is left open more than seven days, desist from further trenching until existing trenches are completely backfilled.

F. Excavation for Subdrainage System - Provide excavation for foundation subdrainage system, except for footing drains, with vertical sides for a distance of at least twice pipe diameter above bottom of pipe; make excavation suitably wide to allow to clear on each side of pipe. Grade bottom of trench excavations to obtain required slope, and tamp to provide a firm bed for drain pipe bedding material.

G. Removal of Unsatisfactory Soil Materials - Excavate unsatisfactory soil materials that extend below required elevations to depth directed by COTR.

H. Unauthorized Excavation

1. Unauthorized excavation is removal of materials beyond indicated subgrade elevations or side dimensions specified without specific direction. Replace unauthorized excavation material as specified at no additional cost.

2. Fill unauthorized excavation under foundations or retaining walls by lowering bottom elevation of footing or base to excavation bottom without altering approved top elevation. Elsewhere,

backfill unauthorized excavations and compact as specified for authorized excavations of same classification.

I. Removal of Existing Underground Utilities - Demolish and remove from excavation existing underground utilities indicated to be removed. Permanently close open ends of existing underground utilities with masonry bulkheads, threaded galvanized metal caps, plastic plugs, or other suitable, approved method. Wood plugs are not permitted.

3.4 FILLING, BACKFILLING AND COMPACTION

A. Backfill excavations as promptly as work permits, but not until completion of following:

1. Removal of concrete formwork, shoring, and bracing

2. Completion of concrete waterproofing and subdrainage system

3. Inspection, testing, and approval of underground utilities, subdrains, and other construction

4. Removal of trash and debris

B. Remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials before placement of fill material. Sloped surfaces steeper than 1:4 (vertical:horizontal) - Plow, strip, or break up so that fill material will bond with existing material. Scarify, condition, and compact existing ground surface to required depth (minimum) and percent of maximum density.

C. Place backfill and fill material in layers of maximum in loose depth; moisten or aerate as necessary to provide optimum moisture content; and then compact to specified density. Do not place backfill or fill material on surfaces that are muddy, frozen, icy, or contain frost.

D. Bring up backfill and fill materials adjacent to structures evenly around structure. Compact with power-driven hand tampers within a horizontal distance equal to depth of backfill or fill.

3.5 GRADING

Uniformly grade areas within limits of grading, including adjacent transition areas. Ensure that finished surface is smooth and even, compacted, is free of voids, has uniform levels or slopes, and is maximum above or below indicated subgrade elevations (except below walks where the limits are 0 above and below). Maximum deviation of when tested with a straightedge.

Hand grade areas adjacent to structure to drain away from structure and to prevent ponding of water after rains.

3.6 MAINTENANCE

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

3.7 DISPOSAL OF EXCESS AND WASTE MATERIALS

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

SECTION 02500

ASPHALT-CONCRETE PAVING AND MARKINGS
12/01

PART 1 GENERAL

1.1 SUMMARY

This section specifies requirements for asphalt concrete paving.

1.2 REFERENCES

American Association of State Highway and Transportation Officials (AASHTO)

AASHTO M247	Glass Beads Used in Traffic Paint
AASHTO M248	Ready-Mixed White and Yellow Traffic Paints

American Society for Testing and Materials (ASTM)

ASTM D692	Coarse Aggregate for Bituminous Paving Mixtures
ASTM D1073	Fine Aggregate for Bituminous Paving Mixtures

State of California Department of Transportation (CalTrans)

CalTrans Spec	Standard Specification

1.3 SUBMITTALS

Refer to Section 01300, Submittals. Submit the following:

SD-02, Manufacturer's Catalog Data

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

SD-05, Mix Designs

Mix Designs for asphalt concrete mixes, including compaction curve.

SD-13, Certificates

Certificates for asphalt binder, prime coat and tack coat.

SD-21, Delivery Dockets

Delivery Dockets for asphalt concrete.

PART 2 PRODUCTS

2.1 ASPHALT CONCRETE MATERIALS

Asphalt Concrete - Type B, maximum, medium gradation, 1992 CalTrans Spec Section 39, Asphalt Concrete.

Asphalt Binder - Steam-refined paving asphalt, Grade AR 4000, 1992 CalTrans Section 92, Asphalts.

Prime Coat - Liquid asphalt, Grade SC-70, 1992 CalTrans Spec. Section 93, Liquid Asphalts.

Tack Coat - Asphalt emulsion, RS 1, 1992 CalTrans Spec. Section 94, Asphaltic Emulsions.

Coarse Aggregate - ASTM D692. Fine aggregate - ASTM D1073. Sand equivalent value: 30, minimum.

2.2 PAVEMENT MARKING

Paint - AASHTO M248, Type S. Parking lanes and crosswalks white, and traffic lanes yellow.

Glass Beads for Reflectorized Paint - AASHTO M247, Type 1.

PART 3 EXECUTION

3.1 GENERAL

A. Weather Limitations

1. Apply bituminous prime and tack coat only when ambient temperature in shade is above and when temperature has not been below for 12 hours immediately before application. Start application when aggregate base course is dry or contains moisture not in excess of amount permitting uniform distribution and required penetration.

2. Construct asphalt concrete courses only when ambient temperature is above and underlying base course is dry.

B. Transportation of Mixtures

1. Transport asphalt-concrete mixtures from mixing plant to jobsite in trucks with tight, clean, smooth beds coated with a minimum amount of a concentrated solution of hydrated lime and water to prevent adhesion of mixture to truck beds.

2. Cover each load of mixture with canvas or similar material sufficiently large and heavy to retard heat loss and to protect mixture from weather.

3. In cool weather or for long hauls, insulate entire contact area of each truck bed. Securely fasten covers.

4. Deliver mixture so that minimum temperature of mixture at time of dumping into paver is .

5. Ensure that trucks do not travel on mixture until compaction is complete and until asphalt concrete pavement surface will support traffic without measurable deformation.

3.2 PREPARATION

A. Surface Preparation - Remove loose or other objectionable materials from aggregate base course surface or other contact surface immediately before applying bituminous prime coat.

B. Priming Base Course Surface

1. Uniformly apply bituminous prime coat to prepared base course surface. Rate of application: to of surface. Temperature of bituminous material at time of application: to .

2. Squeegee excess prime coat material from surface. Treat areas missed by bituminous prime coat distributor with prime coat material using hand sprayers.

3. After applying prime coat material, allow surface to dry, undisturbed for 48 hours, minimum. Blotting prime coat with fine aggregate is not permitted.

C. Priming Other Contact Surfaces

1. For contact surfaces of curbs, gutters, manholes, and other structures projecting into or abutting concrete pavement apply a thin, uniform coating of bituminous tack coat material before placing asphalt-concrete mixture.

2. After applying tack coat, allow surface to dry until suitably tacky to receive asphalt-concrete mixture. Squeegee excess tack coat material from surface.

3.3 PLACING ASPHALT-CONCRETE

A. Place asphalt-concrete mixture on prepared surface, spread uniformly, and strike off. Place asphalt-concrete in layers of approximately equal thickness; maximum thickness of layer after compaction. When width of paved area is less then (such as in trench repair or patching), material may be placed in one course.

B. Pavement Placing - Begin placing along centerlines of areas to be paved on a crowned section, at high side of a section with a one-way slope, and in direction of traffic flow. Place mixture for each course in strips wide minimum. Progressively place strips after rolling first strip. Extend rolling to overlap preceding strips. Place continuously.

C. Hand Placing

1. In areas where machine spreading is not practicable, spread and finish with heated hand tools.

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

D. Joints

1. Ensure that joints have same texture, density, and smoothness as other sections of course. Make joints between old and new pavements, or between successive days' work, so as to ensure a continuous bond between old and new sections of pavement.

2. Offset transverse joints in succeeding courses 600 mm minimum. Cut back edge of previously placed course to expose an even vertical surface over full thickness of course.

3. Offset longitudinal joints in succeeding courses 150 mm minimum. When edges of longitudinal joints are irregular or do not conform to specifications, cut back edge to expose an even vertical surface over the thickness of course.

3.4 COMPACTION

A. Start compaction as soon after placing as asphalt-concrete mixture will bear weight of roller without undue displacement.

B. During rolling, keep wheels moist with minimum amount of water required to avoid picking up asphalt-concrete mixture.

C. In places not accessible to the rollers, compact mixture with hot hand tampers.

D. Start rolling longitudinally at extreme sides of lanes, and proceed towards center of pavement, except on superelevated curves. On superelevated curves, start rolling on low side and progress to high side, overlapping on successive trips by at least one-half width of rear wheel of roller.

E. Make alternate trips of roller of slightly different lengths.

F. Ensure that rollers move at a slow but uniform speed, with drive roll or wheel nearest paver. Maximum speed: for steel-wheeled rollers, for pneumatic-tired rollers.

G. Rolling

1. Initial rolling - Perform immediately after rolling longitudinal joints and edges. Operate rollers as close to paver as possible without causing undue displacement. Make preliminary tests of crown, grade and smoothness immediately after initial rolling.

2. Second rolling - Perform as closely as possible after initial rolling, while mixture is hot and suitable for proper compaction. Make rolling continuous (at least three complete coverages) until mixture has been compacted. Undue displacement is not permitted.

3. Finish rolling - Perform while mixture is suitably warm for removal of roller marks. Continue rolling until roller marks are eliminated and course has specified density.

H. Patching Deficient Areas

1. Saw-cut and remove asphalt concrete mixtures that become mixed with foreign materials or that are defective (such as low areas or "bird-baths"), replace with fresh asphalt-concrete mixture to obtain require grade and smoothness for finished surface, and compact to specified density.

2. Remove pavement in deficient areas to full thickness of asphalt-concrete course, cut sides perpendicular and parallel to direction of traffic, and make edges vertical. Spray edges with bituminous tack coat material.

3. Skin patching an area that has been rolled is not permitted.

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

3.5 QUALITY CONTROL

The Government may extract diameter pavement specimens of each completed asphalt concrete. Repair test holes. Ensure that thickness does not vary from plan thickness by more than for base course and for surface course.

Finished surface of each asphalt-concrete course will be tested for smoothness with a straightedge applied parallel with, and at right angles to, centerline of paved area. Maximum allowable variation from straightedge: for lower course surface, for wearing course surface.

Crown of each asphalt-concrete course will be tested for conformance to required cross section with a crown template centered on, and at right angles to, centerline of crown. Maximum allowable variation of finished crown surface from crown template: for each asphalt-concrete course.

Ensure that final surface has a uniform texture and conforms to required grade and cross section. Immediately correct low or defective areas by cutting out and replacing faulty areas.

3.6 PAVEMENT MARKING

Cure new pavement surfaces for 7 days before applying marking materials. Where oil or grease are present on old pavement, scrub affected areas with approved detergent or degreaser, and rinse thoroughly.

Apply paint at a rate recommended by manufacturer, when air and pavement temperatures are between and , and maximum relative humidity is 85 percent for one hour after application.

Where reflectorized paint is specified, dispense glass beads uniformly at a rate of 1.2 kg/L of paint.

Markings - Sharply outlined and of uniform thickness. Strip widths - as indicated. If discoloration of paint occurs due to bleeding of bitumen, apply paint in two coats. Place traffic control markers along newly painted lines to protect lines from damage.

END OF SECTION

SECTION 03300

CAST-IN-PLACE-CONCRETE
12/01

PART 1 GENERAL

1.1 SUMMARY

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

1.2 REFERENCES

American Concrete Institute (ACI)

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

American Society for Testing and Materials (ASTM)

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

U.S. Army Corps of Engineers, Concrete Research Division (CRD)

CRD-C 572 Polyvinylchloride Waterstops

1.3 SUBMITTALS

Refer to Section 01300 , Submittals. Submit the following:

SD-04, Shop Drawings

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

SD-05, Mix Designs

Mix Designs, for each concrete mix to be used.

SD-06, Manufacturer's Instructions

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

SD-10, Test Reports

Mill test reports for reinforcement.

SD-14, Samples

Samples, for exposed-aggregate.

SD-21, Delivery Dockets

Delivery Dockets, for ready-mixed concrete.

1.4 QUALITY CONTROL

Conform to ACI 318M.

Ready-mixed Concrete - Manufactured and delivered by an experienced ready-mix concrete manufacturer, in accordance with ASTM C94.

Job-mixed Concrete Batching and Mixing - ACI 304.

The Government will inspect formwork, reinforcement, and embedded items before concrete placement. Correct discrepancies before placing concrete in forms.

Schedule concrete placement with the inspector at least 24 hours in advance. The Government will perform quality-control testing during construction. Slump tests are required for each load, each time water is adjusted and for each set of compression test cylinders. Four cylinders will be taken for each day or for each 40 m3 of concrete placed, whichever is more stringent.

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

PART 2 PRODUCTS

2.1 CONCRETE MATERIALS

Aggregates - ASTM C33; maximum size.

Cement - ASTM C150, Type II. Use one uniform brand and type of cement for concrete with exposed finished surface.

Air-entraining Admixtures - ASTM C 260.

Water-reducing, Retarding, and/or Accelerating Admixtures - ASTM C494. Do not use calcium chloride.

Pozzolans - ASTM C618, Class C or Class F with 4 percent maximum loss on ignition and 20 percent maximum cement replacement by weight.

Minimum Compressive Strength: 20 MPa at 28 days. Maximum slump: +/- . Maximum water/cement ratio: 0.55.

2.2 REINFORCEMENT

Steel Bars - , Grade 400, except that 10M bars may be Grade 300.

Welded Wire Fabric - Cold drawn steel wires welded at intersections, ASTM A185. Use 10M wires at on center, each way. Unless specifically required otherwise, do not use rolled type welded wire fabric.

2.3 FORM MATERIALS

Forms - ACI 347; of wood, steel, or other approved material. Type, size, shape, quality, and strength of form materials are subject to approval by COTR.

Form Oil - Clear compound that will not discolor or injure concrete.

Supports for Rebar - Plastic. Ensure that supports required to be of steel are galvanized.

2.4 WATERSTOPS

Flat dumbbell type; polyvinylchloride; minimum thick for widths up to ; minimum thick for widths over ; CRD-C 572.

2.5 CHEMICAL FLOOR HARDENER

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

2.6 CURING COMPOUND

Spray-applied, white-pigmented, ASTM C309.

PART 3 EXECUTION

3.1 FORMWORK

Conform to ACI 347. Ensure that forms are true to line and grade, mortar-tight, and sufficiently rigid to prevent objectionable deformation under load. Ensure that form surfaces for permanently exposed faces are smooth and free of irregularities and holes. Chamfer exposed joints and exposed edges. Recess internal ties minimum from final exposed concrete surfaces.

Forms for Exposed Surfaces - Coat with a nonstaining form release coating shortly before placing concrete. Do not allow form release agent to come into contact with reinforcement or existing concrete to be bonded. Forms for unexposed surfaces may be wetted instead of being coated immediately before placing concrete, except in freezing weather.

3.2 STEEL REINFORCEMENT

Shop fabricate in accordance with ACI 318M, including details, bends and splices.

Ensure that reinforcement is free of loose, flaky rust and scale, and of oil, grease, or other coatings that may reduce bond with concrete.

Secure reinforcement in place with metal or concrete supports, spacers, or ties. Minimum concrete cover at surfaces exposed to earth: . Minimum concrete cover at other surfaces: 50 mm, unless otherwise indicated.

Wire Mesh Reinforcement - Place to full width and length of slabs and walks (less), at mid-depth, and support at maximum. Lap mesh minimum one full mesh plus . Fasten laps at each edge.

Place rod reinforcing as indicated; conform to ACI 315 and ACI 318M.

Terminate reinforcement +/- from edges and from each side of expansion and construction joints.

3.3 EMBEDDED ITEMS

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

3.4 CONCRETE PLACEMENT

Convey concrete from mixers to forms as rapidly as practicable by methods that prevent segregation or loss of ingredients. Hot weather concreting - ACI 305. Cold weather concreting - ACI 306.

Place concrete within 90 minutes after mixing. Place on clean, damp surfaces free of ice, frost, mud, debris, or objectionable coatings. Consolidate with internal mechanical vibrators supplemented by handspading and tamping. Work into corners and angles of forms and around reinforcement and embedded items without permitting materials to segregate.

Place concrete in horizontal layers thick maximum, at a rate that will prevent formation of cold joints. Place slabs in one lift.

Screed and float concrete before bleeding begins.

3.5 JOINTS

Construct joints true to line, with faces perpendicular to surface of concrete. Make longitudinal joints parallel to centerlines of walks and slabs. Make transverse joints perpendicular to centerline. Joint locations - Maximum variation of from true position. Make edges of joints on adjacent sections flush.

Do not saw-cut joints, unless otherwise indicated. Make saw-cut joints square- edged. Remove slurry from joints and adjacent concrete before it dries.

Construct expansions joints in slabs and walks at a maximum distance of on center. Fill expansion joints with joint fillers. Ensure that expansion joints in walks coincide with those in adjacent curbs and gutters.

Construct isolation joints in slabs and walks to full depth where these slabs and walks abut curbs, buildings, manholes, utility poles, steps, or other fixed structures.

Extend premolded joint fillers for expansion and isolation joints full width and depth of joint. Make top to below finished surface. Attach joint fillers securely to prevent displacement during concrete placement.

After concrete is cured, clean joints of foreign matter (including membrane-curing compound); then immediately seal joints with specified sealer and completely fill joint. Clean spills immediately; protect joints from traffic until cured.

Install control joints in slabs, curbs, and gutters at maximum intervals of ; and in walks at maximum intervals of . Form joints with a jointing tool, preformed removable strips, or other approved means. Extend control joints into concrete for a least 0.25 of depth, and make approximately wide.

3.6 FINISHING

Do not begin finishing operations until surface water has disappeared. Use of dry cement as an absorptive material is prohibited.

Exposed aggregate surfaces - Cover entire surface uniformly with approved aggregate. Evenly spread aggregate, tamp, and level with a wooden screed or float.

Steel trowel finish interior slab surfaces and slab surfaces that are to be covered with resilient flooring, paint, or other finish coating systems. Start final troweling when a ringing sound is produced as trowel is moved over surface. Consolidate surface by hand troweling.

Broom finish slab surfaces that form final walking surfaces. Provide finish with to amplitude. Make finish straight and perpendicular to edges of slab.

Wood float finish other unformed surfaces.

Finish edges, including those at formed joints, with a radius edging tool, and remove edger marks.

Ensure that finished surfaces are free of trowel, edger, and uneven broom marks are uniform in texture and appearance, and are plane to a tolerance of 1:500 when checked with straightedge placed on surface in any direction. Remove surface defects by grinding.

3.7 STRIPPING AND CURING

A. Remove forms carefully to prevent damage to concrete.

B. Do not remove forms before expiration of following minimum times:

1. Arches, beams, and deck-type slabs 144 hours

2. Columns, walls and steps 48 hours

3. Conduit in open cut 72 hours

4. Ground slabs, curbs, and walks 24 hours

3.8 CURING

Begin final curing immediately after removal of forms (if at less than 7 days). Adequately protect concrete from damage until fully cured.

Cure concrete by an approved method for 7 days minimum. Use moist curing, moisture retaining cover, membrane curing, or combinations thereof. Moist curing is keeping surface of concrete wet, or covering with absorptive cover saturated and kept wet. Moisture-retaining cover curing is covering concrete surfaces with a continuous impermeable cover, or leaving formed surfaces in forms. Membrane curing is applying specified membrane-forming curing compound to damp concrete surfaces as soon as moisture film has disappeared at a rate determined by manufacturer.

3.9 CHEMICAL-HARDENER TREATMENT

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

3.10 REPAIR OF FORMED SURFACES

Repair formed surfaces exposed to view, or that will be in contact with water or earth, immediately after removal of forms. Repair defective concrete, voids left by removal of tie rods, and ridges and local bulging on concrete surfaces. Fill voids left by removal of tie rods with dry-patching mortar. Repair defective concrete by cutting out unsatisfactory material and placing new concrete secured with keys, dovetails, or anchors. Excessive rubbing of formed surfaces is not permitted.

3.11 CONCRETE SAMPLING AND TESTING

Slump Tests - Performed for each truckload of concrete, each time quantity of water is adjusted, and for each set of compression test cylinders.

Compression Test Cylinders - Three taken each day or for each of concrete placed. Tested one at 7 days, one at 14 days, and one at 28 days.

SECTION 03346

LIGHTWEIGHT CONCRETE
12/01

PART 1 GENERAL

1.1 SUMMARY

This section specifies requirements for lightweight concrete fill over metal roof and floor decks.

1.2 REFERENCES

American Society for Testing and Materials (ASTM)

ASTM C94	Ready-Mixed Concrete
ASTM C150	Portland Cement
ASTM C260	Air-Entraining Admixtures for Concrete
ASTM C309	Membrane-Forming Compounds for Curing Concrete
ASTM C330	Lightweight Aggregates for Structural Concrete

1.3 SUBMITTALS

Refer to Section 01300, Submittals. Submit the following:

SD-01, Data

Data - Mix design Data for Lightweight Concrete shall be submitted 15 calendar days before start of specified work. Mix design data shall be prepared by an approved concrete testing service.

1.4 DEFINITION OF LIGHTWEIGHT CONCRETE FILL

Lightweight concrete fill means concrete with a 28-day, air-dry density of not less than nor more than .

1.5 QUALIFICATIONS FOR READY-MIX CONCRETE MANUFACTURER

Concrete shall be manufactured and delivered to the Worksite by a ready-mix concrete manufacturer experienced in ready-mix lightweight concrete.

PART 2 PRODUCTS

2.1 LIGHTWEIGHT CONCRETE MATERIALS

Aggregates - Fine and coarse lightweight aggregates conforming to ASTM C332, Group II, or ASTM C330.

Portland Cement - ASTM C150, Type II.

Air-entraining Admixture - ASTM C260.

Water for Mixing Concrete - Potable.

Ready-mix Lightweight Concrete - ASTM C94.

2.2 CONCRETE CURING MATERIALS

Concrete slabs shall be cured using water-based curing compound that meets moisture retention requirements of ASTM C309.

2.3 QUALITY OF CONCRETE

General - The proportion of concrete ingredients shall be selected to produce a homogeneous, workable concrete when using methods of mixing, placing, and finishing specified herein, and shall have the compressive strength and other properties specified.

Lightweight Concrete Properties - Lightweight concrete shall consist of portland cement, water, and lightweight coarse and fine aggregates without admixtures or aeration except air-entraining admixture, and shall have the following properties:

PROPERTY	VALUE
Design compressive strength at 28 days	Not less than
Aggregate size	, maximum
Slump at point of concrete discharge	, maximum
Total air content by volume at point of concrete discharge	Minimum 4 percent, maximum 6 percent
Air-dry density at 28 days	Not less than 1360 kg/m3 nor more than

PART 3 EXECUTION

3.1 SAMPLING AND TESTING

Quality Control Testing During Construction - Lightweight concrete will be sampled and tested for quality during placement of concrete.

Design Mix - Testing of lightweight concrete materials proposed for use in the Work and the design mix shall be done by the Contractor.

3.2 PREPARATION BEFORE CONCRETE PLACING

General - Surfaces to receive lightweight concrete fill shall be free of debris, loose material, standing water, and other deleterious substances before start of concrete placing.

Permanent Metal Forms for Concrete - Forms for concrete, including reinforcement and other embedded items, shall be completed, inspected, and approved before start of concrete placing.

Edge Forms and Screed Strips - Edge forms and intermediate screed strips shall be set accurately to obtain indicated elevations and contours in

finished lightweight concrete fill surface, and shall be sufficiently strong to support vibrating bridge screeds or roller pipe screeds if nature of specified finish requires use of such equipment. Concrete surface shall be aligned to elevations of screed strips by use of strike-off templates or approved compacting-type screeds.

3.3 CONCRETE CONVEYING

Transfer to Concrete at Worksite - Concrete shall be handled from point of delivery and transfer to concrete conveying equipment and to locations of final deposit as rapidly as practicable by methods that will prevent segregation and loss of concrete mix materials.

Mechanical Equipment for Conveying Concrete - Equipment for conveying concrete shall ensure a continuous flow of concrete at delivery end and shall be approved. Runways for wheeled concrete-conveying equipment shall be provided form concrete delivery point to locations of final deposit. Inner surfaces of concrete-conveying equipment shall be maintained free of hardened concrete, debris, water, and other deleterious materials.

3.4 CONCRETE PLACING AND FINISHING

A. Weather Limitations and Protection - Concrete shall not be placed when temperature of the atmosphere is below .

B. Depositing

1. Concrete that becomes nonplastic and unworkable, that does not meet the quality control limits specified, or that has been contaminated by foreign materials shall not be used in the Work. Use of retempered concrete will not be permitted. Rejected concrete shall be removed from Worksite and disposed of as approved.

2. Lightweight concrete shall be placed and consolidated in a continuous operation until the placing of a panel or section is completed. During concrete placing operations, concrete shall be consolidated by vibrating bridge screeds, roller pipe screeds, or other approved method so that concrete is worked around embedded items and into corners. Consolidation operations shall be limited to time necessary to obtain consolidation of concrete without bringing an excess of lightweight coarse aggregate to the surface. Concrete to be consolidated shall be as dry as possible, and surfaces shall not be manipulated before finishing operations. Concrete shall be brought to correct level with a straightedge and struck off. Bull floats or derbies shall be used to smooth surface. Sprinkling of water on plastic surface is not permitted.

C. Float Finish - After concrete has been placed, struck off, consolidated and leveled, it shall not be worked further until ready for floating. Floating shall begin when water sheen has disappeared or when concrete mix has stiffened sufficiently to permit proper operation of a power-driven float, or when both conditions have occurred. Surface shall then be consolidated with power-driven floats. Hand floating shall be used in locations inaccessible to power-driven floats. Magnesium, aluminum, or other approved finishing tools suitable for finishing lightweight concrete shall be used. Surface shall be plane to a maximum tolerance of 1:500 when

tested with a straightedge placed on the surface at not less than 2 different angles. High spots shall be cut down and low spots shall be filled. Surfaces shall be uniformly sloped to drains. Immediately after completion of leveling, surface shall be refloated to a uniform, smooth, granular texture.

D. Trowel Finish - After completion of float finish as specified, the surface shall receive a trowel finish. Magnesium, aluminum, or other approved finishing tools suitable for finishing lightweight concrete shall be used. The first troweling after completion of floated finish shall be done by a power trowel and shall produce a smooth surface that is relatively free of defects but that may contain some trowel marks. Additional troweling shall be done by hand after surface has hardened sufficiently. Final troweling shall be started when a ringing sound is produced as the trowel is moved over the surface. Surface shall be consolidated by hand troweling operation. Finished surface shall be free of trowel marks, uniform in texture and appearance, and shall be plane to a maximum tolerance of 1:1000 when tested with a 3 m straightedge placed anywhere on the surface in any direction. Surface defects of sufficient magnitude to show through the floor covering shall be removed by grinding.

3.5 CONCRETE CURING AND PROTECTION

A. General

1. Freshly placed concrete shall be protected from premature drying and cold or hot temperatures, and shall be maintained without drying at a relatively constant temperature for period of time necessary for hydration of cement and proper hardening of concrete.

2. Initial curing shall immediately follow concrete finishing operation. Concrete shall be kept continuously moist for not less than 72 hours.

3. Final curing shall immediately follow initial curing and before the concrete has dried. Final curing shall continue until cumulative number of hours or fractions thereof (not necessarily consecutive) during which temperature of air in contact with concrete above has totaled 168 hours. Rapid drying at end of curing period shall be prevented.

B. Curing Methods:

Interior concrete slab surfaces shall be cured with a membrane-forming, water-based curing compound that meets the moisture retention requirements of ASTM C309. Curing compound shall be applied to damp concrete surface as soon as moisture film has disappeared. After curing for 45 to 60 days, remaining residue shall be removed by wire brushing or by washing with a light solution of muriatic acid or trisodium phosphate. All residues shall be removed.

C. Protection from Mechanical Injury - During curing period, concrete shall be protected form damaging mechanical disturbances (particularly load stresses, heavy shock, and excessive vibration).

3.6 INSPECTION AND ACCEPTANCE PROVISIONS

A. Evaluation of Quality Control Test Results

1. Lightweight concrete delivered to the point of final placement having a unit weight of fresh concrete that varies more than 2 percent from the design mix wet unit weight or having a slump exceeding the value specified shall not be used in the Work.

2. Compressive strength tests will be considered satisfactory if the average of any group of five consecutive compressive strength tests selected is in each instance equal to or greater than the 28-day design compressive strength of the class of concrete, and if not more than one compressive strength test in 10 has a value less than 90 percent of the 28-day design compressive strength.

3. If compressive strength tests fail to meet the minimum requirements specified, concrete represented by such tests will be rejected and shall be replaced with acceptable concrete at no additional cost to the Government.

B. Concrete Sampling and Testing - Slump tests will be done for each truckload of concrete, each time water is adjusted, and for each set of compression test cylinders. Three compression cylinders will be taken each day, or for each of concrete placed, and will be tested one at 7 days, one at 14 days, and one at 28 days.

C. Surface Finish Requirements

1. Finished surface of lightweight concrete fills shall be tested for smoothness with a straightedge placed anywhere on the surface in any direction. The entire surface area shall be tested. Surface smoothness shall be plane to a tolerance of +/- maximum.

2. The final surface shall be of uniform texture and shall be within specified tolerances for smoothness and slope. Low or defective areas shall be immediately corrected by cutting out faulty areas and replacing them with fresh concrete of the same concrete class as required to obtain specified surface requirements. High areas shall be removed by grinding until specified surface requirements are obtained. Other remedial measures may be performed subject to approval of the COTR.

SECTION 05100

STRUCTURAL STEEL
12/01

PART 1 GENERAL

1.1 SUMMARY

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

1.2 REFERENCES

American Institute of Steel Construction (AISC)

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

American Society of Mechanical Engineers (ASME)

ASME B.18.22M	Metric Plain Washers

American Society for Testing and Materials (ASTM)

ASTM A36M	Carbon Structural Steel
ASTM A53	Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A108	Steel Bars, Carbon, Cold Finished, Standard Quality
ASTM A148M	Steel Castings, High Strength, for Structural Purposes
ASTM A153	Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A242M	High-Strength Low-Alloy Structural Steel
ASTM A307	Carbon Steel Bolts and Studs, 60 000 psi Tensile Strength
ASTM A325M	High-Strength Bolts for Structural Steel

	Joints (Metric)
ASTM A500	Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A514M	High-Yield-Strength, Quenched and Tempered Alloy Steel Plate, Suitable for Welding
ASTM A525M	General Requirement for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process (Metric)
ASTM A668M	Steel Forgings, Carbon and Alloy, for General Industrial Use
ASTM A759	Carbon Steel Crane Rails
ASTM B695	Coatings of Zinc Mechanically Deposited on Iron and Steel
ASTM C150	Portland Cement
ASTM C404	Aggregates for Masonry Grout
ASTM C658	Chemical-Resistant Resin Grouts for Brick or Tile
ASTM E164	Ultrasonic Contact Examination of Weldments
ASTM E709	Magnetic Particle Examination
ASTM F959M	Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners (Metric)

American Welding Society, Inc. (AWS)

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

US Army Corps of Engineers, Concrete Research Division (CRD)

CRD-C621	Nonshrink Grout

Steel Structures Painting Council (SSPC)

SSPC SP3	Power Tool Cleaning

1.3 SUBMITTALS

Refer to Section 01300, Submittals. Submit the following:

SD-02, Manufacturer's Catalog Data

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

SD-04, Shop Drawings

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

SD-06, Manufacturer's Instructions

Manufacturer's Instructions for load-indicating washers.

SD-10, Test Reports

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

SD-20, Welding Procedures and Qualifications

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

1.4 QUALIFICATIONS

Structural steel fabrication and erection - Performed by an organization experienced in structural steelwork similar to work specified herein.

Welders - Certified to have been qualified by tests in accordance with AWS D1.1 or under an equivalent approved qualification test.

Perform tests on test pieces in positions and with clearances equivalent to those actually encountered. If a test weld fails to meet requirements, perform immediate retest of two test welds and ensure that each test weld passes. Failure in the immediate retest requires that welder be retested after further practice or training, and that a complete new set of test welds be made.

1.5 FABRICATION REQUIREMENTS

A. Unless otherwise indicated, AISC M016, AISC S303 and AISC S329 govern Work.

B. Design of members and connections for any portion of structure not indicated - Completed by fabricator and indicated on detail drawings.

C. Substitution of sections or modification of details - Submit with

detail drawings for approval, and indicate reasons for action taken.

D. Fabricate and assemble structural steel in shop to greatest extent possible. Parts not assembled in shop - Secure by bolts for shipment.

E. Splices of members are permitted only where indicated. Splices not indicated are subject to approval. Field splices in compound joints are not permitted.

F. Tolerances in fabrication and erection - Conform to AISC S303.

G. Connections

1. One-sided or other types of eccentric connections are not permitted, unless indicated and approved.

2. Shop connections - Welded unless otherwise indicated.

3. Field connections - Bolted, except where welded connections are indicated, as follows:

a. ASTM A325M high-strength threaded fasteners - Use for bolted connections, except where otherwise specified.

b. ASTM A307 low carbon steel threaded fasteners - May be used only for bolted connections of secondary members to primary members, such as purlins, girts, and other framing members carrying only nominal stresses and for temporary bracing to facilitate erection.

4. High-strength bolting - Conform to AISC S329. Unless otherwise noted, use slip-critical connections as modified by bonding and grounding requirements. Use load-indicating washers and hardened steel washers with high-strength bolts, in accordance with ASTM F959M.

5. Cut, drill or punch at right angles to surface of metal; do not make or enlarge holes by burning. Ensure that holes are clean-cut, without torn or ragged edges. Remove outside burrs resulting from drilling or reaming operations with a tool making a bevel.

6. Insert bolts into holes without damaging thread. Protect bolt heads from damage during driving. Ensure that bolt heads and nuts rest squarely against metal. Where bolts will be used on beveled surfaces having slopes greater than 1:20 with a plane normal to bolt axis, provide beveled washers to give full bearing to head or nut.

7. ASTM A307 low carbon steel threaded fasteners - Ensure that length extends through, but not more than 6 mm beyond, nuts. Draw bolt heads and nuts tight against work with a wrench not less than 380 mm long. Tap bolt heads with a hammer while nut is being tightened. Nuts - Locked after tightening. Where self-locking nuts are not furnished, provide upset bolt threads.

H. Shear Connectors

1. Shear connectors - Shop weld to beams or girders in composite

construction; space as indicated.

2. Headed stud-type shear connectors - Automatically end welded in accordance with headed stud manufacturer's printed recommendations, and by personnel familiar with installation equipment and procedures.

I. Column Bases and Bearing Plates

1. Provide column bases under columns; milled and attached to columns as indicated.

2. Provide bearing plates under beams, girders, and trusses resting on footings, piers, or walls.

J. Trusses

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

2. Camber of trusses: 1:1000, unless otherwise indicated.

1.6 BONDING AND GROUNDING

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

1.7 DRAINAGE HOLES

Drill diameter drainage holes to eliminate water traps; locate holes as indicated on detail drawings. Ensure that hole size and location do not adversely affect structural integrity.

PART 2 PRODUCTS

2.1 STRUCTURAL STEEL

Carbon Grade Steel - ASTM A36M.

High-strength Low-alloy Steel - ASTM A242M.

Stainless Steel - ASTM A242M.

High-strength Alloy Steel Plate - ASTM A514M.

Structural Tubing - ASTM A500, Grade B.

Steel Pipe - ASTM A53, Grade B, Type E or S.

Crane Rails - ASTM A759. Provide rails with tight end joints suitable for crane service, joint bars matching rail section, and joint bar bolts and nuts conforming to ASTM A325M, complete with AREA-01 alloy steel spring washers and fixed or floating type rail clamps.

Castings - ASTM A148M, Grade 550-345.

Forgings - Mild carbon steel, ASTM A668M, Class E.

2.2 FASTENERS

High-strength Bolts, Nuts and Washers - ASTM A325M. Galvanizing - ASTM A153 and ASTM B695.

Other Bolts and Nuts - ASTM A307, Grade A. Round washers - ASME B18.22.M, Type B, plain. Galvanizing - ASTM A153 and ASTM B695.

Anchor Bolts, Nuts and Washers - ASTM A307. Galvanizing - ASTM A153.

Stud Shear Connectors - ASTM A108, Grade 1015 or 1020, cold-finished carbon steel.

Load-indicating Washers - ASTM F959M.

2.3 WELDING MATERIALS - AWS D1.1.

Filler Metal - AWS D1.1, 70 Series.

Electrodes - AWS A5.5, E70XX.

2.4 PROTECTIVE COATING

Galvanized Products - Hot-dip galvanized after fabrication; ASTM A525M, Z275.

Steelwork - Shop primed, except surfaces of steel to be encased in concrete, surfaces to be welded, contact surfaces to be high-strength bolt connected, galvanized surfaces, and surfaces of crane rails. Surface preparation - SSPC SP-3.

Primer and Other Paint - As specified in Section 09890, Protective Coating of Carbon Steel.

2.5 GROUT

A. Shrinkage-resistant Grout - CRD-C621, premixed and packaged ferrous aggregate grouting compound.

B. Portland Cement Grout - ASTM C150, Type I or Type II. Aggregate for cement grout - Clean, sharp, uniformly graded natural abrasive; ASTM C404, Size 2. Mixing water - Potable.

C. Anchoring Adhesive - ASTM C658. Acceptable products:

1. CIA-GEL/R, Covert Operations, Inc., P.O. Box 3009, Long Beach, CA 90853. Telephone (310) 490-7226.

2. Burkepoxy Pistol Pak, Burke, 2221 Kenmore Ave., Tonawanda, NY 14150. Telephone 1-(800) 423-9140.

3. HIT Dowelling (C-100), HILTI, Inc., P.O. Box 21148, Tulsa, OK 74121. Telephone (918) 252-6000.

PART 3 EXECUTION

3.1 GENERAL

Perform erection of structural steel in accordance with AISC M016 and AISC S303, with modifications and additional requirements as specified.

Equipment - Suitable and safe for workmen. Maintain falsework in a safe and stable condition until steel structure is fully self-supporting.

Galvanize exterior metal fabrications, including anchor bolts, fasteners, washers and parts or devices necessary for proper installation, unless otherwise indicated.

3.2 ANCHOR BOLTS

Perform bolting and other connections between structural steel and foundations or existing structural steel as part of the work.

Accurately locate bolts and anchors, and build into connecting work; preset by using templates or other methods to locate bolts and other connections.

3.3 SETTING COLUMN BASES AND BEARING PLATES

Ensure that loose and attached column base plates and bearing plates for beams and similar structural members are aligned with wedges or shims and are bedded with damp-pack bedding.

Concrete and Masonry Bearing Surfaces - Clean free of laitance, dirt, oil, grease, and other foreign material. Roughen concrete surfaces, but not enough to interfere with placing bedding. Clean bottom surface of base or bearing plates free of dirt, oil, grease, and other foreign materials.

Make space between top of bearing surface and bottom of base or bearing plate approximately 4 percent of width of base or bearing plate, but not less than 13 mm for base or bearing plates that are less than 300 mm wide. Support and align base or bearing plates on steel wedges or shims. Provide forms to retain grout until it sets.

3.4 SHEAR CONNECTORS

A. Cleaning - Thoroughly clean surface where stud will be attached. Remove scale by grinding or sandblasting where it is sufficiently thick to interfere with proper welding.

B. Welding - Establish correct arc current and time cycle. Hold welding gun steadily during cycle until weld metal has solidified.

C. Trial Welds - Establish welding procedure by making trial welds on test plates and adjust weld current, time cycle, lift, and other variables until satisfactory welds are obtained.

1. Test studs - Same type and size as those that will be used in production.

2. Test plate - Approximately same thickness as steel flange to which studs will be welded.

D. Welded Studs - Provide full 360 degree welds.

E. Weld Test

1. Bend down 3 successive test studs by hammering, with no sign of failure in weld. Record details of procedure.

2. Bend down minimum 5 percent of stud welds during production in presence of Testing Agency's Inspector to check quality of welds.

3. If unsatisfactory welds are made, if fillet at base of stud is less than 360 degrees, if there is excessive expulsion and weld spatter, or if as-welded stud height is greater than normal, stop welding immediately and correct procedure as necessary. Perform bend test on unsatisfactory welds.

4. Inspect studs for lack of fillet at base and perform bend test. Repair studs with incomplete fillet by adding fillet weld where needed using manual shielded metal arc process. Perform bend test on repaired studs.

3.5 FIELD ASSEMBLY

Assemble structural steel frames to lines and elevations indicated. Align and adjust members forming parts of a completed frame or structure after assembly and before fastening. Fasten splices of compression members after bringing abutting surfaces into complete contact. Clean bearing surfaces and surfaces that will be in permanent contact before members are assembled.

Splices are permitted only where indicated. Remove erection bolts used in welded construction and fill holes with plug welds.

Bracing, adequacy of temporary connections and supports, alignment, and removal of paint on surfaces adjacent to field welds - As specified in AISC S303.

Install high-strength bolted connections with load-indicating washers.

Welding for redrilling is not permitted. Do not enlarge holes more than greater than specified hole diameter without approval of COTR.

3.6 GAS CUTTING

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

3.7 CRANE RUNWAYS

Erect runways complete with columns, girders, beams, bracing, crane rails, crane stops, and other required components as indicated. Gage, alignment, and elevation of rails - Accurate to a tolerance of +/- . Rail joints - Staggered with respect to each other on opposite sides of runway, and not coinciding with girder joints. Make top of rails flush at joints.

3.8 TOUCHUP PAINTING

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

3.9 INSPECTIONS AND ACCEPTANCE PROVISIONS

A. Inspection by the Government will include proper preparation, size, gaging location, and acceptability of welds; identification marking; operation and current characteristics of welding sets in use; and installation of high-strength bolts.

B. Inspection of Welding - Performed in accordance with AWS D1.1, Section 6, Inspection. Nondestructive testing performed as follows:

1. Visual inspection - All welds.

2. Magnetic particle testing - ASTM E709. All partial penetration welds.

3. Ultrasonic testing - ASTM E164. All full penetration welds.

C. Inspection of High-strength Bolted Connections - Performed in accordance with AISC S329.

1. For bolts installed using direct tension indicator devices, a representative sample of minimum 3 devices for each diameter and grade of fastener will be tested with 3 typical bolts in a calibration device capable of indicating bolt tension.

2. Average gap between face of direct tension indicator and underside of bolt head: .

SECTION 05311

STEEL FLOOR DECK
12/01

PART 1 GENERAL

1.1 SUMMARY

This section covers the supply and installation of the composite corrugated metal deck including accessories for floor and roof.

1.2 REFERENCES

American Iron and Steel Institute (AISI)

AISI SG-673	Cold-Formed Steel Design Manual

American Society for Testing and Materials (ASTM)

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

American Welding Society, Inc. (AWS)

AWS A2.4	Standard Symbols for Welding, Brazing and Nondestructive Examination
AWS A5.1	Carbon Steel Electrodes for Shielded Metal Arc Welding
AWS D1.1	Structural Welding Code - Steel
AWS D1.3	Structural Welding Code - Steel Sheet

Military Specifications (MS)

MS DOD-P-21035	Paint, High Zinc Dust Content, Galvanizing Repair (Metric)

Underwriters Laboratories Inc. (UL)

UL-02	Electrical Appliance and Utilization Equipment Directory

1.3 SUBMITTALS

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

SD-01, Data

Data - Manufacturer's Catalog Data shall show type, voltage and amperage for the following items:

Welding equipment

Welding rods and accessories

SD-04, Drawings

Drawings - Fabrication Drawings for the following items shall be in accordance with Paragraph 2.5, Fabrication:

Metal deck units

Metal cover plates

Metal closures

SD-04, Drawings

Installation Drawings for metal deck units shall include the following:

Field measurements shall be taken before preparation of drawings and fabrication.

Details and layouts indicating the structural framing, location, length and markings of the metal deck units, corresponding with he sequence and procedure to be followed in placing and fastening the deck units; and location, type, and sequence of welded connection; welds shall be indicated in accordance with AWS A2.4.

Deck unit cross section, with dimensions, and complete unit section properties including diaphragm shear capacity.

Accessories and methods of installation, including reinforcement at openings.

Size and number of openings to be cut in the metal decking.

When both fire-resistance-rated and non-rated construction are required, the location of fire-resistance-rated construction shall be indicated.

SD-06, Instructions

Instructions - Installation instructions shall indicate the metal deck unit manufacturer's recommended method and sequence of installation.

SD-08, Statements

Statements - Welding procedures shall be in accordance with AWS D1.1.

SD-13, Certificates

Certificates of Compliance for welder qualification shall be in accordance with Paragraph 1.4, Qualifications of Welding Work.

SD-13, Certificates

Certificates of Compliance shall be provided for the following items showing conformance to the referenced standards contained in this section:

Galvanizing repair paint

Repair paint

Metal floor and roof units

1.4 QUALIFICATIONS FOR WELDING WORK

Welders shall be certified to have been qualified by test in accordance with AWS D1.3 or under an equivalent approved qualification test.

1.5 DELIVERY, STORAGE, AND HANDLING

Decking stored at the Worksite before erection shall be stacked on platforms or pallets, and covered to provide a weathertight enclosure and protection against the weather.

Packaged materials shall be stored in their original, unbroken package in a dry area until needed for installation.

Floor decking shall not be used for storage or as a working platform until the floor deck units have been permanently fastened in position. Floor decking shall not be damaged or overloaded during construction.

1.6 PERFORMANCE REQUIREMENTS

A. Properties of Sections

1. Properties of metal floor deck sections shall be computed on the basis of the effective design width, as limited by the provisions of AISI SG-673.

2. Floor deck section properties, including section modulus and moment of inertia per meter of width, shall equal or exceed the required values of section properties indicated on drawings.

B. Underwriters Laboratories Inc. Listing and Label - Metal floor deck units shall be listed in UL-02 Building Material Directory, Steel Form and Floor Units, (CHWX), and each floor deck unit shall bear UL label and marking.

PART 2 PRODUCTS

2.1 STRUCTURAL-QUALITY STEEL SHEETS

Steel sheets shall be hot-dip galvanized, carbon steel sheets having minimum yield point of conforming to ASTM A525M, Z275.

2.2 ELECTRODES FOR MANUAL SHIELDED METAL ARC WELDING

Electrodes shall meet the requirements of AWS D1.1, and shall be covered mild steel electrodes conforming to AWS A5.1, E60 series.

2.3 GALVANIZING REPAIR PAINT

Paint shall be a high-zinc-dust content paint for regalvanizing welds in galvanized steel, and shall conform to MS DOD-P-21035.

2.4 DECK TYPE

A. Deck shall be composite floor deck having deformations and indentations to provide a mechanical bond with the concrete. Deck section and properties are indicated on drawing.

B. Metal Closures

1. Closures for cell flutes shall be fabricated from the specified commercial-quality steel sheets not less than nominal thick before galvanizing.

2. Closures for openings between floor decking and other construction shall be fabricated from the specified structural-quality steel sheets not less than nominal thick before galvanizing.

3. Metal closures shall be of the configuration required to provide tight-fitting closures at open ends of cells or flutes and sides of the floor decking.

2.5 FABRICATION

Fabrication of metal decking shall be in accordance with SDI. Floor deck units shall be of sufficient length to span three or more supports wherever possible.

PART 3 EXECUTION

3.1 GENERAL

Metal floor deck units and accessories shall be installed in accordance with the approved shop drawings and descriptive data, and as specified.

3.2 WELDING

Welds shall conform to AISI SG-673, Fusion-Welds.

Procedures for manual, shielded metal arc welding, the appearance and quality of welds made, and the methods used in correcting welding work shall conform to AWS D1.3, Workmanship and Technique, except for such requirements that are clearly not applicable to light-gage steel construction.

3.3 PLACING FLOOR DECK UNITS

Supporting members shall be completely in place before the placing of metal floor deck units is started. Units shall be placed on the supporting steel framework and adjusted to final position with ends bearing on the supporting members and accurately aligned, end to end, before being permanently fastened. End bearings shall be minimum . Floor deck units shall be placed in straight alignment for the entire length of run of cells and with close alignment between cells at ends of abutting floor deck units. Placing and aligning of the units shall be done to

maintain the required number of units indicated on the approved shop drawings and to prevent stretching or contracting of the sidelap interlocks.

3.4 FASTENING FLOOR DECK UNITS

Floor deck units shall be fastened to the steel supporting members at ends and at intermediate supports, parallel and perpendicular to deck span, by welds. Spacing of welds shall be one weld at each trough at support members transverse to deck, and on center at support members parallel to deck. Welds shall be minimum diameter fusion welds. Welding sequence and procedure shall be coordinated with the placing of the floor deck units. Blow holes shall be cause for rejection.

Sidelaps between adjacent floor deck units shall be locked together at maximum on center by welding for all spans.

3.5 CUTTING AND FITTING

Cutting and fitting of floor deck units shall be performed where indicated and as required for the passage of other work projecting through, or adjacent to, the floor decking.

Additional metal reinforcement and closure pieces shall be provided as required for strength, continuity of the floor decking, or the support of other work.

3.6 REINFORCEMENT AT OPENINGS

Floor decking around openings to in size shall be reinforced by means of a flat, galvanized, structural-quality steel sheet placed over the opening on the top of the floor decking and fusion welded to the surface of the floor decking. Steel sheets shall be minimum 1.2 mm thick before galvanizing and minimum wider and longer in size than the opening. Spacing of welds shall be maximum on center, with one weld minimum at each corner.

3.7 METAL CLOSURES

Metal closures shall be provided for open ends of cell flutes at openings, columns, walls, and other building construction, and to close openings between floor decking and other building construction. Metal closures shall be tack welded in position.

3.8 TOUCHUP PAINTING

After floor decking installation, scarred areas on the top and bottom surfaces of the metal floor decking and on the surface of supporting steel members shall be wire-brushed, cleaned, and touchup painted. Scarred areas shall include welds, weld scars, bruises, and rust spots. Galvanized surfaces shall be touched up with galvanizing repair paint. Painted surfaces shall be touched up with paint for the repair of painted surfaces.

SECTION 05500

METAL FABRICATIONS
12/01

PART 1 GENERAL

1.1 SUMMARY

This section specifies requirements for miscellaneous steel items.

1.2 REFERENCES

American Institute of Steel Construction (AISC)

AISC S303	Code of Standard Practice for Steel Buildings and Bridges

American Society for Testing and Materials (ASTM)

ASTM A36M	Carbon Structural Steel
ASTM A47M	Ferritic Malleable Iron Castings (Metric)
ASTM A48M	Gray Iron Castings (Metric)
ASTM A53	Pipe, Steel, Black and Hot-Dipped, Zinc-Coded, Welded and Seamless
ASTM A123	Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A153	Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A283M	Low and Intermediate Tensile Strength Carbon Steel Plates
ASTM A366M	Steel, Sheet, Carbon, Cold-Rolled, Commercial Quality
ASTM A500	Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A525M	General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Commercial Quantity
ASTM A526M	Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Commercial Quality
ASTM A569M	Steel, Carbon (0.15 Maximum, Percent) Hot-Rolled Sheet and Strip, Commercial Quality
ASTM A575M	Steel Bars, Carbon, Merchant Quality,

M-Grades

ASTM A786M	Rolled Steel Floor Plates

American Welding Society, Inc. (AWS)

AWS A2.4	Standard Symbols for Welding, Brazing and Nondestructive Examination
AWS A5.1	Carbon Steel Electrodes for Shielded Metal Arc Welding
AWS D1.1	Structural Welding Code - Steel

Code of Federal Regulations (CFR)

29 CFR 1910	Occupational Safety and Health Standards

Federal Specifications (FS)

FS FF-B-561	Bolts (Screw), Lag
FS FF-B-575	Bolts, Hexagon and Square
FS FF-B-588	Bolt, Toggle, and Expansion Sleeve, Screw
FS FF-N-836	Nut, Square, Hexagon. Cap, Slotted, Castle Knurled. Welding and Single Ball Seat
FS FF-S-92	Screw, Machine: Slotted, Cross-Recessed or Hexagon Head
FS FF-S-111	Screw, Wood
FS FF-S-325	Shield, Expansion; Nail, Expansion; and Nail, Drive Screw (Devices, Anchoring, Masonry)
FS FF-W-84	Washers, Lock (Spring)
FS FF-W-92	Washer, Flat (Plain)
FS RR-C-271	Chains and Attachments, Welded and Seamless
FS RR-G-661	Grating, Metal, Bar Type (Floor, Except for Naval Vessels)
FS RR-T-650	Treads, Metallic and Nonmetallic, Skid Resistant

1.3 SUBMITTALS

Refer to Section 01300, Submittals. Submit the following:

SD-02, Manufacturer's Catalog Data

Manufacturer's Catalog Data for catalog items.

SD-04, Shop Drawings

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

SD-20, Welding Procedures and Qualifications

1.4 QUALIFICATIONS FOR WELDING WORK

Welding Procedures - In accordance with AWS D1.1.

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

1.5 REQUIREMENTS

Furnish and install supplementary parts necessary to complete each item. Furnish promptly to the appropriate trades anchors, sockets, or fastenings required for securing metal work to other structures. Details and specifications of items for which standard products are available are representative guides of minimum requirements for such items. Standard products, generally meeting such requirements, will be accepted subject to approval. Provide continuous welding along entire area of contact except where tack welding is indicated. Tack welding is not permitted on exposed surfaces.

Use templates and patterns for proper fitting of hardware and other accessories wherever feasible.

Make substitutions of materials or modification of details, or both, only when warranted and approved.

Drill diameter drainage holes to eliminate water traps. Indicate locations of holes on detail drawings for approval of COTR. Ensure that hole sizes and locations do not affect structural integrity.

1.6 FABRICATION

Fabricate miscellaneous structural steel work in accordance with AISC S303.

Mill joints to a close fit. Corner joints - Coped or mitered, well-formed, and in true alignment. Form and fabricate joints exposed to weather so as to exclude water.

Castings - Sound and free from warp or defects that impair strength and appearance. Ensure that exposed surfaces have a smooth finish and sharp, well-defined lines and arises. Mill joints to a close fit.

Provide holes as indicated for securing items to metal work.

PART 2 PRODUCTS

2.1 STRUCTURAL STEEL

Plates, Shapes, and Bars - ASTM A36M.

Bent or Cold Formed Plates - ASTM A283M, Grade C.

Square or Rectangular Tubing - ASTM A500, Grade B; hot formed, welded or seamless.

Steel Pipe - ASTM A53, Grade B, Type E or S.

Bars and Bar Sizes - ASTM A575, Grade M1020.

Hot-rolled Sheets and Strip - ASTM A569M, uncoated.

Cold-rolled Sheets - ASTM A366M, uncoated.

Galvanized Sheets - ASTM A526. Galvanizing - ASTM A525M, Z275.

Gray iron Castings - ASTM A48M, Class 30.

Malleable Iron Castings - ASTM A47M, Grade 32510 or Grade 35018.

2.2 RAISED PATTERN STEEL FLOOR PLATES

Structural-quality ASTM A36M steel with a raised figure pattern at regular intervals on surface flatback style conforming to ASTM A786M, Pattern 3, 4 or 5.

2.3 STEEL BAR GRATING

Provide FS RR-G-661, Type I or II; ASTM A36M steel. Provide end-banding bars, anchors, and other components as required to suit conditions indicated. Steel grating galvanized after fabrication.

2.4 FASTENERS

A. Bolts - Regular hexagon head, carbon steel, coarse thread, FS FF-B-575, Type II, Gr 1.

B. Nuts - Regular hexagon head, carbon steel, coarse thread, FS FF-N-836, Type II, Style 4, Gr A.

C. Lag Bolts - Square head, carbon steel, FS FF-B-561, Type I or II, Style 2.

D. Toggle Bolts - Carbon steel, tumble wing type, FS FF-B-588, Type II.

E. Machine Screws - Phillips flat head, carbon steel, FS FF-S-92, Type III, Style 2C or 3C.

F. Wood Screws - Phillips flat head, carbon steel, FS FF-S-111, Type I, Style 2C.

G Plain Washers - Round, general, carbon steel, FS FF-W-92, Type A, Grade I, Class A.

H. Lock Washers - Helical spring, carbon steel, FS FF-W-84, Class A.

I. Concrete Wedge Anchors - Galvanized, Redhead, Hilt, or approved equal, of nominal bolt diameter and actual embedment specified.

J. Masonry Anchorage Devices - Expansion shields conforming to FS FF-S-325, Group, Type, and Class as follows:

1. Machine screws < diameter Group I, Type 1, Class 1

2. Machine screws > diameter Group I, Type 1, Class 2

3. Lag bolts Group II, Type 1, Class 1

4. Bolts Group II, Type 2, Class 1

K. Electrodes for Manual Shielded Metal Arc Welding - AWS D1.1; mild steel electrodes conforming to AWS A5.1, E60 series.

2.5 FINISHES

Items Specified to be Galvanized - Hot-dip galvanized after fabrication in accordance with ASTM A123 or ASTM A153, as applicable. Minimum mass of coating: of surface.

Miscellaneous Metal Work, except metal surfaces embedded in concrete or masonry, surfaces and edges to be field welded, and galvanized surfaces - Prime as specified in Section 09890, Protective Coating of Carbon Steel, unless otherwise indicated.

Miscellaneous Metal Work Exposed to View - Provide architectural top-coats as specified in Section 09900, Architectural Painting.

2.6 FABRICATED PRODUCTS

A Cast Abrasive Thresholds

1. Thresholds - Gray iron castings with fluted tread and abrasive grit embedded uniformly into walking surface at time of casting. Gray iron castings - ASTM A48M Class 20. Abrasive: #20 grain aluminum oxide or silicon carbide, or a combination of both. Screws for securing cast-iron thresholds - Zinc- or cadmium-coated.

2. Thresholds to concrete floor slab - Secured with lead expansion shields and flathead machine screws.

B. Curb Edge Bars - Structural steel shapes of sizes indicated, galvanized all-welded construction, with mitered corners and continuously welded joints. Provide anchors welded to curbs for embedding in concrete or masonry construction, maximum from each curb end and corners, and maximum on center. Anchors - Structural steel bars wide x thick unless otherwise indicated, with length as required for a minimum embedment of in concrete.

C. Floor Gratings and Frames

1. Gratings - Carbon steel with parallel bearing bars, right angle or diagonal cross members, conforming to FS RR-G-661, Type I or

Type II. Grating panel and bearing bar sizes - As indicated. Provide each panel with end-banding bars, four saddle clip anchors designed to fit over two bearing bars, and four stud bolts with plain washers and nuts.

2. Frames - Structural steel angles, all-welded construction, fabricated so that tops of frames and floor grating are flush with finished floor. Provide anchors welded to frame, spaced at 150 mm maximum from ends of frame sections, maximum from corners, and maximum on center between end and corner anchors. Anchors - Structural steel bars, wide x thick unless otherwise indicated, length as required for a minimum embedment of in concrete.

3. Grating panels - Removable. Stud bolts to receive saddle clip anchors - Field welded to frame. Notching of bearing bars at supports is not permitted. Provide openings in grating as indicated.

4. Gratings and frames, fasteners and clips - Galvanized.

D. Floor Plate Covers and Frames

1. Covers - Carbon steel plates with a raised figure pattern at regular intervals on surface, conforming to ASTM A786M, Pattern No. 3, 4, or 5.

2. Cover sections - Width and thickness as indicated. Length - Limited by maximum mass of . Provide each floor plate cover section with holes to receive flathead machine screws and two flush lifting rings (one at each end of section). Ensure that covers are free of sharp edges and burrs.

3. Frames - Structural steel angles and steel bar stops, all-welded construction, fabricated so that tops of frames and floor plate covers are flush with finished floor. Provide anchors welded to frame, spaced at maximum from ends of frame sections and corners, and maximum on center. Anchors - Structural steel bars wide x thick unless otherwise indicated, length as required for a minimum embedment of 150 mm in concrete. Drill and tap frames to receive machine screws.

4. Plate covers - Removable and secured to frame with machine screws at maximum from each cover end and at maximum on center. Machine screws - Zinc- or cadmium-coated. Provide openings in plate covers as indicated.

5. Floor plates and frames - Galvanized.

E. Ladders

1. Ladders - Fixed-rail type, located and detailed as indicated. Rungs solid-section structural steel rods at on center. Side rails - Structural steel flat bars x with rounded edges unless otherwise indicated, on center, and conforming to 29 CFR 1910.27. Rungs - Fitted into punched holes in side rails, welded, and ground smooth. Splices and connections - Provide a smooth transition with original members, without projections that are sharp or more extensive than required for joint strength.

Provide ladders with structural steel brackets, drilled to receive anchor bolts, and welded to side rails. Bracket spacing: maximum.

2. Ladders, brackets and fasteners - Galvanized.

F. Ladder Safety Cages

1. Cages - Basket guard hoop type, located and detailed as indicated; fabricated from structural steel flat bars and assembled by bolting or welding. Provide wide x thick top and bottom hoops, and intermediate hoops at maximum on center between top and bottom hoops. Provide wide x thick hoops between wide hoops at maximum on center. Provide vertical bars wide x thick at or 40 diameters maximum. Fasten hoops to steel ladder side rails with steel bolts, or shop weld.

2. Ladder safety cages and fasteners - Galvanized.

G. Loose Steel Lintels

1. Provide lintels of structural steel shapes as indicated for openings and recesses in masonry walls and partitions. Lintels consisting of more than one member - Welded together to form one unit. Minimum bearing at each side of openings: .

2. Lintels installed in exterior walls - Galvanized.

H. Metal Safety Nosings for Concrete Treads

1. Provide nosings for interior concrete stair treads and concrete platforms and landings; nonskid type, cast iron class, with radius nose lip, conforming to FS RR-T-650, Composition D, Type 5.

2. Make nosings to shorter in length than width of concrete tread, platform or landing. Provide each nosing with integrally cast anchors for embedding in fresh concrete, maximum from each nosing end and maximum on center.

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

J. Roof Scuttles

1. Roof scuttles - Single-leaf type, sized to provide a minimum clear opening of x .

2. Steel sheets - Prime painted, electrode posited galvanized, hot-rolled carbon steel sheets. Covers and curbs: m thick (14 ga). Cover liner: thick (22 ga).

3. Cover - Formed from one piece of sheet with hemmed edge and corners full welded and ground smooth; insulated with glass fiber or rigid fiberboard insulation thick. Insulation - Covered and protected by specified steel sheet cover liner.

4. Curbs - Made of sheet in height, formed with mounting flange with holes for securing to roof deck. Provide curb with an integral metal cap flashing of same metal and thickness as curb, with corners full welded and ground smooth. Insulate curb on exterior face with rigid fiberboard insulation thick.

5. Scuttles - Completely assembled with heavy pintle hinges, compression-spring operators enclosed in telescopic tubes or enclosed torsion-spring operators, automatic locking hold-open arm with hand-grip handle, positive snap latch with an operating handle inside and outside, provisions for padlocking on inside, and chloroprene elastomer weatherseal. Hardware - Zinc- or cadmium-coated.

K. Safety Chains

1. Provide chains for each guarded opening were indicated, complete with snap fasteners on each end and eye bolts for attachment of chains.

2. Chains - Galvanized, welded type, proof coil steel, diameter nominal size, with 33 links per meter minimum, proof loading minimum, conforming to FS RR-C-271, Type I, Grade C, Class 4.

3. Snap fasteners - Boat type with strength equivalent to chain proof loading. Eye bolts for attachment of chains: diameter bolt with diameter eye; strength equal to chain proof loading. Safety fasteners and eye bolts - Galvanized.

4. Provide two chains longer than anchorage spacing for each guarded opening. Mount top chain minimum above floor, and mount second chain above floor.

L. Shelf Angles

1. Angles attached to concrete framing - Structural steel angles with slotted holes to receive diameter bolts, maximum from each end and maximum on center.

2. Angles installed in exterior walls - Galvanized.

3. Provide wedge-type concrete inserts, complete with fasteners, for attachment of shelf angles to cast-in-place concrete.

M. Steel Pipe Railings

1. Provide steel pipe railings, including guard at open-sided areas, consisting of top rail, intermediate rail and posts, and handrails at walls, as indicated.

2. Minimum sizes: nominal diameter, and standard weight pipe conforming to ASTM A53, Type E or Type S, Grade B; or nominal diameter, , round structural steel tubing.

3. Join posts, rails, and corners by one of following methods:

a. Use flush-type steel railing fittings, welded and ground smooth, and secure railing splice locks with diameter hexagonal recessed-head setscrews.

b. Make mitered and welded joints by fitting post to top rail and intermediate rail to post, mitering corners, groove welding joints, and grinding smooth. Railing splices - Butted and reinforced by a tight-fitting interior sleeve long minimum.

4. Railings may be bent at corners instead of joining, provided bends are made in suitable jigs and cylindrical cross section of pipe is maintained throughout entire bend.

5. Provide kickplates between railing posts where indicated, comprising steel flat bars minimum high x thick. Secure kickplates as indicated.

6. Railings, including pipe, fittings, brackets, fasteners, and other ferrous metal components - Galvanized.

N. Steel Stairs

1. Steel stairs - Constructed to conform to sizes and arrangements indicated. Provide steel framing, hangers, columns, struts, clips, brackets, bearing plates, and other components as required to support stairs and platforms.

2. Stringers - Structural steel channels or structural steel plates, or a combination thereof, as indicated. Close exposed ends of stringers.

3. Construct platform of structural steel channel headers and miscellaneous framing members as indicated. Bolt headers to stringers and newels; bolt framing members to stringers and headers.

PART 3 EXECUTION

3.1 GENERAL

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

3.2 FASTENING TO CONSTRUCTION-IN-PLACE

Provide anchorage devices and fasteners where necessary for fastening miscellaneous steel items to construction-in-place. Fastening includes threaded fasteners for concrete inserts embedded in cast-in-place concrete; masonry anchorage devices and threaded fasteners for solid masonry and concrete-in-place; toggle bolts for hollow masonry and stud partitions; through bolting for masonry and wood construction; lag bolts and wood screws for wood construction; and threaded fasteners for structural steel. Fastening to wood plugs in masonry or concrete-in-place is not permitted.

3.3 CUTTING AND FITTING

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

3.4 FIELD WELDING

Procedures for Welding - As approved. For appearance and quality of welds made, and methods used in correcting welding Work, conform to AWS D1.1, Workmanship and Technique.

Provide continuous welding along entire area of contact. Exposed welds - Ground smooth.

3.5 THREADED CONNECTIONS

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

SECTION 06100

ROUGH CARPENTRY
12/01

PART 1 GENERAL

1.1 SUMMARY

This section specifies requirements for wood framing and sheathing.

1.2 REFERENCES

American Society for Testing and Materials (ASTM)

ASTM A36M	Carbon Structural Steel
ASTM A525M	General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process (Metric)
ASTM E84	Surface Burning Characteristics of Building Materials

American Wood Preservers Bureau (AWPB)

AWPB LP2	Surface Burning Characteristics of Building Materials

American Wood-Preservers' Association (AWPA)

AWPA A3	Determining Penetration of Preservatives and Fire Retardants
AWPA P5	Water Borne Preservatives

International Conference of Building Officials, Uniform Building Code (UBC)

UBC Std. 23-1	Classification, Definition and Methods of Grading for All Species of Lumber
UBC Std. 23-2	Construction and Industrial Plywood

1.3 SUBMITTALS

Refer to Section 01300, Submittals. Submit the following:

SD-13, Certificates

Certificates; for fire-retardant-treated lumber, wood-preservative treatment, and fasteners.

1.4 DELIVERY, HANDLING, AND STORAGE

Securely bundle wood materials and ship with adequate moisture-resistant covers to protect from damage by weather or handling during delivery, when

stored, and during construction.

Wood Materials Stored Outdoors before immediate use - Place in orderly piles on blocks above ground. Store lumber in stacks, allowing for air circulation within stacks, and protect with moisture-resistant covers.

PART 2 PRODUCTS

2.1 WOOD

A. General

1. Wood materials - Conform to UBC Chapter 23. Grading of lumber - UBC Std. 23-1. Grading of plywood - UBC Std. 23-2.

2. Framing lumber, board lumber, and plywood - Ensure that each piece bears trademark and grade identification of manufacturer's association or authorized inspection bureau under whose rules lumber is manufactured and graded.

3. Boards, dimension lumber, and timber - Douglas Fir-Larch (as defined by UBC) unless otherwise indicated, graded in accordance with NGLA, WCLIB, or WWRA rules.

4. Grade requirements, unless otherwise noted, are as follows:

a.	Studs and plates	No. 3
b.	Joists and rafters	No. 2
c.	Bracing and blocking	No. 2
d.	Beams and stringers	No. 1
e.	Posts and timbers	No. 1
f.	Decking	Commercial
g.	Boards	Appearance
h.	Plywood	CDX
i.	Glu-lam beams	24FV4

B. Fire-Retardant-Treated Lumber

1. Submit reports of results of retention-penetration test boring cores, weight test of plywood panels, and performance ratings. Treatment and performance inspection - Performed by an independent, qualified test agency that establishes performance rating.

2. Provide materials that, after treatment, have a maximum flame-spread rating of 25, with no evidence of significant progressive combustion when tested for 30 minutes in accordance with ASTM E84. Fuel contributed: 15 maximum. Smoke developed: 5 maximum.

3. Provide solid lumber materials that, after treatment, have a minimum penetration of of fire retardant material when tested by a borer core in accordance with AWPA A3. Provide plywood materials with a minimum retention of when tested by weighing before and after treatment.

4. Ensure that approved fire-retardant materials bear identification showing their fire performance ratings issued by an approved testing agency.

5. Ensure that, after treatment, solid lumber is kiln-dried to reduce moisture to 19 percent maximum, and that plywood is kiln-dried to reduce moisture to 15 percent maximum.

C. Preservative Treated Lumber

1. Treat following wood members with pressure-preservative in accordance with AWPB LP2, with each piece bearing AWPB stamp indicating point of treatment, preservative symbol, symbol of standard, date of treatment, and moisture content after treatment:

a. Wood sills, plates, rough bucks, and frames in exterior masonry wall openings

b. Wall plates, nailers, and furring in contact with exterior masonry or concrete

c. Blocking and nailers for roof deck, sub fascia members, roof cants and saddles.

2. Preservative - Water-borne, conforming to AWPA P5, and air-dried or kiln-dried to reduce moisture content to 15 percent maximum.

3. Treated wood exposed in the final structure - Free from objectionable odors, and not harmful or corrosive to adjacent materials or anchorages.

2.2 ANCHORS AND FASTENERS

Nails for roof blocking, cants, and nailers, and those used to fasten exposed wood fascias or finished wood members exposed to the weather - Galvanized. Power-driven staples - Galvanized, Type III, Style 3.

Bolts, Nuts, Wood Screws, Lag Screws, and Washers - Carbon steel, galvanized.

Expansion Shields, Expansion Nails, and Drive Screw Devices - Approved by COTR.

Where specified only by part number, steel framing anchors, hangers, and straps refer to Simpson part number. Simpson brand or other ICBO-approved steel products may be used. Custom-fabricated products - Submit shop drawings to COTR for approval before fabrication. Steel - ASTM A36M. Galvanizing - ASTM A525M, Z275.

PART 3 EXECUTION

3.1 INSTALLATION

Construct Work as detailed and scheduled. Unless otherwise indicated, conform to UBC Section 2326.

Frame members for passage of ducts and pipes; do not cut, notch, or bore members more than 0.25 of their depth without approved reinforcement. Do not notch or bore beams, girders, posts, timbers, and braces except as indicated on design drawings or as previously approved by COTR. Do not notch or bore any two contiguous repetitive members, except as indicated or approved.

Provide washers under bolt heads or nuts in contact with wood. Bore lumber to receive bolts.

Use double studs at openings. Headers - Consist of two pieces of x depth, set on edge and nailed together. Depth of header - As detailed or, if not detailed, as follows:

Maximum opening, mm	900	1200	1600	2000	4200	>2400
Minimum header depth, mm	89	140	184	235	286	Approved by COTR

SECTION 06200

FINISH CARPENTRY
12/01

PART 1 GENERAL

1.1 SUMMARY

This section specifies requirements for finish carpentry, including wood paneling, wood trim, cabinets, shelving, and casework.

1.2 REFERENCES

American National Standards Institute (ANSI)

ANSI A156.9	Cabinet Hardware
ANSI A156.16	Auxiliary Hardware
ANIS A156.18	Materials and Finishes

American Society for Testing and Materials (ASTM)

ASTM C1036	Flat Glass
ASTM D1037	Evaluating Properties of Wood-Base Fiber and Particle Panel Materials

Architectural Woodwork Institute (AWI)

AWI-01	Architectural Casework - General

Federal Specifications (FS)

FS FF-H-1819	Hardware, Builders'; Auxiliary Locks
FS MMM-A-125	Adhesive, Casein-Type, Water and Mold Resistant

Hardwood Plywood Manufacturers Association (HPMA)

HPMA HP-1	Standard for Hardwood and Decorative Plywood

National Electrical Manufacturers Association (NEMA)

NEMA LD 3	High-Pressure Decorative Laminates
NEMA LD 3.1	Performance, Application, Fabrication, and Installation of High-Pressure Decorative Laminates

National Wood Window and Door Association (NWWDA)

NWWD IS-1	Wood Flush Doors

1.3 SUBMITTALS

Refer to Section 01300, Submittals. Submit the following:

SD-02, Data

Manufacturer's Catalog Data for hardware and plastic laminate.

Manufacturer's Standard Color Charts for plastic laminate and finished wood, including color charts.

SD-04, Drawings

Shop Drawings for cabinets, shelving, and casework.

SD-06, Instructions

Manufacturer's Instructions for plastic laminate.

SD-13, Certificates

Certificates for labeled materials indicating flame spread, fuel contributed, and smoke-developed ratings.

1.4 DELIVERY, HANDLING, AND STORAGE

Protect materials from damage during delivery, when stored, and during construction. Remove and replace damaged and defective materials.

Deliver trim, paneling, cabinet work, and other finish millwork items and bring into building only after building has dried out, after installation of wet materials, and when there is no danger of damage to materials due to excessive moisture.

Store hardboard, plywood paneling and particleboard as recommended by manufacturer for minimum 48 hours in rooms where they are to be installed.

1.5 FIELD MEASUREMENTS

Take field measurements before fabrication and installation of materials to verify and supplement indicated dimensions.

PART 2 PRODUCTS

2.1 PLYWOOD PANELING MATERIALS

A. Quality and Construction

1. Hardwood plywood - HPMA HP-1, Grade A, with specialty grade characteristics as specified herein. Face veneers - Manufactured with a 3-ply particleboard core or, at mill option, with a lumber or veneer core; match approved samples.

2. Panels - Good one side. Backing veneer - HPMA HP-1, Backing Grade 4 or better, hardwood veneer suitable for balancing face veneer. Exposed edges - Provide factory-applied edge banding of same species as face veneer.

3. Hardwood plywood - Type II, bonded with water-resistant adhesives.

4. Moisture content of hardwood plywood paneling - Certified to not exceed 12 percent at time of mill shipment.

5. Hardwood plywood paneling - Polish sanded, sealed, and factory finished. Back surfaces - Factory sealed. Cut edges - Sealed at worksite. Face veneers - Provide manufacturer's standard seal, stain-filler, and conversion varnish, applied in minimum four separate coats to a total dry film thickness of . Color of finish - Match approved color sample.

6. Hardwood plywood paneling used for interior finish - Maximum flame spread 75 and maximum smoke development 100, unless more stringent requirements are indicated.

B. Architectural Grade Hardwood Plywood: 19 mm thick, with following specialty grade characteristics:

1. Face veneers - Plain sliced, NWWD IS-1.

2. Panel faces - Stock panels, lotted and numbered. Install in running match indicated by panel numbers and as recommended by manufacturer.

3. Panels - Attached to furring and wall framing by concealed mechanical fasteners with no exposed face nailing.

C. Hardwood Plywood Paneling - Selected 5-ply, thick, prefinished and backsealed material, face veneer, indicated species; HPMA HP-1, Grade A.

1. Sizes: m wide by maximum required length for full height of wall.

2. Provide grooves on center, and random intermediate grooves at joints in veneer.

D. Utility Plywood Shelving: 19 mm thick particleboard, ANSI A208.1, manufactured from wood flakes, particles and shavings, and bonded with urea-formaldehyde resin.

2.2 SOLID WOOD MATERIALS

Solid Wood Trim: 300-S-4, Economy Grade, milled to indicated profile. Moldings, joint tolerances, miters, construction quality, and surface finish - Conform to AWI-01 Standing and Running Trim and Rails.

Material furnished in maximum practical length for end use.

Material - Kiln-dried; maximum moisture content 12 percent at time of delivery to Worksite.

Corners - Mitered, tightly butted, and secured.

Wood Trim - Carefully selected to match hardwood plywood paneling.

Exposed Nailing - Countersunk finishing nails. Fill countersunk holes with matching wood filler or putty.

Wood Trim - Hand sanded at Worksite to a smooth clean finish, free of

machine or tool marks, abrasions, raised grain, or similar imperfections.

2.3 FASTENERS AND ADHESIVES

Wood Screws - Carbon steel or brass. Wood screws exposed to view - Brass with an oval head with cross recess drive.

Adhesives for Interior Millwork and Trim - Moisture-resistant type, FS MMM-A-125, Type II, water- and mold-resistant.

2.4 CABINETS, COUNTERS, AND CASEWORK

A. Materials and Construction

1. Hardwood plywood for cabinets, counters, shelving, and casework - HPMA HP-1, Grade A, of specified thickness and face-veneer species, good two sides. Veneers - Type II, bonded with water-resistant adhesives. Exposed edges - Provide factory-applied edge banding, same species as face veneer.

2. Cabinets, counters, shelving, and casework - Economy grade and mill built to AWI-01 quality standards for casework.

3. Flush cabinet doors - Hardwood plywood with matching solid hardwood edges. Lipped doors - Hardwood plywood with lumber core. Drawer fronts - Minimum thick solid wood or edge-banded hardwood plywood with veneer species to match cabinet.

4. Cabinet doors - Lumber core or, at mill option, veneer core or particleboard edged with solid hardwood matching face veneer species.

5. Cabinet plywood - Prefinished and matching hardwood wall paneling for type and cut of veneer; polish sanded, sealed, and ready for finishing. Face veneers - Rotary cut or plain sliced with no sapwood allowed.

B. Particleboard Core Materials

1. Wood particleboard - Mat-formed particleboard, ANSI A208.1, Type 1 (interior) medium density, Grade 1-M-2; laminated construction, composed of large wood flakes at core and finer wood flakes at each surface. When tested in accordance with ASTM D1037, minimum modulus of rupture of , maximum water absorption of 15 percent in 24 hours, maximum swelling thickness of 6 percent in 24 hours, maximum moisture content of 7 percent, and maximum linear expansion of 0.15 percent.

2. Wood particleboard for exposed shelving or casework - Sanded and sealed on both surfaces, exposed edges trimmed with x solid poplar, birch, or oak; tongue-and-groove or butt joints glued to particleboard with water-resistant glue.

C. Glass Shelving and Doors

1. Glass shelving and all-glass cabinet doors: 6 mm thick, clear, polished, plate glass with ground and swiped edges; FS DD-G-451, Type I, Class 1, Quality q3.

2. Finger pulls for all-glass doors - Flush, chrome plated, diameter.

3. Glass cabinet doors in wood frames - Minimum thick, flat sheet clear glass; ASTM C1036, Type I, Class 1, Quality q4.

2.5 CABINET HARDWARE

ANSI A156.9. Screws and attachments - Finished to match hardware item. Finishes - ANSI A156.18.

A. Adjustable Shelf Supports and Rests

1. Shelf supports - Adjustable, wrought brass, nickel plated, with increment adjustment slots and with provision for screw fastening on center vertically. Flush-applied supports - B24072. Surface-applied supports - B24062. Shelf rests - Type B240Q2, wrought brass, nickel plated, minimum projection of and minimum width of .

2. Shelf rests for use in drilled holes - B84021, wrought steel, nickel plated with 10 mm long, diameter pin; overall length .

B. Cabinet Hinges - Wrought steel, ANSI A156.9.

1. Full mortise, loose-pin hinges - B81021, 5-knuckle, button tip, wrought steel, finish 652 or 639.

2. Semiconcealed cabinet hinges for flush plywood gates and doors - B21201, 5-knuckle, button tip, finish 639 or 652.

3. Continuous hinges - B81491, wrought steel, chrome plated, thick with steel pin, countersunk screw holes on center; width when open, .

4. Hinges for lipped door cabinets - B81382, wrought steel, with high barrel, fast button tip pins, mortise jamb leaf, finish 639 or 652.

C. Cabinet Catches

1. Cabinet catches - B83091, friction catch, with wrought steel case and strike, and spring-cushioned rubber rollers.

2. Magnetic catches - B43141, Type 1, aluminum case, minimum 18 N pull.

D. Pulls

1. Door and drawer pulls - B12012, contemporary-design, centers, screw attached from inside.

2. Knob-type pulls - B22132 or B42132, diameter, anodized aluminum knob and shank.

E. Drawer Slides - B85072, ball bearing full extension drawer slides for attachment to each side of drawer. Provide rubber stops at striking points.

F. Closet Hanger Bars - ANSI A156.16, Type L03131, wrought-brass, nickel-plated, telescoping tubing, minimum wall thickness. Seamless outer tube diameter - Minimum . Provide each wall plate with minimum two screw holes for attachment. Provide nickel-plated wrought steel center supports for spans over .

G. Locks - FS FF-H-1819; all brass, ANSI A156.18, finish US26D, pin-tumbler type with dead bolt.

1. Drawer locks and cabinet locks - Half-mortise, minimum 5-pin tumblers, diameter cylinder, throw dead bolt with brass strike.

2. Sliding cabinet door locks - Push-bolt type, 4-pin tumbler, diameter cylinder with brass cup strike.

H. Sliding Door Hardware

1. Track for all-glass sliding cabinet doors - Steel, zinc-plated, ball bearing assembly consisting of upper channel guide, shoes for glass doors, ball-bearing carrier, and a lower track.

2. Upper channel guides: wide by high with a minimum mass of .

3. Shoes for glass doors - Designed for 6 mm thick glass; high with a curved underside, minimum mass of .

4. Ball bearing carrier to carry hardened steel ball bearings spaced on center with two-point suspension between shoe and anvil of lower track; minimum mass of carrier .

5. Lower track: x double-channel track, designed with a center anvil in each channel to carry ball bearings, minimum mass of .

2.6 PLASTIC LAMINATES

Color, Pattern, and Finish - Selected by COTR from samples of approved manufacturer.

Countertop Surface, Edges, and Backsplash: thick, high-pressure laminate NEMA LD 3 and NEMA LD 3.1.

Plastic Laminate Surfaces for Counter Fronts, Gates, and Paneling: thick, high-pressure laminate.

Backing Sheets for Plastic-laminate Panels - Minimum thick laminated plastic.

Backing Sheets for Plastic-laminate Veneer Panels - Bonded to core material with an adhesive as recommended by plastic laminate manufacturer.

Adhesives for Plastic-laminate Panels - Phenol-resorcinol and melamine or contact adhesive.

2.7 PRIMING AND SEALING

Plywood Paneling - Factory finished, with back surfaces sealed.

Mill-fabricated Cabinets, Casework, and Solid Wood Trim scheduled for clear, natural finish - Provide one mill-applied coat of an approved clear

sealer of a type compatible with final finish.

PART 3 EXECUTION

3.1 GENERAL

Install paneling and finished millwork items only when temperature and humidity conditions approximate interior conditions that will exist when building is occupied. Ensure that relative humidity in building at time of installation of materials is within limits recommended by manufacturer.

3.2 HARDWOOD PLYWOOD PANELING

Arrange each panel in room immediately before installation for best color and grain pattern, and identify each panel with a number on panel back to ensure proper location when installed.

Nail panels to wall sheathing as recommended by manufacturer, for a combination gluing and semiconcealed nailing installation method. Inside corners - Butt jointed, with one panel scribed, the other butted. Outside corners - Provide hardwood-faced aluminum molding. Running joints - Standard V-joint. Grooves or striations - Nailed through and nail heads concealed with matching putty. Trim - Solid hardwood of same species as paneling.

3.3 WOOD TRIM

Set wood trim straight, plumb and level, closely fitted, and rigidly fastened. Countersink nail heads of exposed work, and fill holes with matching wood filler.

Ensure that joints are tight and formed to conceal shrinkage. Shop miters over - Glued and splined.

Furring and framing to receive paneling - Check for plumb and true plane surface. Make adjustments before proceeding with work.

3.4 COUNTERS, CABINETS, AND CASEWORK

Provide continuous back panels for counters, cabinets, shelving, and casework. Open-backed or skeleton-framed units are not acceptable. Provide back panels of minimum thick hardwood plywood, or of tempered hardboard when painted or concealed. Provide exposed or semi-exposed backs of hardwood plywood, of same veneer as face of cabinet.

Provide thick exposed backs of counters, desk fronts, partitions, and island or peninsula cabinets dadoed and glued under pressure into cabinet sides.

Construct cabinet bases of x framing, with toe space of height x depth, unless otherwise indicated. Provide cross rails at cabinet ends, points of concentrated loads, and intervals of maximum.

Make cut-outs for sinks of sizes indicated.

Countersink exposed finishing nails; fill countersunk holes with a matching wood filler or putty. Staples are not permitted in exposed cabinet work or casework.

Machine sand exposed wood surfaces at mill to specified standard, and then apply final sanding at Worksite to provide a smooth clean finish, free of machine or tool marks, abrasions, raised grain, or similar imperfections.

Install complete with trim and fillers to provide a finished product.

3.5 PLASTIC LAMINATE COUNTER TOPS, EDGES AND BACKSPLASHES

Bond plastic laminate to substrate as specified in Paragraph 2.4.B, Particleboard Core Materials, or to close-grained hardwood plywood, Graded DFPA B-D, or better.

Provide core minimum thick for horizontal applications and minimum thick for vertical applications.

Bond plastic laminate to approved core material with adhesives as recommended by laminate manufacturer.

Ensure that exposed edges and ends of countertops and backsplashes are of same plastic laminate material as that specified for countertop. Color - Match that of countertop. Exposed edges - Round to radius.

3.6 SHELVING

Construct and assemble shelving in accordance with AWI-01, to specified grade.

Provide uprights and wall cleats of solid wood, minimum x , nailed to walls and shelving with finishing nails.

SECTION 07200

BUILDING INSULATION
12/01

PART 1 GENERAL

1.1 SUMMARY

This section specifies requirements for thermal and acoustic insulation, except insulation for piping and ductwork.

1.2 REFERENCES

American Society for Testing and Materials (ASTM)

ASTM A390	Zinc-Coated (Galvanized) Steel Poultry Fence Fabric (Hexagonal and Straight Line)
ASTM C519	Density of Fibrous Loose-Fill Building Insulations
ASTM C578	Rigid, Cellular Polystyrene Thermal Insulation
ASTM C665	Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
ASTM C764	Mineral Fiber Loose-Fill Thermal Insulation
ASTM E84	Surface Burning Characteristics of Building Materials
ASTM E96	Water Vapor Transmission of Materials
ASTM E119	Fire Tests of Building Construction and Materials
ASTM E154	Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover

Federal Specifications (FS)

FS HH-B-100	Barrier Material, Vapor (for Pipe, Duct and Equipment Thermal, Insulation)
FS HH-I-530	Insulation Board, Thermal, Unfaced Polyurethane or Polyisocyanurate
FS HH-I-1030	Insulation, Thermal (Mineral Fiber, for Pneumatic or Poured Application)
FS UU-B-790	Building Paper, Vegetable Fiber (Kraft, Waterproofed, Water Repellent and Fire

Resistant)

1.3 SUBMITTALS

Refer to Section 01300, "Submittals". Submit the following:

SD-02, Manufacturer's Catalog Data

Manufacturer's Catalog Data for materials.

SD-13, Certificates

Certificates of Compliance for materials specified by referenced specifications; fire-retardant treated wood furring strips.

1.4 QUALITY CONTROL

Ensure that products conform to UBC for flame-spread and smoke-developed ratings. Do not expose anywhere in building (including above-ceiling spaces) any insulating and facing materials with a flame-spread rating greater than 25, or a smoke-developed rating greater than 450.

Where insulation is identified by "R" value, provide sufficient thickness of insulation to achieve indicated value.

PART 2 PRODUCTS

2.1 THERMAL INSULATION

A. Glass-Fiber Insulation

1. Provide batts and rolls of nominal thicknesses and widths indicated. Insulation - ASTM C665 Type I unfaced insulation, Type II Kraft faced insulation, Type III foil faced insulation with a UL rating of 25/50 in accordance with ASTM E84.

2. Blown-in fibrous-glass insulation - ASTM C764.

B. Mineral-Fiber Insulation

1. Mineral fibers - Textile type. Nominal density: .

2. Mineral-fiber batts - Nominal thickness as indicated, width and length as required to suit construction conditions, ASTM E119 Type I unfaced insulation, Type II with membrane faced insulation.

3. Mineral-fiber flexible blankets - Nominal thickness as indicated, width and length as required to suit construction conditions, blanket form, resilient type, for use below and above ambient to , ASTM E119, factory-applied vapor-barrier facing on one side with nailing tabs on both edges.

4. Vapor barriers - Fire-retardant, high-vapor transmission type, with aluminum foil laminated to creped paper, FS HH-B-100 Type II.

5. Blown-in mineral-fiber insulation - Pneumatic-application type, maximum 1 percent loss on ignition, loose-fill insulation, FS HH-I-1030 Type I, Class A.

C. Rigid Board

1. Rigid polystyrene board - Of thickness indicated, extruded polystyrene, ASTM C578 Type IV.

2. Rigid polyurethane board - Of thickness indicated, FS HH-I-530, Type I.

D. Interior Vapor Barrier

1. Vapor barrier - Fire-retardant, high-vapor transmission type, with aluminum foil laminated to creped paper, FS HH-B-100 Type II.

2. Vapor-barrier tape - Minimum wide with fire-retardant pressure-sensitive adhesive coating on one face; fire-retardant, high-vapor transmission type with aluminum foil laminated to creped paper, FS HH-B-100, Type II.

E. Water-Vapor Barrier Subgrade Covers - Resistant to decay in accordance with ASTM E154. Maximum water-vapor permeance after exposure in resistance-to-decay test in accordance with ASTM E96, Water Method. Provide one of following materials:

1. Clear polyethylene sheeting, thick.

2. Polyethylene-coated barrier paper consisting of thick polyethylene film laminated to one surface of rot-resistant, water-resistant, uncreped and reinforced barrier paper; paper to conform to FS UU-B-790, Type I, Grade A, Style 4.

3. Asphalt-core board, surfaced both sides with asphalt-saturated and asphalt-coated felt, with minimum mass of , and maximum thickness.

F. Fasteners and Adhesives

1. Fasteners: perforated plate, minimum wide prong, of sufficient length to bend to bottom of notch; cold-rolled carbon steel, zinc coated. Washers: diameter, slotted type, zinc coated.

2. Nails - Zinc-coated steel, common style, of size required to suit application.

3. Staples - Galvanized steel, flat top crown, of size required to suit application.

4. Wire netting - Hexagonal zinc-coated steel poultry netting with mesh size and (18 ga) wire, ASTM A390.

5. Adhesive - Bonding strength of 310 N per clip after a 3-day drying time at ; temperature range of - to .

6. Vapor-barrier adhesive - Fire resistant, suitable for bonding laps in vapor-barrier material, and as recommended by manufacturer of each type of vapor-barrier material used in Work. Use natural sand for ballast over water-vapor barrier subgrade covers in crawlspaces.

PART 3 EXECUTION

3.1 GENERAL

Cut and fit insulation material as necessary to fully insulate small areas between closely spaced framing members and to accommodate piping, conduit, outlet boxes, and other construction penetrating insulation material.

Install vapor barriers (affixed to principal face of insulation material, and separately attached) so as to provide a continuous vapor-barrier seal. Prevent tears, breaks, or ruptures that might interfere with effectiveness of vapor barrier.

3.2 PREPARATION

Install insulation only after building construction has progressed sufficiently to ensure that inclement weather will not damage or wet insulation material.

Ensure that electrical wiring, plumbing, and other concealed work is complete and approved before starting building insulation work.

Ensure that surfaces on which thermal insulation materials will be applied are clean, smooth, dry, and free from projections that might puncture vapor barrier. Supplement construction with nailers, furring strips, or other members to support the insulation in its proper location.

3.3 PERIMETER INSULATION SYSTEM

Perimeter Insulation Applied to Foundation Walls - Install before placing drainage fill. Apply insulation boards to interior side of outside foundation walls; secure to foundation wall surface with spot-applied bonding adhesive in accordance with adhesive manufacturer's printed directions. Apply boards lengthwise, with ends and sides closely butted together and with vertical joints broken.

Perimeter Insulation Applied on Horizontal Surfaces - Install after placing drainage fill. Apply insulation boards horizontally under concrete slabs on ground where indicated, with ends and sides closely butted together and surface leveled to finish flush with drainage fill surface. Protect boards by covering horizontal surfaces with water-vapor barrier subgrade covers.

Lay subgrade cover sheets with minimum 150 mm laps at edges and ends. Seal lapped joints with adhesive.

3.4 WALL AND CEILING INSULATION

Ensure that batts fit snugly between wall and ceiling framing members. Cut batts to length for each space, allowing sufficient length for attachment at top and bottom in walls, and for snugly butting together in ceiling. Where plumbing stacks or vents occur in outside walls, apply insulation between winter-cold side of wall and pipe.

Batts with Membrane Facing or Enveloping Membranes - Install with affixed flanged membrane facing toward winter-heated side of construction. Form additional end flanges of vapor-barrier membrane facing at ends of batts by cutting or pushing away insulation material, leaving facing for attachment to framing. Nail or staple flanges to framing members at

maximum 150 mm on center. Seal joints at perimeter of cutouts, end joints between batts in ceiling construction, and tears or ruptures in the membrane facing with vapor barrier tape.

Batts Without Membrane Facing - Secure in place between framing members with wood nailing strips or an approved adhesive recommended by insulation materials manufacturer.

Install vapor barriers after batts are placed, and apply to winter-heated side of construction. Secure by nails or staples, with edges over framing members. Cut and fit vapor barrier to accommodate piping, conduits, outlet boxes, and other penetrations. Seal joints at perimeter of cutouts and tears or ruptures in vapor-barrier with vapor-barrier tape.

3.5 FLOOR INSULATION

Place batts with membrane facing or enveloping membranes between floor-framing members, with vapor-barrier membranes facing toward winter-heated side of construction. Place batts in a long length, with batt ends butted snugly together and with both sides fitting snugly against framing members; secure in place with wire netting stapled to edges of framing members.

3.6 PRECAST CONCRETE WALL PANEL

Place mineral-fiber flexible blankets between wood furring strips on interior surfaces of precast concrete wall panels, with vapor barriers affixed to blankets facing toward winter-heated side of construction and with blankets fitting snugly against furring strips. Cut blankets to required length for each space to be insulated, leaving a 50 mm vapor barrier facing tab at each end for attachment at top and bottom. Nail or staple vapor-barrier tabs on edges and ends of blankets to furring strips at maximum 150 mm on center; overlap vapor-barrier tabs. Seal tears or ruptures in vapor-barrier facing with vapor-barrier tape.

3.7 BLOWN-IN MINERAL-FIBER

Place blown-in mineral-fiber insulation between ceiling framing members with a pneumatic blowing machine to thickness and density indicated. Ensure that soffit vents remain open. Determine density of in-place blown-in mineral-fiber insulation in accordance with ASTM C519.

3.8 INSPECTION AND ACCEPTANCE

Building insulation work will be rejected for any of following deficiencies: thermal insulation material not conforming to type and nominal thickness indicated; insulated construction not having small areas between closely spaced framing members fully insulated; installed thermal-insulation material damaged or wetted by exposure to inclement weather; installed vapor barriers having tears, breaks, or ruptures that cannot be sealed with vapor-barrier tape or other approved method; installed blown-in insulation not conforming to indicated installed density.

Remove defective work and replace with acceptable work, at no expense to the Government.

SECTION 07400

PREFORMED ROOFING AND SIDING
12/01

PART 1 GENERAL

1.1 SUMMARY

This section specifies requirements for providing and installing metal siding and roofing systems for walls and roofs.

1.2 REFERENCES

American Institute of Steel Construction (AISC)

AISC S303	Code of Standard Practice for Steel Buildings and Bridges

American Iron and Steel Institute (AISI)

AISI SG-673	Cold-Formed Steel Design Manual

American Society for Testing and Materials (ASTM)

ASTM A36M	Carbon Structural Steel
ASTM A366M	Steel, Sheet, Carbon, Cold-Rolled, Commercial Quality
ASTM A463M	Steel Sheet Aluminum - Coated by the Hot-Dip Process
ASTM A525M	General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process (Metric)
ASTM B209M	Aluminum and Aluminum-Alloy Sheet and Plate (Metric)
ASTM D1056	Flexible Cellular Materials - Sponge or Expanded Rubber

American Welding Society, Inc. (AWS)

AWS A5.1	Carbon Steel Electrodes for Shielded Metal Arc Welding
AWS D1.1	Structural Welding Code - Steel

Department of Defense (DOD)

DOD-P-21035	Paint, High Zinc Dust Content, Galvanizing Repair (Metric)

Federal Specifications (FS)

FS HH-I-558	Insulation, Blocks, Boards, Blankets, Felts, Sleeving (Pipe and Tube Covering), and Pipe Fitting Covering Thermal (Mineral Fiber, Industrial Type)
FS QQ-L-201	Lead Sheet
FS TT-S-227	Sealing Compound: Elastomeric Type, Multi-Component (for Calking, Sealing, and Glazing in Buildings and Other Structures)
FS TT-S-230	Sealing Compound: Elastomeric Type, Single Component (for Calking, Sealing, and Glazing in Buildings and Other Structures)

Steel Structures Painting Council (SSPC)

SSPC PAINT 12	Cold-Applied Asphalt Mastic (Extra Thick Film)

1.3 SUBMITTALS

Refer to Section 01300, "Submittals". Submit the following:

SD-02, Manufacturer's Catalog Data

Manufacturer's Catalog Data on catalog products.

SD-04, Drawings

Shop Drawings indicating completely dimensioned structural frame and erection layouts, openings, special framing details, construction details at corners, ridges, eaves, building intersections, curbs, and flashing. Indicate material, thickness, width and length, special miters or bevel cuts, location and type of mastic and metal filler strips, location and erection of subgirts, sandwich walls, and fire-rated walls where indicated.

SD-10, Test Reports

Coatings and base metal of metal roofing and siding - Type of test as specified.

Mastic filler strips and joint sealant - Chemical composition and mechanical usability.

Soundness tests, per AWS A5.1, for electrodes for manual shielded metal-arc welding.

SD-13 Certificates

Certificates for fasteners, galvanizing repair paint, and paint for repair of painted surfaces; fire-rated wall construction;

gypsum wallboard.

SD-14, Product Samples

Product Samples of metal roofing and siding, ; color panels , for color range; fasteners; metal closure strip long, each required type; insulation .

1.4 DELIVERY, HANDLING, AND STORAGE

Carefully handle metal roofing and siding at all times to prevent damage to surfaces, edges, and ends. Arrange with manufacturer for adequate packaging and protection during shipment and offsite storage.

Upon arrival of roofing and siding at Worksite, check sheets for damage, dampness, and wet storage stain. Remove moisture from dampened or wetted sheets. Store and protect sheets not immediately used in Work in a covered, dry location that provides good air circulation free from effects of moisture and other corrosive environments. Do not use damaged or stained sheets in Work.

1.5 FIELD MEASUREMENTS

Take field measurements before preparing drawings and starting fabrication.

1.6 QUALIFICATIONS

Manufacturer - Have a qualified engineering staff performing design under direction of a licensed Civil Engineer.

Erection of Work - Performed by manufacturer, or by an experienced erection firm licensed by or acceptable to manufacturer.

Welding Procedures - AWS D1.1. Operators may make only those types of weldments for which they are specifically qualified.

1.7 PERFORMANCE REQUIREMENTS

A. Compute properties of steel roofing and siding sections using design procedures of AISI SG-671 or SG-673. Ensure that section properties, including yield point, section modulus, and moment of inertia per meter of width, equal or exceed required values of section properties indicated.

B. Deflection of Roofing and Siding - Maximum span/180 under indicated total dead and live load.

C. Resistance to Gross Uplift: 3.4 kPa for eave overhang, and 2.4 kPa for other roof areas.

D. Resistance to Wind Pressure Loading - Minimum 1.9 kPa for exterior metal siding.

E. Total Dead and Live loads, Uniform and Concentrated - As indicated.

F. Movements

1. Seismic and wind movements - Conform to UBC.

2. Thermal movements - Allow for temperature range of - to .

G. Water Infiltration - Ensure that water does not infiltrate into interior of building.

PART 2 PRODUCTS

2.1 ALUMINUM MATERIALS

Aluminum Roofing and Siding - ASTM B209M; continuous, roll-formed sheets, Alclad 3004-H36 alloy. Minimum ultimate tensile strength: . Minimum yield strength: . Finish - Low specular gloss.

Length of Roofing Sheets - Sufficient to bridge three spans minimum plus required end lap. Length of siding sheets - Full height of walls, with no horizontal joints.

Insulated Panels - Specified exterior and interior aluminum sheets erected in accordance with manufacturer's printed instructions. Insulation - Thickness and density as specified herein.

Field-formed Flashing, Corners, Closers, Fillers, and Aluminum Expansion Joints - Flat aluminum sheet, thick, same finish and alloy as specified for roofing and siding, except that temper may be Alclad 3004-0 annealed temper.

2.2 STEEL MATERIALS

A. Construction

1. Roofing and siding sheets and panels - Roll formed to specified profile, thickness and depth as indicated; plumb and true, and within the tolerances listed in ASTM A525M. Flashings, dormers, closers, fillers, metal expansion joints, ridge rolls, and other sheet metal accessories - Factory-formed material of same type and quality finish as specified for roofing and siding sheets, and minimum thick.

2. Length of roofing sheets - Sufficient to bridge three spans minimum plus required end lap. Length of siding sheets - Full height of walls, with no horizontal joints.

3. Roofing material - Before coating, minimum thick, unless otherwise indicated. Siding material - Before coating, minimum thick, unless otherwise indicated.

4. Side joint laps - Manufacturer's standard lapped joint for specified corrugation profile, sealed and then fastened with sheet metal screws; or a factory-formed, interlocking side joint formed with a standing seam side lap approximately high, and with a factory-applied joint seal, as indicated.

5. Insulated panels - Exterior and interior steel sheets of specified profiles and coating with insulation of thickness indicated. Secure panels in accordance with manufacturer's printed instructions and as specified.

B. Finish

1. Galvanized sheets - ASTM A525M, Z275.

2. Aluminum-coated sheets - ASTM A463M, Type II. Coating: 99 percent commercially pure aluminum with a maximum of 1 percent silicon plus iron; hot-dip applied to both sides of steel sheet to a minimum of surface, both sides, and a total minimum thickness of.

3. Baked-enamel-coated sheets - Hot-dip galvanized steel in accordance with ASTM A525M, Z275; with a two-coat, baked-on, thermo setting acrylic enamel, alkyd melamine, or vinyl-solution finish to a minimum dry-film thickness of 0.03 mm. Roofing sheets and siding sheets exposed on one side only - Finish coat one side and standard wash coat on reverse side. Siding sheets exposed on two sides - Finish coated on both sides. Color of sheets - As selected from manufacturer's standard colors.

2.3 SUBGIRTS AND FORMED SHAPES

Panel Subgirts, T-bars, Z-bars, and Angles - Die-formed shapes, ASTM A36M steel, hot-dip galvanized in accordance with ASTM A525M, Z275.

Die-formed Subgirts - Minimum uncoated thickness of (18 ga), bar shapes minimum . T-bars - Minimum uncoated thickness of (22 ga). Z-bars - Minimum uncoated thickness of (14 ga).

Concealed Clips - Hot-dip-galvanized steel ASTM A366M; coating designation ASTM A525M, Z275, all (18 gage).

Electrodes for Manual, Shielded Metal Arc Welding - AWS D1.1, Part B; covered, mild-steel electrodes, AWS A5.1.

2.4 FASTENERS

Exposed Fasteners for securing sheets to structural steel framing or to subgirts: #14 self-tapping, Type B, recessed hexagon-head, stainless steel screws with cadmium-plate finish; length as required for the application. Fastener assembly includes a stainless steel washer and a neoprene washer, or an integral stainless steel and neoprene washer. Exposed head of fastener - Match color of roofing and siding sheets with plastic caps or factory-coated heads. Exposed fasteners for securing overlap-type side laps of steel sheets, and for securing accessory steel flashing: #14 x Type B recessed hexagon-head, chromium-nickel-steel screws with stainless steel and neoprene washers. Screw head caps - Match color of sheets.

Exposed Fasteners for securing sidelaps of aluminum sheets, and for securing aluminum flashing to roofing and siding sheets: #12 x , slotted pan-head Type A aluminum, sheet metal screws with aluminum and neoprene washers.

2.5 CLOSURE MATERIALS

Mastic Closure Strips - Closed-cell, expanded cellular rubber; ASTM D1056, Type S, Class SCE-41 CMP; cut or premolded to exact configuration of specified roofing and siding material; uniform in appearance, free of weak sections, bubbles, cracks, and defects. Adhesive for use with closure strips - Type recommended and furnished by closure strip manufacturer.

Metal Closure Strips - Factory fabricated accessories matching type,

thickness, and corrugation profile of specified roofing and siding. Aluminum closure strips - Mill-finish aluminum, Alclad 3004-H36, minimum thick. Steel closure strips - Same thickness and finish as exterior roofing and siding panels.

Sealants - Approved gunnable type for use in hand- or air-pressure calking guns at temperatures above 40°C (or frost-free application at temperatures above); used around doors, windows, masonry, and other construction material. Solids content - Minimum 85 percent of total volume. Use sealant that dries with a tough, durable surface skin that permits sealant to remain soft and pliable underneath, providing a weathertight joint. Migratory staining is not permitted on painted or unpainted metal, stone, glass, vinyl, or wood.

Joints - Primed with a compatible one-component or two-component primer as recommended by sealant manufacturer.

Sealant for Shop-applied Calking - Approved gun grade, nonsag one-component polysulfide or silicone conforming to ASTM C920FS TT-S-230, Type II. Curing time - Sufficient to ensure sealant's plasticity at time of field erection.

Sealant for Field-applied Calking - Approved gun grade, nonsag one-component polysulfide or two-component polyurethane with an initial maximum Shore A durometer hardness of 25, conforming to ASTM C920FS TT-S-227, Type II. Color - Match panel colors.

2.6 INSULATION

Semirigid Glass-Fiber Insulation Board - Conforming to FS HH-I-558, Form A, Class 1, Class A fire-hazard classification with a minimum density of , and thick unless otherwise indicated. Thermal conductivity (K) - Maximum 35 mW/(m K).

Rigid Glass-Fiber Insulation - Conforming to FS HH-I-558, Form A, Class 1, Class A fire-hazard classification with a minimum density of , and thick unless otherwise indicated. Thermal conductivity (K) - Maximum . Factory-painted, glass-mat surface on exposed side.

Mineral Fiber Insulation - Conforming to FS HH-I-558, Form A, Class 1, Class A fire-hazard classification, with a minimum density of, and thick, unless otherwise indicated. Thermal conductivity (K) - Maximum . Factory-applied, UL rated, aluminum-foil facing on exposed surface.

2.7 REPAIR OF FINISH-PROTECTED MATERIALS

Galvanizing Repair Paint - High-zinc-dust content paint, compatible with specified galvanized-finish roofing and siding material, conforming to DOD-P-21035. Repair paint for color finish enameled roofing and siding - Compatible paint of same formula and color as specified finish furnished by roofing and siding manufacturer.

Repair Paint for Aluminized Steel - Acrylic paint conforming to MIL-P-28578.

2.8 LEAD FLASHING FOR MECHANICAL SERVICES

conforming to FS QQ-L-201, Grade B, or , 6 percent antimonial hard lead of best commercial grade.

PART 3 EXECUTION

3.1 GENERAL

Erect exterior and interior roofing and siding in accordance with approved erection drawings, printed instructions and safety precautions of manufacturer, and as indicated and specified.

Do not subject sheets to overloading, abuse, or undue impact. Do not apply bent, chipped, or defective sheets.

Erect sheets true and plumb, and in exact alignment with horizontal and vertical edges of building, securely anchored, and with indicated rake, eave, and curb overhang.

Install work to allow for thermal movement of roofing and siding, and movement of building structure. Provide permanent freedom from noise due to wind pressure.

Install exterior panels of insulated walls so as to provide ventilation of space between exterior panel and insulation.

Touch up weld burns and abrasions due to assembly with proper finish repair material.

Uncovered edge of top sheet at sidelaps - Turn down for roofing and turn in for siding and doors, unless otherwise indicated.

Lay roofing sheets with corrugations in direction of roof slope.

Install siding sheets with corrugations vertical.

Make end laps of exterior roofing sheets minimum ; side laps of standard exterior corrugated sheets minimum 2.5 corrugations; side laps of V-bean corrugated sheets minimum 1.5 corrugations.

Make end laps of exterior siding sheets minimum 150 mm; side laps of external siding sheets two full corrugations for standard corrugated sheets and minimum 1.5 corrugations for V-beam and ribbed corrugated sheets.

3.2 ALIGNMENT OF STRUCTURAL FRAME

Inspect erected structural steel frame for plumb and true surfaces. Correct misalignment of framing and erection not in accordance with AISC S303 before commencing installation of roofing and siding.

3.3 WELDING

Conform to AWS D1.1 for procedures for manual shielded metal-arc welding, appearance and quality of welds made, and methods used in correcting welding work.

3.4 FASTENING SYSTEM

A. Provide exposed fasteners of materials and spacing as specified, with applied plastic head caps to match color of specified roofing and siding; or concealed clips and fasteners installed in accordance with manufacturer's printed instructions.

B. Single Sheet, Uninsulated Metal Roofing and Siding

1. Attach roofing and siding with fasteners of suitable length to penetrate support member and extend minimum 6 mm on inside of member.

2. Space standard, corrugated, and fasteners approximately on center at each support and on center at end lap supports. Space side lap fasteners at on center, maximum.

3. Space V-beam roof and side sheet fasteners at approximately on center at end lap supports and on center at intermediate supports. Space side lap fasteners at on center, maximum.

4. Fasten interlocking side laps by die-clinching at approximately on center for walls and at approximately on center for roofs.

C. Sandwich Wall Construction

1. Space temporary self-tapping screws for interior sandwich walls or interior roof panels so as to securely hold sheets until insulation and exterior sheets are installed.

2. Make end laps of interior roofing and siding sheets minimum . Make side laps in conformance with manufacturer's written instructions for type and profile of specified sheet.

3. Interlocking side joints - Factory calked. Seal overlap joints with a continuous bead of specified joint sealant.

4. Install subgirts at indicated spacing, but maximum on center, and secure to interlocking edge of interior sheets with self-tapping screw fasteners, fillet welding, or clips spaced at on center maximum.

D. Metal and Insulation-Faced Construction - Consists of specified exterior metal roofing, siding, and rigid insulation board. Install insulation at right angles to structural supports and screw-fastened through metal, insulation, and into support. Fastener spacing - As specified.

3.5 DISSIMILAR METALS

Insulate dissimilar metals (except steel and zinc) from each other by painting, or by other approved system, as recommended by roofing and siding manufacturer and as specified.

Insulate aluminum from other metals by painting other metals with one coat of bituminous paint conforming to SSPC PAINT 12 #12 cold-applied asphalt mastic to a minimum thickness of . Backpaint aluminum surface where it is impractical to paint other material.

Backpaint aluminum surfaces in contact with lime mortar, concrete, or other masonry materials with a thick coat of #12 asphalt mastic.

3.6 JOINT SEALANTS

Make joints weathertight. Seal joints of metal roofing. Seal with

specified joint sealant end joints of metal siding, flashing at corners, ridges, eaves, rakes, curbs, and openings in walls and roofs. Make sealing beads continuous, minimum 13 mm diameter, and apply so as to ensure a weathertight joint.

3.7 FLASHING AND CLOSURE INSTALLATION

A. Metal Flashing

1. Install concealed metal flashing of thickness and profile indicated at heads and sills of openings and at curbs and holders for closure and filler strips.

2. Install exposed metal flashing at building corners, jambs and sills, rakes and eaves, junctions between metal siding and roofing, valleys and changes of slope or direction in metal roofing, and building expansion joints and gutters. Provide exposed metal flashing of same material, color, and finish as metal roofing and siding.

3. Provide exposed flashing with locked and blind-soldered end joints, and expansion joints at intervals of maximum. Form expansion joints to profile indicated with end joints flat-seamed, locked, and soldered, and with free-sliding, sleeve type slip joints at intervals, designed to allow for expansion and contraction and to remain weathertight.

4. Exposed flashing and flashing subject to rain penetration - Bed in joint sealant.

5. Fasten flashing at maximum on center for roofs, and at maximum on center for walls.

6. Install lead flashing at openings and pipe projections through metal surfaces, and hammer-form to corrugation profile to form an exposed flashing maximum wide.

7. Install pipe sleeve flashing for pipe and vent projections through metal roofing.

8. Insulate flashing in contact with dissimilar metal with asphalt mastic material to prevent electrolytic deterioration.

9. Ensure that valley flashing has following minimum widths and joints:

ROOF SLOPE	FLASHING WIDTH, mm	JOINT
Under 1:3	600	Clinch-lock
1:3 to 1:1·7	450	Clinch-lock
Over 1:1·7	300	Lap joint

10. Open-valley flashing - Minimum wide at top, and width increasing at 1 percent of length. Fasten flashing at edges only. Seal open ends of metal corrugations with mastic closure strips.

11. Form drips with edge folded back to form a reinforced drip edge.

B. Closures

1. Install metal closure strips at following locations:

a. At open ends of metal ridge rolls

b. At open ends of corrugated or ribbed pattern roofs, and at intersection of wall and roof unless open ends are concealed with formed eave flashing

c. At rake of metal roof, unless open end has a formed flashing member

d. At other areas, as indicated.

2. Install mastic closure strips as indicated.

3.8 METAL WAINSCOT

Provide flat sheet metal wainscot facing over exposed sidewall insulation; extend from floor to height as indicated, and connect to girt and finish with a metal closure strip.

Fit metal sheet between insulation and behind flanges of T-bars, and secure in place with specified sheet metal fasteners spaced at approximately 1200 mm on center.

3.9 ACCEPTANCE PROVISIONS

Erect metal roofing and siding straight and true, with plumb vertical lines correctly lapped and secured as recommended by manufacturer. Horizontal lines - Maximum variation 1:4000.

Application of metal roofing and siding will be subject to inspection and test for leakage by Government inspectors; inspection and tests will be conducted without cost to Contractor.

Repair scratches, abrasions, and minor surface defects of finish with specified repair materials. Ensure that finished repaired surfaces are uniform and free from variations in color and surface texture.

Immediately remove repaired metal surfaces that are not acceptable to the Government, and replace with new material.

SECTION 07500

ASPHALT BUILT-UP ROOFING
12/01

PART 1 GENERAL

1.1 SUMMARY

This section specifies requirements for asphalt roofing, including associated insulation and accessories.

1.2 REFERENCES

American Society for Testing and Materials (ASTM)

ASTM A525M	General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process (Metric)
ASTM C36	Gypsum Wallboard
ASTM C150	Portland Cement
ASTM C209	Cellulosic Fiber Insulating Board
ASTM C317	Gypsum Concrete
ASTM C332	Lightweight Aggregates for Insulating Concrete
ASTM C552	Cellular Glass Thermal Insulation
ASTM C726	Mineral Fiber Roof Insulation Board
ASTM C728	Perlite Thermal Insulation Board
ASTM C1289	Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
ASTM D41	Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
ASTM D312	Asphalt Used in Roofing
ASTM D371	Asphalt Roll Roofing (Organic Felt) Surfaced with Mineral Granules; Wide Selvage
ASTM D517	Asphalt Plank
ASTM D1227	Emulsified Asphalt Used as a Protective Coating for Roofing
ASTM D1752	Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete

	Paving and Structural Construction
ASTM D1863	Mineral Aggregate Used on Built-Up Roofs
ASTM D2178	Asphalt Glass Felt Used in Roofing and Waterproofing
ASTM D2822	Asphalt Roof Cement
ASTM E96	Water Vapor Transmission of Materials

Federal Specifications (FS)

FS SS-C-153	Cement, Bituminous, Plastic
FS SS-S-200	Sealants, Joint, Two-Component, Jet-Blast-Resistant, Cold-Applied, for Portland Cement Concrete Pavement

1.3 SUBMITTALS

Refer to Section 01300, Submittals. Submit the following:

SD-02, Manufacturer's Catalog Data

Manufacturer's Catalog Data, on each insulation material and accessory.

1.4 WARRANTY

Provide a warranty from roofing manufacturer. Term of warranty: 15 years, unless otherwise specified.

PART 2 PRODUCTS

2.1 THERMAL INSULATION (OR UNDERLAYMENT) MATERIALS

Fiberboard Type (wood or cane) Rigid Roof Insulation - ASTM C209.

Gypsum Board - ASTM C36.

Mineral-wool, Mineral-fiber, and Fiberglass Rigid Roof Insulation - ASTM C726.

Expanded-perlite Rigid Roof Insulation - ASTM C728.

Cellular-glass Insulation - ASTM C552.

Gypsum Concrete Roofs - ASTM C317, Class A. Water - Potable.

Lightweight Concrete Roof Aggregates - ASTM C332, Group I. Portland cement - ASTM C150, Type IA or IIIA. Water - Potable. Lightweight concrete design mix: 1 bag () of portland cement to 1.5 bags () of aggregate; minimum compressive strength of at 28 days.

Polyisocyanurate Thermal Insulation Board - ASTM C1289.

2.2 ROOFING FELTS

Base Sheet - ASTM D4601, Type II, non-perforated, FM approved, UL classified

Roofing Felt - ASTM D2178, Type VI, Table 1 and 2

Cap Sheet - Wide selvage asphalt roll roofing, ASTM D3909

Sheathing Paper - Rosin-sized with a mass of minimum, or unsaturated felt with a mass of approximately .

Polyvinyl Chloride Sheet Vapor Barriers - Unplasticized virgin polyvinyl chloride, minimum thickness , with water vapor permeance 0.10 maximum on a spot-by-spot basis, not as an average. Permeance - Measured in accordance with ASTM E96, Water Method.

2.3 FASTENERS AND ADHESIVES

A. Fasteners

1. Roofing nails - Galvanized (annular or spiral-threaded for plywood deck), of sufficient length for maximum penetration into deck or wood nailer. Self-clinching nails - Minimum holding capacity of 89 N per fastener, when driven.

2. Self-tapping screws - Galvanized, #12 minimum.

3. Insulation holddown clips - As recommended by insulation manufacturer, and as approved.

B. Adhesive

1. Bituminous plastic cement - ASTM D4586, Type II

2. Adhesive for application of insulation or underlayment - Nonflammable (except for foamglass) and conforming to UL, for roof-deck construction assembly. Apply full mop coat of asphalt adhesive before installing insulation.

3. Adhesive for application of film polyvinyl sheet vapor barriers - Rubber-base, water-resistant material with a nontoxic vehicle especially prepared for application of polyvinyl sheet membrane to roof decks. Flame spread of 10 maximum, and holding power minimum.

C. Bitumen

1. Asphalt primer - ASTM D41.

2. Steep asphalt - ASTM D312, Type III.

3. Asphalt-base emulsion - ASTM D1227, Type I.

4. Plastic cement - ASTM D4586, Type II, with asphalt-saturated felts.

2.4 AGGREGATE SURFACING

ASTM D1863, sieve size.

2.5 ACCESSORIES

Cants - Treated fiberboard; reduce angle covered into two equal angles. Face of cant strip shall have an angle of 45 degrees and vertical height of . Fiberboard - ASTM C726, treated for moisture resistance by an integral treatment of wax or bituminous impregnation.

Expansion-joint Filler Strips - Nonextruding and resilient nonbituminous type; ASTM D1752, Type I or II.

Compound - Cold-applied, two-component, elastomeric polymer, FS SS-S-200.

2.6 ROOF WALKWAYS

ASTM D517, mineral surfaced asphalt planks thick, consisting of a homogeneous core of asphalt, plasticizers, and fillers bonded between two saturated and coated facing sheets. Top side surfaced with ceramic granules.

2.7 BASE FLASHING SHEET

SBS modified asphalt sheet produced for base flashing applications. Construction shall consist of SBS bitumen surrounding a minimum of one layer of fiberglass or polyester mat. Opposed surface to have mineral surface. Ungranulated sheets shall be surfaced with a cap sheet. Sheet shall conform to ASTM D5147 and have the following minimum properties:

Thickness	(0.0158 inches)
SBS rubber content	12% minimum
Elongation @ -18°C (0°F)	No cracks
Tensile Strength (Machined)	(115 lbs)
Tensile Strength (Cross Machine)	(100 lbs)
FM approval rating	Class 1 & I-60
Reinforcement	Polyester or Fiberglass
UL fire rating	A

2.8 GLASS FABRIC

ASTM D1668, Type I, width, woven fabric asphalt saturated.

2.9 REFLECTIVE MEMBRANE COATING

Membrane coating for protection of applied membrane shall be the manufacturer's premium reflective white coating. Coating may be comprised of acrylic coating formulated to provide specified fire rating and to provide long-term membrane protection.

PART 3 EXECUTION

3.1 GENERAL

Verify that work of other trades that penetrates roof deck, or requires men and equipment to traverse roof deck, is complete. Examine deck surfaces for inadequate anchorage, foreign material, moisture, and unevenness that would prevent execution and quality of application.

Proceed with roofing application only after defects have been corrected. Starting work designates acceptance of surfaces by Contractor.

Make roofing installation continuous, with operations proceeding together. Base sheet and specified plies of felt follow shingle-fashion as a single composite operation.

Apply roofing only when ambient temperature is above .

Interval between application of base sheet and succeeding plies: 48 hours maximum.

Before stopping work on each working day, or when work is interrupted due to rainfall or other causes, seal roof against intrusion of water. Bring base sheet to edge of insulation, install dams and effectively glaze exposed felts. Do not leave insulation or unglazed felts exposed during rainfall or overnight.

Ensure that traffic over partially or completely finished roofing is only on planks or on or thicker plywood.

Bitumen quantities specified for laminating insulation, attaching base sheets, laminating successive plies of felts, or flood coating are for square meter minima, not averages for areas.

Remove debris from roof at end of each work day.

3.2 SURFACE PREPARATION

Ensure that surfaces on which thermal insulation materials will be applied are clean, smooth, dry, and free from projections that might puncture vapor barriers. Surfaces will be inspected and approved before start of roof insulation work.

3.3 HEATING BITUMENS

Heat asphalt and apply at its Equiviscous Temperature (EVT) +/- .

Provide thermostatic controls and visible thermometer on kettle, maintain them in working order, and keep them calibrated.

Provide immersion thermometers accurate within +/- , and check temperatures frequently. If temperature of bitumens in applicators is below specified amounts, removal and replacement of affected roofing may be required.

3.4 VAPOR BARRIER

A. Polyvinylchloride Sheet

1. Apply vapor barriers to deck with adhesive applied in ribbons at a minimum rate of , in accordance with manufacturer's printed instructions.

2. Perform vapor barrier seaming by heat welding or by adhesive bonding as recommended by manufacturer. Apply adhesive with a multiple-nozzle wheeled applicator.

3. Install vapor barrier directly ahead of installation of

insulation. Organize Work so as to avoid walking over vapor barrier; confine traffic over installed vapor barrier to areas where protective plywood sheets have been laid.

B. Felt-type Vapor Barriers

1. Vapor barrier - One layer of base sheet. Lap plies at edges and at ends. Embed base sheet and lapped edges and ends in full hot application of steep asphalt.

2. On nailable decks - Nail each ply and from bottom to edge; stagger nails. Broom-in each ply to complete embedment.

3. On gypsum - Lay first vapor barrier ply dry directly over gypsum surface; lap edges 50 mm and nail at 300 mm on center with 44 mm headed square-cut nails or flatheaded bright nails through metal disks. Solidly mop second ply over first ply, with joints broken between plies; lap edges 50 mm and nail as specified for first ply. Other fastening devices may be used, provided minimum holding power of each device is 89 N when driven in deck.

4. On concrete - Where asphalt-saturated felts are used over cast-in-place concrete, channel- or spot-mop first ply in place over asphalt primer. Where coal-tar-saturated felts are used, channel- or felt-mop first ply directly over concrete deck. Channel mop in one direction with approximately spacing between strips and with ends left open. Space spots uniformly in spot-mopping, with no closed pockets between spots.

5. On decks composed of precast units, channel-mop hot bitumen to +/- away from joints in deck. Lap plies , and solid-mop between plies.

3.5 INSULATION

Install insulation as recommended by manufacturer and as specified. In patched areas, install insulation to match existing thickness to avoid ponding.

If total nominal thickness is equal to or greater than 38 mm, install insulation in two layers. Do not rupture vapor barrier during installation of insulation. Do not install more insulation at one time than can be protected from wetting or other damage by placement of roofing membranes on same day or before rain or dew.

Install layer to receive roofing membrane with longitudinal joints parallel to short dimension of roof. Stagger joints in each layer. Solid-mop first layer and between layers. Lay membrane with edges in moderate contact, but do not force into place. Stagger end joints.

Lay vapor-barrier felts perpendicular to roof slope.

Tape joints of insulation board if required by manufacturers of insulation or roofing.

Install temporary water cutoffs at completion of each day's work, and remove upon resumption of work.

3.6 BUILT-UP ROOFING

A. Install roofing in accordance with approved roofing manufacturer's specification and NRCA Roofing and Waterproofing Manual.

1. 10-Series for temporary roofs and vapor retarders

2. 20-Series for insulation attachment

3. 30-Series for nailable roof decks

4. 40-Series for insulated roof decks

5. 50-Series for concrete roof decks

6. 60-Series for existing built-up roofing (BUR) substrate

B. Mechanical Application - When mechanical roofing-application equipment is used, place planks, plywood, or other approved protection over roof insulation or roofing. Confine traffic to protected area. Ensure that felt machines contain a sufficient quantity of bitumen at proper temperature to ensure that holidays are not formed in bitumen.

C. Valleys

1. Continue base sheets across valleys and terminate 450 mm from valley. Continue felt plies across valleys and terminate 300 mm from valley. Terminate exposed laps on a line from, and parallel to, gutter valley. Successively mop-in two plies of felt, and wide, over each felt line of termination.

2. If application can be completed without wrinkles, buckles, or fishmouths and if side laps do not face direction of drainage, roofing felts and base sheets may be laid continuously across or parallel to shallow valleys such as those formed by reverse-slope roofs. For this application, reinforce valleys with one ply of felt, wide, centered on valley gutter and laid in a solid mopping of asphalt over top ply of roofing.

3.7 FLASHING

A. Cant Strips - Install in angles formed at wall and other vertical surfaces as backing for base flashings. Lay cant strips in a solid coat of bituminous cement just before laying roofing plies. Ensure that cants have a 140 mm face dimension, are continuous, and are installed in as long lengths as practicable.

B. Flashing

1. Provide flashing in angles formed at walls and other vertical surfaces, and where required to make Work watertight. Use bituminous plastic cement for applying flashing. Provide and install flashing immediately after placing top ply of roofing, and return and seal or cap and seal to waterproof edges and ends. Step flashing where vertical surfaces abut sloped roof surfaces. Ensure that sheetmetal reglet up to which base flashing is installed is maximum and minimum above roofing surfaces.

2. Install flashing in accordance with NRCA Roofing and Waterproofing Manual, and manufacturer's instructions.

C. Crickets shall be installed at all equipment platforms, duct penetrations, curbs, and sleepers perpendicular to the flow of water.

3.8 ACCESSORIES

A. Walkway

1. Install asphalt plank walkway systems for protection of roofing membrane. Apply adhesive at the manufacturer's specified rate to the roof membrane areas to receive the walkway planks.

2. Allow for space between adjacent boards for drainage.

3.9 MINIMUM MATERIAL WEIGHTS (PER SQUARE METER)

Ensure that asphalt assembly conforms to design schedule. Quantities cited in schedule are minimum quantities per square meter. Failure to make these minima by any amount in excess of 1 percent will be grounds for rejection.

SECTION 07600

FLASHING AND SHEETMETAL
12/01

PART 1 GENERAL

1.1 SUMMARY

This section specifies requirements for flashing and other sheetmetal work.

1.2 REFERENCES

American Society for Testing and Materials (ASTM)

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

Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

SMACNA-93	Architectural Sheet Metal Manual

1.3 SUBMITTALS

Refer to Section 01300, Submittals. Submit the following:

SD-04, Shop Drawings

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

PART 2 PRODUCTS

2.1 SHEETMETAL MATERIALS

Materials - Minimum SMACNA-93 thickness and weights.

Aluminum Sheet and Strip - Alclad 3003, Alclad 3004, or Alclad 3005, ASTM B209M, embossed finish, clad one side and of specified temper. Minimum tensile strength: .

Lead Flashing and Lead Washers: , thick.

Galvanized Steel Sheet - ASTM A526M, regular coating, designation Z90.

Stainless Steel: thick (26 ga), A304, corrosion-resistant steel.

Copper - Standard electrolytic tough-pitch copper, Type ETP, or fire-refined tough-pitch copper, Type FRTP, as classified in ASTM B224 and conforming to ASTM B370, light cold-rolled temper.

2.2 SHEET METAL THICKNESSES

Following table specifies minimum acceptable sheet thickness for corresponding applications:

APPLICATION	COPPER kg/m2	ALUMINUM mm	STAINLESS STEEL mm (gage)	GALVANIZED STEEL mm (gage)	LEAD kg/m2
Building expansion joints, cap	4.9	0.81	0.4 (28)	0.6 (24)	--
Bellows or flanges, U-type	4.9	--	0.4 (28)	0.6 (24)	--
Flashings					
Base	6.1	0.81	0.4 (28)	0.9 (22)	14.6
Cap, supports	4.9	0.81	0.4 (28)	0.6 (24)	12.2
Coping, parapet, thru-wall	4.9	--	0.4 (28)	0.6 (24)	12.2
Cleats, x	4.9	0.81	0.5 (26)	0.7 (24)	--
Edge strips, wide	7.3	1.27	0.6 (24)	1.0 (20)	--
Reglets	3.1	--	0.3 (30)	0.4 (30)	--
Receivers, cap flashings	4.9	--	0.4 (28)	0.6 (24)	--
Gravel stop fascias					
Corrugated sheets	4.9	0.81	0.4 (28)	0.6 (24)	--
Smooth sheets to	4.9	0.81	0.4 (28)	0.6 (24)	--
Smooth sheets over	6.1	1.27	0.5 (26)	0.9 (22)	--
Gutters, end caps, continuous cleats, cover plates, conductor heads and splash pans	4.9	0.81	0.4 (28)	0.6 (24)	--
Downspouts	4.9	0.61	0.3 (30)	0.6 (24)	--
Scupper linings 50 mm wide, and gutter hangers 25 mm wide	3 mm	3.18	1.2 (18)	3.5 (10)	--
Strainer wire gage/diameter	No. 9	3.66 mm	2.77 mm	3.05 mm	--

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

2.3 FASTENERS AND SOLDER

Fasteners - Of same metal as material joined, or of a metal compatible with material joined.

Solder and Flux - ASTM B32. Solder - SN50.

2.4 CEMENTS AND SEALING COMPOUNDS

Bituminous Plastic Cement - Asphaltic-base material conforming to ASTM D4586, compatible with roofing asphalts and asphalt primer.

Sealing Compound - Gun grade, one-component, nonsag, elastomeric, conforming to ASTM C920. Base material - Polyurethane, resistant to 50 percent joint movement.

Aluminum-seam Sealant - As recommended by aluminum manufacturer.

2.5 ENDLAP SEALANT TAPE

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

Sealant tape shall not sag more than (0.05 inches) after hanging in the vertical position for 48 hours.

Penetration limits (degrees of hardness) determined in accordance with ASTM D217, 300 gram cone:

At	(0ºF ±2ºF)	45 ±minimum
At	(77ºF ±2ºF)	100 ±minimum
At	(120ºF ±2ºF)	135 ±minimum

Composition shall be isobutylene-isoprene rubber and fine inert silica fillers. Asbestos fillers are not acceptable.

Thickness shall be 3 mm (0.125 inches).

Flexibility per ASTM C765 - no cracking at (-60ºF).

Webbing and elongation - at (0ºF), minimum 500%; at (77ºF), minimum 1000%.

Cohesive Tensile Strength per ASTM D897 metal) - (25 psi) minimum.

PART 3 EXECUTION

3.1 GENERAL

A. Sheetmetal Work - Conform to drawing details and to applicable plate number and design and installation recommendations of SMACNA-93. Ensure that finished sheetmetal installation is free from water leakage.

B. Ensure that surfaces to receive sheetmetal work are clean, smooth, dry, and free from defects and projections that might affect Work.

Make surfaces plumb and true to a maximum tolerance of 1:1000, with no dips, waves, or uneven surfaces exceeding 1:1000 in any direction. Make lines, arises, and angles sharp and uniform. Fold back exposed edges of sheetmetal to form a wide hem on concealed side.

C. Fastening Methods

1. Use concealed fasteners. Nail only one edge to permit freedom of expansion perpendicular to line of nailing. Space nails at maximum on center. Ensure that nails penetrate backing by minimum.

2. Use cleats for securing edges of sheetmetal members over wide and at other designated locations. Fasten cleats with two nails, and fold end over nails. Lock other end of cleat into seam or folded edge of member being fastened. Space cleats at maximum.

3. Fit screws with neoprene or lead washers to protect surface of metal sheet and to provide a watertight connection.

D. Seams

1. Seams and lock joint construction - Conform to SMACNA-93, Plate 131.

2. Make seams straight and uniform in height, width, and finish as follows:

a. Flat-lock seams: wide minimum

b. Lap seams, when soldered - Finish wide minimum

c. Lap seams, not soldered - Overlap minimum

d. Loose-lock expansion seams: wide minimum providing for minimum movement within joint. Completely fill joint with sealant with bed thickness minimum

e. Flat seams - Make in direction of flow. Seams that are not soldered - Completely fill with approved sealant.

E. Provisions for Expansion and Contraction

1. Expansion-joint configuration - Conform to drawing details and to SMACNA-93.

2. Expansion joints in concrete walls - Conform to SMACNA-93, Plate 82, Figure B. Ensure that each member does not exceed in length and runs continuously from top of footing to top of wall.

3. Floor slab expansion joints - Conform to SMACNA-93, Plate 83. Lap joints and solder before installing in concrete floor slab.

F. Dissimilar Metals - Isolate from each other by painting with bituminous paint.

3.2 FLASHING

A. Reglets and Flashing Receivers - Conform to SMACNA-93. Cut masonry

joints or concrete to form a saw-cut reglet. Cut slots to a minimum depth of and approximately thick.

B. Base Flashing

1. Install metal base flashing where roof abuts vertical surfaces, in valleys, at ridges, and where roof slope changes. Configuration - Conform to SMACNA-93.

2. Extend flashing 200 mm minimum up vertical surfaces.

C. Cap and Counter Flashing

1. Install metal cap or counter flashing where horizontal roof surfaces abut vertical wall surfaces, at copings, at joints between existing and new construction, at penetrations of roof surfaces, and at equipment supports. Configuration - Conform to SMACNA-93.

2. Form flashing in 3 m lengths, except where shorter pieces are required; lap end joints minimum; do not solder joints.

D. Edge Trim Strips - Provide a formed drip edge.

E. Flashing at Roof Penetrations and Equipment Supports - Install metal flashing conforming to SMACNA-93 where piping, conduit, or equipment supports penetrate roof surfaces. Single-pipe vents - Flashed with lead flashing or a two-piece formed-metal housing of specified sheetmetal, installed in accordance with SMACNA-93, Plate 59, Figures B and C.

3.3 GRAVEL-STOP FASCIAS

Install gravel-stop fascias at exposed edges of built-up roofs. Configuration - Conform to SMACNA-93. Secure in place lower edge of each gravel-stop fascia section by hooking over a continuous edge strip or cleat. Extend out flanges of each section on top of roofing felts minimum.

Provide 6 mm open joint between each gravel-stop fascia section, with a wide plate centered on joint. Install system in conformance with SMACNA-93, Plate 38.

3.4 GUTTERS AND DOWNSPOUTS

A. Gutters

1. Gutter design - In accordance with SMACNA-93.

2. Pitch gutters to drain at 1:200 maximum. Gutters supports - In accordance with SMACNA-93. Support spacing: on center, maximum.

3. Fold back edges of gutters to form a continuous hook deep minimum. Support gutters by continuous cleat 64 mm wide, minimum.

4. Outlet tubes with flanges - Riveted and soldered to gutters; extend tubes into downspouts. Insert downspout strainer into each outlet tube.

5. Provide gutter expansion joints at on center maximum, in accordance with SMACNA-93, Plate 6.

B. Downspouts

1. Provide downspouts on outside walls from gutters, conductor heads, and scuppers.

2. Join downspouts to gutters at outlet tubes, and join to each other by telescoping end joints into lower section.

3. Fabricate downspout hangers of same material as downspouts. Provide one hanger at top and bottom of each downspout section.

4. Install elbows where downspouts terminate on splash blocks or roof pans. Fit downspouts neatly into cast-iron boots or drain pipes where downspouts terminate in drainage lines; fill joints to full height of bell with portland cement mortar caps.

3.5 MISCELLANEOUS DRAINAGE ITEMS

Conductor Heads - Conform to SMACNA-93, Plate 25; fabricate of same material and thickness as downspout. Seams - Locked and soldered. Close top openings with removable 13 mm mesh screens. Installation - Conform to SMACNA-93.

Scupper Lining - Provide metal scupper linings conforming to SMACNA-93, Plate 30, through wall and roof openings. Project linings beyond walls or fascias, and terminate in conductor heads, spouts, or overflow openings. Surfaces to receive linings - Coat with bituminous cement.

Splash Pans - Provide metal splash pans conforming to SMACNA-93, Plate 35, Alternate Section 2. Material - Same as for downspouts.

3.6 CLEANING

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

SECTION 07900

SEALANTS AND CALKINGS
12/01

PART 1 GENERAL

1.1 SUMMARY

This section specifies requirements for sealants and calkings.

1.2 REFERENCES

American Society for Testing and Materials (ASTM)

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

Federal Specifications (FS)

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

1.3 SUBMITTALS

Refer to Section 01300, Submittals. Submit the following:

SD-02, Manufacturer's Catalog Data

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

SD-06, Manufacturer's Instructions

Manufacturer's Instructions, for each type of sealing compound to

be used in Work. Include surface preparation, recommended joint dimensions, and sealing-compound application.

1.4 DELIVERY, HANDLING, AND STORAGE

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

PART 2 PRODUCTS

2.1 COLOR OF SEALANT

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

2.2 BACKUP MATERIAL

A. Polyethylene Backup Material - Expanded closed-cell polyethylene rod. Use polyethylene with following property values:

1. Density - ASTM D1622, to .

2. Compression deflection - ASTM D1056, minimum 25 percent at .

3. Tensile strength - ASTM D1623, minimum .

4. Water absorption - ASTM D1056; maximum 5 percent by weight.

B. Synthetic Rubber Backup Material - Expanded closed-cell elastomeric preformed rods or tubes. Provide rods for joints and under in width; rod diameter minimum 30 percent greater than joint width. Provide tubes for joints over in width; tube outside diameter minimum 50 percent greater than joint width, and tube wall thickness minimum .

2.3 BOND-PREVENTIVE MATERIAL FOR SEALING COMPOUNDS

Compatible with, and nonadhering to, sealing compound used. Material compatible with following, as best suited for application: Polyethylene pressure-sensitive tape (ASTM C726), waxed-paper pressure-sensitive tape (FS UU-P-270), or aluminum foil (FS QQ-A-1876).

2.4 PRIMER-TO-SEALANT COMPOUNDS

Paint Primer for Calking Compound - Aluminum paint, FS TT-P-38.

Primer for Elastomeric Sealing Compound - As recommended by sealing-compound manufacturer for use on kind of substrate material encountered in Work. Test primer for staining, durability, and dirt pickup on the surfaces to be sealed.

2.5 ONE-COMPONENT SEALANTS

Calking Compound - Oil- and resin-base gun type, FS TT-C-598, Type I.

Polysulfide-base Elastomeric Sealing Compound - Nonsag type, resistant to 25 percent total movement, FS TT-S-230, Type II, Class B, except that base material is polysulfide.

Urethane-base Elastomeric Sealing Compound - Nonsag, resistant to 50 percent total movement, FS TT-S-230, Type II, Class A, except that base material is urethane.

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

2.6 SOLVENTS AND CLEANING AGENTS

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

PART 3 EXECUTION

3.1 GENERAL

Install calking and sealing materials in accordance with approved catalog data and as specified.

Use components of each formula only with that formula; do not intermix components of different formulas. Do not use thinners or other additives to modify formula.

Do not install calking and sealing compounds when ambient temperature is below 4°C or above 38°C. Do not apply exterior calking and sealing compounds in damp or rainy weather; ensure that surfaces of joints to be sealed have dried from effects of such weather.

Do not allow condensation to form on joint surfaces that will receive calking or sealing compounds. Provide ventilation as required to prevent formation of condensation on such surfaces.

3.2 SURFACE PREPARATION

Clean surfaces of joints to be sealed free of loose particles, oil, grease, water, frost, surface dust, coatings, and other foreign matter, by brushing, sandblasting, acid washing or solvent methods, as recommended by sealant manufacturer. Remove laitance from cleaning before applying sealant.

Joints Receiving Calking Compound - Minimum depth , maximum depth . Give porous surfaces such as masonry, concrete, stone, or wood on sides of joint cavity a uniform coating of paint primer for calking compound.

Joints Receiving Elastomeric Sealing Compound - Minimum depth . Depth of elastomeric sealing compound - Equal to joint width in joints up to wide; in joints to wide.

Joints with a Depth less than Specified Minimum - Rake out to obtain proper depth. Joints with a depth exceeding specified maximum - Fill with rope yarn or polyethylene backup material to obtain proper depth; pack rope yarn backup material tightly; roll polyethylene backup material into joint cavity so as to avoid lengthwise stretching, twisting, and braiding.

Mask adjacent finished surfaces, as required, to protect them from smears.

3.3 APPLICATION

Gun-apply calking compound with a nozzle of proper size to fit joint width, and solidly force compound into joint cavity. Ensure that finished exposed surfaces of calking compound are sufficiently convex to result in a flush joint when calking compound has dried, and are uniformly smooth and free from wrinkles.

Gun-apply elastomeric sealing compound with a nozzle of proper size to fit joint width, and force compound into joint cavity with sufficient pressure to expel air and to solidly fill joint cavity. Firmly tool surface of sealing compound in place using wetting agent recommended by manufacturer of sealing compound. Ensure that finished exposed surfaces of sealing compound are slightly concave, uniformly smooth, and free from cracking and air bubbles.

Ensure that metal and other surfaces to receive joint-sealant tape are clean and dry. Place tape on one surface with removable backing exposed. Remove backing immediately before placing next plate. After plates are placed and lapped and holes in plates are matched, cold-punch holes for bolts through tape, or pierce tape through bolt holes with an X-shaped cut without deforming tape adjacent to bolt holes. Do not stretch tape; lap tape minimum at splices. At corner laps of plates and at other laps requiring additional sealant material to make waterproof joints, place as many thicknesses of tape as required to fill voids. Store tape at ambient temperatures of less than , and handle and store so as to not deform tape from its original shape.

3.4 INSPECTION AND ACCEPTANCE PROVISIONS

Clean surfaces adjoining sealed joints free of compound smears or other soiling resulting from application of specified compounds.

Calking and sealing work will be rejected if color does not match that of approved sample, if finished surface does not conform to requirements, or if compound fails to adhere to joint surfaces at sides of joint.

Remove defective work and replace with new acceptable work.

SECTION 08000

DOORS AND WINDOWS
12/01

PART 1 GENERAL

1.1 SUMMARY

This section specifies requirements for swing and sliding doors, windows, frames, finish hardware, storefronts, and glazing.

1.2 REFERENCES

Aluminum Association (AA)

AA DAF 45	Designation System for Aluminum Finishes

American Architectural Manufacturers Association (AAMA)

AAMA 804.1	Voluntary Specification and Test Method for Sealants

American National Standards Institute (ANSI)g

ANSI Z97.1	Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test

American Society for Testing and Materials (ASTM)

ASTM A36M	Carbon Structural Steel
ASTM A501	Hot-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A527M	Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Lock-Forming Quality
ASTM A570M	Steel, Sheet and Strip, Carbon, Hot-Rolled, Structural Quality
ASTM B209M	Aluminum and Aluminum-Alloy Sheet and Plate (Metric)
ASTM C669	Glazing Compound for Back Bedding and Face Glazing of Metal Sash
ASTM C1036	Flat Glass
ASTM D1037	Evaluating Properties of Wood-Base Fiber and Particle Panel Materials
ASTM E152	Fire Tests of Door Assemblies
ASTM E331	Water Penetration of Exterior Windows,

	Curtain Walls, and Doors by Uniform Static Air Pressure Difference

American Welding Society, Inc. (AWS)

AWS D1.1	Structural Welding Code - Steel

Department of Defense (DOD)

DOD-P-21035	Paint, High Zinc Dust Content, Galvanizing Repair (Metric)

Federal Specifications (FS)

FS TT-S-230	Sealing Compound: Elastomeric Type, Single Component (For Calking, Sealing, and Glazing in Buildings and Other Structures)
FS TT-P-791	Putty: Linseed-Oil Type (for Wood-Sash-Glazing)

National Fire Protection Association (NFPA)

NFPA 80	Fire Doors and Fire Windows

National Wood Window and Door Association (NWWDA)

NWWDA IS-1	Wood Flush Doors

1.3 SUBMITTALS

Refer to Section 01300, Submittals. Submit the following:

SD-02, Data

Manufacturer's Catalog Data on catalog items.

SD-04, Drawings

Shop Drawings, Include door and frame locations in building, layout and elevations, dimensions, shapes and sizes of members, thicknesses of metals, types and locations of shop and field connections, details of anchorage to other construction, glazing method, and construction and erection details.

SD-07, Schedule

Equipment and Fixture Schedule - indicate type, quantity, manufacturer's name, catalog number, location, and finish.

SD-10, Test Reports

Certified laboratory test reports of anodic-coating tests, as specified.

SD-14, Samples

Product Samples of exposed-to-view surfaces, approximately 75 mm

x 150 mm, to illustrate producer's standard color and appearance range.

1.4 PERFORMANCE REQUIREMENTS

A. Aluminum Doors, Windows and Frames

1. Maximum deflection of any metal framing member in a direction normal to plane of entrance wall, when glazed entrance is subjected to specified wind pressure: 1/175 of clear span of member or , whichever value is lesser.

2. Maximum deflection of any metal member in a direction parallel to plane of entrance wall, when metal member is carrying its full design load: 75 percent of design clearance dimension between that member and glass, sash, panel, or other part immediately below.

3. Doors and frames - Designed to provide for expansion and contraction of component parts due to ambient temperature changes from to without causing buckling, opening of joints, overstressing of fasteners, or other harmful effects.

B. Fire rated Doors, Windows, Frames and Hardware - Ensure that doors, windows, frames and associated hardware designated on drawings or schedules with a fire rating (e.g., 3-hour), and those in fire-rated walls and partitions are of types that have been fire tested, rated, and labeled in accordance with ASTM E152 and bear metal UL labels indicating rating in hours duration of exposure to fire, with a letter following hourly rating designating location for which assembly is designed and temperature rise on unexposed face of door at end of 30 minutes of fire exposure, when installed with accordance with NFPA 80.

PART 2 PRODUCTS

2.1 FINISH AND COLOR

As selected and matching approved sample.

2.2 METAL DOORS, WINDOWS, AND FRAMES

A. Materials

1. Hot-rolled steel shapes, plates, and bars - ASTM A36M. Hot-formed steel tubing - ASTM A501. Steel sheet and strip for cold-formed light gage structural members - ASTM A570M, Grade 230.

2. Aluminum alloy and temper - Mechanical properties equal to, or exceeding those of, 6063-T5. Sheets and plates - ASTM B209M, Alloy 5005, and Temper H16.

3. Screws, nuts, washers, rivets, clips, and other miscellaneous fastening devices - Aluminum or stainless steel.

4. Reinforcement: thick aluminum or steel plate.

B. Fabrication

1. Metal parts - Accurately formed. Joints, except those designed to accommodate movement - Accurately fitted and rigidly assembled.

2. Welding - AWS D1.1; perform with filler metals and by methods recommended by producer of metal being welded. Ensure that welds behind finished surfaces cause no distortion or discoloration on exposed side. Welded joints - Clean free of welding flux, and dress on exposed and contact surfaces.

3. Insofar as practicable, perform assembly in manufacturer's plant. Work that cannot be permanently factory assembled - Mark before shipment for assembly at Worksite.

4. Preparations for mortised and concealed hardware - Perform at factory, including cutouts, recesses, mortises, reinforcing, drilling, and tapping.

C. Finishes

1. Surfaces of steel - Shop primed.

2. Exposed-to-view aluminum surfaces - Unless otherwise indicated, polished frosted finish with Class II clear anodic coating conforming to M21-C22-A31, as defined in AA DAF 45. Finish color and appearance - Match approved sample within aluminum producer's standard color range.

2.3 DOORS

A. Provide exterior doors with weatherstripping at heads, jambs, and meeting stiles. Weatherstripping - Silicone treated wool pile inserted in a stainless steel or extruded aluminum-alloy housing; mortised into door edges or frame; designed for easy removal and replacement; adjustable at meeting stiles of pairs of doors.

B Wood Doors

1. Comply with NWWDA IS-1. Facings indicated as stain-transparent finish - Premium grade. Face veneer and veneer cut - Natural Birch, Plain Slice. Top and bottom edges of wood doors and surfaces of cutouts - Factory-sealed against moisture penetration.

2. Doors receiving Worksite-applied finish - Clean and sanded smooth to remove handling and storage marks, raised grain, minor surface marks and abrasions, and left ready for finishing.

3. Hollow core wood flush doors: 7-ply, ladder, mesh or cellular core.

4. Solid core wood flush doors: 5-ply, glue block core, or 7-ply MAT-formed particle board core.

C. Flush Aluminum Doors - Monolithic, smooth aluminum, with a core of kraft honeycomb, phenolic-resin impregnated, bonded to tempered hardboard. Cutouts - Made from solid sheet, without distorted edges. Facing - Concealed under door edging a minimum of 13 mm. Aluminum - Provide color anodized finish, color as selected. Edging - 6063-T5 aluminum alloy channels, fitted to door with adhesive; nonremovable, watertight, and sealed with a nonstaining sealant.

D. Aluminum Store-Front Doors - Swing type, full glazed, stile-and-rail construction with medium stile, as indicated. Stiles and rails - Fabricated of aluminum-alloy tubular extrusions with a wall thickness minimum. Corners - Joined by concealed welding and mechanical fastening. Corner connections - Accurately milled to a hairline watertight joint.

E. Fire-Rated Doors

1. Where doors are scheduled with a fire-resistance rating (e.g., 1.5 hour), provide, label and fire test fire-rated doors, frames, and hardware (including door closers) as an assembly, complete with type of fire-door hardware to be used in Work.

2. Cores - Kiln-dried, selected white pine or other nonresinous soft wood, tongue and grooved, surfaced four sides; laminated construction; number of plies as required by class of opening to be protected. Plies secured with nails spaced at on center minimum each way, driven flush, and clinched.

3. Metal coverings: thick (16 ga) steel sheets conforming to ASTM A527M, Z275. Covering installation - Double-lock-joint construction with wide seams; nailed under seams with galvanized nails on center; free of waves, bulges, kinks, and irregular surfaces; corners mitered with clinch locks and tight joints.

4. Vents - Concealed or on unexposed surfaces; conforming to NFPA 80.

F. Door Louvers and Frames - Inverted 60 degree V-blade, enamel-finished steel, wide, stationary, sightproof. Blades - Spaced at maximum 8 per , formed from thick (20 ga) steel in baked enamel finish, color as selected. Louver retainer stops - Steel or hardwood, matching color and finish of door.

G. Vision Panel - Frames fabricated to size indicated from thick galvanized steel formed to a channel profile with flanges by door thickness, through-bolted to door with galvanized hexagonal pan-head bolts. Glass stops - As detailed, removable on inside only. Glass - As specified in Paragraph 2.6, Glass and Glazing.

2.4 DOOR AND WINDOW FRAMES

A. Door Frames

1. Door frames for flush doors - Steel channel frames, size as indicated, hot-dip galvanized Z275 after fabrication, furnished as part of door assembly by door manufacturer.

2. Frames for fire rated doors - Rated and labeled as required for door.

3. Frames plumb and straight, with joints continuous welded and ground smooth. Provide a continuous steel bar stop, x , welded to frame; hinge pintles and latch keepers welded to jambs in factory; holes for other hardware items drilled and tapped in factory.

B. Aluminum Frames - Fabricated of aluminum-alloy extrusions with a wall

thickness of minimum. Frame joints sealed to prevent leakage. Sizes, shapes, and methods of anchoring - As indicated and as detailed on approved drawings. Reinforcement - Concealed inside frame members, and as indicated on approved drawings.

2.5 GLASS AND GLAZING

A. Glass - Conform to ASTM C1036.

1. Clear plate glass - Plate or float, Type I, Class 1, Quality q3.

2. Tinted glass - Plate or float, Type I, Class 3 (Tinted), Quality q3. Tint - Of color selected by the Government.

3. Tempered glass - ANSI Z97.1, bearing ANSI safety glass marking. Glass before tempering - Plate or float type, as specified in Paragraphs 2.6.A.1 and 2.6.A.2.

4. Figured glass - Rolled, Type II, Class 1(Translucent) or Class 3 (Tinted), Quality q8 (Glazing), Pattern p3 (Random) on one side.

5. Double glazing units - Factory fabricated units consisting of two panels of clear plate or float glass separated by a dehydrated air space, hermetically sealed.

6. Fire-rated wired glass - UL approved for fire windows and doors, UL listed, Guide Designation KCMZ, bearing UL listing and marking. Thickness: . Glass Type II, Class 1, Form 1, Mesh 1 or Mesh 2.

B. Glazing Materials

1. Glazing compound - ASTM C669. Color - Match color of sash as closely as possible.

2. Elastomeric sealing compound - One-component, nonsag, elastomeric type; FS TT-S-230, Type II. Color - Match color of sash as closely as possible.

3. Glazing tape - Non-skinning, non-oily, reinforced class, butyl- or polyisobutylene-base resilient preformed compound; AAMA 804.1.

4. Wood-sash putty - Pure linseed oil type; FS TT-P-791,Type I.

5. Resilient setting blocks - Solid chloroprene elastomeric extrusions with a Shore A durometer hardness of 70 to 90. Thickness - Approximately same as glass-edge clearance dimension. Length: minimum.

6. Resilient spacers - Solid chloroprene elastomeric extrusions with a Shore A durometer hardness of 40 to 50. Spacers: to long, thickness and height to suit application.

7. Preformed glazing gaskets - Elastomeric compression type, extruded to shape with factory-made tight-fitting corners to suit type of flush glazing and glass size.

8. Glazing moldings - Fabricated of aluminum-alloy extrusions, designed for flush glazing, with wall thickness minimum.

Moldings - Snap-in flush glazing type with preformed glazing gasket, sized to receive type and thickness of glass. Moldings on exterior face of doors - Nonremovable type without exposed screws. Moldings carefully fitted and joined at corners.

PART 3 EXECUTION

3.1 INSTALLATION

A. General

1. Install doors, frames, and accessories in accordance with approved shop drawings and descriptive data, and as specified.

2. Install fire-rated doors in accordance with manufacturer's standard procedure and NFPA 80 for fire rating. Install doors, frames, and hardware to operating tolerances required, or those specified herein, if more stringent.

B. Fastening to Other Construction

1. Build-in frames as Work progresses.

2. Deliver to Worksite materials that will be embedded in cast-in-place concrete and masonry construction in time to be installed before start of other construction. Provide setting drawings, templates, and instructions for installation of embedded materials.

3. Provide anchorage devices and fasteners for fastening specified work to construction in place. Fastening to wood plugs in masonry or concrete in place is not permitted. Set anchorage devices in masonry or concrete in place in accordance with manufacturer's printed instructions. Leave drilled holes rough, not reamed, free from drill dust, and sharp and clean with no broken areas or spalls.

C. Placing Frames - Provide temporary supports and bracing to maintain position, stability, and alignment of frames while they are being permanently connected. Install frames plumb, level, and in alignment. Location as indicated +/- , plumb and level within 1:1200, true alignment at joints within .

D. Door Installation - Provide swing doors with maximum clearance at jambs and heads, clearance at meeting edges of pairs of doors, and clearance at bottom. Provide lock edges of doors with proper operating clearance.

E. Glazing

1. Install glass in accordance with manufacturer's printed instructions and as specified.

2. Ensure that operable sash moves freely and properly in frame of unit before start of glazing. Securely fix movable items, or place them in a closed and locked position, until glazing material has set.

3. Sizes of glass indicated are approximate. Determine sizes and

proper edge clearances by measuring actual units to receive glass. Except where specified otherwise, ensure that each piece of glass bears manufacturer's label to identify its type, thickness, and quality. Do not remove labels until approval is obtained.

4. Identify glazed openings during construction period by tapes or flags that are not in contact with glass. Remove temporary labels immediately after glass and glazing work has been approved.

3.2 PAINTING

Painting of Doors and Frames - As specified in Section 09900, Architectural Painting. Clean and wire brush painted walls and prime painted finish door hardware, and touch up with paint originally used. Repair galvanized-finish doors and hardware with paint conforming to DOD-P-21035.

After installation, touch-up paint field welds and scarred surfaces. For touch-up painting use same paint as that used for shop painting steel.

3.3 ACCEPTANCE PROVISIONS

Upon completion of installation, clean work to remove mastic smears and other foreign materials; clean glass surfaces free of glazing- or sealing-compound, smears, and other defacement.

Before final acceptance, check and readjust finish hardware as required to ensure proper operation.

Doors, windows, and frames will be checked by the COTR for warp, twist, delamination, and manufacturing and installation defects. Remove items exhibiting defects and those outside tolerances listed, and replace with new items.

SECTION 08700

FINISH HARDWARE
12/01

PART 1 GENERAL

1.1 SUMMARY

This section specifies requirements for furnishing and installing finish hardware.

1.2 REFERENCES

American National Standards Institute (ANSI)

ANSI A156.1	Butts and Hinges (BHMA 101)
ANSI A156.2	Bored and Preassembled Locks and Latches (BHMA 601)
ANSI A156.4	Door Controls - Closers (BHMA 301)
ANSI A156.5	Auxiliary Locks and Associated Products (BHMA 501)
ANSI A156.16	Auxiliary Hardware (BHMA 1201)
ANSI A156.18	Materials and Finishes (BHMA 1301)

National Fire Protection Association (NFPA)

NFPA 101	Code for Safety to Life from Fire in Buildings and Structures
NFPA 80	Fire Doors and Fire Windows

Steel Door Institute (SDI)

SDI 100	Load Tables and Weight Tables for Steel Joists and Girders

1.3 SUBMITTALS

Refer to Section 01300, Submittals. Submit the following:

SD-01, Data

Manufacturer's Catalog Data

SD-07, Schedules

The Contractor shall submit a hardware schedule indicating the door and frame location, type, size, swing, bevel, material, hardware type by Builders' Hardware Manufacturers Association (BHMA) numbers, and the respective manufacturer's type, name, number, finish, and design.

1.4 COORDINATION

Coordinate work of this section with other directly affected sections involving manufacture of any internal reinforcement for door hardware.

Hardware shall be manufactured to template. Provide templates and, if necessary, the physical hardware to fabricator of doors and frames in ample time to facilitate the work.

1.5 QUALITY ASSURANCE

Manufacturers -shall be experienced and specialized in manufacturing finish hardware.

1.6 FINISHES

Provide hardware with the following finishes conforming to ANSI A156.18:

Hinges, Locksets and Latchsets - Satin stainless steel, BHMA Code 630, unless otherwise indicated.

Hinges at Labeled Openings - Satin chromium plated on steel, BHMA Code 652.

Panic Hardware - Satin chrome, clear anodized, BHMA Code 626 at interior; dull bronze, BHMA Code 612 at exterior.

Astragals - Primed for painting, steel, BHMA Code 600.

Closers - Sprayed, matching locksets and latchsets.

Door Stops, Finish Bolts - Match locksets and latchsets.

Door Holders - Match new exterior hardware finish.

1.7 DELIVERY, STORAGE, AND HANDLING

Deliver hardware with items packed separately, complete and ready for installation with necessary fittings, trim, fasteners, and accessories. Mark packages clearly for identification in accordance with Hardware Schedule. Deliver hardware so that Work may progress without delay or interruption.

Upon delivery of the finish hardware to the Worksite, the Contractor shall be responsible for all material. The hardware shall be protected from damage at all times before and after its installation.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

Acceptable manufacturers or pre-approved equal meeting or exceeding salient product features listed below, except Locksets, Latchsets, and Cylinders (Item B) shall be Best 9K only. Numbers in Hardware Schedule refer to those of the first named manufacturer below.

Hinges - Hager, Stanley, Lawrence, or McKinney.

Locksets, Latchsets, and Cylinders - Best 9K (Ames Research Center Standard).

Exit Devices - Von Duprin.

Overhead Closers - LCN or Sargent.

Manual Bolts - Glynn Johnson, Builders Brass, or Ives.

Gasketing, Astragals, and Thresholds - Pemko, Zero, NGP.

Stops, Holders - Glynn Johnson, Ives, Quality.

2.2 FASTENERS

Fasteners of the proper type, size, quantity, and finish for each hardware item shall be provided. Visible fasteners shall be Phillips-head, bronze or stainless steel finished to match specified hardware.

2.3 HINGES

Hinges shall be full mortise, heavy weight, ball bearing, button tip, template type conforming to ANSI A156.1, Grade 1. Size shall be x .

2.4 LOCKSETS

Cylinder bored locksets and latchsets shall conform to ANSI A156.2, plain design and wrought trim.

Cylinder bored locksets and latchsets for fire-rated doors shall be UL listed and labeled, heavy duty, Series 4000, Grade 1.

Heavy duty usage cylinder bored locksets and latchsets shall be Series 4000, Grade 1.

Locksets and latchsets shall have standardized fronts, cases, and strikes so that varying functions will be interchangeable and will require only one mortise for their installation. Locks and latches shall have beveled bronze fronts, bronze bolts and strikes, brass hubs, and cases with specified finish. Locks shall have Best cylinders conforming to ANSI A156.5, with seven-pin tumblers, steel cylindrical cases, and interior non-corrosive parts.

Locksets and lock cylinders shall be master keyed to the key system established for the installation. All locksets shall be furnished with "Best" 7-pin red construction cores. Temporary construction cores shall be furnished, installed, and maintained in locks during the construction and shall be left in place and shall become the property of the Government.

Where existing door hardware is removed, locksets and lockset cores shall be turned over to the Government.

2.5 THRESHOLDS

Thresholds shall be extruded bronze anodized aluminum 6063-alloy.

Thresholds shall be provided for the full width of the opening at exterior doors.

2.6 FLUSH BOLTS

Flush bolts shall be aluminum, specified finish, conforming to ANSI A156.16, with lever extensions.

Flush bolts shall be a type listed in UL for fire-rated doors.

2.7 LOSERS

Closers shall conform to ANSI A156.4, and shall be provided on emergency fire exits UL labeled, exterior doors, rest rooms and general office doors, and where specified in the hardware schedule.

Closers shall be the surface mounted heavy duty, parallel arm type, Grade 1. Style shall be traditional or modern.

Brackets, reinforcing plates, and accessory fittings shall be provided as required.

2.8 STRAGALS

Astragals shall be prime steel, thick (13 ga) minimum by side minimum.

2.9 EXIT DEVICES

Provide exit devices as required to fulfill all requirements of NFPA 80, NFPA 101, and UL. Provide levers and other trim compatible with other hardware, drop forged trim with solid lever handle, and cylinders of proper size and finishes for smooth operation of exit devices.

2.10 MISCELLANEOUS AND SHELF HARDWARE

A. Door Holders - Floor holder, type L11241, conforming to ANSI A156.16.

B. Door Stops

1. Door stops or bumpers conforming to ANSI A156.16 shall be provided for all doors to protect the hardware and prevent doors from striking walls and fixtures.

2. Floor mounted stops, Type L02141 (dome type) or Type L02161 (dome type for door with thresholds) shall be provided.

C. Door Silencers

1. Door silencers conforming to ANSI A156.16 shall be provided except on fire-rated door frames.

2. Door silencers shall be Type L03011 for metal frames.

3. Three silencers shall be provided for single doors. Two silencers shall be provided for each leaf of pairs of doors for installation in the head rail of the door frame.

PART 3 EXECUTION

3.1 GENERAL

Hardware shall be installed and adjusted in accordance with the

manufacturer's printed instructions and to template dimensions.

3.2 INSPECTION

Inspect doors, frames, and other surfaces to receive items of finish hardware and report defects that might adversely affect the installation or function of the hardware. Commencement of work will imply acceptance of surfaces as being satisfactory and adequate.

Contractor shall coordinate and be responsible for the proper fabrication of work or material to receive hardware. No extra cost will be allowed because of changes or corrections necessary to facilitate the proper installation and operation of the hardware.

3.3 HARDWARE LOCATION

Hardware shall be located in accordance with SDI 100, Table V, except when template dimensions and multiple-item installations require alternative locations.

3.4 HARDWARE SCHEDULE

A. Group 1 - Standard Doors (non-rated)

1.5 pr Butts 112 mm x 112 mm, Hager BB1279
1 Lockset, Best 93K7R15D626
1 Doorstop, Glynn Johnson FB19X
Silencers

B. Group 2 - Standard Double Doors (non-rated)

3 pr Butts 112 mm x 112 mm, Hager BB1279
1 pr Flush bolts, Glynn Johnson FB6W, DP2
1 Lockset, Best 93K7R15D626
1 Doorstop, Glynn Johnson FB19X
Silencers

C. Group 3 - Standard Office Door (fire-rated)

1.5 pr Butts 112 mm x 112 mm, Hager BB1279
1 Door closer, LCN 4011
1 Lockset, Best 93K7R15D626
1 Doorstop, Glynn Johnson GB19X
Door seals, Pemko S88D17

D. Group 4 - Standard Double Doors (fire-rated)

3 pr Butts 112 mm x 112 mm, Hager BB1279
1 pr Flush bolts, Glynn Johnson FB6W, DP2
1 Lockset, Best 93K7R15D626
1 Door closer, LCN 4011
1 Doorstop, Glynn Johnson FB19X
Door seals, Pemko S88D20
1 Astragal, Pemko 357SP

E. Group 5 - Single Doors with Panic Hardware

1.5 pr Butts 112 mm x 112 mm, Hager BB1168
1 Door closer, LCN 4011

1 Exit device, Von Duprin 98L-F
1 Door stop, Glynn Johnson FB19X
Door seals, Pemko S88D17

F. Group 6 - Double Doors with Panic Hardware

3 pr Butts 112 mm x 112 mm, Hager BB1168
1 pr Door closers, LCN 4011
1 Exit device, Von Duprin 9927L
2 Door stops, Glynn Johnson FB19X
1 Astragal, Pemko 357SP
Door Seals, Pemko S88D20

-- End of Section --

SECTION 09200

LATH AND PLASTER
12/01

PART 1 GENERAL

1.1 SUMMARY

This section specifies requirements for lath and portland cement plaster (stucco) for interior and exterior application.

1.2 REFERENCES

American Society for Testing and Materials (ASTM)

ASTM C33	Concrete Aggregates
ASTM C150	Portland Cement
ASTM C207	Hydrated Lime for Masonry Purposes

Federal Specifications (FS)

FS QQ-L-101	Lath, Metal (and Other Metal Plaster Bases)
FS QQ-W-461	Wire, Steel, Carbon (Round, Bare, and Coated)

1.3 SUBMITTALS

Refer to Section 01300, Submittals. Submit the following:

SD-02, Manufacturer's Catalog Data

Manufacturer's Catalog Data, for reinforcement, accessories, and waterproofing compound.

SD-13, Certificates

Certificates indicating fatty-acid content of waterproofing compound.

SD-14, Product Samples

For stucco: x , showing color and texture. For reinforcement: x .

1.4 DELIVERY, HANDLING, AND STORAGE

Deliver materials in original packages, containers, or bundles bearing brand name and name of material. Protect materials from weather, soil, and damage during delivery, storage, and construction.

PART 2 PRODUCTS

2.1 CEMENT PLASTER (STUCCO) MATERIALS

Portland Cement - ASTM C150. Use one brand only throughout Work.

Colored Stucco for Finish Coat - Mill-mixed product using white portland cement. Color - Sun- and lime-proof, and unfading. Deliver colored stucco to Worksite in manufacturer's original packages with labels intact and seals unbroken.

Fiber - Vegetable product, long, clean, well brushed out, and free from tannin. Hair - Goat or cattle hair, to long, and free from dust, grease, balls, and knots.

Hydrated Lime - ASTM C207. Total free unhydrated calcium oxide (CaO) and magnesium oxide (MgO): 8 percent maximum by weight, calculated on as received basis.

Sand - ASTM C33. Clean, hard, and free from loam, silt, and other impurities, and graded as follows:

PERCENTAGE OF SAND RETAINED (BY WEIGHT)

SIEVE SIZE mm	MAXIMUM	MINIMUM
4.75	0	--
2.36	10	0
1.18	40	10
0.60	65	30
0.30	90	70
0.15	100	95

Water - Potable.

Water Repellent - Stearate or oleate of ammonium, sodium, or calcium; powder, liquid, or paste.

2.2 PROPORTIONS

Proportions of materials for portland cement stucco, by volume, are 1 part portland cement (colored, for color coat), 3 parts sand, 0.10 part hydrated lime or quicklime putty.

2.3 ACCESSORIES

Reinforcement - Expanded-metal diamond-mesh lath, FS QQ-L-101, large opening, zinc-coated, minimum mass .

Waterproof Building Paper - Asphalt-impregnated felt, .

Nails for attaching Reinforcement over Wood Sheathing - Large-head galvanized nails with an approved furring device that will permit formation of keys minimum thickness between reinforcement and backing.

Nails for attaching Reinforcement to Vertical Wood Supports: diameter (11 ga) barbed roofing nails with an head, sufficiently long to penetrate minimum into solid wood.

Case-hardened Nails or Powder-actuated Studs with Clip-on Galvanized Washers - Used for attaching reinforcement to concrete and masonry. Use nails and studs of proper length and design for securing reinforcement. Clip-on washers for use with studs: diameter minimum.

Staples for attaching Reinforcement to Vertical Wood Supports: , galvanized.

Wire - Zinc-coated steel. Tie wire for attaching reinforcement to metal supports and lacing wire - FS QQ-W-461; Tie wire diameter (18 ga) minimum; lacing wire diameter (16 ga) minimum.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

Ensure that surfaces that will receive stucco are clean and free from frost, loose particles, dust, dirt, oil, soot, efflorescence, grease, oil, acid, and other matter that might adversely affect satisfactory bond.

Test concrete and masonry surfaces for proper alignment before stuccoing. Surfaces that are out of alignment, out of level, or irregular - Cover with reinforcing material using metal furring as necessary to produce a regular, straight, plumb, and level finish, with stucco from 40 percent thicker to 10 percent thinner than specified.

Cover painted, glazed, and plastered surfaces with reinforcing material.

3.2 REINFORCEMENT

A. General

1. Secure reinforcement applied to wood supports with nails or staples at on center maximum, driven through furring sleeves so as to provide a full and continuous thickness of stucco at back of reinforcement. Where sheets of reinforcement are lapped, drive nails or staples so as to hold lapped edges.

2. Fasten reinforcement on concrete and masonry every vertically and every horizontally with case-hardened nails or powder-actuated studs with clip-on washers to hold reinforcement minimum away from concrete and masonry. Where wood supports adjoin masonry or concrete in same plane, make sure that reinforcement overlaps masonry or concrete minimum.

3. For reinforcement over metal lintels that will be covered by stucco, extend reinforcement vertically over angles to a height of minimum, and horizontally across underside of lintels; secure in an approved manner.

4. For reinforcement over metal flashings that will be covered by stucco, lap flashings 50 mm minimum and extend vertically for a height of minimum.

5. Furring and reinforcing includes hangers, bolts, inserts, clips, fastenings, and attachments of number, size, and design suitable for developing full strength of members.

B. Metal-Lath Reinforcement - Apply straight and without buckles, and

with longer dimension across supports. Apply without integral backing only after a backing of waterproofed building paper or other approved material has been applied to area to receive stucco. End laps: minimum, and occurring only over supports. Side laps: minimum, and tied at intervals of maximum.

3.3 MIXING

Mix hydrated lime with water to form a putty, and let stand a minimum of 15 minutes before using. Protect putty from sun and evaporation when stored.

Accurately measure cement and aggregate for each batch, and mix dry until evenly distributed and uniform in color. Do not use frozen, caked, or lumpy materials. Make batches of a size that can be entirely used within 0.5 hour. Use mechanical mixers except where handmixing of small batches is approved. Clean mixers, mixing boxes, and tools, and keep them free of stucco from previous mixes. Maintain water content at a minimum. Continue mixing until plasticity is obtained. Mix colored mortar to produce a uniform color throughout finished work. Do not use mortar that has begun to set; retempering is not permitted. Add a water repellent to finish coat. If in powder form, mix dry water repellent well with cementing materials. If in liquid or paste form, add repellent to and mix with mixing water. Use sufficient compound to provide of fatty acid for each kilogram of cement in finish coat. When stucco is applied over metal lath, use of hair or fiber per kilogram of cement in scratch coat only.

3.4 APPLICATION

A. General

1. Do not apply stucco when ambient temperature is or lower, or when a drop in temperature below is expected within 48 hours after application. Remove scaffolding and equipment as soon as stucco work is completed. Make sure that items of work adjoining stucco are in place, plumb, straight and true before beginning stucco work.

2. Masonry surfaces that will receive stucco - Dampen evenly with a fog spray immediately before applying stucco.

3. Place metal reinforcing so as to provide a good key before applying stucco.

4. If reinforcing is applied over copper, first give copper a heavy coat of bituminous paint.

5. Unless otherwise indicated, apply stucco in three coats to a total thickness of minimum.

6. Apply stucco coats continuously in one general direction without allowing mortar to dry at edges. Where it is impossible to work full dimension of a wall surface in a continuous operation, make jointing at a break, opening, or other natural division of surface, or behind a downspout. Slightly dampen edges to be joined to produce a smooth confluence.

7. Exterior corners of stucco - Slightly rounded. On soft surfaces, pitch stucco forward to form a drip.

B. Scratch Coat - Make 6 mm thick over reinforcement, and apply under sufficient pressure to form good keys and to completely embed reinforcement. Cross-scratch coat before coat has set, to provide a strong bond. Damp cure 48 hours before applying brown coat.

C. Brown Coat - Make approximately 10 mm thick. Dampen scratch coat evenly with a fog spray to obtain uniform suction before applying brown coat. Apply brown coat to scratch coat with sufficient pressure to force stucco into scratches, and bring to a plumb, true, even surface, but rough in texture. When set sufficiently, float brown coat with a dry float and cross-scratch evenly to form a bond for finish coat. Prevent rapid drying of brown coat by spraying or by other approved methods. Minimum interval between application of brown coat and finish coat: 7 days of dry weather.

D. Finish Coat - Make approximately thick. Colored-cement finish: Conform to approved samples and apply in accordance with manufacturer's directions. Dampen surfaces of brown coat several hours before applying finish coat. Use fog spraying for additional dampening at time of application; dampening by brush is not permitted. Provide finish coat with a float-texture finish.

E. Curing - As soon as finish coat has taken its initial set, protect stucco against direct rays of sun or rapid drying for 6 days minimum. During this time, keep stucco moist by frequent fog spraying. Prevent staining stucco.

3.5 ACCEPTANCE PROVISIONS

Samples of stucco work may be taken by the Government at any time for determining sand content. Remove and replace areas where such sampling shows that excess sand was used, at no additional cost to the Government.

Remove stucco with cracks, blisters, pits, checks, color streaks, or discolorations, and replace with satisfactory new material. Ensure that stucco is clean and sound after other related work has been completed; perform pointing and repairing of damaged portions in an acceptable manner, and match existing stucco in texture and color.

On completion of Work, remove from Worksite scaffolding, equipment, and rubbish accumulated from Work, and leave Worksite in a clean condition.

-- End of Section --

SECTION 09250

GYPSUM WALLBOARD SYSTEMS (DRY WALL)
12/01

PART 1 GENERAL

1.1 SUMMARY

This section specifies requirements for light-gage metal framing and gypsum drywall systems.

1.2 REFERENCES

American Society for Testing and Materials (ASTM)

ASTM C442	Gypsum Backing Board and Coreboard
ASTM C475	Joint Compound and Joint Tape for Finishing Gypsum Board
ASTM C630	Water-Resistant Gypsum Backing Board
ASTM C645	Non-Load (Axial) Bearing Steel Studs, Runners (Track), and Rigid Furring Channels for Screw Application of Gypsum Board
ASTM C754	Installation of Steel Framing Members to Receive Screw-Attached Gypsum

1.3 SUBMITTALS

Refer to Section 01300, Submittals. Submit the following:

SD-02, Manufacturer's Catalog Data

Manufacturer's Catalog Data, for wallboard, joint tapes, and compounds; steel stud framing, metal trim, and accessories; fasteners and adhesives.

PART 2 PRODUCTS

2.1 GYPSUM WALLBOARD

Regular Gypsum Wallboard: thick with tapered edges.

Insulating Gypsum Wallboard: thick and covered with bright, finished aluminum foil on back surface.

Fire-retardant Gypsum Wallboard: thick unless otherwise indicated, Type X.

Regular Gypsum Backing Board: thick unless otherwise indicated, ASTM C442.

Moisture-resistant Gypsum Backing Board - ASTM C630, thick, Type X. USG W/R, Gold Bond MR, or equal.

2.2 METAL FRAMING

Studs, Channels, and Floor and Ceiling Runners - Electrogalvanized, cold-rolled steel, ASTM C645.

Studs: thick (25 ga), wide, with flanges minimum. Provide knuckled studs with knockouts located at m on center, maximum, unless otherwise indicated.

Runner Track: thick (25 ga), wide, unpunched and powder-shot to floor.

Ceiling Main Runner Channels: deep, hot- or cold-rolled galvanized steel. Hot-rolled channels - Minimum mass . Cold-rolled channels - Minimum thick, uncoated steel, minimum wide flanges.

Ceiling Furring Channels - Roll-formed, galvanized steel minimum thick before galvanizing, 35 mm steel face width, depth, with reinforced folded edges.

Furring Channels for Miscellaneous Framing: wide, cold-rolled galvanized steel minimum thick before galvanizing, with a minimum mass of .

2.3 JOINT MATERIALS

Joint Tape - Plain or perforated material, ASTM C475.

Joint Compound - An adhesive with or without fillers, ASTM C475.

Control Joint Material - Roll-formed zinc with a V-frame expansion profile; formed deep by wide, minimum, with a perforated flange wide on each side of joint opening.

2.4 FASTENERS, ACCESSORIES AND TRIM

Screws - Steel, self-tapping drywall type, bugle head. Length - As recommended by drywall manufacturer for type of system being installed.

Wire Hangers - Galvanized soft steel wire minimum diameter, ASTM C754.

Tie Wires - Galvanized soft steel wire minimum diameter, ASTM C754.

Clips used instead of Tie Wire - Galvanized steel with holding power equivalent to that provided by tie wires recommended by gypsum board manufacturer.

Corner Beads - Formed to an angle of 90 degrees, zinc-coated steel minimum thick (26 ga) with wings perforated for nails and cement treatment.

Casing Trim - Hot-dip galvanized steel channel of depth required for wallboard.

PART 3 EXECUTION

3.1 WALL INSTALLATION

Install studs straight and plumb. Furnish runners in longest practicable lengths with butt joints between lengths; attach runners to concrete slabs with power driven fasteners at on center and maximum from each end and each splice.

Place studs maximum from door frames, framed openings, abutting partitions and partition corners. Securely anchor studs directly or with spacers to door frames by bolts or screws.

Provide continuous midheight horizontal bracing in partition heights above . Bracing - Standard runner channel for specified stud size. Secure channel rigidly in place at each stud.

Use head and jamb framing at door openings consisting of a tube made up of one runner channel and one stud. Extend tubes at door jambs full height of partition, and fasten together with screws at minimum of on center at each flange. Fasten tube over door head together with a minimum of three screws for each flange. Extend gypsum wallboard partitions to structural ceiling, unless otherwise indicated. For partitions that do not extend to construction above, brace at top channel with V-frame perpendicular to partition. Locate frames at partition 1/3-points and frame from two , thick (16 ga), lathing channels.

3.2 CEILING INSTALLATION

Hangers - Plumb and spaced at on center, maximum. Loop lower ends of hangar wires around runner channels and twist each wire a minimum of three times around itself. Brace runner channels in position at on center, maximum. Maintain minimum clear space between channel and wall or other building elements.

Ensure that main runner channels suspended from steel joists have wire hanger looped around bottom chord of joist and twisted a minimum of three times around itself.

Ensure that main runner channels suspended from concrete slab construction have hanger wires attached to approved inserts.

Splice main runner channels with nested laps, and tie securely near each end of splice with two loops of diameter (8 ga) hanger wire. Stagger splices.

Install furring channels at right angles to main runner channels or structural supporting members at on center maximum, and fasten with clips or tie wires at a maximum spacing of on center. Screw channels to wooden members. Extend channels to within 50 mm of perimeter walls and abutting elements. Do not anchor channels or bury them in wall.

Splice furring with nested laps, and tie securely near each of splice with two loops of diameter (16 ga) tie wire. Stagger splices.

Reinforce suspension grilles with cold-rolled channels or with furring channels at light troffers or any openings that interrupt main runner or furring channels. Wire tie reinforcing channels to, and parallel to, main runner channels.

Brace ceiling grids against lateral and upward movement at maximum intervals of in each direction.

Ensure that ceilings are supported independently. Do not use hangers for other trades.

3.3 JOINTS

Use gypsum wallboard of maximum feasible lengths to minimize number of end joints. Butt edges of boards together but do not force them. Stagger joints; do not align joints with edge of an opening nor position them so that corners of four boards will meet at a common point.

Ensure that abutting ends or edge joints occur over solid bearing joists and fit neatly and accurately. Support wallboard as recommended by manufacturer, with additional framing at cutouts and openings.

Reinforce joints between wallboard panels and joints at metal trim with joint tape and embedding-type joint compound, and conceal with minimum two additional applications of finishing compound in accordance with printed instructions of gypsum wallboard manufacturer. Fill screw depressions with minimum three coats of joint compound. Conceal flanges at corner beads, edge trim, and control joints with minimum two applications of joint compound, feathered and sanded smooth.

Caulk joints between wallboard and other adjacent materials.

Seal cut edges and holes in water-resistant wallboard to prevent water penetration. Ensure that finished wallboard application is plumb, with an even surface having a maximum variation of 1:750.

-- End of Section --

SECTION 09300

CERAMIC TILE
12/01

PART 1 GENERAL

1.1 SUMMARY

This section specifies requirements for ceramic tile, including quarry tile, for floors and walls, and accessories.

1.2 REFERENCES

American National Standards Institute (ANSI)

ANSI A108.1	Installation of Ceramic Tile with Portland Cement Mortar
ANSI A136.1	Organic Adhesives for Installation of Ceramic Tile
ANSI A137.1	Ceramic Tile

American Society for Testing and Materials (ASTM)

ASTM A185	Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
ASTM C144	Aggregate for Masonry Mortar
ASTM C150	Portland Cement
ASTM C171	Sheet Materials for Curing Concrete
ASTM C206	Finishing Hydrated Lime
ASTM C207	Hydrated Lime for Masonry Purposes
ASTM D226	Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
ASTM D1056	Flexible Cellular Materials - Sponge or Expanded Rubber
ASTM D1752	Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
ASTM D2103	Polyethylene Film and Sheeting

Federal Specifications (FS)

FS TT-S-230	Sealing Compound: Elastomeric Type, Single Component (for Calking, Sealing, and Glazing in Buildings and Other Structures)

1.3 SUBMITTALS

Refer to Section 01300, Submittals. Submit the following:

SD-02, Data

Manufacturer's Catalog Data for tile, mortar and grout, including color charts.

SD-13, Certificates

Provide a Master Grade Certificate for tile before shipment, certifying grade, type, and quantity of material. Ensure that certificate bears certification mark of Tile Council of America (TCA), and is signed by tile manufacturer and by tile installer. Ceramic tile containers - Grade marked as required for Standard Grade specified in ANSI A137.1.

SD-14, Product Samples

Full-size samples of each type, color, and pattern of tile and trim piece.

1.4 DELIVERY, HANDLING, AND STORAGE

Deliver materials in manufacturer's unopened containers with grade seals unbroken. Ensure that seals remain intact until time of use. Furnish cement, lime, and packaged materials for concrete and masonry cement in bags displaying manufacturer's trademark and indicating type of material. Ensure that material is dry and free of lumps.

1.5 PROTECTION

Protect work from damage. Cracked, chipped, or defective work is not acceptable. Close areas where tile work is in progress to traffic and to work of other trades until tile work is completed and cured. Post warning signs after completion, prohibiting work around floors for a minimum of 7 days.

PART 2 PRODUCTS

2.1 CERAMIC TILE

Wall Tile - Standard grade, matt-glazed unit, ANSI A137.1, thick minimum, cushion edge, with spacer lug construction.

Floor Tile - Standard grade, unglazed, impervious porcelain type ceramic mosaic tile, ANSI A137.1. Water absorption: 0.5 percent maximum. Tile nominally thick; cushion edge; factory mounted on sheets unless otherwise indicated.

Provide trim at corners; at head, jamb, and sills of openings; and at tops of wainscots and coves. Use same material as for ceramic tile; conform to ANSI A137.1. Provide sanitary cove units at base of walls; bull noses at top of mounted tile wainscots and coves; cap shapes at external corners; and cap shapes of square corner; combination angle, and stretcher type at internal corners.

2.2 QUARRY FLOOR TILE

Standard grade, 13 mm thick square-edge-ground four sides, unglazed, natural clay tile, ANSI A137.1. Color and size - As indicated, matching approved samples. For tile with abrasive aggregate surface, provide minimum 7.5 percent by weight of abrasive grains.

Trim - Standard grade trim units, ANSI A137.1. Match color, size, and finish of approved samples.

2.3 MORTAR AND GROUT

A. Materials

1. Cement - ASTM C150, Type I.

2. Aggregate - Washed, sharp, uncoated natural sand, ASTM C144. Gradation: 100 percent passes a sieve, and 95 percent passes a sieve.

3. Lime - ASTM C206 and ASTM C207, Type S.

4. Water - Potable.

B. Mortar - Job-mixed, unless otherwise specified.

1. Setting bed mix for walls - By volume; from 6 parts portland cement, 0.5 part hydrated lime, and 5 parts damp sand to 1 part portland cement, 1 part hydrated lime, and 7 parts damp sand.

2. Setting bed mix for floors - By volume; 1 part portland cement, 5 parts dry sand or 6 parts damp sand, and 0.10 part hydrated lime, mixed with sufficient water to make a stiff mix.

3. Dry-set portland cement mortar - ANSI A108.1.

4. Organic adhesive mortar - ANSI A136.1, Type I.

C. Grout

1. Grout for porcelain wall and ceramic mosaic tile - Commercial portland cement grout mixture, ANSI A108.1.

2. Grout for quarry floor tile: 1 part portland cement, 2 parts sand, and 0.5 part hydrated lime, by volume. Color - As indicated.

3. Epoxy grout - Two-component, of an approved type and color, formulated in accordance with ANSI A108.1, and certified by manufacturer as suitable for use with quarry tile.

2.4 EXPANSION JOINT MATERIALS

Preformed Joint Filler - Closed-cell, expanded cellular rubber, ASTM D1056; sponge rubber or cork, ASTM D1752, Type I, II, or III; or an approved type of vinyl tubing or foam rope, as recommended by sealant manufacturer.

Joint Sealant - FS TT-S-230, Type II.

2.5 MEMBRANE

Waterproofing Membrane: 0.73 kg/m2 asphalt-saturated building felt, ASTM D226, Type I; or thick polyethylene film, ASTM D2103.

Bond-preventive Material for Expansion Joints receiving Sealant - Strips of polyethylene tape or aluminum foil of same width as joint.

2.6 METAL REINFORCEMENT

Reinforcing for Mortar Bed - Plain, cold-drawn welded steel wire, ASTM A185; x x diameter (16 ga), x x diameter (13 ga), or x x diameter (16 ga).

Expanded-steel Lath - Painted, self-furring, minimum mass , ANSI A108.1.

PART 3 EXECUTION

3.1 PREPARATION

Before commencing work, establish field pattern and border line locations and center work symmetrically so that tiles are not cut to less than half-size. Align joints in wall tiles vertically and horizontally; staggered joints are not acceptable.

Maintain tile and areas to receive tile at a minimum temperature of for minimum 2 days before starting work and minimum 3 days after completion.

Ensure that previously finished surfaces that will receive quarry tile are clean, dry, and free of oils, waxes, and curing compounds, and are firm, level, and plumb. Remove loose particles, laitance, and foreign material from concrete surfaces. Roughen concrete surfaces as required to receive tile by wire brushing, sandblasting, chipping, or scarifying.

3.2 INSTALLATION OF TILE

Installation and Workmanship - ANSI A108.1. Comply with printed instructions of manufacturers of commercial mortars and grouts.

Set quarry tile in a portland cement mortar bed, reinforce with welded wire fabric separated from subfloor by a membrane as indicated, and grout and cure in accordance with ANSI A108.1.

Set glazed tile in an organic adhesive mortar.

Ensure that finished tile installation does not display uneven surfaces or high or low spots in excess of 1:750 when measured with an straightedge in any direction. Measure tile floors pitched to a floor drain at any point along a radius from floor drain.

3.3 EXPANSION AND CONTROL JOINTS

Provide expansion-joint fillers and sealants at joints as indicated and where tilework abuts walls, curbs, columns, utility lines, and other restraining surfaces where expansion and control joints are located in the backing; where compressive stresses or movement may be transmitted to tilework; and in large floor areas to provide a joint spacing of to each way. Treat and seal expansion joints as specified in ANSI A108.1 with specified joint filler and sealant.

3.4 CLEANING

Upon completion of setting and grouting, sponge and thoroughly wash tile, and polish with clean, dry cloths.

Perform acid cleaning of quarry tile in accordance with tile manufacturer's printed directions and not before installation has cured for 10 days. Protect metal surfaces, enameled cast iron, and vitreous plumbing fixtures from effects of acid cleaning of adjacent tile surfaces. Flush surfaces thoroughly with water after acid cleaning. Remove materials or fixtures damaged by acid cleaning, and replace at no additional cost to the Government.

3.5 ACCEPTANCE PROVISIONS

Remove damaged and unacceptable portions of completed Work, and replace with new Work to match adjacent surfaces at no additional cost to the Government.

Clean surfaces of Work, and adjacent surfaces soiled as a result of this Work. Remove Work equipment, surplus materials, and rubbish from Worksite.

-- End of Section --

SECTION 09500

ACOUSTIC CEILINGS
12/01

PART 1 GENERAL

1.1 SUMMARY

This section specifies requirements for suspended grid, acoustic panels, and tiles for acoustic ceiling installations.

1.2 REFERENCES

American Society for Testing and Materials (ASTM)

ASTM A366M	Steel, Sheet, Carbon, Cold-Rolled, Commercial Quality
ASTM A489	Carbon Steel Lifting Eyes
ASTM A591M	Steel Sheet, Electrolytic Zinc-Coated, for Light Coating Mass Applications
ASTM B221M	Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
ASTM B633	Electrodeposited Coatings of Zinc on Iron and Steel
ASTM C423	Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
ASTM C635	Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings
ASTM C636	Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels
ASTM E413	Classification for Rating Sound Insulation

Federal Specifications (FS)

FS FF-B-588	Bolt, Toggle, and Expansion Sleeve, Screw
FS FF-S-92	Screw, Machine: Slotted, Cross-Recessed or Hexagon Head
FS FF-S-111	Screw, Wood
FS FF-S-325	Shield, Expansion; Nail, Expansion; and Nail, Drive Screw (Devices, Anchoring, Masonry)

1.3 SUBMITTALS

Refer to Section 01300, Submittals. Submit the following:

SD-02, Manufacturer's Catalog Data

Manufacturer's Catalog Data for materials.

SD-10, Test Reports

Certified reports of tests required in Paragraph 1.4, Performance Requirements.

1.4 PERFORMANCE REQUIREMENTS

Noise Reduction Coefficient (NRC) Grade of Acoustic Ceilings: 0.70 to 0.80; tested or certified by an approved testing laboratory in accordance with ASTM C423.

Sound Transmission Classification (STC) of Indicated Acoustic Ceilings - Continuous at partitions, 45 to 49; interrupted at partitions, 45 to 49. Tested by an approved testing laboratory by 16-frequency test method, ASTM E413.

PART 2 PRODUCTS

2.1 ACOUSTIC MATERIALS

Mineral-fiber tile units, nominal size, with specified edges and pattern.

2.2 SUSPENSION SYSTEM

Finish of Exposed-to-view Surfaces - Baked-on white enamel, passing high humidity test specified in ASTM C635.

Steel Sheets - Carbon steel conforming to ASTM A366M, with 3.81 μm minimum electrodeposited zinc coating conforming to ASTM B633, or electrolytic-zinc-coated sheets of commercial quality carbon steel with Class C zinc coating conforming to ASTM A591M.

Extrusions - Aluminum Alloy 6063, Temper T5, ASTM B221M.

Main Runners - Cold-formed bulb-tee sections, single- or double-web type, fabricated from specified steel sheets. Web height: minimum. Bottom flange width: minimum. Webs drilled or grooved to receive cross runner end tabs and main runner splices.

Structural Classification - Heavy duty, ASTM C635. Steel sheets for single-web type - Minimum thick. Steel sheets for double-web type - Minimum thick.

Exposed Cross Runners - T-sections fabricated of same metal as, and designed for use with, main runners; ASTM C635. Web height: . Flange width - Same as for main runner. Cross runners - Provide web ends for tab-lock attachment to adjoining cross runners through web of main runner for alignment with a minimum of torsional movement and lateral displacement.

Provide hold-down clips, connectors, main runner splice plates, and other

accessories required to complete ceiling installation, designed for use in type of suspension system used.

Moldings - Cold-formed angle or U-shape sections, fabricated from specified steel sheets thick minimum.

2.3 FASTENERS

Concrete Wedge Anchors - Redhead, Hilti, or approved equal, of nominal bolt diameter specified.

Eyebolts - Weldless, forged-carbon-steel, straight-shank type; ASTM A489, Type I; diameter minimum, zinc-coated or cadmium plated.

Machine Screws - FS FF-S-92, Type III, Style 1C, zinc-coated carbon steel.

Wood Screws - FS FF-S-111, Type I, Style 1C, zinc-coated carbon steel.

Toggle Bolts - Of class best suited for work; FS FF-B-588, Type II, Class A, Style 1.

Anchorage Devices for Eyebolts - FS FF-S-325, Group I, Type 1, Class 2.

Anchorage Devices for Machine Screws - FS FF-S-325, Group I, Type 1, Class 1.

Anchorage Devices for Wood Screws - FS FF-S-325, Group IV, Type 1.

Hanger Wire: diameter (8 ga) galvanized, soft annealed mild steel; ASTM C636.

PART 3 EXECUTION

3.1 PREPARATION

Install acoustic material as recommended by manufacturer.

Ensure that work above ceiling line is completed and approved before starting acoustic work.

Maintain spaces to receive acoustic materials at to and maximum 70 percent relative humidity for minimum 48 hours before and during installation of acoustic work, and until final acceptance.

3.2 ARRANGEMENT OF CEILINGS

Arrange acoustic tiles so that units less than one-half width do not occur; joints are parallel with room axis in both directions, straight and in alignment; and tile joint or tile centerline centers on ceiling fixtures.

Arrange runners so that main runners are parallel with room axis indicated; units less than one-half width do not occur; and, where recessed lighting fixtures are indicated, main runners are located parallel to long dimension of each fixture and on both sides of fixture.

3.3 SUSPENSION SYSTEM

A. Hangers

1. Set masonry anchorage devices in masonry or concrete in accordance with anchorage device manufacturer's printed instructions. Leave drilled holes rough, not reamed, and free from drill dust.

2. Fastening to wood plugs in masonry or concrete is not permitted.

3. Ensure that hanger wires hang vertically from joists or structural members; tie hanger wire to inserts embedded in concrete or to anchorage devices in concrete, wood or steel.

4. Install compression posts with sets of four diagonal wires at on center maximum.

B. Runners and Moldings

1. Space main runners at on center; support runners by hangers spaced maximum from each end and on center maximum. Keep members away from walls or partitions. Attach hangers to members to prevent vertical movement or rotation of member.

2. Attach cross runners at right angles to main runners at on center with clips that maintain tight contact between cross- and main-runners when ceiling loads are imposed.

3. When x lay-in panels are used, install intermediate, exposed cross runners parallel to main runner and intersecting long cross runners at midpoint.

4. Install moldings at walls and other vertical surfaces, except where movable metal partitions with caps designed to receive suspension system members are indicated.

C. Erection Tolerances

1. Install members level within 1:1200. Perform leveling with hanger wires taut to prevent subsequent downward movement of members when ceiling loads are imposed. Do not make kinks or bends in hanger wires as a means of leveling members.

2. Install cross runners at required center distances within ; make this tolerance noncumulative beyond . Intersecting cross runners form a 90° angle.

3. Join abutting and intersecting runners and moldings so that exposed surfaces of two abutting or intersecting runners lie within of same horizontal and vertical planes. Ensure that there is no visually apparent angular displacement of longitudinal axis of one runner with respect to other runner; and horizontal gap between exposed surfaces of abutting or intersecting members is maximum.

4. Cut wall molding at inside corners and bend to conform to corner; neatly butt wall molding at outside corners. Provide corner caps where corners are constructed of bullnose masonry units. Fasten moldings to wall at maximum from each end, and on center.

3.4 MARKING LOCATION OF CONTROLS

Mark with identification plates access units in acoustic ceilings that are located directly below mechanical system controls. Provide aluminum plates thick, diameter, stamped with letters AP, finished in same manner as acoustic material, and attached by an approved method near one corner on face of each access unit.

3.5 ACCEPTANCE PROVISIONS

Remove damaged and unacceptable portions of completed Work, and replace with new Work to match adjacent surfaces at no additional cost to the Government.

Clean surfaces of new Work, and adjacent surfaces soiled as a result of Work. Remove Work equipment, surplus materials, and rubbish from Worksite.

-- End of Section --

SECTION 09600

CARPET
12/01

PART 1 GENERAL

1.1 SUMMARY

This section specifies requirements for carpet and accessories.

1.2 REFERENCES

American Society for Testing and Materials (ASTM)

ASTM E648	Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source

Carpet and Rug Institute, Inc. (CRI)

CRI 104	Installation of Commercial Textile Floorcovering Materials

Federal Specifications (FS)

FS SS-W-40	Wall Base: Rubber, and Vinyl Plastic

National Fire Protection Association (NFPA)

NFPA 253	Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source
NFPA 258	Determining Smoke Generation of Solid Materials

1.3 SUBMITTALS

Refer to Section 01300, Submittals. Submit the following:

SD-02, Manufacturer's Catalog Data

Manufacturer's Catalog Data, for materials specified in Part 2 - Products.

SD-04, Shop Drawings

Indicate location of seams, edge moldings, and carpet direction.

SD-06, Instructions

Manufacturer's Instructions, for carpeting.

SD-14, Product Samples

x samples of each type of carpet and padding to be used, and of seam tape, edge molding, and other accessories.

PART 2 PRODUCTS

2.1 CARPETING

These specifications are based on products of Mohawk Commercial Carpet. Products similarly designed and closely comparable in appearance, finish, physical properties and detail may be provided by alternative manufacturers on condition that complete manufacturer's data verifying products equal to or exceeding those of the recommended products are submitted and approved.

The following specifies construction for broadloom carpet Type I, 100 percent Amoco XXX Continuous Multifilament Polypropylene:

Type:	Tufted textured level loop
Finished pile height:	
Stitches per meter:	446
Pile content:	DuPont Antron legacy nylon
Pile weight:	minimum
Primary backing:	100% polypropylene
Secondary backing:	Action Bac
Dye method:	Solution dyed
Weight density factor:	Denier - 3000 ply - 3
Flammability:	
Radiant panel test:	Class I, 0.45 W/cm2
Smoke density:	450 maximum, NFPA 258
Color and pattern:	As indicated on drawings

2.2 CARPET PAD

Where indicated on drawings, sponge rubber, flame spread per NFPA 253.

2.3 MOLDINGS

Vinyl or aluminum; installed where floor covering material changes or carpet edge does not abut a vertical surface.

2.4 BASE

Vinyl conforming to FS SS-W-40, not less than thick, color as selected from manufacturer's full line. Straight style, high. Base - Furnished in rolls minimum long. Corners - Premolded with wings minimum long.

PART 3 EXECUTION

3.1 PREPARATION

Removal and Replacement of Furniture - Responsibility of Contractor.

Ensure that floors are dry, clean, smooth, and level before any carpet is installed. Do not start work until defects have been corrected.

3.2 INSTALLATION

If padding is specified, lay on concrete subfloors in longest possible lengths and minimum number of sections, and securely adhere to subfloor with cement to prevent shifting and buckling. Remove bubbles and apply a slight stretch to pad. Lay pad seams out so that carpet seams will not fall directly over them.

Install carpeting in accordance with CRI 104 and carpet manufacturer's specifications using smooth-edge, direct glue down throughout.

Provide free edges of carpet, except at walls, with vinyl or aluminum edge stripping installed so as to prevent tripping.

Stretch carpet in both directions, maintaining seams straight and eliminating wrinkles and buckles. Attach carpet securely at edges and openings. Ensure that direction of carpet pile in each area is uniform throughout.

Run carpeting under open-bottom items, such as heating convectors, and install tightly against columns, walls, and cabinets so that exposed portions of floor are covered with carpet. Install carpet around floor outlets and similar obstructions.

3.3 SEAMS

A. Keep seams to practicable minimum. Avoid locating seams at conspicuous locations, near doors, or at pivot points. Ensure that locations are approved before seaming. Seams - Hot-melt taped, with a minimum breaking strength of ; completely free of puckering and fraying; lying flat, and invisible. Ensure that matched seams are straight and patterns, where provided, match in every respect.

B. Make seams in accordance with manufacturer's specifications and as follows, unless otherwise indicated and approved:

1. Lay carpet in same direction.

2. Ensure that seams that are perpendicular to doors or entryways do not occur at doorways or entryways.

3. Center seams occurring at doors directly under doors.

4. Ensure that seams at changes of direction in corridor follow wall line parallel to carpet direction.

3.4 PROTECTION

During work, protect carpet with dropcloths or heavy reinforced, nonstaining kraft paper. At completion of work, remove covering, vacuum-clean carpet, remove soils, and leave carpet in an approved condition.

3.5 ACCEPTANCE PROVISIONS

Thoroughly clean surfaces of new carpeting and adjacent surfaces soiled as a result of this work. Remove work equipment, surplus materials, and rubbish from Worksite. Remove damaged and unacceptable portions of work, and replace with new carpeting.

-- End of Section --

SECTION 09650

RESILIENT FLOORING
12/01

PART 1 GENERAL

1.1 SUMMARY

This section specifies requirements for resilient flooring including floor tile, base, stair threads, risers, skirts, and related work.

1.2 REFERENCES

Federal Specifications (FS)

FS L-F-475	Floor Covering Vinyl, Surface (Title and Roll), with Backing
FS P-W-155	Wax, Floor, Water-Emulsion
FS SS-T-312	Tile, Floor: Asphalt, Rubber, Vinyl, Vinyl-Asbestos

1.3 SUBMITTALS

Refer to Section 01300, Submittals. Submit the following:

SD-02, Manufacturer's Catalog Data

SD-02, Manufacturer's Standard Color Charts

SD-13, Certificates of Compliance, for fire safety requirements

SD-14, Product Samples

PART 2 PRODUCTS

2.1 FLOORING

Resilient Flooring, Base, and Edging Strips - From manufacturer's standard color range as selected by the Government.

Vinyl Composition Tile (VCT) - FS SS-T-312, Type IV, Composition I, x x .

Sheet-vinyl Flooring - FS L-F-475, Type II, Grade A, thick minimum; suitable for above-grade, on-grade, and below-grade applications.

2.2 ADHESIVES AND SEALERS

Substrate Primer Sealer - As recommended by resilient flooring manufacturer for type and location of substrate and for end use of area to be covered; nonstaining to resilient flooring.

Emulsion Adhesive - Use with emulsion primer. Cutback adhesive - Use with cutback primer. Ensure that adhesive is nonstaining to resilient flooring.

2.3 BASE AND ACCESSORIES

Base - Vinyl, thick, color as selected from manufacturer's full line; straight style, high unless otherwise indicated. Base - Furnished in rolls minimum long. Corners - Premolded with wings minimum long.

Vinyl Reducer Strips: wide, thick, in lengths to minimize joints.

Vinyl Feature Strips: thick.

Edge Strips - Extruded-aluminum alloy 3 mm thick and wide, butt type, and rounded or beveled on exposed edge. Strips drilled for flathead screws at on center.

PART 3 EXECUTION

3.1 PREPARATION

Install specified materials only when normal temperature and humidity conditions approximate interior conditions of building when occupied.

Refer installation of resilient flooring until other work that might cause damage to flooring has been completed.

Ensure that surfaces to receive specified materials are clean, smooth, cured, and free from materials detrimental to achieving required bond. Coat concrete substrate surfaces with a primer/sealer as recommended by resilient-material manufacturer.

3.2 APPLICATION

Apply adhesive and vinyl composition tile flooring as recommended by flooring manufacturer.

Apply adhesive and sheet vinyl flooring as recommended by flooring manufacturer.

Apply adhesive and base as recommended by base manufacturer.

Apply vinyl reducer strips in conjunction with specified flooring materials where required. Tightly butt reducer strips to resilient flooring with fewest possible seams, as approved by manufacturer.

Apply vinyl feature strips in conjunction with specified flooring materials to pattern indicated. Tightly butt feature strips to resilient flooring with fewest possible seams, as approved by manufacturer.

Install edge strips at exposed edges of resilient flooring and where thresholds are not required. Make top surface flush with resilient flooring. Secure strips to subfloor with aluminum-alloy countersunk screws at maximum from ends and on center. Secure strips to concrete with countersunk anchors or expansion sleeves and countersunk screws.

3.3 ACCEPTANCE REQUIREMENTS

Following application of floor tile, clean and wax floor to conform to FS P-W-155. Place a minimum of two coats of wax.

Upon completion of vinyl composition tile flooring installation, furnish spare tiles of each type, color, and pattern from same lot as those installed at rate of five tiles for each 1000 tiles (or fraction thereof) installed.

Upon completion of sheet vinyl flooring installation, furnish extra material of each type, color, and pattern from same lot as installed for 1 percent of area installed.

-- End of Section --

SECTION 09800

SPECIAL COATINGS
12/01

PART 1 GENERAL

1.1 SUMMARY

This section covers special coatings on fascia metal and metal stairs.

1.2 REFERENCES

American Society for Testing and Materials (ASTM)

ASTM E380	Standard Practice for Use of the International System of Units (SI) (The Modernized Metric System)

Military Specifications (MS)

MS MIL-C-83286	Coating Urethane, Aliphatic Isocyanate, For Aerospace Applications
MS MIL-P-24441/1	Paint, Epoxy-Polyamide, Green Primer, Formula 150, Type I
MS MIL-P-24441/GEN	Paint Epoxy-Polyamide

Steel Structures Painting Council (SSPC)

SSPC PAINT 27	Basic Zinc Chromate-Vinyl Butyral Wash Primer
SSPC SP 1	Solvent Cleaning
SSPC SP 2	Hand Tool Cleaning
SSPC SP 3	Power Tool Cleaning
SSPC SP 5	White Metal Blast Cleaning

1.3 SUBMITTALS

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

SD-01, Data

Manufacturer's Catalog Data shall be submitted for the following items including manufacturer's name and identification. Data shall include detailed analysis of each special coating material required for the project, with all the coating constituents measured as percentages of the total weight of the coating. Manufacturer's data concerning application, thinning, and average coverage per liter shall be included.

SD-07, Schedules

Material, Equipment and Fixture List shall be submitted consisting of a list of proposed equipment to be used in performance of construction work.

SD-13, Certificates

Certificates of Compliance shall be submitted for epoxy coating showing conformance with the referenced standards contained in this section.

SD-14, Samples

Three color chips at least x of each finish, color and gloss as scheduled shall be submitted.

1.4 DELIVERY, HANDLING, AND STORAGE

Special coating materials shall be delivered to the project in their original containers bearing manufacturer's name, descriptive label, and coating formulations. Containers shall be new and unopened.

Special coating materials shall be stored in tightly closed containers in a covered, well-ventilated area where they will not be exposed to excessive heat, fumes, sparks, flame, or direct sunlight. Water-based coatings shall be protected against freezing.

Solvents, thinners, and equipment cleaners shall be stored with the same care as the coating materials.

1.5 FIELD TESTS

Government may take dry-film tests from time to time on finished surfaces. Additional coatings shall be applied to surfaces where there is less than the minimum specified dry-film thickness.

1.6 PROTECTIONS AND SAFETY PRECAUTIONS

Adjacent materials and equipment shall be protected against damage from spillage, dripping, and spatter of coating materials. Building materials and equipment shall be left clean and with all damaged surfaces corrected. "WET PAINT" signs to indicate newly painted surfaces shall be provided.

Forced ventilation for interior spaces shall be provided during application and drying of coatings to prevent the buildup of toxic or explosive concentrations of solvent vapors.

Fire extinguishes of the required quantity and correct type shall be provided to combat flammable liquid fires.

Rags used to wipe up coating materials, solvents, and thinners shall be disposed of by drenching them with water and putting them in a covered metal container.

1.7 CLEANUP

Application equipment shall be cleaned promptly and thoroughly with a

suitable solvent after each use and stored in clean, covered, well-ventilated container.

At the end of each working day, discarded paint materials, rubbish, dirty rags, and other similar trash shall be removed from the project.

At the completion of the work, paint spots shall be removed from finish surfaces and the project left in a clean condition.

PART 2 PRODUCTS

2.1 EPOXY COATINGS

A. General

1. Epoxy coatings shall conform to MS MIL-P-24441/GEN, as modified.

2. Vehicle resins for finish coats shall be based on a polyamide-cured, epoxy-resin material. Finish coats shall be applied with a dry-film thickness of not less than per coat. Finish color and gloss shall be as indicated.

B. Ferrous and Galvanized Metal Surface Coatings - Coatings on ferrous and galvanized metal surfaces shall be a prime coat and not less than two finish coats. Prime coat shall be based on an epoxy-resin material with a metallic-zinc pigment as recommended by the coating manufacturer for the substrate to be coated and the end use of the coated surface. Resin solids and zinc pigment shall not be less that 80 percent of the total weight of the coating material. Prime coat shall be applied with a total dry-film thickness of not less than . Finish coats shall be epoxy-based coatings as specified.

C. Aluminum Surface Coatings - Coatings on aluminum surfaces shall be a prime coat and not less than two finish coats. Prime coat shall be epoxy polyamide conforming to MS MIL-P-24441/1. Prime coat shall be applied with a total dry-film thickness of not less than . Finish coats shall be aliphatic polyurethane using ASTM E380 and conforming to MS MIL-C-83286.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

A. Ferrous Metals

1. Ferrous metals shall be cleaned in accordance with SSPC SP 5 using wet-sand blasting or vacuum-blast cleaning equipment. Surfaces shall be primed promptly after cleaning.

2. After cleaning, ferrous surfaces shall be coated with an epoxy coating using ASTM E380 and conforming to MS MIL-P-24441/GEN.

B. Galvanized Surfaces

1. Galvanized surfaces scheduled to be painted shall be solvent cleaned in accordance with SSPC SP 1. Rusted and highly soiled surfaces shall be cleaned in accordance with SSPC SP 2 or SSPC SP 3. Care shall be taken not to damage or remove galvanizing.

2. After cleaning, galvanized surfaces shall be treated with a metal pretreatment coating applied in accordance with SSPC PAINT 27 and coated with an epoxy coating using ASTM E380 and conforming to MS MIL-P-24441/GEN.

C. Aluminum Surfaces

1. Aluminum and aluminum-alloy surfaces scheduled to be painted shall be solvent cleaned to remove oil, grease, soil, and other foreign matter. Soiled surfaces shall be cleaned with a stiff bristle brush or aluminum wool.

2. After cleaning, aluminum surfaces shall be coated with an epoxy coating using ASTM E380 and conforming to MS MIL-P-24441/GEN.

3.2 COATING MATERIAL PREPARATION

A. General

1. Coating materials shall be mixed and prepared in accordance with the coating manufacturer's directions for the particular material and coat to be applied. Materials that are not in actual use shall be kept in closed containers.

2. Coating materials that have been mixed with an automatic shaker shall be allowed to stand to let air bubbles escape, then given a final hand mixing before application. Materials shall be stirred so as to produce a mixture of uniform density, and shall be stirred at frequent intervals during application to prevent skinning. Film that may form on the surfaces of the material shall not be stirred into the material. Film shall be removed and strained, if necessary.

B. Thinning - Thinning shall be done in accordance with coating manufacturer's directions for the particular material and coat.

C. Tinting - Prime and intermediate coats of paint shall be a slightly different tint from the finish coat to facilitate identification of each coat. Tinting shall be done by the coating manufacturer and clearly identified as to color and coat.

3.3 APPLICATION OF COATING MATERIALS

A. General

1. Exterior painting shall not be performed in damp or rainy weather. Interior painting shall not be allowed until the building in enclosed and has thoroughly dried out. No painting will be allowed below and above . Painting application shall be in accordance with the coating manufacturer's recommendations, and as specified.

2. Application of coating shall be done by skilled applicators. Coatings shall be applied to clean and properly prepared surfaces. Coatings shall be applied carefully with clean, high-quality application equipment. Sufficient time shall be allowed between coats to ensure complete drying and curing. Surfaces shall be sanded and dusted between coatings, as required, to produce a surface free of visible defects. High

gloss coatings and clear finished shall be lightly sanded between coats to ensure bond of following coats.

3. Coats shall be applied to the surfaces in an even film. Cloudiness, spotting, holidays, laps, application marks, runs, sags, and other similar surface imperfections shall be removed and recoated as directed.

4. Coating lines such as wainscots shall be sharp, true, and well-defined. Tape may be used to establish coating lines, providing tape is removed before ragging or sawtooth edges form.

5. Surfaces, including edges, corners, crevices, welds, and other similar changes in surface plane, shall receive a dry-film thickness not less than specified.

B. Brush Application - Brushes shall be clean and the proper size and type for high-quality application of the specified coating materials. Slow-dry coatings shall be brushed out. Quick-dry coatings shall be brushed only enough to spread out evenly.

C. Roller Application

1. Roller covers shall be clean and of the proper nap length, nap texture, and material for high-quality application of the specified coating materials.

2. Roller application shall be done carefully and shall be equivalent in all respects to the same coats applied by high-quality brush application.

D. Spray Application

1. Spray application equipment shall be limited to airless-spray equipment and electrostatic-spray equipment. Equipment shall be clean and operated by workmen skilled in high quality application of coating materials.

2. Spray application of coatings shall be limited to finish coats on metal frameworks, siding, decking, wire mesh, and other surfaces where hand work would be inferior. Sprayed coatings shall be carefully applied and equivalent in all respects to the same coats applied by high quality brush application. Each spray coat shall be permitted to cure before the succeeding coat is applied. Doubling back with application equipment, for the purpose of building up film thickness of two coats in one operation, will not be permitted.

3. Surfaces adjacent to areas to be spray coated shall be covered to prevent damage from overspray, coating rebound, and spray drift.

3.4 ACCEPTANCE PROVISIONS

Repairing - Damaged and unacceptable portions of completed work shall be removed and replaced with new work to match adjacent surfaces at no additional cost to the Government.

Cleaning - Surfaces of the work, and adjacent surfaces soiled as a result of the work, shall be cleaned. Equipment, surplus materials, and rubbish

from the work shall be removed from the site.

-- End of Section --

SECTION 09890

PROTECTIVE COATINGS OF CARBON STEEL
12/01

PART 1 GENERAL

1.1 SUMMARY

This section specifies requirements for protective coating of carbon steel.

1.2 REFERENCES

American Society for Testing and Materials (ASTM)

ASTM C920	Elastomeric Joint Sealants

Steel Structures Painting Council (SSPC)

SSPC SP 1	Solvent Cleaning
SSPC SP 3	Power Tool Cleaning
SSPC SP 10	Near-White Blast Cleaning

1.3 SUBMITTALS

Refer to Section 01300, Submittals. Submit the following:

SD-02, Data

Manufacturer's Catalog Data for materials proposed for use.

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

SD-06, Instructions

Manufacturer's Instructions for materials proposed for use.

1.4 DELIVERY, HANDLING, AND STORAGE

Deliver materials in their original, unopened containers bearing manufacturer's name, shelf-life, product identification, and batch number.

Store coatings, thinners, and cleaners in tightly closed containers in a covered, well-ventilated area where they will be protected from exposure to extreme cold or heat, sparks, flame, direct sunlight, or rainfall. Follow manufacturer's instructions for storage limitations.

1.5 PROTECTION OF EQUIPMENT AND ADJACENT SURFACES

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

1.6 PERSONNEL SAFETY

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

PART 2 PRODUCTS

2.1 ABRASIVE BLASTING MATERIAL

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

2.2 SEALANT COMPOUND

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

2.3 PROTECTIVE COATINGS

A. Coating System

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

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

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

B. Architectural Finish Coat - Apply, if required, as specified in Section 09900, Architectural Painting.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

A. General

1. Before installation abrasive blast surfaces that will become inaccessible after installation, and faying surfaces that are part of slip-critical joints, and coat with inorganic zinc only.

2. Coat prepared surfaces within 6 hours after completion of surface preparation and before rusting or recontamination occurs. Reprepare surfaces not coated within 6 hours, or that show rusting or contamination, regardless of length of time after preparation.

3. Sequence surface preparation and coating operations so that freshly applied coatings will not be contaminated by dust or foreign matter.

4. Inspect and degrease surfaces as required before subsequent surface preparation and application of protective coatings. Perform degreasing by solvent cleaning, detergent washing, or steam cleaning. Conform to SSPC SP 1 for solvent cleaning.

B. Abrasive Blasting

1. Conform to SSPC SP 10. Ensure that compressed air used for abrasive blasting is free of moisture and oil.

2. Do not blast following surfaces:

a. Galvanized steel and prefinished surfaces, except when specified to be blast-cleaned in coating schedule.

b. Piston rods and bearing surfaces.

3. Maintain a minimum nozzle pressure of .

4. Remove weld slag, weld spatter, and foreign matter from surfaces to be coated before abrasive blasting, using mechanical methods as specified.

5. Blast cleaning - Achieve a to anchor profile, as indicated. Use scalers or abrasive disks or wheels in accordance with SSPC SP 3. Surface cleanliness - Conform to SSPC SP 10.

3.2 COATING APPLICATION

A. General

1. Use manufacturer's recommendations for thinning, mixing, handling, and applying product. If conflict exists between this specification and manufacturer's recommendations, this specification takes precedence.

2. Ensure that compressed air used for spraying coatings is free of moisture and oil.

3. Ensure that each coat of material applied is free of runs; sags; blisters; bubbles; mud cracking; variations in color, gloss, and texture; holidays; excessive film build; foreign contaminants; and dry overspray.

4. Do not apply coating when rain is imminent or when temperature or humidity is outside limits recommended by coating manufacturer.

5. To prevent moisture condensation during application, ensure that surface temperature is minimum above dew point.

6. Thoroughly work coatings into joints, crevices, and open spaces.

7. Adequately protect newly coated surfaces from damage.

8. Apply coatings by airless or conventional spray.

B. Mixing and Application Procedures

1. Stir material thoroughly with an instrument that will not induce air into coating.

2. Strain mixed material through a 600 μm to 300 μm mesh screen.

3. Agitate material continuously and slowly during application of inorganic zinc coatings to maintain uniform suspension. Avoid continuous rapid agitation.

4. Thin material for workability and improved spray characteristics only. Use only amount of thinner mix recommended by manufacturer.

5. Adjust spray equipment to produce an even, wet coat with minimum overspray.

6. Apply material in even, parallel passes, overlapping 50 percent. Ensure that welds, cutouts, sharp edges, rivets, crevices, and bolts receive proper coverage and thickness.

7. When used, keep pressure pot at same level as or above spray gun pressure for proper material delivery.

8. When dry through (dry to handle), check film thickness with a calibrated nondestructive dry-film thickness gage. If less than specified thickness, apply additional material as required. Obtain proper DFT for inorganic zinc coating in a single application, which may consist of multiple passes, while coating is still wet.

C. Dry-Film Thickness - Apply inorganic zinc coating to a dry-film thicknesses of to .

3.3 TOUCH-UP

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

Prepare surface as specified herein.

Use inorganic zinc for touch-up and repair of inorganic zinc and hot-dip galvanizing.

Apply as specified herein.

3.4 CALKING

For coating system, perform calking after application and curing of coating.

Calk exterior joints, including joints in members between intermittent welds; perimeter of bearing surfaces between floor plates and supporting members (inside, outside, top, and bottom); stair treads, where joined to channel stringers; openings of or smaller. Use foam filler backup as required.

3.5 INSPECTION

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

-- End of Section --

SECTION 09900

ARCHITECTURAL PAINTING
12/01

PART 1 GENERAL

1.1 SUMMARY

A. This section specifies requirements for exterior and interior on-site painting, exclusive of corrosion protection of structural steel.

B. Surfaces that are to be painted include the following:

1. Exposed surfaces, except those for which a factory-applied finish coating is specified, and those that would be damaged or whose function would be impaired by painting.

2. Concealed surfaces that are specified as painted, and those for which painting is required by NFPA codes and standards.

3. Fire sprinkler piping (exposed or concealed) - Painted red.

4. Covers of junction boxes and condulets (connectors of conduit) for fire/smoke alarm wiring - Painted red.

C. Painting of mechanical systems shall be in accordance with Section 15000, General Mechanical.

D. Unless specified otherwise, mechanical room ceilings shall be painted white.

1.2 SUBMITTALS

Refer to Section 01300, Submittals. Submit the following:

SD-02, Manufacturer's Catalog Data

Manufacturer's Catalog Data, for each paint, including color charts.

SD-14, Product Samples

Brushouts of each color proposed.

1.3 PROTECTION

Remove and reinstall, or provide acceptable protection for, materials that may become splattered or damaged by painting work. Post WET PAINT signs to indicate newly painted surfaces.

PART 2 PRODUCTS

2.1 COMPLIANCE

The following products comply with required performance standards; other paint manufacturers' products of equal quality may be acceptable if

submitted and approved.

	DUNN-EDWARDS	SINCLAIR	KELLY-MOORE
Inhibitive metal primer	(See Section 09890)		
Pigmented sealer			
Concrete block filler	W305	1010	521
Concrete sealer	W709	18	125
Acrylic emulsion	W701	1300	1105
Undercoater	42-1	14	1711
Latex block filler			
Alkali resistant primer			
Enamel undercoat			
Exterior wood primer			
Acrylic latex, flat			
Acrylic latex gloss			
Water base acrylic epoxy			

PART 3 EXECUTION

3.1 PREPARATION

Do not perform exterior painting in rainy weather or when rain is imminent. Do not apply paints or coatings when temperature or humidity is outside limits recommended by manufacturer.

Ensure that surfaces are clean, dry, and free from contaminants and foreign matter. Remove mildew and chalking, and thoroughly sterilize surfaces. Remove chipped, peeling, or blistered paint, and spot-prime surface. Dull and roughen hard glossy surfaces to ensure proper adhesion.

Metal Surfaces - Remove oxide or corrosion by hand, power tool, or blast cleaning.

Ensure that wooden surfaces are smooth. Seal knots with a mixture of equal parts of shellac and alcohol. Fill nail holes, cracks, and other defects with plastic wood or putty. Back-prime concealed surfaces before installation.

Masonry Surfaces - Clear large cracks, voids, and other major surface imperfections of loose material, and fill with mortar.

Plaster and Drywall Surfaces - Fill cracks and other surface imperfections with spackling compound, and sand smooth.

3.2 MIXING AND APPLICATION

A. Comply with manufacturer's recommendations for surface preparation, thinning, mixing, handling, and applying product. Apply coatings as follows:

1. Thoroughly stir material to produce a uniform mixture.

2. Thin material for workability and improved spray characteristics, but only in accordance with manufacturer's instructions.

3. Uniformly apply each coat at wet-film thickness specified by manufacturer.

4. Ensure complete coating of sharp edges, corners, and crevices.

B. Ensure that each coat applied is free of runs, sags, bubbles, foreign contaminants, dry overspray, brush and roller marks, holidays, or other evidence of poor application. Ensure that finish coats t show good hiding characteristics and uniform color, gloss, and texture.

C. Spot-painting to correct damaged surfaces will be allowed only when touch-up area blends into surrounding finish. Otherwise, recoat entire area. Perform touch-up using same method of application as that used to apply original material.

3.3 ACCEPTANCE PROVISIONS

Number of coats specified are minima. Ensure acceptable paint finishes of uniform color, texture and finish; free from cloudy or mottled appearance in surface; and evident thickness of coatings. Final application - So complete that addition of another coat of paint would not increase masking characteristics.

Remove paint or coating splatter and spills from floors, adjacent walls, hardware, and other finished surfaces. Leave Work area clean and free from rubbish and accumulated material.

3.4 PAINT SCHEDULE

SURFACE	PRIMER	UNDERCOAT AND FINISH COAT	FINISH COLOR AND GLOSS
Interior metal	Inhibitive metal primer	Water-based acrylic epoxy	
Interior masonry (rough/porous)	Latex block filler	Water-based acrylic epoxy	
Interior masonry (smooth)	Pigmented sealer	Water-based acrylic epoxy	
Exterior masonry (rough/porous)	Latex block filler	Acrylic latex	
Exterior masonry (smooth)	Alkali-resistant primer	Acrylic latex	
Interior wood	Water-based enamel	Water-based acrylic epoxy	
Exterior wood	Exterior wood primer	Acrylic latex	
Interior plaster	Pigmented sealer	Water-based acrylic epoxy	
Interior drywall	Pigmented sealer	Water-based acrylic epoxy	

-- End of Section --

SECTION 10100

METAL TOILET PARTITIONS
12/01

PART 1 GENERAL

1.1 SUMMARY

This section specifies requirements for metal toilet partitions.

1.2 REFERENCES

Aluminum Association, Inc. (AA)

AA DAF-45	Designation System for Aluminum Finishes

American Society for Testing and Materials (ASTM)

ASTM A167	Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM A336M	Alloy Steel Forgings for Pressure and High-Temperature Parts
ASTM A385	Providing High-Quality Zinc Coatings (Hot-Dip)
ASTM A525M	General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process (Metric)
ASTM A526M	Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process (Metric)
ASTM B456	Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium
ASTM D2092	Preparation of Zinc-Coated (Galvanized) Steel Surfaces for Painting

Federal Specifications (FS)

FS FF-B-588	Bolt, Toggle, and Expansion Sleeve, Screw
FS FF-S-325	Shield, Expansion; Nail, Expansion; and Nail, Drive Screw (Devices, Anchoring, Masonry)
FS QQ-A-200/3	Aluminum Alloy 2024, Bar, Rod, Shapes, Tube and Wire, Extruded
FS QQ-C-320	Chromium Plating (Electrodeposited)

1.3 SUBMITTALS

Refer to Section 01300, Submittals. Submit the following:

SD-02, Data

Manufacturer's Catalog Data, for partitions.

SD-04, Drawings

Shop Drawings, indicating type of partition, location, mounting heights, cutouts, and reinforcement required for toilet room accessories.

1.4 DELIVERY, HANDLING, AND STORAGE

Deliver materials in original, unopened packages or containers bearing brand name and name of material. Protect materials from weather, soil, and damage during delivery, storage, and construction.

1.5 FIELD MEASUREMENTS

Take field measurements before preparation of drawings and fabrication to ensure proper fit.

PART 2 PRODUCTS

2.1 GALVANIZED STEEL SHEET

Cold-rolled, stretcher-level, commercial quality material conforming to ASTM A526M; zinc coating conforming to ASTM A525M, Z275. Surface preparation of material for painting - ASTM D2092, Method A.

2.2 SOUND-DEADENING CORES

Treated kraft paper honeycomb cores with a cell size of maximum. Resin-material content - Minimum 11 percent of finished core weight. Provide expanded cores faced on both sides with kraft paper.

2.3 PARTITION FABRICATION

Partition Panels, Doors, Screens, and Pilasters - Fabricated from thick minimum galvanized-steel face sheets with formed edges; minimum thick.

Face Sheets - Pressure-laminated to sound-deadening core, with edges sealed with a continuous locking strip and corners mitered and welded.

Welds - Ground smooth.

Provide concealed reinforcement for installation of hardware, fittings, and accessories. Surface of face sheets - Smooth and free from wave, warp, or buckle.

2.4 FINISH

Enamel Coating - Factory-applied baked acrylic enamel coating system; durable, washable, stain-resistant, mar-resistant finish.

Before application of an enamel coating system, solvent-clean galvanized

steel surfaces to remove processing compounds, oils, and other contaminants harmful to coating adhesion. After cleaning, coat surfaces with a metal-pretreatment phosphate coating. After pretreatment, finish exposed galvanized-steel surfaces with a baked-enamel coating system as specified.

2.5 FASTENERS

Steel Anchoring Devices and Fasteners - Hot-dip galvanized after fabrication; ASTM A385. Galvanized anchoring devices to be concealed.

Toggle Bolts - FS FF-B-588.

Masonry Anchors - FS FF-S-325.

Exposed Fasteners - Provide one-way heads.

2.6 HARDWARE AND FITTINGS

Cold-rolled Sheet Steel - ASTM A336M, commercial quality. Chrome plating - ASTM B456. Other finishes - FS QQ-C-320, Class I, Type I or II.

Aluminum - FS QQ-A-200/3. Clear anodic coating - AA DAF 45.

Stainless Steel - ASTM A167, Type 302 or 304; #4 finish.

Exposed Fasteners - Match hardware and fittings.

Wall Brackets - Two-ear panel brackets, T-style, stock.

Panel-to-Pilaster Brackets - Stirrup style.

2.7 DOOR HARDWARE

Hinges - Self-lubricating with indicated swing; cutout-insert type; with gravity return movement; adjustable to hold in-swinging doors open at any angle up to 90 degrees and outswinging doors to 10 degrees.

Latch and Pull - Combination rubber-faced door strike and keeper equipped with emergency access.

Coat Hooks - Combination units with hooks and rubber tipped pins.

2.8 CEILING-HUNG PARTITIONS

Pilasters: thick minimum, with face sheets thick minimum. Anchoring device at top of pilaster - Welded to reinforced face sheets; minimum two round threaded rods, lock washers, and leveling-adjustment nuts. Anchoring device - Designed to transmit strain and loading on pilaster directly to structural support above without putting strain or loading on finished ceiling. Trim piece at top of pilaster: high, fabricated from minimum thick stainless steel.

2.9 FLOOR-SUPPORTED PARTITIONS

Pilasters: thick minimum with face sheets minimum thick. Anchoring device at bottom of pilaster - Steel bar minimum x , welded to reinforced face sheets; minimum two round anchorage devices for securing to floor slab. Anchorage devices - Complete with threaded rods, expansion shields,

lock washers, and leveling-adjustment nuts. Trim piece at floor: high, and fabricated from minimum thick stainless steel.

2.10 OVERHEAD-BRACED PARTITIONS

Pilasters: thick minimum with face sheets thick minimum. Anchoring device at bottom of pilaster - Channel-shaped floor stirrup fabricated from minimum thick material, and a leveling bolt. Stirrup secured to pilaster with minimum 5 mm bolt and nut after pilaster is leveled. Stirrup secured to floor with minimum two lead expansion shields and sheetmetal screws. Overhead brace - Fabricated from a continuous extruded aluminum tube minimum wide by high, wall thickness. Finish - AA-C22A31 in accordance with AA DAF 45. Brace - Set and secured into top of each pilaster. Trim piece at floor: high, and fabricated from minimum thick stainless steel.

2.11 SCREENS

Entrance Screens - Fabricated from same types of panels, pilasters, and fittings as toilet partitions.

Urinal Screens - Fabricated from same types of panels and pilasters as toilet partitions; wall hung with mounting brackets. Fittings and fasteners - Stainless steel.

PART 3 EXECUTION

3.1 INSTALLATION

Install partitions rigid, straight, plumb, and level, with panels centered between fixtures. Provide panel clearance maximum, and secure panels to walls and pilasters with minimum two wall brackets attached near top and bottom of panel. Locate wall brackets so that holes for wall bolts occur in masonry or tile joints. Secure panels to pilasters with brackets matching wall brackets.

Secure panels to ceramic tile on hollow plastered walls or hollow concrete-masonry walls with toggle bolts and M6-20 screws.

Secure panels to solid masonry or concrete with lead or brass expansion shields designed for use with M6-20 screws. Shield length: minimum.

Secure pilasters to structural support or floor. Leveling device - Readily accessible for leveling, plumbing, and tightening installation. Make bottoms of doors parallel to floor when doors are closed.

3.2 ACCEPTANCE PROVISIONS

After completion of installation, make final adjustments to pilaster-leveling devices, door hardware, and other working parts of partition assembly.

Remove damaged and unacceptable portions of completed work, and replace with new work.

Clean surfaces of Work and adjacent surfaces soiled as a result of Work in an approved manner. Remove equipment, surplus materials, and rubbish from Worksite.

-- End of Section --

SECTION 10800

TOILET AND BATH ACCESSORIES
12/01

PART 1 GENERAL

1.1 SUMMARY

This section specifies requirements for toilet and bath accessories.

1.2 REFERENCES

American Society for Testing and Materials (ASTM)

ASTM A366M	Steel, Sheet, Carbon, Cold-Rolled, Commercial Quality
ASTM A385	Providing High-Quality Zinc Coatings (Hot-Dip)
ASTM A525M	General Requirements for Steel Sheet, Zinc-Coated (Galvanized by the Hot-Dip Process (Metric)
ASTM A526M	Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Commercial Quality
ASTM A568M	Steel, Sheet, Carbon, and High-Strength, Low-Alloy, Hot Rolled and Cold-Rolled, General Requirements for
ASTM B456	Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium
ASTM C1036	Flat Glass
ASTM D2092	Preparation of Zinc-Coated (Galvanized) Steel Surfaces for Painting

1.3 SUBMITTALS

Refer to Section 01300, Submittals. Submit the following:

SD-02, Manufacturer's Catalog Data

Manufacturer's Catalog Data, for items specified in Part 2 - Products.

1.4 DELIVERY, HANDLING, AND STORAGE

Protect materials from weather, soil, and damage during delivery, storage, and construction.

Deliver materials in their original packages, containers, or bundles bearing brand name and name of material.

PART 2 PRODUCTS

2.1 MATERIALS

Stainless Steel - AISI, Type 302 or 304. Provide exposed surfaces with a #4 finish, unless otherwise specified.

Steel Sheet - Cold-rolled commercial quality, ASTM A366M and ASTM A568M. Surface preparation and pretreatment - Provided as required for subsequent finish.

Concealed mounting devices and fasteners for accessories - Fabricated from same materials as accessories or from galvanized steel. Exposed mounting devices and fasteners - Finished to match accessories. Provide fasteners of theft-resistant type.

2.2 FINISHES

Galvanized Steel Sheet - Hot-dip coated, commercial quality, minimum spangle, ASTM A526M, with minimum zinc coating conforming to ASTM A525M. Surface preparation for painting - ASTM D2092, Method A.

Chromium Coating - Nickel and chromium electrodeposited on brass, ASTM B456, type and/or class as specified. Provide coating with a satin finish unless otherwise specified.

Enamel Coating - Factory applied, gloss white, baked acrylic. Provide coating that is washable and suitable for intended use.

2.3 MIRROR GLASS

Type 1, Class 1, quality q1, thick polished plate or float glass with silvering, copper backing, and protective coating.

2.4 FASTENERS AND MOUNTING DEVICES

Hot-dip coated after fabrication, ASTM A385.

2.5 DISPENSERS AND RECEPTACLES

Fabricated from minimum thick stainless steel, all-welded construction, recessed unless otherwise indicated, no mitered corners, rolled exposed edges. Doors - Hung with full-length stainless steel piano hinges. Recessed accessories - Fabricated to be recessed in a nominal depth wall opening.

A. Paper Towel Dispensers

1. Recessed dispenser - Sized to dispense minimum 400 C-fold or 700 multifold paper towels with an interchangeable paper drop. Door secured with a tumbler lock.

2. Surface-mounted dispenser - Sized to dispense minimum 400 multifold paper towels. Exposed surfaces to be smooth and without blemishes. Provide slots at dispenser sides to monitor for refill.

B. Waste Receptacle

1. Recessed receptacle flange - Fabricated from one piece, seamless construction, no mitered corners. Door secured with a tumbler lock. Removable waste container - Minimum capacity ..

2. Surface-mounted receptacle - Seamless construction, continuously welded bottom pan, heavy-duty vinyl removable liner with capacity of . Liner secured to receptacle at four points with grommeted holes hung from stainless steel hooks.

C. Feminine Napkin Dispenser

1. Dispenser sized for minimum 20 napkins or tampons. Dispenser door - Fabricated from minimum 1.3 mm thick stainless steel with returned edges for rigidity. Door hung with a full-length stainless steel piano hinge and secured with a tumbler lock. Door embossed with word NAPKIN. Brand name advertising will not be permitted. Dispenser operates with coin mechanism; provide separate lock for coin box.

2. Recessed dispenser - Fabricated for recessing in a wall opening 150 mm deep maximum.

D. Feminine Napkin Disposal Receptacle

1. Flange fabricated of one-piece seamless construction, no mitered corners. Door - Self-closing and embossed with words NAPKIN DISPOSAL and PUSH. Recessed stainless steel finger grip provided for servicing receptacle.

2. Partition-mounted disposal - Semi-recessed for servicing two toilet compartments.

E. Toilet Tissue Dispenser

1. Single- or double-fold dispenser - Fabricated to accommodate minimum 1250 single-fold toilet tissues. Front of dispenser hinged at bottom and secured at top with a lock. Dispenser fabricated with tight seams and joints.

2. Multi-roll dispenser - Fabricated to dispense minimum two x core tissue rolls; recessed in a wall opening maximum in depth. Door - Bottom hung and secured with a tumbler lock. Spare roll - Accessible to patron after first roll is empty by pushing a release bar.

F. Liquid-Soap Dispenser - Chrome-plated brass with minimum 89 mm spout-to-shank dimension and minimum plastic soap container refillable by removing push button cap or head assembly.

2.6 MIRROR AND SHELF

Mirror - Stainless steel frame with corners mitered, welded, and ground smooth, and a face width of . Backing sheet - Fabricated from minimum thick galvanized steel secured to frame with concealed screws. Edges and back of mirror glass - Protected with continuous wood fill strips and moisture-proof shock-absorbing back padding. Provide concealed galvanized steel wall hanger of suitable size for mirror. Mirror hung and locked in place with minimum two vandal-resistant locking screws.

Shelf - One-piece, thick stainless steel with a turned edge and secured with galvanized steel brackets.

2.7 OTHER ACCESSORIES

Grab Bar - Fabricated from minimum thick, 32 mm outside diameter seamless stainless steel tubing. Wall flanges - Fabricated for concealed installation from minimum thick stainless steel, minimum diameter. Flanges fully welded to grab bar. Concealed mounting plate fabricated from stainless or galvanized steel. Secure flanges to mounting plate with minimum four stainless steel vandal-resistant setscrews. Provide exposed surfaces with a finish as specified unless finish is indicated as nonslip. Nonslip finish - Penned or light knurled.

Towel Bar - Fabricated from minimum thick, outside diameter seamless stainless steel tubing. Support posts - Fabricated for concealed installation from satin-finish chromium-plated brass or stainless steel. Concealed mounting brackets - Fabricated from same material as support posts. Support posts - Secured to mounting brackets with a locking setscrew.

Robe Hook - Double type, fabricated from satin-finish chromium-plated brass. Projection from back of flange to end of hook: minimum. Concealed mounting bracket - Fabricated from solid brass. Hook - Secured to mounting bracket with a locking setscrew.

PART 3 EXECUTION

3.1 ANCHORAGE

Secure accessories to supporting substrates with anchors of types indicated by following substrate construction.

Plaster, Gypsum Board and Thin-Set Tile - Secure accessories with toggle bolts or wood screws passing through plaster to a wood backing. Toggle bolts - Minimum #10-24 screws of required lengths for finish thickness. Wood screws - Minimum #8 of length required for finish thickness and providing minimum penetration into wood.

Solid Masonry, Concrete, or Tile set in Mortar - Secure accessories with lead expansion shields or cast-in integral anchors. Lead expansion shields - Minimum #8 wood screws with a shield length of 25 mm minimum. Integral anchors - Deformed bars minimum long cast into a predrilled hole with quickset mortar or plaster of paris.

Metal Partitions - Secure accessories with T-nuts and through-bolts minimum #10-24, of lengths required for partition thickness.

3.2 GRAB-BAR ANCHORS

Through-bolt Anchors - Designed and installed for a minimum withdrawal strength of per anchor. Front and back plates - Fabricated from minimum thick steel, with surface area required for design strength. Through bolts - Minimum diameter threaded rod with hexnut and lockwasher; length of rod determined by wall thickness.

Adhesive-applied Anchor Plate - Fabricated from minimum thick perforated plate adhesive-applied to supporting substrate. Adhesive - Thermoset

epoxy-based resin developing minimum shear strength per bar anchor. Secure grab-bar back plate to anchor plate with minimum two #10-24 screws of length required for thickness.

Embedded Plate Anchors - Fabricated from minimum thick plates, with width and length of bar as indicated. Plate U-clamped to partition studs or channels. Secure embedded plates to studs or channels on each side of grab-bar support. Secure bar back plate to anchor plate with minimum two #10-24 screws of length required for thickness.

3.3 ACCEPTANCE PROVISIONS

Remove damaged and unacceptable portions of completed work, and replace with new work at no additional cost to the Government.

Clean surfaces of Work, and adjacent surfaces soiled as a result of Work, in an approved manner. Remove equipment, surplus materials, and rubbish from Worksite.

-- End of Section --

SECTION 12303

CABINETS, STEEL AND WOOD
12/01

PART 1 GENERAL

1.1 SUMMARY

This section covers the Government furnished-Contractor installed (GFCI) cabinets in the laboratories and exam room.

1.2 REFERENCES

American National Standards Institute (ANSI)

ANSI B18.6.1	Wood Screws (Inch Series)

American Society for Testing and Materials (ASTM)

ASTM A 325M	High-Strength Bolts for Structural Steel Joints (Metric)
ASTM F 836M	Stainless Steel Metric Nuts

Federal Specifications (FS)

FS FF-B-588	Bolt, Toggle; and Expansion Sleeve, Screw
FS FF-S-325	Shield, Expansion; Nail, Expansion; and Nail, Drive Screw (Devices, Anchoring, Masonry)

1.3 SUBMITTALS

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

SD-04, Drawings

Installation Drawings shall be submitted for Cabinets in accordance with Paragraph 3.1, Installation. Drawings shall include location of cabinets, detail of cabinets related and dimensional positions, and locations for roughing-in plumbing, including sinks, faucets, strainers and cocks.

1.4 DELIVERY, STORAGE, AND HANDLING

Cabinets shall be delivered, stored, and handled in a manner that will prevent damage and disfigurement.

PART 2 PRODUCTS

2.1 MATERIALS

Screws - ANSI B18.6.1, Group, Type and Class as applicable.

Anchoring Devices - FS FF-S-325, Group, Type, and Class as applicable.

Toggle Bolts - FS FF-B-588, Type I, Class A, Style 2.

Nuts - ASTM F 836M, corrosion-resistant steel.

Bolts - ASTM A 325M, heavy, hexagon head bolts, corrosion-resistant steel.

PART 3 EXECUTION

3.1 INSTALLATION

Casework shall be installed plumb with countertops level to within 1:3000.

Base cabinets shall be leveled by adjusting leveling screws.

Scribe strips shall be scribed and fitted to irregularities of adjacent surfaces. Gap opening shall not exceed 0.

Cases shall be secured permanently to floor and wall construction using diameter masonry anchors, spaced 750 mm maximum on center, minimum of two for each case.

Wall cases shall be supported on continuous thick galvanized steel hanging brackets.

Wall cases shall be secured in position with screws to blocking.

Adjoining cases shall be bolted together. Width of joints shall not exceed .

Closer strips, filler strips, and finish moldings shall be provided as required.

Doors shall be adjusted, hardware adjusted, and surfaces cleaned and waxed.

3.2 CLEANING

On completion of cabinet installation, marred or abraded finished surfaces shall be touched up.

Crating and packing materials shall be removed from premises.

Surfaces shall be wiped down to remove fingerprints and markings, and shall be left in clean condition.

3.3 INSPECTION

Casework grounds and supports shall be examined for adequate anchorage, foreign material, moisture, and unevenness that could prevent quality casework installation.

Ensure that electrical and plumbing rough-ins for casework are complete. Do not proceed with installation until defects are corrected.

SECTION 15000

GENERAL MECHANICAL
12/01

PART 1 GENERAL

1.1 SUMMARY

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

1.2 REFERENCES

American Society of Mechanical Engineers (ASME)

ASME A13.1	Scheme for the Identification of Piping Systems

American Society for Testing and Materials (ASTM)

ASTM A123	Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM B766	Electrodeposited Coatings of Cadmium

Federal Specifications (FS)

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

Sheet Metal and Air Conditioning Contractors' National Association, Inc. (SMACNA)

SMACNA-91	Seismic Restraint Manual, Guidelines for Mechanical System

California Code of Regulations (CCR)

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

California Building Standards Commission

CPC	California Plumbing Code
CMC	California Mechanical Code

International Standard Organization (ISO)

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

National Electrical Manufacturer's Association (NEMA)

NEMA MG 1	(1993) Motors and Generators

1.3 QUALITY ASSURANCE

Where materials and equipment are specified to conform to standards of Underwriters Laboratories, UL label or listing will be acceptable as sufficient evidence that items conform to Underwriters Laboratories requirements. Instead of such label or listing, the Contractor may submit a written certificate from any nationally recognized testing agency adequately equipped and competent to perform such services, stating that items have been tested and that units conform to specified requirements, and outlining methods of testing used.

Where materials or equipment are specified to be constructed or tested, or both, in accordance with standards of American Society for Testing and Materials (ASTM), American Society of Mechanical Engineers (ASME), or other standards, a manufacturer's certificate of compliance of each item, or published catalog data certifying compliance, will be acceptable as proof of compliance.

Conformance to such agency requirements does not relieve the Contractor from ensuring that items comply with other requirements of these specifications.

Mechanical work shall comply with CPC, CMC, and CCR Title 24, Section 6. HVAC equipment shall include thermal insulation on ducts and pipes, unitary air conditioners and heat pumps, boilers, furnaces, water and air-cooled water chilling packages, and service water heaters.

1.4 MECHANICAL SYSTEMS IDENTIFICATION

A. Diagrams - Provide a diagram and listing of equipment at each mechanical room. List equipment by design drawing designation, manufacturer, model, and capacities such as flow rates, pressure and temperature differences, heating and cooling capacities, kilowatt rating, pipe sizes, and voltage and current characteristics. Diagrams and listings do not apply for accessories or minor equipment items such as vents, but do apply for equipment such as pumps, water heaters, air-handling system equipment, refrigeration compressors, heat exchangers, and boilers. Diagrams - Provide neat mechanical drawings, minimum x , with extruded aluminum frames and acrylic plastic protection. Locate as directed by COTR. Make number of charts and diagrams equal to the number of mechanical equipment rooms. Where more than one chart per space is required, mount charts in edge-pivoted, swinging leaf, extruded aluminum frame holders that open to 170 degrees.

B. Identification Tags - Install identification tags of brass or aluminum indicating function of a valve, control or similar component on such system devices. Tags: diameter, stamped marking, wired to valve or equipment items with diameter (12 ga) stainless steel wire.

C. Service Labeling in accordance with ASME A13.1. In addition:

1. Label exposed piping, including pipe concealed in accessible spaces and insulated, bare, and painted pipe designating service and flow direction. Separately identify similar services with different temperatures or pressures. Where system pressure may exceed (gage), include this pressure in label. Provide labels for the following:

a. At each point of entry and exit of pipe passing through walls

b. At each change in direction, i.e., elbows, tees

c. In congested or hidden areas and at access panels at each point required to clarify service or indicated hazard.

d. In long straight runs; locate labels at distances within eyesight of each other but maximum on center.

2. Label lettering: high. Where pipes, bare or insulated, are outside diameter or less, attach labels on thick (16 ga) aluminum sheet to pipe with diameter (12 ga) stainless steel wire. Ensure that labels are visible from primary service and operating area.

D. Equipment Identification Plates

1. Provide standard manufacturer's identification plates for each piece of equipment.

2. In addition to standard manufacturer's identification plates, provide engraved laminated phenolic identification plates for each piece of mechanical equipment. Identification plates designate function of equipment. Submit designation with shop drawings.

E. Color Coding. The following colors shall be used in painting (color coding) of mechanical systems, piping, and equipment. Exact shades shall match existing colors and shades as designated by the Government.

Description	Color
Boilers	silver (steam and hot water)
Natural gas	yellow
Stack	silver
Steam system (supply and return)	white (paint not required if insulated)
Hot water (supply and return)	white with blue stripes (paint not required if insulated)
Make-up water	blue
Chillers	gray
Condenser piping and pumps	light blue (including exposed piping at tower)
Chilled water piping and pumps	dark blue (paint not required if insulated)
Air handler and ducts	white (paint not required if outside duct surface is insulated)
Makeup water	blue
Refrigerant pipe	orange (paint not required if insulated)
Air compressors and piping	light blue-green
Vacuum pumps and piping	black
Fire protection systems	red
Roof-top ventilation	gray
Cooling towers	light blue (unless otherwise specified)

	Same as condenser water piping
Domestic water (hot or Cold)	Green (paint not required if insulated)

Color coding (painting) of outside surface of piping insulation, lagging, or jacketing is not required. All components and piping shall be labeled with equipment/piping function and direction of flow, self-stick-on labeling. Labeling shall be at each point of entry and exit of piping through walls, at each change in direction in congested or hidden areas, and at all access panels to clarify service or indicated hazard. Labels shall be located at distances within eyesight of each other, which shall not exceed 20 m. All labels shall be visible and legible from primary service and operating areas.

1.5 COORDINATION

Coordinate work of different trades so that interferences between piping, equipment, Ductwork, structural, and electrical work are avoided. Furnish offsets in piping and fittings complete in place.

1.6 INTERPRETATION OF DRAWINGS AND SPECIFICATIONS

Design drawings are diagrammatic and do not show all offsets, bends, elbows, or other specific elements that may be required for proper installation of Work. Provide additional bends, offsets, and pipe required by vertical and horizontal equipment, fixture locations, or other job conditions to complete Work at no additional cost to the Government.

Provide, and keep up-to-date, a complete record set of drawings showing every change in red from original specifications and drawings; obtain prints from COTR; keep this set of prints on Worksite, and use only as a record set. Record set will be retained by the Government.

1.7 PREVENTION OF CORROSION

Protect metallic materials against corrosion. Give equipment enclosures rust-inhibiting treatment, and provide standard finish.

Do not use aluminum in contact with earth. Protect aluminum where connected to dissimilar metals by approved fittings, barrier material, or treatment.

Ferrous parts such as anchors, bolts, braces, boxes, bodies, clamps, fittings, guards, nuts, pins, rods, shims, thimbles, washers, and miscellaneous parts not of stainless steel or nonferrous materials - Hot-dip galvanized in accordance with ASTM A123 for exterior locations, and cadmium-plated in accordance with ASTM B766 or FS QQ-P-416 for interior locations.

1.8 MEASUREMENTS AND MEASUREMENT DATA

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

Test Equipment - List of all test equipment used, including manufacturer, model number, serial number, calibration date, certificate of calibration, and special personnel qualifications

required.

Equivalency - If the contractor uses an equivalent test or procedure to meet the requirements of the contract specification, the contractor shall provide to the government proof of equivalency.

PART 2 PRODUCTS

2.1 ANCHORAGE

A. Ensure that seismic anchorage of piping and ductwork, conforms to SMACNA-91.

B. Brace or anchor mechanical equipment to resist horizontal forces acting in any direction, as follows:

1. Fixed equipment on grade: 30 percent of operating weight.

2. Fixed equipment on structure: 45 percent of operating weight.

3. Emergency power and communications equipment on grade: 40 percent of operating weight.

4. Emergency power and communications equipment on structure: 60 percent of operating weight.

5. Flexibly mounted equipment: 4 times above values.

C. Simultaneous Vertical Force: 1/3 of horizontal force.

D. Where anchorage details are not indicated, field installation is subject to approval by COTR.

E. Proof load tests for expansion type anchor bolts loaded in pullout or shear.

1. Ensure that bolts have ICBO approval.

2. Test 50 percent of bolts (alternate bolts in any ground arrangement) in tension to twice allowable tensile load.

2.2 FINISHES

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

PART 3 EXECUTION

3.1 INSTALLATION

Install materials and equipment as indicated and in accordance with manufacturer's approved recommendations, International Conference of Building Officials (ICBO) Uniform Mechanical Code, Uniform Plumbing Code, and Uniform Building Code, whichever is more stringent. Perform installation so that there is no degradation of designated fire ratings of walls, partitions, ceilings, and floors. Except as otherwise indicated, install emergency switches and alarms in conspicuous locations.

No installation shall be permitted which blocks or otherwise impedes

access to any existing machine or system. All hinged doors shall swing open a minimum of 120 degrees. The area in front of all access doors shall be clear a minimum of . The area in front of all access doors to electrical circuits shall be clear the minimum distance to energized circuits as specified in OSHA Standards, part 1910.333 (Electrical-Safety Related work practices) and an additional .

Except as otherwise indicated, emergency switches and alarms shall be installed in conspicuous locations. All indicators to include gauges, meters, and alarms shall be mounted in order to be easily visible by people in the area.

3.2 EQUIPMENT PADS

Provide equipment pads where indicated and of sizes indicated or, if not indicated, of sizes conforming to shape of each piece of equipment served with a minimum margin around equipment and supports.

3.3 CUTTING AND PATCHING

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

3.4 CLEANING

Thoroughly clean exposed surfaces of piping and equipment that have become covered with dirt, plaster, or other material during handling and construction before such surfaces are prepared for final finish painting or are enclosed within building structure.

Before final acceptance, ensure that mechanical equipment including piping, ducting, and fixtures, is clean and free from dirt, grease, and finger marks.

SECTION 15050

BASIC MECHANICAL MATERIALS AND METHODS
12/01

PART 1 GENERAL

1.1 SUMMARY

This section specifies standard basic mechanical work.

1.2 REFERENCES

American Institute of Steel Construction (AISC)

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

American National Standards Institute (ANSI)

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

American Society of Mechanical Engineers (ASME)

ASME A112.19.2M	Vitreous China Plumbing Fixtures
ASME B16.1	Cast Iron Pipe Flanges and Flanged Fittings
ASME B16.3	Malleable-Iron Threaded Fittings
ASME B16.5	Pipe Flanges and Flanged Fittings
ASME B16.9	Factory-Made Wrought Steel Buttwelding Fittings
ASME B16.22	Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
ASME B16.25	Buttwelding Ends
ASME B16.26	Cast Copper Alloy Fittings for Flared Copper Tubes
ASME B16.39	Malleable Iron Threaded Pipe Unions, Classes 150, 250, and 300
ASME B31.1	Power Piping
ASME B31.3	Chemical Plant and Petroleum Refinery Piping
ASME B36.10M	Welded and Seamless Wrought Steel Pipe
ASME-16	Boiler and Pressure Vessel Code; Section

	VIII, Pressure Vessels Division 1 - Basic Coverage
ASME-17	Boiler and Pressure Vessel Code; Section IX, Welding and Brazing Qualifications

American Society for Testing and Materials (ASTM)

ASTM A6M	General Requirements for Rolled Structural Bars, Plates, Shapes, and Sheet Piling
ASTM A53	Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
ASTM A74	Cast Iron Soil Pipe and Fittings
ASTM A105M	Forgings, Carbon Steel, for Piping Components
ASTM A126	Gray Iron Castings for Valves, Flanges, and Pipe Fittings
ASTM A183	Carbon Steel Track Bolts and Nuts ASTM A197M Cupola Malleable Iron (Metric)
ASTM A216M	Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service
ASTM A234M	Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures
ASTM A278M	Gray Iron Castings for Pressure-Containing Parts for Temperatures up to 350 Degrees C (Metric)
ASTM A312M	Seamless and Welded Austenitic Stainless Steel Pipes
ASTM A480M	General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip
ASTM A563M	Carbon and Alloy Steel Nuts (Metric)
ASTM B32	Solder Metal
ASTM B62	Composition Bronze or Ounce Metal Castings
ASTM B88M	Seamless Copper Water Tube (Metric)
ASTM B370	Copper Sheet and Strip for Building Construction
ASTM B749	Lead and Lead Alloy Strip, Sheet, and Plate Products

ASTM C67	Sampling and Testing Brick and Structural Clay Tile
ASTM C109	Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or 50-mm Cube Specimens)
ASTM C190	Tensile Strength of Hydraulic Cement Mortars
ASTM C404	Aggregates for Masonry Grout
ASTM C476	Grout for Masonry
ASTM C564	Rubber Gaskets for Cast Iron Soil Pipe and Fittings
ASTM C920	Elastomeric Joint Sealants
ASTM D2000	Standard Classification System for Rubber Products in Automotive Applications
ASTM E1	ASTM Thermometers
ASTM F104	Standard Classification System for Nonmetallic Gasket Materials
ASTM F568	Carbon and Alloy Steel Externally Threaded Metric Fasteners

American Welding Society (AWS)

AWS A5.8	Filler Metals for Brazing and Braze Welding
AWS WHB-2	Welding Handbook, Volume 2

Factory Mutual Engineering and Research (FM)

FM P7825	Approval Guide

Federal Specifications (FS)

FS FF-S-325	Shield, Expansion; Nail, Expansion; and Nail, Drive Screw (Devices, Anchoring, Masonry)
FS HH-I-558	Insulation, Blocks, Boards, Blankets, Felts, Sleeving (Pipe and Tube Covering), and Pipe Fitting Covering, Thermal (Thermal Fiber, Industrial Type)

Military Specifications (MS)

MS MIL-C-18480	Coating Compound, Bituminous, Solvent, Coal-Tar Base

Manufacturers Standardization Society of the Valve and Fittings Industry (MSS)

MSS SP-58	Pipe Hangers and Supports - Materials, Design and Manufacture
MSS SP-67	Butterfly Valves
MSS SP-69	Pipe Hangers and Supports - Selection and Application
MSS SP-70	Cast Iron Gate Valves, Flanged and Threaded Ends
MSS SP-72	Ball Valves with Flanged or Butt-Welding Ends for General Service

Sheet Metal and Air Conditioning Contractors' National Association, Inc. (SMACNA)

SMACNA-91	Seismic Restraint Manual, Guidelines for Mechanical Systems

1.3 GENERAL REQUIREMENTS

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

1.4 SUBMITTALS

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

SD-01, Data

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

SD-01, Data

Manufacturer's Catalog Data shall be submitted for the following items:

Pipe and fittings
Piping specialties
Valves
Miscellaneous materials
Supporting elements
Spare parts
Pumps
Compressors
Fans
Motors

SD-04, Drawings

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

SD-04, Drawings

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

SD-07, Schedules

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

SD-09, Reports*

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

Hydrostatic tests
Air tests
Valve-operating tests
Drainage tests
Pneumatic tests
Non-destructive electric tests
System operation tests

SD-19, Operation and Maintenance Manuals

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

PART 2 PRODUCTS

2.1 PIPE AND FITTINGS

A. Type BCS, Black Carbon Steel (for Chilled, Hot, and Cooling-Tower Water Pipes)

1. Pipe DN20 through DN250 shall be Schedule 40 seamless black carbon steel, conforming to ASTM A53, Type S. Grade A should be used for permissible field bending.

2. Pipe DN300 through DN610 shall be wall seamless black carbon steel, conforming to ASTM A53, Type S.

3. Fittings DN50 and under shall be Class 150 working steam pressure (wsp) banded black malleable iron, screwed, conforming to ASTM A197M and ASME B16.3.

4. Unions DN50 and under shall be Class 250 female, screwed, black malleable iron with brass-to-iron seat, and ground joint, conforming to ASME B16.39.

5. Fittings DN65 and over shall be steel butt weld, conforming to ASTM A234M and ASME B16.9 to match pipe wall thickness.

6. Flanges DN65 and over shall be Class 150 forged-steel conforming to ASME B16.5, welding neck to match pipe wall thickness.

B. Type BCS-125, (Service for Steam and Condensate Piping)

1. Pipe DN6 through DN40 shall be Schedule 40 steam, Schedule 80 condensate, furnace butt welded, black carbon steel, conforming to ASTM A53, Type F and ASME B36.10M.

2. Pipe DN50 through DN250 shall be Schedule 40 steam, Schedule 80 condensate, seamless or electric-resistance welded black carbon steel, conforming to ASTM A53 Type S and ASME B36.10M.

3. Pipe DN300 through DN600 shall be wall seamless welded black carbon steel, conforming to ASTM A53 Type S and ASME B36.10M.

4. Fittings DN50 and under shall be Class 150 wsp banded black malleable iron, screwed, conforming to ASTM A197M and ASME B16.3.

5. Fittings DN65 and over shall be wall thickness to match pipe, long radius butt weld, black carbon steel, conforming to ASTM A234M, Grade WPB and ASME B16.9.

6. Flanges DN65 and over shall be Class 150, forged carbon-steel welding neck, with raised face or flat face and concentric serrated finish, conforming to ASTM A105M and ASME B16.5.

7. Grooved pipe couplings and fittings shall not be used.

C. Type GCS, Galvanized Carbon Steel (for Potable Water and Rain Water Leader System)

1. Pipe DN15 through DN250 and where indicated shall be Schedule 40 seamless steel conforming to ASTM A53, Type S.

2. Pipe DN300 and over shall be wall, seamless, galvanized steel, conforming to ASTM A53, Grade B.

3. Fittings DN50 and under shall be Class 150 wsp banded galvanized malleable iron, screwed, conforming to ASTM A197M and ASME B16.3.

4. Unions DN50 and under shall be Class 150 wsp female, screwed, galvanized malleable iron with brass-to-iron seat and ground joint.

5. Fittings DN65 and over shall be wsp cast-iron flanges and flanged fittings, conforming to ASTM A126, Class A and ASME B16.1.

6. Grooved pipe couplings and fittings shall conform to Paragraph 2.2.G, Grooved Pipe Couplings and Fittings.

7. Contractor has the option of using Class 150 wsp banded galvanized malleable iron screwed fittings, conforming to ASTM A 197M and ASME B16.3.

D. Type GCS-DWV, Galvanized Steel Drain, Waste and Vent

1. Pipe (all sizes) shall be Schedule 40 seamless galvanized carbon steel, conforming to ASTM A53, Grade A.

2. Furnace butt weld pipe is acceptable for sizes less than DN50.

3. Risers DN80 and larger shall be Type CISP-DWV.

4. Fittings shall be galvanized, screwed, cast iron, recessed pattern drainage fittings, conforming to ASTM A126.

5. Long radius fittings shall be used wherever space permits. Short-turn tees, branches, and ells may be used for vent piping and connections of branch lines to battery fixtures, except wall-hung water closets.

E. Type CISP-DWV, Cast-Iron Drain, Waste and Vent - Soil pipe drain, waste, and vent bell-and-spigot type pipe shall be cast iron, conforming to ASTM A74. Joints shall be calked and leaded in lines where necessary to provide proper leaktight support and alignment. Joints may be elastomeric compression type, conforming to ASTM C564. Hubless joints may be used where indicated. Pipe class shall be extra-heavy (CISP-DWV-XH).

F. Type CPR, Copper

1. Type CPR-A, Copper Above Ground

a. Tubing DN50 and under shall be seamless copper tubing, conforming to ASTM B88M, Type L (hard-drawn for all horizontal and all exposed vertical lines, annealed for concealed vertical lines).

b. Fittings DN50 and under shall be Class 150 wsp wrought-copper solder joint fittings conforming to ASME B16.22.

c. Unions DN50 and under shall be Class 150 wsp wrought-copper solder joint conforming to ASME B16.22.

d. Solder shall be 60-40 tin-antimony, alloy Sb-5, conforming to ASTM B32.

2. Type CPR-U, Copper Under Ground

a. Piping shall be Type K seamless copper tube, conforming to ASTM B88M. Socket-joint fittings shall be wrought copper, conforming to ASME B16.22.

b. Fittings for connection to corporation cocks shall be cast bronze, flared-type, conforming to ASME B16.26. Joints shall be brazed, except joints in drain lines may be soldered. Brazing rod shall be Classification BCP-5, conforming to AWS A5.8.

3. Type CPR-INS, Copper Under Ground Insulated

a. Piping shall be insulated type K seamless copper tube conforming to ASTM B88M. Socket-joint fittings shall be wrought copper, conforming to ASME B16.22. Joints shall be brazed, except joints in drain lines may be soldered.

b. Insulation shall be not less than DN50 thick, suitable for continuous service temperature of not less than . Insulation shall be factory-molded, closed-cell polyurethane foam of not less than density. Insulation shall be waterproofed with an extruded rigid Type II virgin polyvinylchloride, with minimum wall thickness of through outside diameter (od), through od, and through od. Fitting covers shall be fabricated from same materials and thickness as adjacent pipe cooling according to the manufacturer's directions.

G. Grooved Pipe Couplings and Fittings

1. Grooved pipe couplings and fittings shall not be used on space heating hot water pipes.

2. Couplings shall have a housing, fabricated in two or more parts, of black, ungalvanized malleable iron castings. Coupling gasket shall be molded synthetic rubber conforming to ASTM D2000. Coupling bolts shall be oval-neck, track-head type, with hexagonal heavy nuts conforming to ASTM A183.

3. All pipe fittings used with couplings shall be fabricated of black, ungalvanized malleable iron castings. Where a manufacturer's standard-size malleable iron fitting pattern is not available, approved fabricated fittings may be used.

4. Fittings shall be fabricated from Schedule 40 or wall ASTM A53, Grade B seamless steel pipe; long radius seamless welding fittings with wall thickness to match pipe, conforming to ASTM A234M and ASME B16.9.

2.2 PIPING SPECIALTIES

A. Air Separator

1. Air separated from converter discharge water shall be ejected by a reduced-velocity device vented to the compression tank.

2. Air separator shall be carbon steel, fabricated, tested, and stamped in conformance with ASME-16 for service pressures not less than .

B. Air Vents

1. Manual air vents shall be globe valves.

2. Automatic air vents on pumps, mains, and where indicated shall be of ball-float construction. Vent inlet shall be not less than DN20, and the outlet shall be not less than . Orifice shall be . Trim shall be corrosion-resistant steel conforming to ASTM A480M. Vent shall be fitted with try-cock. Vent shall discharge air at

any pressure to . Outlet shall be copper tube routed.

C. Compression Tank

1. Compression tank shall be designed, fabricated, tested and stamped for a working pressure of not less than in accordance with ASME-16. Tank shall be hot-dip galvanized after fabrication to produce not less than of single-side surface.

2. Tank accessories shall include red-lined gage-glass complete with glass protectors and shutoff valves, air charger and drainer, and manual vent.

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

E. Flexible Pipe

1. Flexible pipe vibration and pipe noise eliminators shall be constructed of wire-reinforced chloroprene-impregnated cloth and cord materials and shall be flanged. Flanges shall be backed with ferrous-metal backing rings. Nonmetallic exterior surfaces of the flexible pipe shall be coated with an acid- and oxidation-resistant chlorosulphinated polyethylene. Flexible pipe shall be rated for continuous duty at and .

2. Unit pipe lengths, face-to-face, shall be not less than the following:

INSIDE DIAMETER (DN)	UNIT PIPE LENGTH, mm
To 65, inclusive	300
80 to 100, inclusive	450
125 to 300, inclusive	600

F. Flexible Metallic Pipe

1. Flexible pipe shall be the bellows-type with wire braid cover and shall be designed, constructed, and rated in accordance with ASME B31.3.

2. Working pressure minimum rating shall be at .

3. Minimum burst pressure shall be four times working pressure at . Bellows material shall be AISI 300 series corrosion-resistant steel. Braid shall be AISI 300 series corrosion-resistant steel wire.

4. Threaded end connections shall be hex-collared Schedule 40, AISI 300 series corrosion-resistant steel conforming to ASTM A312M.

5. Flanged end connection rating and materials shall conform to specifications for system primary-pressure rating.

G. Flexible Metal Steam Hose

1. Hose shall be bellows type with wire braid cover and shall be designed, constructed, and rated in accordance with ASME B31.3.

2. Working steam pressure rating shall be at .

3. Minimum burst pressure shall be nine times working steam pressure at .

4. Bellows material shall be AISI 300 series corrosion-resistant steel. Braid shall be AISI 300-series corrosion-resistant steel wire.

5. Threaded end connections shall be hex-collared Schedule 40, AISI 300 series corrosion-resistant steel conforming to ASTM A312M.

6. Flanged end connection rating and materials shall conform to specifications for system primary-pressure rating.

H. Pressure Gages

1. Pressure gages shall conform to ANSI B40.1 and to requirements specified herein. Pressure gages shall be Type I, (for air, steam, and water) Class 1 (pressure). Pressure-gage size shall be nominal diameter. Case shall be corrosion-resistant steel, conforming to any of the AISI 300 series of ASTM A6M, with an ASM No.4 standard commercial polish or better. Gages shall be equipped with adjustable red marking pointer and damper-screw adjustment in inlet connection. Service-pressure reading shall be at midpoint of gage range. Gages shall be equipped with gage isolators. Gages shall have dual (metric/english) scales.

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

I. Sight-Flow Indicators - Sight-flow indicators for pressure service on and smaller shall be constructed of bronze with specially treated single- or double-glass sight windows and shall have a bronze, nylon, or tetrafluoroethylene rotating flow indicator mounted on an AISI Type 304 corrosion-resistant steel shaft. Body may have screwed or flanged end. Assembly shall be pressure- and temperature-rated for the applied service. Flapper flow-type indicators are not acceptable.

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

K. Pump Suction Strainers

1. Strainer body shall be cast iron, rated for not less than at , with flanges conforming to ASME B16.1, Class 125. Strainer construction shall be such that there is a machined surface joint

between body and basket that is normal to the centerline of the basket.

2. Minimum ratio of open area of each basket to pipe area shall be 3 to 1. Basket shall be AISI 300 series corrosion-resistant steel wire mesh with perforated backing.

3. Mesh shall be capable of retaining particles larger than , with a pressure drop across the strainer body of not more than when the basket is two-thirds dirty at maximum system flow rate. Reducing fittings from strainer-flange size to pipe size shall be provided.

4. A differential-pressure gage fitted with a two-way brass cock shall be provided across the strainer.

5. Manual air vent cocks shall be provided in cap of each strainer.

L. Line Strainers, Water Service

1. Strainers shall be Y-type with removable basket. Strainers in sizes DN50 and smaller shall have screwed ends. In sizes DN65 and larger, strainers shall have flanged ends. Body working-pressure rating shall exceed maximum service pressure of system in which installed by at least 50 percent. Body shall have cast-in arrows to indicate direction of flow. Strainer bodies fitted with screwed screen retainers shall have straight threads and shall be gasketed with nonferrous metal. Strainer bodies DN65 and larger fitted with bolted-on screen retainers shall have offset blowdown holes. Strainers larger than DN65 shall be fitted with manufacturer's standard ball-type blowdown valve. Body material shall be cast bronze conforming to ASTM B62. Where system material is nonferrous, metal strainer body material shall be nonferrous metal.

2. Minimum free-hole area of strainer element shall be not less than 3.4 times the internal area of connecting piping. Strainer screens shall have perforations not exceeding . Strainer screens shall have finished ends fitted to machined screen chamber surfaces to preclude bypass flow. Strainer element material shall be AISI Type 304 corrosion-resistant steel.

M. Line Strainers, Steam Service

1. Strainers shall be Y-type with removable strainer element.

2. Body end connections shall be flanged for valves larger than DN50, unless butt weld ends are specified. Screwed end shall be used for sizes DN50 and under to suit specified piping system end connection and maintenance requirements.

3. Strainers located in tunnels, trenches, manholes, and valve pits shall have welded end connections.

4. Body working steam pressure rating shall be the same as the primary valve rating for system in which strainer is installed, except where welded end materials requirements result in higher pressure ratings. Body shall have integral cast or forged arrows to indicate direction of flow. Strainer bodies shall be provided with blowdown valves that have discharge end plugged with a solid

metal plug. Closure assembly shall be made with tetrafluoroethylene tape. Bodies fitted with bolted-on screen retainers shall have offset blowdown holes.

5. Body materials shall be cast steel conforming to ASTM A216M, Grade WCB.

a. Minimum free-hole area of strainer element shall be equal to not less than 3.4 times the internal area of connecting piping. Strainer screens shall have perforations not exceeding or equivalent wire mesh. Strainer screens shall have finished ends fitted to machined screen chamber surfaces to preclude bypass flow. Strainer element material shall be AISI Type 304 corrosion-resistant steel, and shall be fitted with backup screens where necessary to prevent collapse.

N. Bearings

1. Bearing Data - The contractor shall provide to the government the bearing manufacturer and part number for all bearings used in all rotating equipment supplied under this contract. The information shall be included on the sectional drawings for each bearing location.

2. Operating Data - The required equipment data the contractor shall provide the government under this contract shall include the operating speed for constant speed units and the normal operating speed range for variable speed equipment.

3. Gearbox - The contractor shall provide to the government the type and number of teeth on each gear used in the gearbox and the input and output speeds and gear ratios. This information shall be included on the sectional drawings which must be to scale and be specific to gear location.

2.3 VALVES

A. Ball and Butterfly Valves

1. Ball valves shall conform to MSS SP-72. Valves shall be rated for service at not less than at . Valve bodies in sizes DN50 and smaller shall be screwed-end connection type constructed of Class A copper alloy. Valve bodies in sizes DN65 and larger shall be flanged-end connection type. Balls and stems of valves DN50 and smaller shall be manufacturer's standard with hard chrome plating finish. Balls and stems of valves DN65 and larger shall be manufacturer's standard Class C corrosion- resistant steel alloy with hard chrome plating. Balls of valves DN150 and larger may be Class D with 900 Brinell hard chrome plating. Valves shall be suitable for flow from either direction, and shall seal equally tight in either direction. Valves with ball seals held in place by spring washers are not acceptable. Valves shall have adjustable packing glands. Seats and seals shall be tetrafluoroethylene.

2. Butterfly valves shall conform to MSS SP-67. Valves shall be wafer type for mounting between specified flanges, and shall be rated for shutoff and nonshock working pressure. Bodies shall be cast ferrous metal conforming to ASTM A126, Class B, and to

ASME B16.1 for body wall thickness. Seats and seals shall be of the resilient elastomer type designed for field removal and replacement.

B. Drain, Vent, and Gage Cocks

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

2. Pump vent cocks, and where spray control is required, shall be UL umbrella-hood type, constructed of manufacturer's standard polished brass. Cocks shall be male, end threaded, and rated at not less than at .

C. Gate Valves (GAV)

1. Gate valves DN50 and smaller shall conform to MSS SP-72. Valves located in tunnels, equipment rooms, factory-assembled equipment, and where indicated shall be union-ring bonnet, screwed-end type. Packing shall be made of non-asbestos type materials. Valves shall be rising stem type.

2. Gate valves DN65 and larger shall be Type I, (wedge disk, tapered seats, steam rated); Class I (860 kPa steam-working pressure at 178°C saturation); and Class 125, wog (nonshock), conforming to MSS SP-70 and to requirements specified herein. Valves shall be flanged, with bronze trim and outside screw and yoke (OS&Y) construction. Packing shall be made of non-asbestos type materials.

D. Globe and Angle Valves (GLV-ANV)

1. Globe and angle valves DN50 and smaller shall be , conforming to MSS SP-72 and to requirements specified herein. Valves located in tunnels, equipment rooms, factory-assembled equipment, and where indicated shall be union-ring bonnet, screwed-end type. Disc shall be free to swivel on the stem in all valve sizes. Composition seating-surface disc construction may be substituted for all metal-disc construction. Packing shall be made of non-asbestos type materials. Disk and packing shall be suitable for pipe service installed.

2. Globe and angle valves DN65 and larger shall be cast iron with bronze trim. Valve bodies shall be cast iron conforming to ASTM A126, Class A, as specified for Class 1 valves under MSS SP-70. Valve ends shall be flanged in conformance with ASME B16.1. Valve construction shall be outside screw and yoke (OS&Y) type. Packing shall be made of non-asbestos type materials.

E. Standard Check Valves (SCV)

1. Standard check valves in sizes DN50 and smaller shall be swing check conforming to MSS SP-72, except as otherwise specified. Lift checks (lift check horizontal) and , conforming to MSS SP-72, shall be provided where indicated. Swing-check pins shall be nonferrous and suitably hard for the service. Discs shall be composition type. Swing-check angle of closure shall be

manufacturer's standard unless a specific angle is needed.

2. Check valves in sizes DN65 and larger shall be cast iron, bronze trim, swing type. Valve bodies shall be cast iron, conforming to ASTM A126, Class A. Valve ends shall be flanged in conformance with ASME B16.1. Swing-check pin shall be AISI Type 304 or approved equal corrosion-resistant steel. Angle of closure shall be manufacturer's standard unless a specific angle is needed. Valves shall have bolted and gasketed covers.

F. Nonslam Check Valves (NSV)

1. Check valves at pump discharges in sizes DN50 and larger shall be nonslam or silent-check type. Valve disc or plate shall close before line flow can reverse to eliminate slam and water-hammer due to check-valve closure.

2. Valve shall be rated for 1.38 MPa maximum nonshock pressure at 66°C in sizes to DN300. Valves shall be fitted with flanges conforming to ASME B16.1. Valve body may be cast iron conforming to ASTM A278M, Class 40 or equivalent strength ductile iron. Disks shall be corrosion-resistant steel. Pins, springs, and miscellaneous trim shall be manufacturer's standard corrosion-resistant steel. Disk and shaft seals shall be Buna-N elastomer tetrafluoroethyle-ne.

2.4 PUMPS

A. The contractor shall provide to the government the following information on all pumps supplied under the contract:

Number of pump stages
Number of pump vanes per stage
Number of gear teeth for each pump gear
Type of impeller or gear(s)
Rotating speed
Number of volutes
Number of diffuser vanes

B. General Pump Requirements - This specification includes design, construction, installation, and performance features of centrifugal pumps. Pumps shall conform to HI-01, ISO 5199 and ISO 2858 standards for centrifugal pumps, and to requirements specified herein. Pumps shall conform to performance criteria as shown on the drawings and or the equipment schedule.

C. Pump Balancing - Pump impeller assemblies shall be statically and dynamically balanced to ISO 1940/1-1986 G2.5. Correction planes needed for additional weight mass for balancing shall be determined by using a calibrated and certified balancing machine capable of identifying the magnitude and angular position of any unbalance of the impeller.

D. Pump Bearings and Lubrication

1. Bearings shall be heavy-duty ball or roller type and shall have an L-10 rated life of not less than 20,000 hours in accordance with AFBMA 9 or AFBMA 11.

2. Bearings for hot-water service shall be oil-flood lubricated. Oils sumps shall be fitted with constant lever sight oilers and positive means of sump drainage and condensate detection. Provisions shall include FM-approved brass cocks connected to lowest part of bearing sump.

3. Sampling Points-The contractor shall install sampling points and lines in accordance with Method No. 1 published in ISO 4021:1992 titled Hydraulic Fluid Power - Particulate Particle Contamination Analysis - extraction of fluid samples from lines of an operating system, as follows: For Reservoirs and Non-Pressurized Systems-A 1/8" stainless steel line and ball valve is placed in the side of the oil sump or tank. The line shall be located as close to the midpoint of the structure as feasible. In addition, the sample line shall extend internally to and as close to the center of the tank as possible.

E. Pump Protection - Before any pump is operated, sumps and piping systems shall cleaned and flushed to remove all particles larger than or larger than one-half of the smallest pump axial or radial clearance, whichever is smaller. Permanent and temporary pipeline strainers shall be in place and shall be cleaned frequently to prevent cavitation. Temporary strainers shall not be removed until after system acceptance, unless otherwise approved.

F. Pump Alignment - Before attempting alignment, the contractor shall demonstrate that the load does not have any load/force imposed by the piping system. Minimum alignment values (below) are for pump and driver at normal running temperatures. Value must be compensated for thermal growth. Limited movement of the pump and driver (commonly known as bolt-bound) must be corrected to ensure alignment capabilities. Hold down bolts shall not be undercut in order to perform adjustments.

1. Shims shall be commercially die-cut, without seams or folds and be made of corrosion resistant stainless steel. No more than three shims shall be used at any single point.

2. Units with drive motor over 15 hp shall have alignment jack bolts installed.

TABLE 1. Coupled Shaft Alignment Tolerance Values

Soft Foot:

Motor Speed (RPM)	Maximum Movement
All	<0.0508 mm at each foot

For short couplings:

Motor Speed (RPM)	Parallel Off set	Angularity (mm/254 mm)
<1000	0.12700 mm	0.3810 mm
1200	0.10160 mm	0.2540 mm
1800	0.07620 mm	0.1270 mm
3600	0.05080 mm	0.0762 mm
7200	0.02540 mm	0.0635 mm

G. Vibration Analyzer

1. The contractor shall use an FFT analyzer to measure vibration levels. It shall have the following characteristics: dynamic range greater than ; a minimum of 400 line resolution; a frequency response range of 5Hz-10KHz (300 - 600000 cpm); the capacity to perform ensemble averaging; the capability to use Hanning window; auto-ranging frequency amplitude; a minimum amplitude accuracy over the selected frequency range of + or - 20% or = or - 1.5dB.

2. An accelerometer , either stud-mounted or mounted using a rare earth, low mass magnet and sound disk (or finished surface) shall be used with the FFT analyzer to collect data. The mass of the accelerometer and its mounting shall have minimal influence on the frequency response of the system over the selected measurement range.

H. Vibration Data - Vibration data shall be collected in the axial, vertical, and horizontal direction for each pump bearing.

TABLE ## MAXIMUM ALLOWABLE VIBRATION LEVELS FOR POSITIVE DISPLACEMENT AND CENTRIFUGAL PUMPS

	LINE-AMPLITUDE BAND LIMITS	
BAND	FREQUENCY RANGE (CPM)	VELOCITY (INCH/SEC - PEAK)
1	0.3 x RPM 0.8 x RPM	0.04
2	0.8 x RPM 1.2 x RPM	0.075
3	1.2 x RPM 3.5 x RPM	0.04
4	3.5 x RPM 120,000 CPM	0.03

2.5 CENTRIFUGAL COMPRESSORS

The contract shall provide to the government the following information on all centrifugal compressors supplied under this contract.

Compressor Type

Number of compressor sections

Number of blades per section

Number of diffusers

Number of vanes per diffuser

Number of gear teeth on drive gear

Number of driven shafts

Number of gear teeth per driven shaft

Rotating speed of each rotor

Lubricating Oil Information, viscosity grade in ISO units, AGMA or SAE classification and identification of all additives

Grease lubricant information, type of base stock, NLGI number, type and percent of thickener, dropping point, and base oil viscosity range in SUS

Products - Compressor shall conform to performance criteria as shown on the drawings and or the equipment schedule.

2.6 FANS

The contractor shall provide to the government the following information on all fans supplied under this contract:

Type of fan or blower
Number of rotating fan blades/vanes
Number of stationary fan blades/vanes
Rotating speed(s)

The contractor shall provide to the government the following additional information if the fans/air handlers are belt driven:

Number of belts
Belt lengths
Diameter of the drive sheave at the drive pitch line
Diameter of the driven sheave at the drive pitch line

For all fans supplied under the contract, the contractor shall ensure sufficient access to the fan is present to allow for cleaning and in-place balancing of the fan.

Fans shall be propeller type, of corrosion-resistant construction, and shall be statically and dynamically balanced to ISO 1940/1-1986, G2.5.

Fans shall conform to performance criteria as shown on the drawings and or the equipment schedule.

Vibration Data - Vibration data shall be collected in the axial, vertical, and horizontal direction for each motor bearing. Two narrowband spectra for each data collection point shall be obtained in the following manner: For all machines regardless of operating speed, a 5 to 500 Hz spectrum with a minimum of 400 lines of resolution shall be obtained. An additional spectrum of 5 to 2500 Hz or 5 to 5000 Hz shall be acquired for machines operating at or below 1800 RPM or greater than 1800 RPM, respectively.

Vibration shall conform to the following table:

TABLE # MAXIMUM ALLOWABLE VIBRATION LEVELS FOR FANS

BAND	FREQUENCY RANGE	VELOCITY LINE AMPLITUDE BAND LIMITS(INCH/SEC PEAK)	
1	0.3 x RPM min - 0.8 x RPM fan	0.04	DIRECT COUPLED

		0.075 BELT DRIVE
2	0.8 x RPM fan - 1.2 x RPM fan/motor	0.075
3	1.2 x RPM fan/motor - 3.5 x RPM fan/motor	0.04
4	3.5 x RPM fan/motor - to Fmax = 60,000 CPM	0.03
		ACCELERATION BAND LIMITED OVERALL AMPLITUDE LIMITS (g's PEAK)
1	0.3 x RPM min - to Fmax = 120,000 CPM	0.5

RPM min = Lowest system speed (e.g. Belt speed if Belt Driven, Fan speed if direct drive coupledRPM fan/motor = Fan or motor speed whichever is greater (IN/SEC)

2.7 MOTORS

A. The contractor shall provide to the government the following information on all electric motors rated over 7.5 hp and those specified to meet a special vibration class in accordance with NEMA MG-1.

Motor type
Bearing information
Resistance
Winding Inductance
Cooling fan blades
Number of rotors
Number of rotor bars
Number of stator slots
SCR firing sequence

B. Factory Test - Electrical tests shall consist of winding resistance, insulation resistance, and high potential tests. Certified copies of Factory test results shall be submitted to the government for approval prior to shipment from factory. Previous test reports on identical motors are not acceptable for these tests.

C. Equipment

1. Design, fabrication, testing and performance of motors shall be in accordance with NEMA MG 1 and ISO 1940/1.

2. Motors shall conform to performance criteria as shown on the drawings and or the equipment schedule.

3. Allowable balance limits shall be in accordance with ISO 1940/1.

4. Motors shall have factory-sealed ball bearings with an L-10 rated life of not less than (80,000) hours in accordance with AFBMA 9 or AFBMA11.

5. Motors with weatherproof/waterproof enclosures shall have

permanent accelerometers installed in the horizontal, vertical and axial directions. The enclosure shall have a penetration installed to enable the accelerometer cables to be routed to outside the enclosure. A data collection box shall be mounted to the outside of the motor enclosure in a location that is easily accessible. Data collection box shall be rated NEMA 4R or NEMA 6X, non-metallic sealed NEMA Standard boxes.

D. Installation - Motors shall be bolt mounted. Motor feet shall be coplanar within 0.001 inch. Base mounting points shall be accessible and adjustable to enable machine alignment. Motors over (15) hp shall have alignment jack bolts installed to enable alignment.

E. Alignment - Before attempting alignment, the contractor shall demonstrate that the load does not have any load/force imposed by the piping system. Minimum alignment values (below) are for motor and load running at normal running temperatures. Value must be compensated for thermal growth. Limited movement of the motor or load (commonly known as bolt-bound) must be corrected to ensure alignment capabilities. Hold down bolts shall not be undercut in order to perform adjustments. Shims shall be commercially die-cut, without seams or folds and be made of corrosion resistant stainless steel. No more than three shims shall be used at any single point.

TABLE 1. Coupled Shaft Alignment Tolerance Values

Soft Foot:

Motor Speed (RPM)	Maximum movement
All	< at each foot

For short couplings:

Motor Speed (RPM)	Parallel Off set	Angularity (mm/)
<1000		
1200		
1800		
3600		
7200		

F. Electrical Tests

1. Perform continuity tests on all phases.

2. Perform insulation resistance and polarization index test on each phase of motor. Insulation tests on 480-volt motors shall be conducted using a 1000-volt insulation test set. Insulation tests on motors rated less than 480-volts shall be conducted using 500-volt insulation test set.

3. Test data shall include the location and identification of motors and megohm reading versus time. Test data shall be recorded at 15, 30, 45 seconds and 1 minute increments thereafter up to 10 minutes. Megohm readings shall not be less than 25 megohms for each phase and each phase reading shall be within 10 percent of the other two.

4. Calculate the polarization index of each phase by dividing the 10

minute reading by the 1 minute reading. The polarization index shall be greater than 1.25. Any values lower shall be rejected and the motor returned to the factory.

G. Vibration Analyzer

1. The contractor shall use an FFT analyzer to measure vibration levels. It shall have the following characteristics: dynamic range greater than 72db; a minimum of 400 line resolution; a frequency response range of 5Hz-10KHz (300 - 600000 cpm); the capacity to perform ensemble averaging; the capability to use Hanning window; auto-ranging frequency amplitude; a minimum amplitude accuracy over the selected frequency range of + or - 20% or = or - 1.5dB.

2. An accelerometer , either stud-mounted or mounted using a rare earth, low mass magnet and sound disk (or finished surface) shall be used with the FFT analyzer to collect data. The mass of the accelerometer and its mounting shall have minimal influence on the frequency response of the system over the selected measurement range.

H. Vibration Data

1. Vibration data shall be collected in the axial, vertical, and horizontal direction for each motor bearing.

2. Two narrowband spectra for each data collection point shall be obtained in the following manner: For all machines regardless of operating speed, a 5 to 500 Hz spectrum with a minimum of 400 lines of resolution shall be obtained. An additional spectrum of 5 to 2500 Hz or 5 to 5000 Hz shall be acquired for machines operating at or below 1800 RPM or greater than 1800 RPM, respectively.

Vibration limits shall conform to the following:

TABLE 9.1A MAXIMUM ALLOWABLE VIBRATION LEVELS FOR ELECTRIC MOTORS
FRACTIONAL AND INTEGRAL HORSEPOWER AC/DC MOTORS
VELOCITY LINE-AMPLITUDE BAND LIMITS

BAND	FREQUENCY RANGE (CPM)	STANDARD (INCH/SEC - PEAK)
1	0.3 x RPM - 0.8 x RPM	0.04
2	0.8 x RPM - 1.2 x RPM	0.075
3	1.2 x RPM - 3.5 x RPM	0.04
4	3.5 x RPM - 8.5 x RPM	0.03
5	8.5 x RPM - 60,000 CPM	0.03
6	60,000 CPM - 120,000 CPM	0.03

I. Leveling of Equipment Upon Installation - The contractor shall level all installed rotating electrical and mechanical machinery. After installation, the equipment shall not exceed a maximum slope of the base and the frame of 0.001 inch per foot. The contractor shall report to the government the type and accuracy of the instrument used for measuring the level; e.g., a 12-inch machinist's level graduated to 0.0002 inch per foot.

2.8 MISCELLANEOUS MATERIALS

A. Bituminous Coating

1. Bituminous coating shall be a solvent cutback, heavybodied material to produce not less than a 0.30 mm dry-film thickness in one coat, and shall be as recommended by the manufacturer to be compatible with factory-applied coating and rubber joints.

2. For previously coal-tar coated and uncoated ferrous surfaces underground, bituminous coating shall be solvent cutback coal-tar type conforming to MS MIL-C-18480.

B. Bolting - Flange and general purpose bolting shall be hex-head and shall conform to ASTM F568, Class 4.8 or above (bolts, for flanged joints in piping systems where one or both flanges are cast iron). Heavy hex-nuts shall conform to ASTM A563M. Square-head bolts and nuts are not acceptable. Threads shall be coarse-thread series.

C. Elastomer Calk - Polysulfide- or polyurethane-base elastomer calking material shall be two-component type conforming to ASTM C920.

D. Escutcheons

1. Escutcheons shall be manufactured from nonferrous metals and shall be chrome-plated except when AISI 300 series corrosion-resistant steel is provided. Metals and finish shall conform to ASME A112.19.2M.

2. Escutcheons shall be one-piece type where mounted on chrome-plated pipe or tubing, and one-piece of split-pattern type elsewhere. Escutcheons shall have provisions consisting of setscrews for maintaining a fixed position against a surface.

E. Flashing

1. Sheet lead shall conform to ASTM B749, Grade B (intended for use in laboratories and shops in general application).

2. Sheet copper shall conform to ASTM B370 and shall be of not less than mass.

F. Flange Gaskets - Compressed non-asbestos sheet conforming to ASTM F104, Type 7-P1161A, coated on both sides with graphite or similar lubricant, with nitrile composition, binder rated .

G. Grout - Shrink-resistant grout shall be premixed and packaged metallic-aggregate, mortar-grouting compound conforming to ASTM C404 and ASTM C476, with the following properties:

1.	Tensile strength	ASTM C190	, minimum
2.	Compressive strength	ASTM C109	, minimum
3.	Shrinkage, linear		0.3 percent, maximum
4.	Water absorption	ASTM C67	0.1 percent, maximum
5.	Bond strength to steel in shear		, minimum

H. Pipe Thread Compounds - Tetrafluoroethylene tape to thick shall be used in potable and process water and in chemical systems for pipe

sizes to and including DN25. Tetrafluoroethylene dispersions and other suitable compounds may be used for all other applications upon approval; however, no lead-containing compounds may be used in potable water systems.

2.9 SUPPORTING ELEMENTS

A. Necessary piping systems and equipment supporting elements shall be provided including, but not limited to, building structure attachments; supplementary steel; hanger rods, stanchions, and fixtures; vertical pipe attachments; horizontal pipe attachments; anchors; guides; and spring-cushion, variable, or constant supports. Supporting elements shall be suitable for stresses imposed by systems pressures and temperatures and natural and other external forces normal to this facility without damage to supporting element system or to work being supported.

B. Supporting elements shall be UL listed and conform to ASME B31.3, FM P7825, FS FF-S-325, MSS SP-58, and MSS SP-69 except as noted.

C. Attachments welded to pipe shall be made of materials identical to that of pipe or materials accepted as permissible raw materials by referenced code or standard specification.

D. Supporting elements exposed to weather shall be hot-dip galvanized. Materials shall be of such a nature that their apparent and latent-strength characteristics are not reduced due to galvanizing process. Supporting elements in contact with copper tubing shall be electroplated with copper.

E. Type designations specified herein are based on MSS SP-58 and MSS SP-69. Masonry anchor group-, type-, and style-combination designations shall be in accordance with FS FF-S-325. Support elements, except for supplementary steel, shall be cataloged, load rated, commercially manufactured products.

F. Building Structure Attachments

1. Anchor Devices, Concrete and Masonry

a. (1) Group I - Shield, expansion (lead, bolt and stud anchors)
(2) Group II - Shield, expansion (bolt anchors)
Type 2 - Machine bolt expansion shield anchors
Class 2 - Open-end expansion shield anchors
Style 1 - Single-end expansion shield anchors
Style 2 - Double-end expansion shield anchors
(3) Group III - Shield, expansion (self-drilling tubular expansion shell bolt anchors)
(4) Group VIII - Anchors, expansion (nondrilling)

b. Cast-in, floor mounted, equipment anchor devices shall provide adjustable positions.

c. Masonry anchor devices shall be built-in.

d. Powder-actuated anchoring devices shall not be used to support any mechanical systems components.

2. Beam Clamps

a. Beam clamps shall be center-loading Type 21, 28, 29, 30, UL listed, cataloged and load-rated commercially manufactured product.

b. When it is not possible to use center-loading beam clamps, eccentric-loading beam clamps, Type 20 may be used for piping sizes DN50 and less. For pipe sizes over DN50, provide two counterbalancing clamps per point of pipe support. Where more than one rod is used per point of pipe support, rod diameter shall be determined in accordance with referenced standards.

3. C-Clamps - C-clamps shall not be used.

G. Horizontal Pipe Attachments

1. Single Pipes

a. Piping in sizes to and including DN50 shall be supported by Type 6 solid malleable iron pipe rings, except that split-band-type rings may be used in sizes up to DN25.

b. Piping in sizes above DN50 through DN200 inclusive shall be supported by Type 1 attachments.

c. Type 1 and Type 6 assemblies shall be used on vapor-sealed insulated piping, and shall have an inside diameter larger than pipe being supported to provide adequate clearance during pipe movement.

d. Use Type 12 devices with double-bolted angle-iron wall or fixture clips in pipe chases to support fixture supply piping.

e. Where thermal movement of a point in a piping system would cause a hanger rod to deflect more than 4 degrees from the vertical or where a horizontal point movement exceeds , pipe rolls as indicated in details shall be used.

f. Type 40 shields shall be used on insulated piping. Area of the supporting surface shall be such that compression deformation of insulated surfaces does not occur. Longitudinal and transverse shield edges shall be rolled away from the insulation.

g. Insulated piping without vapor barrier on roll supports shall be provided with Type 39a saddles for pipe sizes to DN300 and Type 39b for pipe sizes DN300 and larger.

h. Spring supports shall be as indicated.

2. Parallel Pipes - Trapeze hangers fabricated from approved structural steel shapes, with U-bolts, shall be used in congested areas and where multiple pipe runs occur. Structural steel shapes shall conform to supplementary steel requirements or be of commercially available, proprietary design, rolled steel.

H. Vertical Pipe Attachments

1. Vertical pipe attachments shall be Type 8.

2. Shop drawing data shall include complete fabrication and attachment details of any spring supports.

I. Hanger Rods and Fixtures

1. Only circular cross section rod hangers may be used to connect building structure attachments to pipe support devices. Pipe, straps, or bars of equivalent strength shall be used for hangers only where approved.

2. Turnbuckles, swing eyes, and clevises shall be provided as required by support system to accommodate temperature change, pipe accessibility, and adjustment for load and pitch. Rod couplings are not acceptable.

J. Supplementary Steel - Where it is necessary to frame structural members between existing members or where structural members are used instead of commercially rated supports, such supplementary steel shall be designed and fabricated in accordance with AISC S328.

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

PART 3 EXECUTION

3.1 PIPE INSTALLATION

Piping systems shall be fabricated and installed in accordance with ASME B31.3, MSS SP-69, and AWS WHB-2.

Connections between steel piping and copper piping shall be electrically isolated from each other with dielectric unions or flanges with flange insulating kit rated for the service.

Final connections to equipment shall be made with unions for sizes up to DN50 and flanges for sizes DN65 and above, provided every 30 m of straight run. Unions shall be provided in the line downstream of screwed- and welded-end valves.

Pipe ends shall be reamed before joint connections are made.

Screwed joints shall be made up with tetrafluoroethylene joint compound or tape, and not more than three threads shall show after joint is made up.

Joint compounds shall be applied to the male thread only, and care shall be exercised to prevent compound from reaching the unthreaded interior of the pipe.

Screwed unions, welded unions, or bolted flanges shall be provided wherever required to permit convenient removal of equipment, valves, and piping accessories from the piping system for maintenance.

Piping systems shall be securely supported with due allowance for thrust forces, thermal expansion and contraction, and shall not be subjected to mechanical, chemical, vibrational or other damage as specified in ASME B31.3.

Field welded joints shall conform to AWS WHB-2, ASME B31.3, and ASME-17.

Piping systems butt weld joints shall be made without backing rings. Joint configuration shall conform to ASME B16.25.

Cutting of metallic piping shall be by wheel cutters or other machines designed specifically for that purpose. Electric-arc and oxyacetylene cutting is not permitted.

Precautions shall be taken during installation of flexible pipe and hose including flushing/purging with water, steam, and compressed air to preclude bellows failure due to pipe line debris lodged in bellows. Installation shall conform to manufacturer's instructions.

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

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

3.2 VALVES

Valves shall be provided in piping mains and all branches and at equipment where indicated and as specified.

Valves shall be provided to permit isolation of branch piping and each equipment item from the balance of the system.

Riser and downcomer drains above piping shutoff valves in piping DN65 and larger shall be provided. Shutoff valve body shall be tapped and fitted with a DN15 plugged globe valve.

Valves unavoidably located in furred or other normally inaccessible places shall be provided with adequately sized access panels approved for the location.

3.3 SUPPORTING ELEMENTS INSTALLATION

Supporting elements shall be provided in accordance with the referenced codes and standards.

Piping shall be supported from building structure. No piping shall be supported from roof deck or from other equipment such as pipe, duct, or cable tray.

Anchorage of piping and equipment shall be in accordance with Section 15000, General Mechanical.

3.4 PENETRATIONS

Effective sound stopping and adequate operating clearance shall be provided to prevent structure contact where piping penetrates walls, floors, or ceilings into occupied spaces adjacent to equipment rooms; where similar penetrations occur between occupied spaces; and where penetrations occur from pipe chases into occupied spaces. Occupied spaces shall include space above ceilings where no special acoustic treatment of ceiling is provided. Penetrations shall be finished to be compatible with surface being penetrated. Seal exterior wall sleeves watertight, using mechanically expandable chloroprene inserts with mastic sealed metal components.

Sound stopping and vapor-barrier sealing of pipe shafts and large floor and wall openings shall be accomplished by packing to high density with properly supported fibrous-glass insulation or, where ambient or surface temperatures do not exceed 49°C, by foaming-in-place with self-extinguishing, 32 kg/m3 density polyurethane foam to a depth not less than 150 mm. Foam shall be finished with a rasp. Vapor barrier shall be not less than 3 mm thick vinyl coating applied to visible and accessible surfaces. Where pipe passes through fire-rated partitions, use only UL rated assemblies for required fire rating.

3.5 SLEEVES

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

Sleeves passing through steel decks shall be continuously welded or brazed to the deck.

Sleeves that extend through floors, roofs, load bearing walls, and fire barriers shall be continuous and fabricated form Schedule 40 steel pipe, with welded anchor lugs. All other sleeves shall be formed by molded linear polyethylene liners or similar materials that are removable. Diameter of sleeves shall be sufficiently large to accommodate pipe, insulation, and jacketing without touching the sleeve, and shall provide a minimum clearance. Sleeve size shall accommodate mechanical and thermal motion of pipe to preclude transmission of vibration to walls and the generation of noise.

Space between a pipe, bare or insulated, and the inside of a pipe sleeve or a construction surface penetration shall be packed solid with a mineral fiber conforming to FS HH-I-558, Form B, Type 1 (flexible blanket), Class 8, (to). This packing shall be provided wherever the piping passes through firewalls, equipment room walls, floors, and ceilings connected to occupied spaces, and other locations where sleeves or construction-surface penetrations occur between occupied spaces. Where sleeves or construction surface penetrations occur between conditioned and unconditioned spaces, the space between a pipe, bare or insulated, and the inside of a pipe sleeve or construction surface penetration shall be filled with an

elastomer calk to a depth of . Surfaces to be calked shall be oil- and grease-free.

Exterior wall sleeves shall be calked watertight with lead and oakum or mechanically expandable chloroprene inserts with mastic-sealed metal components.

3.6 ESCUTCHEONS

Escutcheons shall be provided at all penetrations of piping into finished areas. Where finished areas are separated by partitions through which piping passes, escutcheons shall be provided on both sides of the partition. Where suspended ceilings are installed, plates shall be provided at the underside only of such ceilings. For insulated pipes, the plates shall be sufficiently large to fit around the insulation. Escutcheons shall be chrome-plated in occupied spaces and of size sufficient to effectively conceal openings in building construction. Escutcheons shall be firmly attached with setscrews.

3.7 FLASHINGS

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

3.8 UNDERGROUND PIPING INSTALLATION

Before being lowered into a trench, piping shall be cleaned, visually inspected for apparent defects, and tapped with a hammer to audibly detect hidden defects.

Suspect cast-ferrous piping shall be further inspected by painting with kerosene on external surfaces to reveal cracks.

Defective materials found shall be distinctly marked using a road-traffic quality yellow paint; defective material shall be promptly removed from the site.

Where conduit passes through walls below grade and ground floor slab, pass conduit through pipe sleeves larger than conduit and make watertight with expansion plugs. Where pipe penetrates earth or concrete grade, ensure that minimum of corrosion-protected pipe is exposed to view.

After conduit has been inspected, and not less than 48 hours before being lowered into a trench, external surfaces of cast ferrous conduit shall be coated with a compatible bituminous coating for protection against brackish ground water. Application shall be single coat, in accordance with the manufacturer's instructions, to result in a dry-film thickness of not less than .

Perform excavation and backfill operations as specified in Section 02200, Site Preparation and Earthwork. Excavations shall be dry and clear of extraneous materials when pipe is being laid.

Cutting of piping shall be by wheel cutters or other machines designed specifically for that purpose. Electric-arc and oxyacetylene cutting are not permitted.

Laying of pipe shall begin at the low point of a system. When in final acceptance position, pipe shall be true to the grades and alignment

indicated, with unbroken continuity of invert. Blocking and wedging are not permitted.

Bell or grooved ends of piping shall point upstream.

Changes in direction of drainage piping shall be made with long sweep fittings.

Necessary socket clamping, piers, bases, anchors, and thrust blocking shall be provided. Rods, clamps, and bolting shall be protected with a coating of bitumen.

Underground piping below supported or suspended slabs shall be supported from the slab with a minimum of two supports per length of pipe. Supports shall be protected with a coating of bitumen.

On excavations that occur near and below building footings, the backfilling material shall consist of cured compressive-strength concrete poured or pressure-grouted up to the level of the footing.

Vertical downspouts; soil, waste, and vent stacks; water risers; and similar work shall be properly supported on approved piers at the base and provided with approved structural supports attached to building construction.

Metallic piping laid underground - Wrap in polyethylene. After pressure testing and before backfilling, thoroughly clean joints and valves and wrap or cover with heat-shrink tubing. Then test coated and wrapped pipe and valves with an electric holiday detector operating at to . Repair defects by clipping back coatings to bare metal and recoating as specified for original work, to the satisfaction of the COTR.

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

Valves - Install where indicated, set plumb, and centered on valves. Where feasible, locate valves outside traffic areas. Carefully tamp soil around each valve box to a distance of on all sides of the box, or to undisturbed trench face if less than . Protect valve boxes located in roads or sidewalks by a concrete slab as indicated.

3.9 DISINFECTION

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

SECTION 15260

PIPING INSULATION
12/01

PART 1 GENERAL

1.1 SUMMARY

This section specifies requirements for pipe insulation.

1.2 REFERENCES

American Society for Testing and Materials (ASTM)

ASTM B209M	Aluminum and Aluminum-Alloy Sheet and Plate (Metric)
ASTM C195	Mineral Fiber Thermal Insulating Cement
ASTM C449M	Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement
ASTM C533	Calcium Silicate Block and Pipe Thermal Insulation
ASTM C534	Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form
ASTM C552	Cellular Glass Thermal Insulation
ASTM C592	Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type)
ASTM C795	Thermal Insulation for Use in Contact with Austenitic Stainless Steel
ASTM C916	Adhesives for Duct Thermal Insulation
ASTM C920	Elastomeric Joint Sealants
ASTM C921	Determining the Properties of Jacketing Materials for Thermal Insulation
ASTM C1136	Flexible, Low Permeance Vapor Retarders for Thermal Insulation
ASTM D579	Greige Woven Glass Fabrics
ASTM D1927	Rigid Poly(Vinyl Chloride) Plastic Sheet
ASTM E84	Surface Burning Characteristics of Building Materials
ASTM E96	Water Vapor Transmission of Materials

National Fire Protection Association (NFPA)

NFPA 220	Types of Building Construction
NFPA 255	Surface Burning Characteristics of Building Materials

Society of Automotive Engineers, Inc. (SAE)

SAE AMS 3779	Tape, Adhesive, Pressure-Sensitive Thermal Radiation Resistant
SAE AMS 3779/2	Tape, Adhesive, Pressure-Sensitive Thermal Radiation Resistant, Aluminum Coated Glass Cloth

1.3 SYSTEM DESCRIPTION

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

1.4 PERFORMANCE REQUIREMENTS

Thermal insulation system materials shall be noncombustible, as defined by NFPA 220. Adhesives, coatings, sealants, facings, jackets, and thermal insulation materials, except cellular elastomers, shall have a flame-spread classification (FSC) of 25, and a smoke-developed classification (SDC) of 50. These maximum values shall be determined in accordance with ASTM E84 and NFPA 255. Adhesives, coatings, and sealants shall be nonflammable in their wet state.

Adhesives, coatings, and sealants shall have published or certified temperature ratings suitable for the entire range of working temperatures normal for the surfaces to which they are to be applied.

1.5 SUBMITTALS

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

SD-01, Data

Manufacturer's Catalog Data shall be submitted for the following items:

Adhesives
Coatings
Insulating cement
Insulating materials
Jacketing
Tape materials

PART 2 PRODUCTS

2.1 MATERIALS

Materials shall be compatible and shall not contribute to corrosion, soften, or otherwise attack surfaces to which applied in either the wet or

dry state. Materials to be used on stainless steel surfaces shall conform to ASTM C795. Materials shall be asbestos free and conform to the following:

A. Adhesives

1. Cloth Adhesives - Adhesives for adhering, sizing, and finishing lagging cloth, canvas, and open-weave glass cloth shall be a pigmented polyvinyl acetate emulsion and shall conform to ASTM C916, Class 1, Grade A or B.

2. Vapor-Barrier Material Adhesives - Adhesives for attaching laps of vapor-barrier materials and presized glass cloth and for attaching insulation to itself, to metal, and to various other substrates, shall be solvent-base, synthetic-rubber type and shall conform to ASTM C916, Class 2, Grade A or B for attaching fibrous-glass insulation to metal surfaces. Solvent shall be nonflammable.

3. Cellular Elastomer Insulation Adhesive - Adhesive for cellular elastomer insulation shall be a solvent cutback chloroprene elastomer conforming to ASTM C916, Type II or III, Class 1, and shall be of a type approved by the manufacturer of the cellular elastomer for the intended use.

B. Coatings

1. Outdoor Vapor-Barrier Finishing - Coatings for outdoor vapor-barrier finishing of insulation surfaces such as fittings and elbows shall be nonasphaltic, hydrocarbon polymer, solvent-base mastic containing a blend of nonflammable solvents. Coatings shall conform to ASTM C1136 and ASTM C921.

2. Indoor Vapor-Barrier Finishing - Coatings for indoor vapor-barrier finishing of insulation surfaces shall be a pigmented resin and solvent compound and shall conform to ASTM C1136, Type II.

3. Outdoor and Indoor Nonvapor-Barrier Finishing - Coatings for outdoor and indoor nonvapor-barrier finishing of insulation surfaces shall be pigmented polymer-emulsion type recommended by the insulation material manufacturer for the surface to be coated and shall be applied to specified dry-film thickness.

4. Cellular-Elastomer Insulation Coating - Finish coating for cellular-elastomer insulation shall be a polyvinylchloride lacquer approved by the manufacturer of the cellular elastomer.

5. Coating Color - Coating color shall be white.

C. Insulating Cement

1. General Purpose Insulating Cement - General purpose insulating cement shall be diatomaceous silica and shall conform to ASTM C195. Composite shall be rated for service and shall have a thermal-conductivity maximum of 0.123 W/(m.K) at mean temperature for thickness.

2. Finishing Insulating Cement - Finishing insulating cement shall

be mineral-fiber, hydraulic-setting type conforming to ASTM C449M.

D. Calking - Calking used with specified insulation materials shall be an elastomeric joint sealant in accordance with ASTM C920, Type S, Grade NS, Class 25, Use A.

E. Corner Angles - Corner angle piping insulation shall be nominal aluminum by with factory applied kraft backing. Aluminum shall be in accordance with ASTM B209M, Alloy 3003.

F. Insulation Materials - Insulation conductances shall be maximum values, as tested at any point, not an average. Insulation conductance found by test to exceed the specified maximum shall either be replaced or augmented by an additional thickness to bring it to the required maximum conductance and a complete finishing system.

1. Mineral Fiber - Mineral fiber shall conform to ASTM C592, shall be suitable for surface temperatures up to , and shall be of not less than 64.1 kg/m3 density. Thermal conductivity shall be not greater than 0.037 W/(m K) at mean.

2. Pipe Barrel - Pipe barrel insulation shall be Form D, sleeving, pipe, and the tube covering, Type III, molded, Class 12, for use at temperatures up to and including .

3. Pipe Fittings - Pipe fitting insulation shall be Form E, molded pipe fitting covering, Class 16, for use at temperatures up to and including .

4. Flexible Blankets - Flexible blankets shall be Form B, blankets and felts, flexible, Class 6, resilient for use at temperatures up to and including , minimum 16 kg/m3 density. Thermal conductivity shall be not greater than 1.53 W/(m K) at mean.

5. Cellular Elastomer - Cellular elastomer shall conform to ASTM C534, except that the water-vapor permeability shall not exceed 0.44 ng/(Pa s m2) mercury pressure difference for thickness.

6. Cellular Glass - Cellular glass shall conform to ASTM C552, Type II, pipe covering. Substitutions for this material are not permitted.

7. Calcium Silicate - Calcium silicate shall conform to ASTM C533. Thermal conductivity shall be not greater than 0.53 W/(m K) at mean.

G. Jacketing

1. Aluminum Jackets

a. Aluminum Jackets - Aluminum sheet shall be in accordance with ASTM B209M and shall be thick with factory-applied vapor barrier on the insulation side. Aluminum shall be made from smooth, polished, Temper H14, Alloy 3003. Straps shall be AISI 300 series corrosion-resistant steel, thick, 13 mm wide for pipe under DN300, and wide for pipe over DN300.

b. Elbow jackets shall be thick, deep-drawn, die-shaped, two-piece

components for long-radius, butt-welded elbows manufactured from the same materials as specified for jackets, with factory-attached vapor-seals in underside of the aluminum. Preinsulated, voidless, jacketed components conforming to these specifications shall be used. Preinsulated fittings shall have a overlay beyond route for weld bead.

c. Vapor barrier shall be 3 kg/m2 kraft paper with polyethylene coating.

d. Pipe jackets shall have not less than longitudinal and circumferential lap.

e. Sealant for longitudinal and butt joints of aluminum jacketing shall be an aluminum-pigmented, butyl, polymer sealant with high-butyl solids.

2. Glass Cloth Jackets

a. Glass cloth shall be plain-weave glass cloth conforming to ASTM C579, Style 141 and shall weigh not less than before sizing. Cloth shall be factory applied wherever possible.

b. Glass reinforcing cloth shall be a leno weave, 26-end and 12-pick thread conservation, with a warp and fill tensile strength of width and width, respectively, and with a mass of not less than . At the Contractor's option, Style 191 leno-weave glass cloth conforming to ASTM D579 may be provided.

3. PVC Jackets

a. Polyvinylchloride (PVC) shall be a thick, factory-premolded, pipe-barrel sheeting vapor-barrier jacketing. Material shall be self-extinguishing, and shall conform to ASTM D1927, Composition A polyvinylchloride, Type II, high-impact strength, moderate chemical resistance. Permeability rating shall be 0.574 ng/(Pa s m2) of mercury pressure difference, determined in accordance with ASTM E96. Vapor-barrier joint adhesive shall be manufacturer's standard solvent-weld type.

b. Vapor barrier shall conform to ASTM C1136, Type I, low-vapor transmission, high-puncture resistance for use on insulation for piping, ducts, and equipment.

4. 3-Ply Laminate

a. Jacketing shall be a 3-ply laminate of white-bleached kraft, bonded to not less than thick aluminum foil and reinforced with glass fiber.

b. Water-vapor permeance rating of the composite shall be pressure differential, determined in accordance with ASTM E96.

H. Tape - Glass lagging shall be a knitted elastic cloth specifically suitable for continuous spiral wrapping of insulated pipe bends and fittings and shall produce a smooth, tight, wrinkle-free surface. Tape shall conform to SAE AMS 3779, SAE AMS 3779/2, ASTM D579, and ASTM C921, and shall weight not less than .

2.2 PIPING SYSTEMS

Insulation thicknesses and pipe sizes are in millimeters. Pipe size is inclusive dimensionally, and includes pipe nominal pipe size (NPS) and tubing outside diameter.

A. Hot-Water, Steam, and Condensate-Return Piping - Insulation shall be mineral fiber with glass cloth jacket, Type T-2. Thickness shall be not less than that given in the following list. Aboveground pipes, valve bodies, fittings, unions, flanges, and miscellaneous surfaces shall be insulated.

PIPE SIZE (DN), mm	INSULATION THICKNESS, mm
Up to 100	25
100 to 250	40
250 to 300	50

B. Cold-Water and Condensate-Drain Piping

1. Aboveground outdoor pipes, valve bodies, fittings, unions, flanges, and miscellaneous surfaces shall be insulated.

2. Insulation shall be mineral fiber with glass cloth jacket, Type T-2.

C. Refrigerant Suction Piping - Insulation shall be cellular-elastomer, Type T-3. Thickness shall be nominal . Surfaces, including valve, fittings, unions, and flanges, shall be insulated.

D. Cooling-Tower Circulating Water Piping

1. Insulation shall be cellular-elastomer, Type T-3. Thickness shall be not less than that given in the following list. Aboveground outdoor pipes, valve bodies, fittings, unions, flanges, and miscellaneous surfaces shall be insulated.

PIPE SIZE (DN), mm	THICKNESS EXPOSED TO WEATHER, mm
Up to 50	15
50 to 150	20
150 and larger	25

2. Thickness inside buildings shall be for all pipe sizes.

3. Insulation shall be mineral fiber with aluminum jacket, Type T-6. Thickness shall be not less than that indicated. Aboveground pipes, valve bodies, fittings, unions, flanges, and miscellaneous surfaces shall be insulated.

E. Hot Water Heating Converter - Insulation shall be calcium silicate with glass cloth jacket, Type T-7. Thickness shall be .

F. Chilled-Water and Space Heating Hot Water Pumps - Insulation shall be cellular elastomer, Type T-9. Thickness shall be . Surfaces subject to condensation shall be covered, and a vapor-barrier coating shall be supplied.

G. Low-Pressure Steam and Condensate, Weather-Exposed - Insulation shall be calcium silicate with weatherproof jacket, Type T-17. Thickness shall be not less than that indicated in the following list. All

systems shall be insulated.

PIPE SIZE (DN), mm	INSULATION THICKNESS, mm
100	40
250 and larger	50

PART 3 EXECUTION

3.1 INSTALLATION OF INSULATION SYSTEMS

Contours on exposed work shall be smooth and continuous. Cemented laps, flaps, bands, and tapes shall be smoothly and securely pasted down. Adhesives shall be applied on a full-coverage basis.

Insulation shall be applied only to system or component surfaces that have been tested and approved.

Joints shall be tight with insulation lengths tightly butted against each other. Where lengths are cut, cuts shall be smooth and square and without breakage of end surfaces. Where insulation terminates, ends shall be neatly tapered and effectively sealed, or finished as specified. Longitudinal seams of exposed insulation shall be directed away from normal view.

Materials shall be applied in conformance with the recommendations of the manufacturer.

Surfaces shall be clean and free of oil and grease before insulation adhesives or mastics are applied. Solvent cleaning required to bring metal surfaces to such condition shall be provided.

3.2 SYSTEM TYPES

A. Type T-1, Mineral Fiber with Vapor-Barrier Jacket

1. Piping shall be covered with mineral-fiber pipe insulation with factory- and field-attached vapor-barrier jacket. Vapor seal shall be maintained. Jackets, jacket laps, flaps, and bands shall be securely cemented in place with vapor-barrier adhesive. Jacket overlap shall be not less than . Jacketing bands for butt joints shall be wide.

2. Exposed-to-view fittings and valve bodies shall be covered with preformed mineral-fiber pipe-fitting insulation of the same thickness as the pipe-barrel insulation. Fitting insulation shall be temporarily secured in place with light cord ties. A thick white indoor vapor-barrier coating shall be applied and, while still wet, wrapped with glass lagging tape with 50 percent overlap, and shall be smoothly blended into the adjacent jacketing. Additional coating shall be applied as needed and rubber-gloved to smooth fillet or contour coating, then allowed to fully cure before the finish coating is applied. On-the-job fabricated insulation for concealed fittings and special configurations shall be built up from mineral fiber and a special mastic consisting of a mixture of insulating cement and lagging adhesive diluted with 3 parts water. Where standard vapor-barrier jacketing cannot be used, the surfaces shall be made vapor tight by using coating and glass lagging cloth or tape as previously specified.

3. Instead of materials and methods previously specified, fittings may be wrapped with a twine-secured, mineral-wool blanket to the required thickness and covered with premolded polyvinylchloride jackets. Seams shall be made vapor tight with a double bead of manufacturer's standard vapor-barrier adhesive applied in accordance with the manufacturer's instructions. All jacket ends shall be held in place with AISI 300 series corrosion-resistant steel straps, thick by wide.

4. Pipe insulation shall be set into an outdoor vapor-barrier coating for a minimum of at maximum spacing and the ends of the insulation sealed to the jacketing with the same material to provide an effective vapor-barrier stop.

5. Staples shall not be used in applying insulation. Vapor-barrier materials shall be continuous over all surfaces, including areas inside pipe sleeves, hangers, and other concealments.

6. Piping insulation at hangers shall consist of density, fibrous-glass inserts or expanded, rigid, closed-cell, polyvinylchloride. Junctions shall be sealed with vapor-barrier jacket where required, glass-cloth mesh tape, and vapor-barrier coating.

7. White-bleached kraft paper side of the jacketing shall be on the side exposed to view.

8. Exposed-to-view insulation shall be finished with not less than a dry-film thickness of nonvapor-barrier coating suitable for painting.

B. Type T-2, Mineral Fiber with Glass Cloth Jacket

1. Piping shall be covered with a mineral-fiber pipe insulation with factory-attached, presized, white, glass cloth. Jackets, jacket laps, flaps, and bands shall be securely cemented in place with vapor-barrier adhesive. Jacket overlap shall be not less than . Jacketing bands for butt joints shall be wide.

2. Exposed-to-view fittings shall be covered with preformed mineral-fiber fitting insulation of the same thickness as the pipe insulation and temporarily secured in place with light cord ties. Impregnated glass lagging tape shall be installed with indoor vapor-barrier on 50 percent overlap basis, and the tape shall be blended smoothly into the adjacent jacketing. Additional coating shall be applied as needed, and rubber gloved to a smooth contour. Ends of insulation shall be taped to the pipe at valves DN50 and smaller. On-the-job fabricated insulation for concealed fittings and special configurations shall be built up from mineral fiber and a mixture of insulating cement and lagging adhesive, diluted with 3 parts water. Surfaces shall be finished with glass cloth or tape lagging.

3. Valves 65 mm and larger and all flanges shall be covered with preformed insulation of the same thickness as the adjacent insulation.

4. Exposed-to-view insulation shall be finished with a minimum

dry-film thickness of nonvapor-barrier coating suitable for painting.

C. Type T-3, Cellular Elastomer

1. Piping-system surfaces shall be covered with flexible cellular-elastomer sheet or preformed insulation. Vapor seal shall be maintained. Insulation shall be cemented into continuous material with a solvent cutback chloroprene adhesive recommended by the manufacturer for the specific purpose. Adhesive shall be applied to both of the surfaces on a 100 percent coverage basis to a minimum thickness of wet or approximately of undiluted adhesive.

2. Insulation on cold water piping shall be sealed to the pipe for a minimum of at maximum intervals of to form an effective vapor barrier. At piping supports, insulation shall be continuous through using outside-carrying type clevis hangers with insulation shield. Cork or wood dowel load-bearing inserts shall be installed between the pipe and insulation shields to prevent insulation compression.

3. At pipe hangers or supports where the insulation rests on the pipe hanger strap, the insulation shall be cut with a brass cork borer and a No. 3 superior grade cork inserted. Seams shall be sealed with approved adhesive. Sweat fitting shall be insulated with miter-cut pieces of cellular elastomer insulation of the same nominal pipe size and thickness as the insulation on the adjacent piping or tubing. Miter-cut pieces shall be joined with approved adhesive. Covers shall be slit and sapped over the fitting, and joints shall be sealed with approved adhesive.

4. Screwed fittings shall be insulated with sleeve-type covers formed from miter-cut pieces of cellular elastomer thermal insulation having an inside diameter large enough to overlap adjacent pipe insulation. Pipe insulation shall be butted against fittings. Overlap shall be not less than . Adhesive shall be used to join cover pieces and cement the cover to the pipe insulation.

5. Surfaces exposed to view or ultraviolet light shall be finished with a minimum dry-film thickness application of a polyvinylchloride lacquer recommended by the manufacturer, and applied in not less than two coats.

D. Type T-4, Cellular Glass with Vapor-Barrier Jacket

1. Piping shall be covered with cellular glass insulation and factory- and field-attached vapor-barrier jacket. Vapor seal shall be maintained. Jackets, jacket laps, flaps, and bands shall be securely cemented in place with vapor-barrier adhesive. Jacket overlap shall be not less than wide. Insulation shall be continuous through hangers. Insulation shall be bedded in an outdoor vapor-barrier coating applied to all piping surfaces.

2. Flanges, unions, valves, anchors, and fittings shall be insulated with factory premolded or prefabricated or field fabricated segments of insulation of the same material and thickness as the adjoining pipe insulation. When segments of insulation are used,

elbows shall be provided with not less than three segments. For other fittings and valves, segments shall be cut to the required curvature or nesting size.

3. Segments of the insulation shall be secured in place with twine or copper wire. After the insulation segments are firmly in place, a vapor-barrier coating shall be applied over the insulation in two coats with glass tape imbedded between coats. First coat shall be tinted, the second shall be white to ensure application of two coats. Coatings shall be applied to a total dry-film thickness of minimum. Glass tape seams shall overlap not less than and the tape end not less than .

4. Instead of materials and methods specified above, fittings may be wrapped with thick, vapor-barrier, adhesive-coated strips of cellular elastomer insulation. Insulation shall be under tension, compressed to 25 percent of original thickness, and wrapped until overall thickness is equal to adjacent insulation. Cellular elastomer shall be secured in place with twine and sealed with vapor-barrier coating applied to produce not less than 1.6 mm dry-film thickness. Fittings shall then be covered with premolded polyvinylchloride jackets. Seams shall be made vapor-tight with a double bead of manufacturer's standard vapor-barrier adhesive applied in accordance with the manufacturer's instructions. Jacket ends shall be held in place with AISI 300 series corrosion-resistant steel straps, thick by wide.

5. Anchors secured directly to piping shall be insulated, to prevent condensation, for not less than from the surface of the pipe insulation.

6. White-bleached kraft paper side of jacketing shall be on the side exposed to view. Exposed-to-view insulation shall be finished with not less than a dry-film thickness of nonvapor-barrier coating suitable for painting.

E. Type T-5, Calcium Silicate with Glass Cloth Jacket (at Supports Only) - Piping shall be covered with a calcium-silicate pipe insulation with factory attached and presized, white, glass cloth. Jackets shall be field applied when required. Jackets, jacket laps, flaps, and bands shall be securely cemented in place with vapor-barrier adhesive. Jacket overlap shall be not less than . Jacketing bands for butt joints shall be 100 mm wide. Fittings shall be fabricated from segmented pipe barrel sections bedded in general purpose insulating cement and wired in place. Voids shall be filled with general purpose insulating cement with not less than thick, final coating. Glass lagging tape shall be impregnated with lagging adhesive, wrapped with a 50 percent overlap, and be blended smoothly into adjacent jacketing. Additional adhesive shall be applied as needed and rubber-gloved to a smooth contour.

F. Type T-6, Mineral Fiber with Aluminum Jacket

1. Piping shall be covered with mineral-fiber pipe insulation with factory-attached or field-applied aluminum jacketing.

2. Fittings and valve bodies shall be covered with preformed mineral-fiber pipe-fittings insulation of the same thickness as

the pipe-barrel insulation. Fitting insulation shall be secured temporarily in place with light cord ties. A coating of vapor-barrier mastic shall be applied and, while still tacky, wrapped with glass lagging tape.

3. Additional mastic shall be applied as needed and rubber-gloved to smooth fillets or contours. On-the-job fabricated insulation for special configurations shall be built up from mineral fiber and a mixture of insulating cement and lagging adhesive diluted with 3 parts water. Only where standard aluminum jacketing cannot be used, the surfaces shall be made vapor-tight by using mastic and glass lagging cloth or tape as specified above with an added finish coat of mastic.

4. Pipe insulation shall be set into outdoor vapor-barrier coating for a minimum of at maximum spacing. Ends of the insulation shall be sealed to the jacketing with the same material to provide effective vapor barrier stops.

5. Vapor barrier shall be continuous over all surfaces, including areas inside pipe sleeves, hangers, and other concealment.

6. Piping insulation shall be applied to both sides of pipe hangers. Junctions shall be insulated with a special mixture, glass cloth mesh tape, and mastic as previously specified.

7. Jacket laps, flaps, and bands shall be securely cemented in place with aluminum jacket sealant. Jacketing bands for butt joints shall be wide.

8. Joints, wherever possible, shall be lapped against the weather so that the water will run off the lower edge. Laps shall be in accordance with the pipe drainage pitch. Longitudinal laps on horizontal lines shall be located 45 degrees below the horizontal centerline and alternately staggered . Jacketing material shall be lapped a minimum of , circumferentially sealed with mastic, and strapped to provide a waterproof covering throughout. Straps shall be located on center and shall be pulled up tight to hold jacketing securely in place. Screws shall be used in addition to straps when necessary to obtain a waterproof covering. Extra straps shall be placed on each side of supporting devices and at openings. Where flanging access occurs, a chamfer sheet shall be strapped to the pipe at jacketing.

9. Exposed longitudinal edges of aluminum jacketing shall be stiffened by bending a hem on one edge.

10. Expansion joints shall provide for maximum and minimum dimensional fluctuations.

11. To prevent corrosion, the aluminum jacketing shall not come in direct contact with other types of metal.

12. At openings in jacket, an outdoor vapor-barrier coating shall be applied for in all directions. Jacketing shall be applied while waterproofing is tacky.

13. Screws shall be used at each corner of each sheet, at fitting jackets, and as necessary for the service. Number 7, long,

binding-head aluminum sheet metal screws shall be placed through the mastic seal.

G. Type T-9, Cellular Elastomer

1. Pump surfaces shall be solvent cleaned. Not less than of general purpose insulating cement shall be applied, mixed with nonvapor-barrier adhesive diluted with 3 parts water, to achieve smooth surface and configuration contours. After all water has been removed, surfaces shall be covered with thick cellular elastomer insulation attached and joined into a continuous sheet with an outdoor vapor-barrier coating recommended by the insulating manufacturer for the specific purpose. Coating shall be applied to both of the surfaces on a 100 percent coverage basis with a minimum thickness of 0.254 mm wet, or approximately of undiluted coating. Coating shall be blended into the adjacent flange insulation, and the joint covered with a band of cellular elastomer equal to the flange assembly width. Same coating shall be used to seal insulation to the casing at penetrations and terminations. Pumps shall be insulated in a manner that will permit insulation to be removed to repair or replace pumps.

2. Insulation shall be finished with a 0.051 mm minimum dry-film application of a polyvinylchloride lacquer coating recommended by the manufacturer and applied in not less than two coats.

H. Type T-10, Mineral-Fiber Fill - Voids surrounding pipe shall be packed with mineral-fiber fill.

I. Type T-17, Calcium Silicate Weatherproof Jacket (for Supports Only) - Piping system surfaces shall be covered with calcium silicate insulation. Fittings and valve bodies shall be covered with preformed insulation of the same material and thickness as the adjoining pipe insulation.

SECTION 15400

PLUMBING SYSTEMS
12/01

PART 1 GENERAL

1.1 SUMMARY

This section specifies requirements for plumbing.

1.2 REFERENCES

Air Conditioning and Refrigeration Institute (ARI)

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

Uniform Plumbing Code 2000

American Gas Association (AGA)

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

American National Standards Institute (ANSI)

ANSI A112.18.1M	Plumbing Fixture Fittings
ANSI A112.19.1M	Enameled Cast Iron Plumbing Fixtures
ANSI A112.19.2M	Vitreous China Plumbing Fixtures
ANSI A112.19.3M	Stainless Steel Plumbing Fixtures (Designed for Residential Use)
ANSI A112.19.5	Trim for Water-Closet Bowls, Tanks, and Urinals (Dimensional Standards)
ANSI Z358.1	Emergency Eyewash and Shower Equipment
ANSI Z53.1	Safety Color Code for Marking Physical Hazards

American Society of Mechanical Engineers (ASME)

ASME A112.6.1M	Supports for Off the Floor Plumbing Fixtures for Public Use
ASME A112.21.1M	Floor Drains
ASME B1.20.7	Hose Coupling Screw Threads
ASME B1.21M	Metric Screw Threads - MJ Profile
ASME B16.1	Cast Iron Pipe Flanges and Flanged

Fittings

American Society of Sanitary Engineering (ASSE)

ASSE 1010	Water Hammer Arresters

American Society for Testing and Materials (ASTM)

ASTM A126	Gray Iron Castings for Valves, Flanges, and Pipe Fittings
ASTM A176	Stainless and Heat-Resisting Chromium Steel Plate, Sheet, and Strip
ASTM B88M	Seamless Copper Water Tube (Metric)
ASTM C547	Mineral Fiber Preformed Pipe Insulation

American Waterworks Association, Inc. (AWWA)

AWWA C104	Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
AWWA C500	Gate Valves for Water and Sewerage Systems
AWWA C506	Backflow Prevention Devices - Reduced Pressure Principle and Double Check Valve Types
AWWA C700	Cold Water Meters - Displacement Type, Bronze Main Case

Foundation for Cross-Connection Control and Hydraulic Research (FCCHR)

FCCHR-01	Manual of Cross-Connection Control

Manufacturers Standardization Society of the Valve and Fittings Industry (MSS)

MSS SP-80	Bronze Gate, Globe, Angle and Check Valves

National Fire Protection Association (NFPA)

NFPA 54	National Fuel Gas Code

Plumbing and Drainage Institute (PDI)

PDI WH 201	Water Hammer Arrestors Standard

Southern Building Code Congress International (SBCCI)

SBCCI-02	Standard Plumbing Code

California Building Standards Commission

CPC	California Plumbing Code

1.3 DESIGN REQUIREMENTS

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

Plumbing systems shall be provided and shall include the water supply system, the waste and vent system, and all required plumbing fixtures and fittings. Plumbing fixtures and fittings shall be selected in accordance with the water conservation guidelines as described in SBCCI-02, Appendix J.

1.4 SUBMITTALS

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

SD-04, Drawings

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

SD-04, As-Built Drawings

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

SD-07, Schedules

Material, equipment, and fixture lists shall be submitted for plumbing systems.

SD-09, Reports

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

SD-19, Operation and Maintenance Manuals

Provide six copies for all appliances.

PART 2 PRODUCTS

2.1 WATER SUPPLY SYSTEM COMPONENTS

A. Pipe and Fittings - As specified in Section 15050, Basic Mechanical Materials and Methods.

B. Valves and Specialties

1. Gate Valves - Valves shall be designed for a minimum of 1. Valves shall have screw joints. Valves smaller than DN80 shall be all brass and shall conform to MSS SP-80, Type I. Valves DN80 and larger shall be iron-body, brass-mounted, conforming to AWWA C500.

2. Vacuum and Relief Valves - Vacuum and relief valves shall be of size and type to relieve pressure and prevent the formation of a vacuum. Valves shall automatically remove air from the lines

when the lines are being filled and admit air into the lines when water is being withdrawn in excess of the inflow.

3. Hose Faucets

a. Hose faucets shall be constructed with male inlet threads, hexagon shoulder, and 20 mm hose connection, conforming to ANSI A112.18.1M. Hose-coupling screw threads shall conform to ASME B1.20.7 and ASME B1.21.M.

b. Vandalproof, atmospheric-type vacuum breaker shall be provided on discharge.

4. Globe Valves - Valves shall be , bronze body, conforming to MSS SP-80. Disk shall be free to swivel on the stem. Composition seating surface disk construction may be substituted for all-metal disk construction. Packing shall be a woven non-asbestos material, impregnated with not less than 25 percent, by weight, tetrafluoroethylene resin.

5. Check Valves

a. Standard check valves in sizes DN50 and smaller shall be swing check conforming to MSS SP-80. Lift checks (lift check horizontal) and 860 kPa valves conforming to MSS SP-80 shall be provided.

b. Check valves in sizes DN65 and larger shall be cast iron, bronze trim, swing type. Valve bodies shall be cast iron, conforming to ASTM A126, Class A. Valve ends shall be flanged in conformance with ASME B16.1. Swing-check pin shall be AISI Type 304 corrosion-resistant steel. Valves shall have bolted and gasketed covers.

6. Backflow Prevention Devices

a. Backflow prevention devices shall conform to AWWA C506.

b. Devices DN50 ips and smaller with moving components defined in AWWA C506 shall be constructed of nonferrous metals. Nonmetal components of such devices shall be rated for the applicable service temperature.

c. Bodies of devices DN65 and larger shall be corrosion-resistant ferrous material or bronze, with flanged connections. Metallic operating components and trim shall be nonferrous. Nonmetallic parts shall be rated for the applicable service temperature.

d. External surfaces of devices used in conjunction with equipment with polished or chrome-plated surfaces shall be similarly finished.

e. External surfaces of devices may be rough castings where these devices are used outside the building or in equipment rooms. Devices shall be protected from freezing and shall be installed, tested, and used in conformance with the manufacturer's instructions.

f. Air gaps shall be at least two times the supply pipe diameter,

but not less than 25 mm, as measured vertically, from the flood rim of the supplied device. There shall be no provision for a temporary bypass line around the air gap or water supply tank and pump.

g. Atmospheric Vacuum Breakers (AVB) shall be used only where no back-pressure may occur. Atmospheric vacuum breakers will only provide protection against back-siphonage of nontoxic pollutants. AVB shall be installed downstream of the last shutoff valve and at least above the highest sprinkler head or outlet. AVB shall not be installed where it will be under continuous pressure for more than 12 hours in any 24-hour period. AVB shall be installed in an accessible location.

h. Type PVB pressure vacuum breaker devices shall be used only where there is no possibility of back-pressure. PVB shall be installed in an accessible location to facilitate inspection and servicing. PVB shall be installed a minimum of above the highest outlet, shall conform to ASSE 1010, and shall have tightly closing shutoff valves on each end, and be fitted with properly located test cocks. PVB devices may have pressure on downstream side and may be used for back-siphonage only against pollutants or contaminants.

i. Type DC backflow devices or assemblies are used for low degree of hazard nonpollutants or contaminants. This device shall conform to AWWA C506 and FCCHR-01. This unit shall be installed a minimum of above the ground or flood level. When installed in a pit, a drain must be provided. This assembly device must be furnished with tightly closing shutoff resilient seated valves on each end, and be fitted with properly located test cocks. Outside locations shall include protection against freezing. Critical facility potable water systems and DN65 and larger shall have dual-parallel installation that should be installed in accessible locations.

j. Reduced pressure principle devices shall conform to AWWA C506 and FCCHR-01. This unit shall be installed a minimum of above ground or flood level. This unit shall include tightly closing shut-off valves on each end, and be fitted with properly located test cocks. Indoor installations shall include an airgap-equipped drain adequate for relief valve discharge. Outside installations shall include protection against freezing. Critical water supplies shall have dual-parallel installations that should be installed in accessible locations.

7. Water Meters - Positive displacement disk meters shall coform to AWWA C700, except as otherwise noted. Parts wetted by water shall be bronze. Casing shall be flanged in sizes DN65 and larger. Registers shall be magnetic drive, straight reading. Maximum pressure drop at maximum capacity shall not exceed for meters sized DN40 ips and smaller, and for meters ips and larger.

8. Goosenecks - Copper tubing for gooseneck connections shall conform to ASTM B88M, Type A, annealed.

9. Service Stops - Service stops shall be waterworks ground-key type, oval flowway, T-handle, without drain. Pipe connections

shall be suitable for the type of service pipe used. Parts shall be cast red brass having a nominal composition of 85 percent copper, 5 percent tin, 5 percent lead, and 5 percent zinc, with female ips connections designed for a minimum pressure of .

10. Valve Boxes

a. Valve boxes shall be cast iron, complete with covers. Cast-iron boxes shall be extension type with slide adjustments and with flared bases. The word "WATER" shall be cast in the cover. Boxes shall be installed over each underground gate valve. Boxes shall be of such a length as can be adapted, without full extension, to the depth of cover required over the pipe at the valve location.

b. Provide boxes sufficiently long to have covers flush with finished surface, and allow an additional 75 mm of upward adjustment. Provide guide rings where operating rods are longer than .

c. Minimum 5 mm thick construction; extension type with screw or slide adjustments and flared bases. Valves diameter and under - Fitted with diameter shaft. Valves diameter and larger - Fitted with 133 mm diameter shaft. Bases - Fitted to valve. Internal and external surfaces - Coated with bituminous sealer conforming to AWWA C104.

11. Valve Manholes - Valve manholes shall be constructed in accordance with the designed details.

12. Water-Hammer Arresters - Water-hammer arresters shall be commercially manufactured products consisting of bellows arranged to absorb the energy of pressure waves generated by valve closure in a line in which water is flowing. Arresters shall be nonferrous construction, shall be rated as to capacity, and shall be certified in accordance with PDI WH 201.

13. Wall Hydrants - Wall hydrants shall have brass wall-boxes with nozzles and detachable T-handle and shall be provided with vandalproof type BAT vacuum breakers. Exterior surfaces shall be chrome-plated.

C. Storage-Type Water Heaters

1. Storage-type water heaters shall be gas-fired type unless specified otherwise. Gas-fired water heaters shall be installed in accordance with NFPA 54.

2. Water heaters shall be commercially available models. Model selected shall be of the energy efficient type insulated to an R value of at least K/W.

3. Temperature- and pressure-relief valves shall conform to AGA Z21.22. Type I; combination pressure- and temperature-relief valves shall be installed when the heat input is less than and when the storage is less than . When either or both of the specified conditions are reached or exceeded, Type II, temperature relief, water rated valves shall be installed. Vacuum-relief valves shall be installed on each cold-water branch

connection on the bottom of the water heaters at an elevation above the top of the heater. Vacuum relief valve shall be designed to prevent water heater damage from a reverse flow vacuum.

D. Plumbing Fixtures and Trim

1. Vitreous-china and enameled cast-iron plumbing fixtures shall be white, and shall be the product of the same manufacturer.

2. Exposed traps and double-cone supply tubes for fixtures and equipment shall be connected to rough-piping at the wall, unless otherwise specified in the contract documents. Floor and wall plates shall be as specified herein or as covered by the outfit numbers. Exposed-to-view fixture trimmings, fittings, and fasteners shall be chromium-plated or nickel-plated brass with polished, bright surfaces.

3. Supplies and wastes for lavatories shall be to wall, except as otherwise indicated on the construction drawings. Sleeves are not required at penetrations.

4. Rubber compression type connections are not acceptable. Brass ferrule type fittings shall be required.

5. Fixtures Supports - Wall-hung fixtures shall be supported by ferrous-metal carriers suited to the particular installation conditions. Carriers may be combination type with adjustable fittings. Water closets and urinals shall have supporting feet not less than long. Lavatories shall be supported from the wall by wall-carriers with concealed arms.

6. Lavatories

a. Lavatories and fittings shall conform to ANSI A112.19.2M.

b. Type L-S lavatories shall be Type V, slab type, Class 4, wall hung, by . Inside opening shall be substantially rectangular.

c. Type L-B lavatories shall be Type I, straight back, by . Inside opening shall be substantially rectangular.

d. Type L-C lavatories shall be Type IV, countertop, Class 2, oval flat rim, beadless, self-rimming with rounded rim corner and back ledge, front overflow, oval shaped, seamless, and mirror finish. Materials shall be thick corrosion-resistant steel conforming to ASTM A176, Class 302, A, annealed. Internal size of the lavatory shall be by by deep. Bowls shall be coated externally with sound deadening, nonmarring mastic.

e. Supply fittings shall conform to applicable requirements for faucets in ANSI A112.19.2M.

f. Supply fitting shall be a 100 mm, centerset type with a vandalproof aerator.

g. Supply fitting spout angle and length over the bowl shall provide a water-free back ledge. Horizontal distance from the centerline of the spoutless aerator to the centerline of the supply piping

shall be not less than , and the vertical distance between the centerline of the spout, less aerator, and the fitting base shall be not less than . Supply fittings with handles capable of being turned 360 degrees are not acceptable.

h. Supply piping shall be chrome-plated brass and threaded in accordance with the requirements of ANSI A112.19.2M.

i. Drain fittings shall conform to ANSI A112.19.2M, strainer drain, but with perforated removable strainer and DN32 tailpiece. Adjustable P-trap, with cleanout, shall be Type I.

j. Corrosion-resistant steel lavatories shall be equipped with corrosion-resistant steel drain fittings.

7. Service Sinks

a. Service sinks and fittings shall conform to ANSI A112.19.1M, ANSI A112.19.2M, and ANSI A112.19.3M.

b. Type SS-W service sinks shall be single bowl, mounting trap standard with high nondrilled back, and without a finished apron. Supply fittings shall be a chrome-plated spout, Type SS-W, single, compression, with vacuum breaker and hose with holding bracket.

c. Waste shall be to the wall. P-trap shall be cast iron with acid-resisting enamel inside, brass clean-out plug, and strainer.

d. Type SS-F service sinks shall be single bowl, mounting floor with high nondrilled back, floor-corner mounted, curved or straight front, and enameled cast iron with rim guard. Sinks shall be by overall, back height from the floor, and 150 mm deep. Supply fittings shall be single, compression, with vacuum breaker and 1200 mm hose with holding bracket. Drain fittings shall be .

e. Type SS-T service sinks shall be single bowl, three-side access, floor mounted, terrazzo, with four-side cap-tiling flange, and fabricated from Class 302, annealed corrosion-resistant steel. Fixtures shall be by overall and high. Supply fittings shall be a DN250 spout, chrome-plated, single, compression, with vacuum breaker and hose with holding bracket. Drain fittings shall be .

8. Urinals and Fittings

a. Urinals shall be top-connected, wall-hung bowl with integral flush distribution, wall-hung with integral trap and extended shields, or washout flushing action, in conformance with ANSI A112.19.5 with flush valve.

b. Flush valve shall be exposed flushometer, large diaphragm and large piston, side oscillating handle, with inlet and outlet pipe connections, a vacuum breaker and screwdriver stop, constructed for quiet operation. Exposed parts shall be chrome-plated.

9. Water Closets

a. Water closet, Type WC-1, shall be office and industrial type,

elongated bowl with flush valve, siphon, jet, and wall outlet, in conformance with ANSI A112.19.5, constructed for quiet operation. Seat shall be elongated, open-front, solid-molded, high-impact, polystyrene, white, with check hinge, less cover. Flush valve shall be exposed flushometer, large diaphragm and large piston, side oscillating handle with vacuum breaker and screwdriver stop, constructed for quiet operation.

b. Women's room outfit, Type WC-2, shall be identical, except that seat shall be elongated bowl, industrial, open front with cover. Bumper shall be provided on flush valve.

10. Shower Fittings - Shower fittings shall conform to ANSI Z358.1 with concealed piping and pressure-balancing mixing valve. Shower head shall be Type I, Class 2, adjustable spray.

11. Emergency Shower and Shower Equipment - Emergency shower shall conform to ANSI Z358.1. Markings identifying emergency shower shall be as detailed on plans conforming to ANSI Z53.1. Install only eyewash/shower combination units north of Hunsaker Road and east of Lindbergh Road, as the more restrictive CAL-OSHA regulations apply to these areas.

12. Electric Water Cooler - ARI 1010, floor or wall-mounted as indicated, bubbler style, air-cooled condensing unit, 15 L/h steel splash receptor, and all stainless steel cabinet. Provide ASME A112.6.1M concealed wall hangers with thru-bolts and back plates for mounting on wall hung coolers. CFC refrigerants are not allowed.

13. Wheelchair Electric Water Cooler - ARI 1010, wall-mounted bubbler style with ASME A112.6.1M concealed chair carrier, air-cooled condensing unit, 18 L/h minimum capacity, stainless steel splash receptor, and all stainless steel cabinet, with clearance from front bottom of unit to floor and maximum spout height above floor. Bubblers shall also be controlled by push levers, by push bars, or touch pads one on each side or one on front and both sides of the cabinet. CFC refrigerants are not allowed.

2.2 SANITARY DRAIN, WASTE, AND VENT SYSTEM (DWV)

A. DWV Piping - As specified in Section 15050, Basic Mechanical Materials and Methods.

B. Sanitary Drain Waste and Vent Fixtures

1. Floor Drains (FD)

a. Floor drains shall be complete with traps and bottom outlets.

b. Floor drains located in slabs on earth shall have hub outlets. Drains in slabs not on earth shall have threaded outlets or hub outlets, as required to match piping used.

c. Floor drains shall have integral seepage pans and weepholes.

d. Floor drains fitted with membrane or metal-pan waterproofing shall have clamping-collar assemblies.

e. Ferrous floor-drain surfaces, except the top of grates, shall be given a heavy coating of coal-tar enamel. Coating shall be applied at the factory or in the field before installation and before any rusting has occurred.

f. Type FD-1 floor drains shall conform to ASME A112.21.1M and as indicated. Adjustable collar strainer and fasteners shall be nickel-bronze. Exposed-to-view surfaces shall be satin polished, except in mechanical rooms. Strainer holes shall be square. Strainer diameter shall be nominal . Strainer and body shall be capable of sustaining specified platen load of not less than with not more than deflection with load applied within 5 seconds. Strainer-free area shall be not less than .

2. Cleanouts (CO)

a. Cleanouts shall be per CPC, Chapter 10, and shall be effectively gastight and watertight, sized to provide quick and easy access for plug removal and rodding tools in their specific location. Cleanouts shall be aesthetically located with respect to tile patterns, masonry bond, and alignment.

b. Cleanouts in ceramic-tile and resilient-tile flooring and wall finish shall be rectangular.

c. No cleanout plug shall terminate in or above a finished floor or wall surface except in stack bases and where indicated on the construction drawings.

d. Cleanouts fitted with membrane or metal-pan waterproofing shall have integral seepage pans and weepholes, and clamping-collar assemblies.

e. Cleanouts set outside the building and all cleanouts in building floors shall have adjustable housings.

f. Cast-iron bodies shall be coated with manufacturer's standard material.

1) Type CO-1 for yard cleanouts set in concrete driveways, concrete floors in machine shops, equipment rooms, garages, or heavy vehicular traffic areas. Cast-iron body and setscrew-adjustable housing with deep-set tractor-type cast-iron scoriated cover. Construction shall be heavy duty, suitable for AASHTO H-10 loading.

2) Type CO-2 for heavy-duty service in laboratories, test rooms, and similar areas with finished concrete floors. Cast-iron body and setscrew-adjustable housing with deep-set tractor-type polished nickel-brass or nickel-bronze scoriated cover. Construction shall be heavy duty, suitable for AASHTO H-10 loading.

3) Type CO-3 for building floor areas subject to wheeled traffic loads not as heavy as CO-2 service. Usual selection would be laboratories, test rooms, and similar spaces with finished concrete or tiled floors. Cast-iron body and adjustable housing with polished nickel-brass or nickel-bronze heavy-duty frame and scoriated secured cover. Cover thickness shall be not less than .

4) Type CO-4 for resilient-flooring materials. Cast-iron body and adjustable housing with cover recessed to a depth to accommodate specified resilient-flooring material. Surfaces and fasteners exposed to view shall be constructed of polished nickel-bronze or approved nickel-brass.

5) Type CO-5 for terrazzo-finished floors. Cast-iron body and adjustable housing with minimum recessed anchor cover. Surfaces and fasteners exposed to view shall be constructed of nickel-bronze or approved nickel-brass. Cover shall be equipped with lifting screw.

2.3 SUPPORTING ELEMENTS

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

2.4 INSULATION

Hot-water-piping insulation shall be fiberglass with factory-applied jacket conforming to ASTM C547.

Composite UL-listed jacket and insulation shall have a fire-hazard Classification of flame-spread 25, smoke-developed 50. Wall penetrations shall be sleeved with foamed, flexible insulation, continuous through the sleeve.

Potable hot- and cold-water lines shall be insulated to the extent shown with foamed, flexible insulation. Insulation shall be slipped onto the pipe before making up fittings. Butt joints shall be sealed with adhesive as recommended by the insulation manufacturer. Outdoor insulation shall be coated with an ultraviolet light protective coating recommended by the insulation manufacturer.

For pipe hangers and supports where the insulation rests on the strap of the adjustable clevis pipe hanger, the insulation shall be cut with a brass cork-borer and a number 15 superior grade cork shall be inserted. Seams shall be sealed with suitable adhesive. Cork shall be centered on the strap. Length of the cork shall be modified to suit the insulation thickness.

Fitting shall be insulated with miter-cut pieces of pipe insulation of the same size as applied to the adjacent pipe. Miter-cut pieces shall be joined with adhesive, the covers slit, snapped over the fittings, and the joints sealed with adhesive.

After the piping system has been installed, tested, and placed in satisfactory operation, the hanger load nut above the clevis shall be firmly tightened to ensure proper hanger performance. A nipple shall be placed over the 13 mm diameter clevis bolt as a spacer to ensure that the lower U-strap will not move in on the bolt and deform or compress the insulation.

PART 3 EXECUTION

3.1 EXCAVATION AND BACKFILL

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

3.2 TESTS

Plumbing systems shall be tested to prove tightness of piping and connections and proper operation of equipment and fixtures.

Hydrostatic tests shall be performed by completely filling the piping system with water and eliminating accumulation of air so that any leakage will be immediately apparent. Pressure shall be maintained until pipe under test has been examined, but in no case for less than 1 hour.

Hot- and cold-water piping shall be tested hydrostatically at 1.5 times design pressure or pressure, whichever is higher, for not less than 8 hours with no loss of pressure. Leaks shall be eliminated by replacing the pipe or fitting in question at no additional cost to the Government. Underground hot- and cold-water piping shall be tested before backfilling.

Drainage and venting piping shall be tested before the fixtures are installed. Underground soil and waste piping shall be tested before backfilling. Testing shall be applied to the system in its entirety or in sections.

When the entire system is tested, openings in the pipes shall be tightly closed except the highest opening, and the system shall be filled with water to the point of overflow.

When the system is tested in sections, each opening except the highest opening of the section under test shall be tightly plugged, and each section shall be filled with water and tested with at least water pressure. In testing successive sections, at least the upper of the next preceding section shall be tested so that each joint or pipe except the uppermost 3000 mm of the system has been submitted to a test of at least water pressure. Water shall be kept in the system or in the portion under test for at least 2 hours before the inspection starts. System shall be proved tight at all joints.

3.3 PLUMBING FIXTURES

Materials, equipment, and fixtures shall be installed in accordance with the manufacturer's recommendations. Fixtures and equipment shall be installed to comply with water conservation policy.

Fixtures shall be clean and free of deleterious material before being installed. Before connecting to water, waste, vent, or trap service, the fixture lines shall be blown out with compressed air. During the progress of construction, open ends of fixtures shall be protected at all times to prevent the admission of foreign matter.

3.4 INSULATION

After tests have been completed and surfaces cleaned, insulation shall be installed on hot- and cold-water piping to the extent shown except for chrome-plated brass pipe and other hot-water-exposed supplies to fixtures.

Thickness shall be as required by CCR Title 24, Section 6, and in no case less than for piping DN25 or less, and 25 mm for piping larger than DN25.

Valves and fittings shall be insulated with segments of insulation of the same material and thickness as the adjoining pipe insulation.

3.5 ADJUSTING

Automatic control devices shall be adjusted for proper operation.

3.6 NON-METALLIC UNDERGROUND PIPING

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

3.7 INSTALLATION

Unless otherwise specified in the drawings, final connections to equipment shall have a straight run of 5 times the pipe diameter.

All new work, modifications, changes to natural gas systems to mechanical rooms, etc shall have an approved earthquake valve installed.

SECTION 15500

HEATING, VENTILATING, AND AIR CONDITIONING
12/01

PART 1 GENERAL

1.1 SUMMARY

This section specifies requirements, equipment, material, installation, and testing of heating, ventilating, and air conditioning systems.

1.2 REFERENCES

American Institute of Steel Construction (AISC)

AISC S303	Code of Standard Practice for Steel Buildings and Bridges

Air Movement and Control Association, Inc. (AMCA)

AMCA 210	Laboratory Methods for Testing Fans for Ratings
AMCA 300	Test Code for Sound Rating Air Moving Devices
AMCA 301	Methods for Calculating Fan Sound Ratings from Laboratory Test Data

Air Conditioning and Refrigeration Institute (ARI)

ARI 520	Positive Displacement Refrigerant Compressors, Compressor Units and Condensing Units

American Society of Heating, Refrigerating and Air-Conditioning Engineers Inc. (ASHRAE)

ASHRAE 4	Preparation of Operating and Maintenance Documentation for Building Systems
ASHRAE 52.1	Gravimetric and Dust-Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter
ASHRAE 62	Ventilation for Acceptable Indoor Air Quality

American Society for Testing and Materials (ASTM)

ASTM A36M	Carbon Structural Steel
ASTM A90M	Weight (Mass) of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings

ASTM A123	Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A527M	Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Lock-Forming Quality
ASTM D92	Flash and Fire Points by Cleveland Open Cup

Department of Defense (DOD)

DOD-G-24508	Grease, High Performance, Multipurpose (Metric)

Department of Defense, Military Specifications (MIL)

MIL-F-29177	Filter, Air-Extended Area, Initial Installation
MIL-P-26915	Primer Coating, Zinc Dust Pigmented, for Steel Surfaces

Department of Defense, Military Standards (MIL-STD)

MIL-STD-282	Filter Units, Protective Clothing, Gas-Mask Components and Related Products: Performance Test Methods

National Fire Protection Association (NFPA)

NFPA 70	National Electrical Code
NFPA 90A	Installation of Air Conditioning and Ventilating Systems

Sheet Metal and Air Conditioning Contractors' National Association, Inc. (SMACNA)

SMACNA-85	HVAC Duct Construction Standards - Metal and Flexible
SMACNA-91	Seismic Restraint Manual, Guidelines for Mechanical Systems
SMACNA-92	Fibrous Glass Duct Construction Standards

Underwriters Laboratories Inc. (UL)

UL 181	Factory-Made Air Ducts and Air Connectors
UL 900	Air Filter Units

1.3 SUBMITTALS

Refer to Section 01300, Submittals. Submit the following:

SD-01, Data

Equipment and Performance Data, for items of equipment. Include sound data for supply air-diffusion devices in terms of Noise Criteria (NC) index for capacity range of device.

Manufacturer's Catalog Data, for materials and components for which SD-05 is not provided.

Manufacturer's Standard Color Charts, for items with a factory-finished surface.

SD-04, Drawings

Shop Drawings, for each system. Include exact opening dimensions and location of equipment; schematics for each component; connection and elementary diagrams for systems, and layouts for major components, piping, and ductwork.

As-Built Drawings, for system components and packages.

SD-05, Design Data

Design Analysis and Calculations, for systems designed by Contractor, or designs proposed to be altered by Contractor.

SD-06, Instructions

Manufacturer's Instructions, for system components and packages.

SD-10, Test Reports

Test Reports, for tests performed by Contractor.

SD-13, Certificates

Certificates, for items specified to conform to industry or federal standards.

SD-19, Operation and Maintenance Manuals

Operation and Maintenance Manuals, for each system and each major component thereof.

1.4 PERFORMANCE REQUIREMENTS

HVAC Work - Conform to ASHRAE, SMACNA, and other relevant standards and guidelines listed in Paragraph 1.2 above..

HVAC Appliances and Equipment - Conform to California Energy Efficiency Standards.

1.5 AUTOMATIC CONTROL OF SYSTEMS

Compatible with Siemens Apogee System 600, Center-wide system. Include pneumatic, electronic, electric/electronic, low-voltage electric, or pneumatic/electronic accessories indicated. Sequence of operations controlled - as indicated.

PART 2 PRODUCTS

2.1 PIPING PRODUCTS

Pipe, valves, and fittings - as Specified in Section 15050, Basic Mechanical Materials and Methods, and Section 15400, Plumbing.

2.2 VIBRATION ISOLATORS

A. General

1. Rubber - Natural rubber, Shore A durometer 40 to 60.

2. Elastomer - Chloroprene, Shore A durometer 40 to 60.

3. Weather-exposed metal vibration-isolator parts - Corrosion protected.

4. Springs - Chloroprene coated.

5. Exact mounting sizes and number of vibration isolators - Determined by isolator manufacturer based on equipment that will be installed. Check equipment revolutions per minute and spring deflections to verify that resonance cannot occur.

B. Mountings

1. Type A - Composite pad, with thick elastomer top and bottom layers, molded to contain a pattern with nonslip characteristics in horizontal direction. Elastomer loading: maximum. Minimum overall thickness: . Maximum allowable deflection: .

2. Type B - Double rubber-in-shear or elastomer-in-shear with molded-in steel reinforcement in top and bottom. Maximum allowable deflection: .

3. Type C - Free-standing laterally stable open-spring type for deflections over , with built-in bearing and leveling provisions, thick Type A base elastomer pads, and accessories. Outside diameter of each spring - Equal to or greater than 0.9 times operating height of spring under rated load.

4. Type D - Partially housed type, containing one or more vertically restrained springs with minimum 13 mm clearance maintained around springs, with adjustable limit stops, thick Type A base elastomer pads, and accessories.

5. Type E - Pendulum-suspension configuration, free-standing stable spring with resilient horizontal and vertical restraints to allow movement of maximum in each direction, 6 mm thick Type A base elastomer pads.

6. Type F - Combination spring and rubber-in-shear or elastomer-in-shear steel framed for hanger-rod mounting. Minimum total static deflection: .

C. Bases

1. Type U - Unit isolators without rails, structural-steel bases, or

inertia blocks.

2. Type S - Structural-steel bases common to a supported assembly, made from welded-joint mill-rolled structural steel with closed-perimeter configuration, isolators attached to outrigger supports. Height of steel members - Sufficient to provide stiffness required to maintain equipment manufacturer's recommended alignment and duty efficiency of power-transmission components.

D. Pipe and Duct Vibration Isolation

1. Type G isolators - Devices with in-series contained steel springs and preformed fibrous-glass or chloroprene-elastomer elements for connecting to building-structure attachments. Ensure that devices are loaded by supported system during operating conditions to produce a minimum spring deflection of and elastomer static deflection of .

2. Type H isolators - Devices with contained chloroprene-elastomer elements for connecting to building-structure attachments. Ensure that devices are loaded by supported system during operating conditions to produce a minimum elastomer static deflection of .

3. Type J isolators - Devices with elastomers mounted on floor-supported columns or directly on floor. Ensure that devices are loaded by supported system during operating conditions to produce a minimum elastomer static deflection of .

E. Floor-Mounted Piping - Type K isolators - Devices with springs mounted on floor-supported columns or directly on floor. Ensure that devices are loaded by supported system during operating conditions to produce a minimum spring static deflection of .

F. Vertical Piping

1. Type L isolators - Pipe base-support devices with one or more contained steel springs. Ensure that devices are loaded by supported system during operating conditions to produce a minimum static deflection of . Devices - Equipped with precompression and vertical-limit features, as well as a minimum thick elastomer sound pad and isolation washers for mounting to floor.

2. Type M isolators - Elastomer mounted baseplate and riser pipe-guide devices. Elastomer elements - Contained double acting. Elastomers under rated load - Minimum static deflection of . Isolator sized to accommodate thermal insulation within stationary guide ring.

2.3 INSULATION

Thermal-insulation Materials - Noncombustible, as defined by NFPA 220, and meeting following requirements:

Type	Maximum Thermal Conductivity W/(m K)	Minimum Density kg/m3

Mineral fiber	0.0375	64
Rigid board	0.0635	48
Blanket insulation	0.0389	16
Cellular glass	0.0476	120
Cellular elastomer	0.0389	

Adhesives, Jacketing, and Coatings - As recommended by insulation manufacturer. Coating color - as selected by COTR. Finish coating for cellular elastomer insulation - Polyvinylchloride lacquer approved by manufacturer of cellular elastomer.

All duct insulation shall be on the exterior of the duct only; the interior of all ducting shall be free of any insulating material. Insulation shall not impede access to duct covers/doors used for duct cleaning and maintenance.

2.4 COILS

A. Coil Pressure and Temperature Ratings - Coils designed and tested for following fluid operating pressures and temperatures:

SERVICE	PRESSURE MPa	TEMPERATURE °C	TEST PRESSURE MPa
Steam - low pressure	0.17	131	1.7
Steam - high pressure	1.0	186	1.7
Hot water	1.4	121	1.7
Chilled water	1.4	121	1.7
Volatile refrigerant	1.4	149	2.8

B. Coil Casings - Mill-galvanized sheet metal with minimum zinc coating of of two-sided metal surface conforming to ASTM A527M. Minimum thickness: (16 ga). Casing flanged on four sides for bolted assembly.

C. Coil Headers - Cast iron, brass, copper, or aluminum casting, as indicated.

1. Direct expansion, volatile refrigerant coils - Copper or brass headers with necessary control connections.

2. Steam and water coil headers - Fitted with 6 mm ips spring-loaded plug drains and vent petcocks. Provide automatic vents where needed.

D. Coil Tubing

1. Coils - Constructed of seamless, deoxidized copper tubing with copper fins. Helical coil fins - Wound tight to tubes and solder-coated. Plate fins - Spacer collars in metallic contact with adjacent fin, and fins mechanically bonded to tube. Ensure that bare tube surfaces are not visible within finned portion of coil.

2. Raw coil tube stock - Minimum thickness of wall . Tube minimum outside diameter: .

3. Cooling coils of helical wound copper design - Solder-coated. Tubes - Straight; make turns through headers or return U-bends,

and braze connections and joints. Ensure that coil tubes in water and volatile refrigerant service are parallel and have sufficient intermediate full coil depth supports to prevent sagging of unsupported span due to working fluid pressures and temperatures, and summer and winter coil ambient conditions. Sagging is unacceptable if tube centerline is displaced by more than from centerline of tube connection at outlet header when coils are more than two rows deep and when installed in accordance with manufacturer's instructions. Provide for expansion and contraction so as to preclude sagging and distortion under thermal loads. Slope tubes for free draining.

4. Heating-coil face tube spacing - Maximum on center for outside diameter tubes, for outside diameter tubes, and for smaller tubes.

5. Coil face tube spacing for cooling coils and for helically wound heating coils immediately followed by water-cooling coils - Maximum on center.

6. Coil tube material for superheated-steam service to at - Seamless 90-10 copper-nickel with wall thickness.

E. Coil Circuiting

1. Provide standard or full-circuited water coils with as many full-length tubes in each circuit as there are tubes in depth of coil face. Provide double-circuit water coils with twice as many tubes as for standard coils. Provide half-circuit water coils with half as many tubes as for standard coils, and to next larger whole number where odd numbers are involved.

2. Coils more than two rows deep - Counterflow type, except that for double- or half-circuit coils reasonable deviation from counterflow arrangement will be permitted, provided pressure drop and capacity requirements are met.

F. Drainable Coils - Capable of being purged free of water with compressed air. Self-draining coils - Provide a drain point at end of every tube, pitch coils to that point. Drain provisions include drained headers, U-bends with integral plugs, or nonferrous plugs in cast-iron headers. Ensure that each tube drains substantially dry by gravity alone when drains and vents are open.

G. Testing - Coils factory pressure tested, dehydrated, vacuum tested, purged with inert gas, and sealed before shipment to Worksite. Coil pitch and leveling - Field checked for drainability in presence of COTR.

2.5 UNIT HEATERS

A. General

1. Unit heaters - Suspended type and arranged for discharge of air as indicated on construction drawings. Comply with AGA standards.

2. Casing - Manufactured from minimum thick (20 ga) steel. Casing inside and outside given a phosphate pretreatment, primer, and baked enamel finish. Provide horizontal louvers recessed inside

casing frame.

3. Heat exchangers - Welded construction, heavy-gage aluminized steel, formed in a clam-shell design to completely surround burner. Provide individual combustion chambers for each burner.

4. Burners - Die-formed, aluminum-painted, heavy-gage mild steel with long slot ports for even supply of gas. Burner assembly - Unitized construction with integral crossover for positive burner ignition. Provide a draft diverter as an integral part of each heat exchanger section to allow backdrafts to bypass burner assembly without affecting normal operation.

5. Fans - Propeller type, designed and manufactured for unit heater application; minimum of three aluminum blades per fan.

6. Motors - Totally enclosed, with sleeve bearings and built-in overload protection; mounted to back panel by a fanguard motor mount constructed of spring steel wire.

7. Controls - Include high limit switch, fan controls, a 24 V automatic gas valve with 100 percent safety pilot shutoff, a pressure regulator with leak limiting device, and manual main and pilot valves. Provide an integral junction box for power and control connections.

B. Propeller Unit Heaters (PUH)

1. Unit heaters - Tested and sound rated in accordance with AMCA 300 and AMCA 301; controlled by line-voltage thermostats.

2. Vertical discharge units - Operate at up to 1200 r/min, except that units with output and less operate at up to 1800 r/min. Discharge opening - Covered with a fanguard. Provide louver cone diffusers.

3. Provide adjustable double deflection louvers for horizontal discharge units. Maximum volume and face velocity for horizontal discharge units are:

L/s	m/s
Up to 470	4.1
471 to 1420	4.6
Over 1420	5.1

4. Heating elements - Manufacturer's standard construction, rated for service at minimum at .

5. Casings with smoothly contoured propeller orifice rings - Constructed of minimum thick (20 ga) cold-rolled carbon steel. Casing surface finish includes phosphate pretreatment, prime coating, and baked enamel finish.

6. Propellers - Dynamically balanced, with minimum four aluminum blades. Horizontal-discharge units - Provide with fan inlet safety guard. Motors - Mounted on elastomer vibration isolators.

C. Cabinet Unit Heaters (CUH)

1. Cabinet unit heaters - Quiet-operating type, complete with heating elements, fans and drives, filters, baffles and division walls, control provisions, and enclosures with access panels as necessary. Cabinet - Sized not larger than indicated in detail drawings. Unit pressure components - Rated for service at minimum at system working temperature.

2. Heating element - Manufacturer's standard aluminum fin or serpentine copper-type tube, drainable and ventable. Cataloged capacity of heating element - Constant and permanent. Tube material - Seamless deoxidized copper. Fins - Mechanically connected to tubes. Loose fins at operating temperatures cause a reduction in capacity; replace such material at no additional cost to the Government. Elements with bent fins are not acceptable. Ensure that supports and expansion provisions permit strainfree and noiseless movement of element. Face area of coil - Not less than that indicated in detail drawings.

3. Fan - Centrifugal, forward-curved, double-width, double-inlet type, and statically and dynamically balanced. Fan drives - Direct, except where belt drives are indicated in detail drawings. Belt-driven motors - Fitted with adjustable rails and an adjustable sheave to permit 20 percent adjustment to fan speed. Independent fan shafts - Elastomer mounted in self-aligning antifriction or sleeve-type bearings, with essentially lifetime lubrication. Drives - Two-, three-, or four-speed; switch positions include an off position. Rotating elements - Statically and dynamically balanced. Fan and drive assembly - Vibration isolated. Direct-drive motors - Maximum speed 1200 r/min.

4. Install filters in a bypass-proof frame to ensure filtering of moving air before entry into heating element; filters removable without tools.

5. Enclosure configuration - As indicated in detail drawings. Enclosure surface finish includes manufacturer's standard phosphate pretreatment, prime coat, and baked enamel finish in color as selected by COTR.

6. Backs of recessed units - Insulated with minimum thick density fibrous-glass insulation conforming to NFPA 90A.

7. Sequence of operations - As indicated in Control Diagrams.

D. Unit Ventilators (UV)

1. Unit ventilators - Quiet-operating modular type, complete with heating elements, fans and drives, filters, baffles and division walls, dampers, control provisions, and enclosures with access panels as necessary. Unit pressure components - Rated for service at minimum at system working temperature. Intercomponent wiring - Conform to NFPA 70. Components of unit assembly - UL listed and approved. Provide heating, fan, and control modules with polarized, color-coded, plug-in connections.

2. Heating element - Manufacturer's standard aluminum fin or serpentine copper-tube type, drainable and ventable. Cataloged capacity of heating element - Constant and permanent. Tube

material - Seamless deoxidized copper. Fins - Mechanically connected to tubes. Loose fins at operating temperatures cause a reduction in capacity; replace such material at no additional cost to the Government. Elements with bent fins are not acceptable. Ensure that supports and expansion provisions permit strainfree and noiseless movement of element. Face area of coil - Not less than that indicated in detail drawings.

3. Fans - Centrifugal, forward-curved, double-width, double-inlet type, and statically and dynamically balanced; belt driven, mounted on a common shaft. Shaft - Supported by independent, elastomer-mounted, self-aligning, antifriction or sleeve-type bearings with lifetime lubrication. Motor sheave - Adjustable to provide minimum 20 percent speed variation either way from capacity point. Belt tension - Adjustable. Motors - Manually controlled by two-position on/off switch or by three-position high/low/off switch; elastomer vibration-isolation mounted, permanent split-capacitor type with adjustable rail mounting.

4. Install filters in a bypass-proof frame to ensure filtering of moving air before entry into heating element. Filters removable without tools.

5. Dampers - Opposed-blade type, constructed to resist salt air. Blades - Galvanized steel with mechanically attached or secure sealing provisions not dependent upon adhesives. Bearings - High-grade commercial quality flanged-type with extended race and stainless steel balls and plated races with factory-applied grease conforming to DOD-G-24508. Provide face and bypass damper with external bypass duct if required by unit. Provide mixing dampers as an assembly within a mixing box. Dampers capable of varying proportion of mixed air from 100 percent room air to 100 percent outside air.

6. Enclosure surface finish includes manufacturer's standard phosphate pretreatment, prime coat, and baked enamel finish, except as otherwise provided. Color - As selected by COTR.

7. Wall sleeve - Constructed of minimum thick (18 ga) galvanized carbon steel. Finish consists of manufacturer's standard galvanized surface preparation and minimum two finish coats of baked enamel or one finish coat of high-build epoxy. Color - As selected by COTR.

2.6 FAN COIL UNITS

Units - Type, manufacturer, and model as indicated, or approved equal. Include an enclosure for cabinet models and casing for concealed models.

Enclosure - Constructed of minimum 1.3 mm thick (18 ga) steel, properly reinforced and braced. Discharge louvers - Four-way adjustable, designed to properly distribute air throughout conditioned space. Ferrous-metal surfaces - Galvanized or treated with a rust-inhibiting finish. Exposed-to-view enclosure corners and edges - Rounded. Access doors - Hinged, and provided for piping and control compartments.

Casing - Acoustically and thermally insulated internally with minimum 13 mm thick insulation.

Water coils - Constructed of minimum 13 mm outside diameter seamless copper tubing with copper or aluminum plate fins mechanically bonded or soldered to the tubes, and provided with minimum 16 mm outside diameter control valve.

2.7 AIR HANDLING UNITS (FACTORY ASSEMBLED)

Air Handling Unit - Central-station type, factory fabricated, and sectionally or fully assembled; type, manufacturer, and model as indicated, or approved equal. Fan wheels - Statically and dynamically balanced; dynamic balancing in two planes. Fan rating shall be in accordance with AMCA 210.

Provide one of the following facilities for adjusting fan speed for each air-handling system during air-quantity balancing operations: Variable-pitch drive with variable range; continuously variable drive or power unit; or fixed-pitch pulleys.

Compressor Motors - Hermetically sealed, in accordance with ARI 520, except locate two manually resettable thermal overload protective devices within motor windings.

Exterior Surfaces of Unit Cabinets constructed of Mill-galvanized Steel - Prepared by a phosphatizing treatment, and painted with two coats of manufacturer's standard enamel finish in color selected by COTR.

Provide face and bypass dampers and multizone unit delivery dampers as part of manufacturer's standard unit construction. Add a balancing plate to heating coil when required to equalize resistance in airstreams of multizone units.

Provide double-wall construction for air-handling units located outdoors.

2.8 AIR HANDLING UNITS (FIELD ASSEMBLED)

Air Handling Unit - Central station type of indicated configuration, with enclosure, centrifugal fans, guarded V-belt drives, motors, heating and cooling coils, filters, dampers, vibration isolation provisions, and accessories. Fan wheels - Statically and dynamically balanced; dynamic balancing in two planes. Fan rating shall be in accordance with AMCA 210.

Ceiling - Capable of sustaining scheduled maximum system operating pressure, system testing pressure, and load without permanent deformation or damage. Material - Hot-dip galvanized.

Enclosure Surfaces - Consist of self-supporting ceiling and wall panels mounted on, and fastened to, a concrete curbing. Self-supporting is defined as free of building construction, except building floor.

Coil Supports - Fabricated of structural steel minimum 6 mm thick, hot-dip galvanized after fabrication. Hot-dip galvanizing - Conform to ASTM A123 except that minimum amount of deposited zinc is of single-side surface when tested in accordance with ASTM A90M.

Access Doors - Minimum x , constructed of thick (16 ga) galvanized metal. Provide doors with two heavy-duty hinges with removable pins and two heavy-duty latch sets operable from either side. Latch sets - Cast iron or wrought steel construction with adjustment for wear. Doors - Seal against mechanically retained expanded chloroprene elastomer gaskets.

Provide intermediate-coil, deep drip pans for each tiered coil bank. Provide bottom pans below lowest coil. For tiered cooling coils, extend top pan beyond face of coil, and extend bottom pan minimum beyond base of coil. Where more than two pans are used, make pan extension proportional. Provide adequate supports of same type of material as pans or of hot-dip galvanized angle iron with isolation at interface. Pan material: thick (22 ga), Type 304 stainless steel with silver-soldered joints. Pan - Piped to drain. Exterior of pan - Insulated to prevent condensation.

Eliminators - SMACNA three-break, hooked-edge design, constructed of reinforced thick (16 ga) galvanized steel with assembled brazed joints. Sections - Easily removable for cleaning.

2.9 PACKAGED AIR-CONDITIONING UNITS

A. Window-Type, Packaged, Self-Contained

1. Unit - Packaged self-contained assemblage including hermetic compressor, fans, motor drives, coils and controls for fully automatic operation, intercomponent piping and wiring, totally enclosed weatherproof casing, and frame mounting ready for power connection; provisions for admitting controlled amounts of outside air as makeup and for exhausting internal air; Energy Efficiency Ratio (EER) of 7.5. Refrigerant - R-22; units shipped with a refrigerant holding charge.

2. Controls - Located on front face of unit or with remote thermostat with on/off/fan selector, or at a remote panel. Conditioned-air circulating fan control - Two- or three-speed, gradually adjustable, or solid-state.

B. Console-Type, Packaged, Self-Contained - Floor-mounted assemblage including compressors, fans, motor, drives, coils, water-cooled condenser, controls for fully automatic operation, intercomponent piping and wiring, and a single casing suitable for exposed-to-view office locations ready for field terminal connections. EER of 7.5; units over , EER of 8.2.

C. Remote-Split-Type, Packaged, Self-Contained

1. Air-conditioner - Consists of matched assemblies. Provide each unit complete with frame and enclosure, interconnecting piping and wiring, controls and safety devices, and operating charge of oil. Unit - Ready for full-capacity operation after removal of shipping protection, connection to remote compressor/condenser or condenser, charging, and connection to utilities; shipped with a refrigerant holding charge; exceeding EER of 8.2.

2. Air-cooled condenser - Vertical/horizontal discharge, weather-protected casing; suitable for installation remote from air-conditioning unit. Provide air inlet and discharge grilles with galvanized wire-mesh birdscreens.

3. Water-cooled condensers - Include openings, water and refrigerant connections, purge valves, relief devices, refrigerant valves, liquid-level indicating device, and support provisions.

2.10 DUCTWORK

A. Galvanized Steel Ductwork Materials

1. Galvanized steel ductwork sheet metal - Carbon steel, of lock-forming quality, hot-dip galvanized, with regular spangle-type zinc coating, ASTM A527M, Z275. Phosphatise duct surfaces that will be painted.

2. Sheet metal and reinforcement thicknesses - SMACNA-85.

3. Duct hangers in contact with galvanized duct surfaces - Galvanized steel.

4. Mill-rolled structural steel - ASTM A36M; whenever in contact with sheet metal ducting, galvanize to commercial weight of zinc. Equivalent strength, proprietary-design, rolled-steel structural support systems may be submitted to COTR for approval instead of mill-rolled structural steel.

B. Flexible Duct Materials

1. Flexible duct connectors - UL 181, Class 1 material in accordance with NFPA 90A.

2. Metal duct - Bendable through 180 degrees without damage, with maximum inside bend radius of one-half diameter of duct. Metal - Aluminum or carbon steel. Protective zinc-coat - ASTM A123 or MIL-P-26915.

3. Wire-reinforced cloth duct - Chloroprene or vinyl-impregnated and coated fibrous-glass cloth bonded to and supported by a corrosion-protected spring steel helix. Fabric may be a laminate of metallic film and fibrous glass. Minimum working pressure rating of ducting - Three times maximum system pressure. Temperature range: to .

4. Wire-reinforced fibrous-glass duct - Minimum density fibrous glass bonded to and supported by corrosion-protected spring helix. Vapor barrier: thick minimum, pigmented polyvinylchloride film. Duct - Bendable without damage through 180 degrees, with a maximum inside bend radius of two duct diameters. Minimum wall thickness: . Thermal conductivity - Maximum 0.0332 W/(m K) (Pa s m2) at 24°C mean. Permeance - Maximum 5.75 x /(Pa s m2). Working pressure range: (gage) to (gage). Working temperature range: to Minimum sustained velocity without delamination: . Materials - Conform to NFPA 90A. Acoustic properties - Submit for approval.

C. Manual Volume Dampers

1. Volume damper construction - SMACNA-85.

2. Dampers - Equipped with an indicating quadrant regulator having a locking feature externally located and easily accessible for adjustment. Where damper rod lengths exceed , provide a regulator at each end of damper shaft.

3. Damper shafts - Provide two-end bearings.

4. Splitter damper: thick (22 ga) sheet metal, or two gages heavier than duct in which installed; i.e., thick (20 ga) splitter in thick (22 ga) duct, up to thickness (16 ga) maximum. Hinges - Full length piano-type or thick door type.

5. Damper shaft - Full length and extending beyond damper blade. Use a x shaft for damper lengths up to , and a x shaft for damper lengths above . Where necessary to prevent damper vibration or slippage, provide adjustable support rods with locking provisions external to duct at damper blade end.

6. Dampers in ducts with a width perpendicular to the axis of damper that is greater than - Multiblade type having a substantial frame with blades fabricated of thick (16 ga) metal. Blades - Maximum in width and in length, and pinned or welded to diameter shafts. Dampers greater than in width - Made in two or more sections with intermediate mullions, each section being mechanically interlocked with adjoining section or sections. Provide blades with graphite-impregnated nylon or oil-impregnated sintered bronze bearings, connected so that adjoining blades rotate in opposite directions.

7. Frame for gravity backdraft and relief dampers - Constructed of minimum x , reinforced, thick (16 ga) galvanized carbon steel. Frames and mullions - Solidly secured in place and sealed with elastomer calking against air bypass. Maximum blade width: . Maximum blade length: . Blade material: thick (16 ga) galvanized steel, 1.9 mm thick (14 ga) 6063 or 5052 alloy aluminum, or thick (18 ga) AISI 18-8 stainless steel. Provide blades with mechanically retained seals and 90 degrees limit stops. For dampers used for relief service, provide blades linked together to open 30 degrees minimum on (gage) differential pressure. Shaft bearings - Graphite- impregnated nylon or oil-impregnated bronze.

8. Flexible connectors for sheet metal - UL-listed, , fire-retardant, airtight, woven fibrous-glass cloth impregnated with chloroprene. Clear width, not including clamping section: to .

D. Fire Dampers - Provide fire dampers with wall collars, constructed and labeled in accordance with UL555, in ductwork at fire-rated barriers. Dampers shall be out-of-air stream type suitable for dynamic operations.

E. Combination Fire/Smoke Dampers - Dampers shall have airfoil blades, be both UL555 and UL555S classified. Fire rating shall be at least the same as the rated barrier they are mounted on. Dampers shall be rated as a Leakage Class I Smoke Damper and suitable for dynamic operations. Dampers shall be UL-approved for dual directional airflow. Galvanized steel construction. Dampers shall be complete with manually resettable links, and electronic thermal sensors. Type of actuator, requirements for EP switches, and requirements for built-in or pre-wired smoke detectors shall be as specified on drawings.

2.11 AIR DIFFUSERS

A. General - Provide supply diffusers with combination damper and equalizing grid. Damper - Extracting-splitter type, except where otherwise specified. Provide gaskets for supply-terminal air devices mounted in finished surfaces. Color selection - From manufacturer's standard color chips and approved by the Design Engineer. Use low-velocity systems for ductwork and plenums where maximum air velocity is and maximum static pressure is (gage) positive or negative.

B. Type Air-Diffusion Devices

1. Construction of air-diffusion devices - Aluminum.

2. DRA supply diffuser - Round, with five or more expanding cones with beaded edges to provide hemispherically diffused discharge air. Cones - Arranged to provide a minimum of four air paths that simultaneously diffuse air at to and aspirate room air at 25 percent to 35 percent of discharge volume. Provide antismudge ring and extended cones.

3. DRB supply diffuser - Round, with four or more expanding cones to provide hemispherically diffused discharge air. Cones - Arranged to provide a minimum of three air paths that simultaneously diffuse air at to . Pattern adjustment range - From horizontal to downward projection, and any intermediate point, when mounted on exposed ductwork. Provide integral or separate antismudge ring and extended ceiling cone.

4. DRC combination supply and return diffuser - Round, with four expanding cones arranged to provide one return air path and two supply air paths. Provide a butterfly supply-air damper, an annular return-air damper, and antismudge ring.

5. DRE supply diffuser - Round, with three or more expanding cones to provide discharge air paths that are, minimally, two-position adjustable for horizontal or vertical discharge. Provide antismudge ring.

6. DRH supply diffuser - Half-round, with minimum four semiconical expanding members to discharge diffused air in a 180 degree pattern. Cones - Arranged to provide a minimum of three air paths that simultaneously diffuse air at to . Provide opposed-blade volume control.

7. DP series supply diffuser - Square or rectangular, perforated face plate with opposed blade or splitter-damper volume control, white baked enamel exterior finish, and black matte finish on exposed-to-view interior surface (type DP series diffusers fit a hung ceiling grid system). Deflection direction - As indicated.

8. DLB supply diffuser - Linear bar type, frame mounted, with extruded-aluminum bar and frame. Bars: thick x high, on center; pencil-proof spacing with 0 degree deflection angle. Floor- and sill-mounted diffusers - Heavy-duty reinforced construction to carry 5 kPa loads. Diffusers - Continuous length with hairline butt joints. Provide mitered end caps where diffuser run terminates. Dampers - Opposed-blade type. Provide

an integral, pivoted, bar-type access door and straightening grids.

9. DLS supply diffuser - Linear slot type, extruded aluminum construction, with fully adjustable integral air pattern and volume control vanes that deflect air pattern from horizontal along ceiling to straight down, or any intermediate setting. Pattern control element - Permits complete blanking-off of slot. Slot width: . Number of slots per unit - As indicated in manufacturer's catalog data. Butts in continuous runs - Aligned for hairline joints. Ends of diffuser - Butt against walls without mitered end caps. Provide end caps where slot terminates. Exposed-to-view part of frame - Anodized aluminum. Interior exposed-to-view components - Black matte finish.

10. DSA supply diffuser - Square, with minimum four expanding flared members to provide radially diffused discharge air. Flared members - Arranged so as to provide a minimum of four air paths that simultaneously diffuse air at to . Pattern adjustments - Include horizontal, vertical projection, and an intermediate position or range. Provide integral extended surface to fit into module of lay-in ceiling.

11. Supply grille (GS) - Double deflection type with adjustable face bars parallel to short dimension and adjustable rear bars parallel to long dimension. Provide integral extended surface to fit into module of lay-in ceiling.

12. Return grilles (GR) - Single deflection type with fixed face bars. For grilles installed in vertical surfaces, provide horizontal face bars set downward at approximately 35 degrees from vertical. For grilles installed in horizontal surfaces, provide face bars straight and parallel to short dimension. Provide integral extended surface to fit into module of lay-in ceiling. Device - ADC certified.

13. Supply register (RS) - Double-deflection type, opposed blade damper, with adjustable face bars parallel to short dimension and adjustable rear bars parallel to long dimension. Provide integral extended surface to fit into module of lay-in ceiling.

14. Return register (RR) - Single-deflection type, and fixed face bars with opposed-blade dampers. For registers installed in vertical surfaces, provide horizontal face bars set downward at approximately 35 degrees from vertical. For registers installed in horizontal surfaces, provide face bars set straight and parallel to short dimension.

15. Supply troffer (TS) - Provide complete assembly as indicated in manufacturer's catalog data. Install air handling section of unit under this section.

16. Return troffer (TR) - Provide complete assembly as indicated in manufacturer's catalog data. Install air handling section of unit under this section.

17. Combination supply and return troffer (TSR) - Provide assembly as indicated in manufacturer's catalog data.

2.12 TERMINAL UNITS

A. Dual-Duct Mixing Boxes

1. CV units - Mechanical constant-volume control type with a mechanical controller that is operated by entering mixed-airstream and maintains a constant airflow through unit.

2. Manual damper units - Label with capacity minimum/maximum range to facilitate field adjustment. Provide a calibration chart with each unit.

3. Unit - Factory assembled, complete with casing, air mixing valve assembly, operator, and mechanical constant-volume control, ready for field mounting and connection to control.

4. Components subject to friction - Provide oil-impregnated bronze bearings; graphite-impregnated or lubricant-impregnated nylon bearings; and lubricant-impregnated elastomers, stainless steel, and similar materials.

5. Casing - Fitted with rigid, airtight access panels, easily removable and of ample size to give free access to interior parts. Closure achieved by spring-retained, quarter-turn, slotted-cam captive devices, or similar operating fasteners.

B. Single Duct, Constant Volume, Terminal Reheat Units

1. Units - Include a casing, volume regulators, sound attenuating thermal insulation, and heating coils.

2. Unit casings - Constructed of thick aluminum or (20 ga) mill-galvanized steel, with removable panels for access to interior parts. Units insulated internally with thick mineral-fiber thermal and acoustic insulation conforming to NFPA 90A.

3. Water coils - Constructed of minimum outside diameter seamless copper tubing with aluminum-plate fins mechanically bonded or soldered to tubes, and with minimum outside diameter female solder connectors and manual air vent on return. Coils - Tested at 150 percent of working pressure.

4. Reheat output - Controlled by a room thermostat designed to modulate water flow in coil by positioning a three-way valve.

C. Variable Constant-Volume Boxes

1. Casing - Fabricated from galvanized steel, with internal thermal and acoustic insulation. Insulation - Coated to prevent erosion, and conforming to NFPA 90A.

2. Casing internal leakage - Limited to 1 percent of nominal box capacity when internal pressure is 250 Pa (gage). Casing - Fitted with rigid, airtight access panels, easily removable, and of ample size to give free access to interior parts.

2.13 FILTERS

Filters, Panel Type - Filters shall have pleated media with a filter depth of . Filters shall have minimum dust spot efficiency of 25% and average arrestance of 85% per ASHRAE Standard 52.1. Filters shall have a UL 900 Class 2 listing. Initial filter resistance shall not exceed 40 Pascals at a face velocity of . Filters shall be designed to be replaced at a final pressure drop of .

Filters, Extended Media Type - Filters shall have extended media with a filter depth of . Filters shall have minimum dust spot efficiency of 60% or 80%, as indicated on drawings, per ASHRAE Standard 52.1. Filters shall have a UL 900 Class 2 listing. Initial filter resistance shall not exceed at a face velocity of . Filters shall be designed to be replaced at a final pressure drop of 250 Pascals.

Filter Gages and Manometers - Provide air filter gages or manometers for each type of filter assembly. Gages - Dial-indicator type, graduated to read 0 to (gage), except that gages for HEPA filters read 0 to (gage). Manometers - Measure from (gage) to (gage), and are equipped with a built-in indicator bubble. Gage or manometer - Connected to static-pressure ports of approved design and located so that resistance to airflow is correctly indicated.

PART 3 EXECUTION

3.1 INSTALLATION

Install materials and equipment as indicated and in accordance with approved recommendations of manufacturers. Perform installation so that there is no degradation of designed fire ratings of walls, partitions, ceilings, and floors. Install emergency switches and alarms in conspicuous locations.

Install pipe valves and specialties as indicated, as specified herein, and as recommended by manufacturer.

3.2 CLEANING

Thoroughly clean exposed surfaces of piping and equipment that have become covered with dirt, plaster, or other material during handling and construction before such surfaces are prepared for final finish painting or are enclosed within building structure.

Before final acceptance, ensure that mechanical equipment, including piping, ducting, and fixtures, is clean and free from dirt, grease, and fingermarks.

3.3 BOILERS

Install and test as indicated, as specified, and as recommended by manufacturer.

3.4 AIR HANDLING UNITS

Install coils as indicated, as specified, and as recommended by manufacturer. Set dampers in a fixed position to provide scheduled quantity of outside air.

Provide floor drains where indicated in equipment room layout drawings. Drain line - Minimum DN50.

Provide services of a competent, factory-trained manufacturer's representative to supervise assembly, inspection, and testing of enclosure. Test rigidity of enclosures by starting and stopping fans. Audible popping noises are not permissible.

3.5 DUCTWORK

Construct sheetmetal in accordance with SMACNA-85 and NFPA 90A.

Do not use fibrous-glass ductwork.

Where construction methods for certain items are not indicated or described in referenced standards or herein, perform Work in accordance with ASHRAE 4. Design and fabricate supplementary steel in accordance with AISC S303.

Building openings are fixed as indicated in equipment room layout drawings; provide equipment to suit. Contractor may propose to alter these openings upon prior approval by COTR and at Contractor's expense. Openings indicated in outside walls and roof are approximate. Shop drawings show exact opening dimensions and location of equipment.

Protect open ducting from construction dust and debris in a manner approved by COTR. Clean dirty assembled ducting by subjecting main and branch interior surfaces to air streams moving at velocities of twice specified working velocities at static pressures within maximum ratings. Cleaning may done with filter-equipped, wheel mounted, portable blowers; compressed-air operated perimeter lances that direct compressed air and that are pulled in direction of normal air flow; or by other means approved by COTR. Compressed air used for cleaning ducting - Water- and oil-free. Before acceptance, remove dust and debris from exterior surfaces.

Perform operation tests on each fire damper in presence of COTR by applying localized heat to the thermal sensor and smoke to the controlling smoke detector. After successful testing, reset the damper open.

Anchorage shall be in accordance with Section 15000, General Mechanical.

3.6 FILTERS

Coordinate filter supports and retention elements to provide a substantial, structurally sound, leakproof installation. Filter arrangements - As indicated in manufacturer's catalog data. Holding frames - Gasketed on perimeter, or calked to each other, to supplementary steel, or to closures with elastomeric compounds recommended by filter manufacturer. Prepare substrate as recommended by elastomer manufacturer, including priming of surfaces in areas where elastomer is not confined.

-- End of Section --

SECTION 15514

WET PIPE AUTOMATIC FIRE SPRINKLER SYSTEM
12/01

PART 1 GENERAL

1.1 SUMMARY

The work shall include the provision and installation and testing of a complete and operational extension to the existing automatic fire sprinkler system in accordance with this specifications covering all areas as indicated on the drawings.

The system shall include all standard accessories as are necessary for a complete and operable system. The automatic wet pipe sprinkler system shall include an alarm valve and accessories, pressure switch, water motor gong, fire department connection, sprinkler heads, piping, and post indicator valve.

1.2 REFERENCES

American National Standards Institute (ANSI)

ANSI A13.1	Scheme for the Identification of Piping Systems

American Society for Testing and Materials (ASTM)

ASTM A135	Electric-Resistance-Welded Steel Pipe

American Water Works Association (AWWA)

AWWA C110	Ductile-Iron and Gray-Iron Fittings, 3 in. Through 48 in. (Through) for Water
AWWA C651	Disinfecting Water Mains

Federal Specifications (FS)

FS TT-E-489	Enamel, Alkyd, Gloss, (For Exterior and Interior Surfaces)
FS TT-P-645	Primer, paint, Zinc Chromate, Alkyd Type

National Fire Protection Association (NFPA)

NFPA 13	Standard for the Installation of Sprinkler Systems

1.3 SUBMITTALS

Partial submittals are not acceptable. Submittals of materials shall be approved before the purchase of, or delivery to, the job site. The following shall be submitted in accordance with Section 01300, Submittals:

SD-04, Drawings

Detailed working drawings shall be prepared by a contractor qualified in the layout and design of fire sprinkler systems. Detailed working drawings shall be 1:100 scale (minimum) and shall conform to NFPA 13. Drawings shall include a site plan and sufficient building cross sections to show elevations of building and piping changes. Six complete sets of working drawings shall be submitted via the COTR to the Safety Office Fire Protection Engineer.

As-built drawings shall be shop or working drawings corrected to the actual installed conditions. As-built drawings shall show the installed piping, exact locations of installed equipment, specific interconnections between pressure switch and fire alarm equipment. Drawings shall be submitted to the COTR before final testing of the system.

SD-06, Instructions

Complete, simple, understandable, step-by-step testing instructions giving recommended and required testing frequency of equipment, methods for testing equipment, and a complete trouble-shooting manual.

SD-13, Certificates

Equipment and devices shall be of a make and type listed in the UL Fire Protection Equipment List and/or Factory Mutual Approval Guide for specific purpose for which they are used. Satisfactory proof of the quality of the equipment and materials shall be furnished by the Contractor when the drawings are submitted.

SD-18, Records

The Contractor shall possess a valid C-16 California Fire Sprinkler Contractor's License.

SD-19, Operation and Maintenance Manuals

Maintenance instructions shall be complete, easy-to-read, understandable, and shall provide the following information: Instructions on replacing any components of the system including internal parts; instruction on periodic cleaning and adjustment of equipment with a schedule of these functions; and a complete list of equipment and components with addresses and phone numbers of the manufacturer and local supplier of each item. Six copies shall be submitted.

SD-20, Catalog Cuts

Catalog cuts on materials used in the system shall be submitted. Six complete sets shall be submitted via the COTR to the Fire Protection Engineer, DQH. The submittal package shall include, but not be limited to, the following:

Wet pipe riser assembly
Alarm devices
All valves
Sprinkler heads

Sprinkler cabinet
Fire department connection
Hangers and bracers
Pipes
Couplings

1.4 JURISDICTION

The authority having jurisdiction shall be the COTR.

PART 2 PRODUCTS

2.1 SYSTEM DESIGN

The design shall be based on the requirements and recommendations of NFPA 13 and as follows:

Spacing of Sprinkler Heads - The spacing of the sprinkler heads shall be for ordinary hazard occupancy, per head maximum, except where otherwise indicated.

System pipe sizing shall be per requirements on drawings. The sprinkler piping shall be sized by hydraulic calculations or ordinary hazard pipe schedule. Water supply is at point of connection with the underground main. The use of restricted orifices is not permitted.

Area of Protection - Protection shall be complete, and shall include combustible concealed spaces.

Interference - The sprinkler system shall be designed and installed so as to prevent interference with doors, windows, lights, heating, plumbing or electrical equipment. If a conflict exists between sprinkler piping and other equipment, the sprinkler piping shall be relocated to the extent that the required sprinkler coverage shall be maintained.

2.2 MATERIALS AND EQUIPMENT

A. Pipe and Fittings

1. Above grade and within buildings: Piping DN50 and smaller shall be black steel schedule 40, conforming to ASTM A135. Piping DN65 and larger may be schedule 10 black steel, conforming to ASTM A135.

2. Fittings for piping DN50 and smaller shall be ductile iron screwed fittings class 150 and 300. Screwed fittings for piping DN65 and larger shall be extra heavy pattern. Grooved fittings shall be ductile iron joined with Victaulic style 77 couplings (rated) or equal, with "E" grade gaskets. Piping DN50 and smaller shall use screwed fittings.

   Tapping T's or hole cut T's shall not be used except when connecting to existing piping. In such cases, tapping T's shall be Victaulic style 920 or equal, rated couplings.

3. Welded pipe and fittings shall be in accordance with NFPA 13. Welding shall be shop done, by properly qualified welders. The welding of earthquake braces or hangars it not permitted.

B. Sprinkler Heads - Sprinkler heads shall match existing.

2.3 ALARM DEVICES

Alarm devices shall be located and arranged for operation as required by NFPA 13 and as follows:

Water Pressure Switch - Riser assembly shall be equipped with a UL listed, pressure operated alarm switch (waterproofed for outdoor locations) having a built-in adjustable time retard feature that may be set from 0 seconds to one minute or more. The retard feature shall recycle instantly and automatically, and shall have no build-up. The switch shall be installed on top of the sprinkler retard chamber on the water motor gong alarm line of an alarm valve. The pressure switch time delay shall be set for 30 seconds, and shall be installed and connected so that a flow of water equal to or greater than that from a single ahead will automatically transmit an alarm to the fire department, sound the local evacuation alarm, and light the appropriate annunciator light. The switch shall be equipped with two contacts of the normally open type.

Valve Tamper Switch - The sprinkler system main shut off valve, and other valves as indicated, shall be equipped with a valve shut off/tamper switch. Upon two complete turns or less, the switch shall initiate a supervisory alarm at the control panel and transmit an alarm to the alarm receivers.

Inspector's Test Valves - Inspector's test valves shall be installed and supplied from the highest most hydraulically remote portion of the systems in relation to the riser assembly. Test valves shall be located in accordance with NFPA 13, and piping terminations shall contain a sprinkler test orifice discharging to the outside of the building.

Sleeves - Galvanized steel pipe sleeves shall be provided for pipes passing through masonry or concrete walls, floors, or ceilings with clearance around the sleeve as stated in NFPA 13. Space between the pipe and sleeve shall packed with fire retardant sealant in fire rated walls, and with and mineral wool and caulked in non-rated walls. When permitted by the COTR, flexible couplings on each site of the wall may be used instead of the required pipe clearances.

Flexible Couplings - Additional flexible couplings shall be provided in conformance with NFPA 13.

Gages - Gages shall be provided in conformance with NFPA 13. All gages shall have dual metric/english scales.

Fire Department Connections - Fire department connections shall be provided in conformance with NFPA 13. The fire department connection outlets shall be individually clappered, NST. Drip connection shall be installed.

Pipe Supports - Supports and hangars shall be of an approved pattern and placed to conform to NFPA 13. Sway bracing types and locations shall conform to NFPA 13.

Wall, Floor, and Ceiling Penetrations - Piping passing through walls,

floors, and ceilings shall be provided with chrome plated steel escutcheon plates, except where penetrations are located in concealed spaces.

Signs - Standard signs shall be attached as appropriate in accordance with NFPA 13. System valves, drains, test lines, and system piping shall be labeled and identified with signs in accordance with ANSI A13.1. Piping shall be labeled as sprinkler piping with band type labels at intervals, with flow direction indicated by arrows.

Sprinkler Cabinet - A sprinkler cabinet with the required number of sprinkler heads of ratings and types installed and a sprinkler wrench shall be provided for each system and located adjacent to the riser.

PART 3 EXECUTION

3.1 INSTALLATION

A. The installation shall be accomplished by personnel experienced in the installation of the specific type of system. The services of a qualified technician, experienced in the installation and operation of the type of system being installed, shall be provided to supervise the installation and testing of the system. Piping shall be installed above suspended ceilings and concealed wherever possible. In unfinished areas where piping is exposed, piping shall be installed in a neat and orderly manner not objectionable in appearance.

B. Installation of Screw Jointed Pipe - Piping shall be accurately cut to measurements established by the Contractor, and shall be worked into place without any springing or forcing. In any situation where bending of pipe is required, such bending shall be accomplished by the use of a standard pipe-bending template. Pipe compounds shall be applied to make threads only.

C. Welding - Welding is required to conform to NFPA 13.

D. Repairs - Damage to building and/or equipment resulting from the installation of the sprinkler system shall be repaired by the Contractor.

E. Pitch of Piping

1. Sprinkler piping shall be designed and installed to be pitched to drain back to the main riser drain, and as required by NFPA 13, except in wet pipe system where the piping may be installed level. Where conditions are such that piping cannot be pitched to drain, such as a change in direction to avoid an obstruction, auxiliary drains shall be installed so there are no trapped sections of piping for all lengths containing three or more heads.

2. Valved auxiliary drains shall have hose connection attached.

F. Drains - Main drains shall be valved and piped to discharge at safe points outside each building or to sight cones attached to drains of adequate size to readily carry the full flow from each sprinkler drain under maximum pressure. Auxiliary drains shall be installed where necessary and shall discharge outside the building, or to open slight drains or standard interior floor drains. Direct connection

shall not be made to any of the sewer systems.

G. Interruption of Service - There shall be no interruption of existing sprinkler protection, water, electric, or fire alarm services without prior written permission of the COTR. Permission shall be requested at least 48 hours before planned interruption.

3.2 CLEANING AND PAINTING

A. After installation has passed a satisfactory hydrostatic test, iron and steel parts shall be thoroughly cleaned. Piping and other metal except sprinkler heads, bronze or brass fittings, and moving parts, shall be given a priming coat of zinc chromate in accordance with FS TT-P-645 and a finish coat of red enamel in accordance with FS TT-E-489. Exposed sprinkler piping in finished areas shall be given a finish coat with the background color. Piping shall be field painted unless otherwise approved by the COTR.

B. Sterilization of Water Mains

1. Piping including valves, fittings, and other devices shall be sterilized in accordance with AWWA C651 with a solution of chlorine and water. The solution shall contain not less than 50 parts per million (ppm) of available chlorine. The solution shall be held for not less than 8 hours, at which time the solution shall contain a minimum residue of 2 ppm of available chlorine or the system shall be re-sterilized. After successful sterilization, the piping shall be thoroughly flushed before placing in service. Disposal of contaminated water shall be the responsibility of the Contractor.

2. Underground piping shall have sterilization solution or sterilization tablets entered into the piping before opening connection to the street water main. Introduce solution or tablets into piping during piping assembly at supply end. After successful sterilization, the piping shall be thoroughly flushed before placing in service. Disposal of contaminated water shall be the responsibility of the Contractor.

3.3 FINAL INSPECTION AND TESTS

Upon completion of the installation and as-built drawings, the following inspection and tests shall be made:

Hydrostatic Tests - The system shall be hydrostatically tested, including the fire department connection, as specified in NFPA 13, in the presence of the COTR. Materials and test certificate, as specified in NFPA 13, shall be filled out for hydrostatic tests and submitted. Alarm tests shall be completed and necessary corrections shall be made before final inspection by the Fire Protection Engineer.

Inspection and Tests - The system shall be subjected to operational tests, and when necessary corrections have been accomplished, the COTR shall be advised and will schedule a final inspection and test with the Center's Fire Protection Engineer. The connection of the fire alarm system shall have been in service for at least ten days before the final inspection, with adjustments made to prevent false alarms. The Contractor shall furnish instruments, labor, and materials required for the tests and shall provide the services of

the installation foreman or other competent representative of the Contractor to perform the tests. Any deficiencies found shall be corrected by the Contractor and the system shall be re-tested as necessary. Tests shall include the operation of all features of the systems under normal operations.

SECTION 15900

TEMPERATURE CONTROLS
12/01

PART 1 GENERAL

1.1 SUMMARY

A. Provide labor, material, equipment, and software necessary to meet the functional intent of the system as specified herein. Equipment and labor not specifically referred to herein, or on the plans that are required to meet the functional intent, shall be provided.

B. Provision, installation, and connection of sensors, relays, switches, controllers, and field control devices, except for devices specifically noted to be installed in pipes or ducts under other sections.

C. Provision, installation, and connection of Siemens Apogee System 600 Protocol II Direct Digital Control (DDC) panels.

D. Required interfacing with the existing NASA Ames Facility Management Control System (FMCS).

E. Provision, installation, and connection of communication wiring between DDC panels and existing FMCS trunk line termination point.

F. Control wiring of voltages between terminals at new control panels, field devices, and equipment.

G. Testing, checking, and adjusting of new installation and software.

H. Start-up assistance for HVAC systems.

I. Minimum 8 hours of instruction to Government personnel in the use and maintenance of temperature control hardware and software. Instruction shall include training on system configuration and operation, data display, alarm and status descriptions, requesting data, execution of commands, log requests, and making changes.

J. System Description

1. The control system shall be configured as a distributed processing network. Local Direct Digital Control (DDC) panels shall perform data consolidation and reporting, complex algorithms and calculations, interaction and dynamic process manipulation, as well as overall system supervision, coordination, and control. Sensed data shall be obtained and shared between the local DDC panels, which are located within their particular operating environments.

2. Only Siemens Apogee System 600 Protocol II products will be accepted.

3. Sensing devices shall be electric/electronic unless specified

otherwise.

K. Basic Requirements for FMCS Installation

1. Provide FMCS addition only where indicated on drawings.

2. In accordance with the established standards at Ames, each FMCS addition shall include the following:

a. 1 outside air temperature sensor per building

b. 1 gas meter for each incoming line into the building

c. 1 or more (depending on the feeder configuration) electrical meters/transducers to obtain the total building power demand or consumption (excluding research motor drive power) per building.

3. I/O points associated with a new installation shall be terminated at an existing (or new) control panel mounted within the building where the I/O points reside.

1.2 REFERENCES

American National Standards Institute (ANSI)

ANSI C12.1	Code for Electricity Metering, 8th Edition
ANSI C37.90	Standard for Relays and Relay Systems Associated with Electric Power Apparatus

American Society of Mechanical Engineers (ASME)

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

American Society for Testing and Materials (ASTM)

ASTM B88	Seamless Copper Water Tube
ASTM D1693	Environmental Stress-Cracking of Ethylene Plastics

Institute of Electrical and Electronics Engineers (IEEE)

IEEE C37.90.1	Standard Surge Withstand Capability (SWC) Tests for Protective Relays and Relays Systems

1.3 SUBMITTALS

The following shall be submitted in accordance with Section 01300, Submittals, in sufficient detail to show full compliance with the specification. Six copies of each shall be furnished. Any deviations from the specifications shall be noted on the transmittal letters, indicating reasons for the substitutions.

SD-01, Data

A complete point listing, including Logical Point names, final

User names, Alarm Limits and Priorities, interlocks, and complete PPCL file listings and sketches for Siemens Apogee graphic files. Acceptance test procedures and an Operating and Maintenance Manual for review by the Government shall be included with this submittal.

Submit one Operating and Maintenance Manual containing approved system control loop structures, control programming, as-built documentation, equipment data, spare parts lists, maintenance instructions, and operator and service instructions. After approval and comment by the Government, furnish four complete corrected manuals permanently bound.

SD-02, Manufacturer's Catalog Data

Submit the following items within 30 days of contract award: Catalog cuts, technical data, and descriptive literature on hardware and software systems and components. The data shall be clearly marked and noted to identify specific ranges, model numbers, sizes, and other pertinent data. Hardware cuts shall be tagged with the device names and numbers used on the Drawings.

SD-04, Drawings

Shop drawings showing system configuration and capabilities, sequences of operation, equipment locations, complete wiring and piping diagrams, details, panel configurations and termination assignments, proposed conduit runs, sizes, damper motor mounting details, valve schedules, and a point list keyed to specific hardware submittals. Indicate failure mode of equipment, valves, campers, and other devices (open-closed, on-off). Software submittal including Point names, System names, and flowcharts for PPCL files.

Submit an acceptance testing plan with the software submittals 60 days before scheduled start-up. The plan shall include methods and provisions for validating the functionality of control loops, special control sequences and routines, and the proper operation of sensors and actuators. The COTR will approve and/or modify the submitted procedures and will witness tests conducted by the Contractor.

1.4 OTHER GENERAL REQUIREMENTS

Work under this Section interfaces directly with equipment and systems provided under the Electrical Division and other Mechanical Sections. The Contractor is responsible for coordinating schedules, equipment interfaces, signal compatibility, termination requirements, and power requirements to ensure the proper performance of new and existing systems.

The computer based control system shall comply with standard data formats, voltages, currents, and transmission rates as set forth by IEEE, ASCII, EIA, and standard computer industry conventions.

Electrical work required for the installation of the temperature control system shall be done in conformance with Division 16, Electrical.

Control panel construction shall comply with standards of the Joint Industry Council (JIC) and the National Electrical Manufacturer's

Association (NEMA).

The DDC system described herein will interface with and become a part of the FMCS network. Conventions used with the FMCS will apply to the new DDC system including, but not limited to, the following: Termination standards, failsafe, point and alarm configurations, database conventions, software conventions, and programming procedures. Refer to attachments at the end of this section for a detailed description.

1.5 AS-BUILTS

After completion of work and before final acceptance, provide updated and corrected submittal documentation to as-built conditions. Submit one electronic copy of the as-built drawing files created by a computer aided design (CAD) program compatible with most current versions of CAD program used by the FMCS system manager. One separate reproducible set of drawings shall be furnished. Include record copies of submittal data, shop drawings showing equipment locations, control panel layouts, complete point-to-point interconnecting wiring diagrams, pneumatic piping shop drawings, piping diagrams, conduit runs, damper motor arrangements, and valve schedules.

1.6 GUARANTEE

The guarantee shall include labor, material, and software.

The guarantee shall cover DDC panels, field interface panels, control devices, hardware, and software against any defects in workmanship or improper performance when under the normal usage conditions of the facility. System functional performance shall also be covered under this guarantee.

Provide four-hour response to guarantee calls at all times within one year after the entire project has been accepted.

The Contractor shall guarantee the availability of repair and replacement parts for any of the components provided, as well as qualified repair technicians, for a minimum of five years from the date of final acceptance of the system. Should the Contractor fail to make available such support, the Contractor shall, at no additional cost to the Government, provide comparable or better components and any required software modifications to maintain system capabilities.

PART 2 PRODUCTS

2.1 LOCAL DIRECT DIGITAL CONTROL

A. Local direct digital control shall be accomplished by Contractor-furnished DDC panels. The panels will form a portion of the Ames FMCS network. Products to be furnished herein, and their installation requirements, shall also follow the guidelines given in Attachment 1 at the end of this section.

B. Direct Digital Control (DDC) Panels

1. DDC panels shall be complete with components, standard or optional, to meet functional requirements as described in this section and the drawings.

2. Panels and components shall be manufactured by Siemens and will be capable of operating on Apogee System 600 Protocol II networks.

3. Each DDC panel shall be connected directly to the FMCS network, sensors, actuators, switches, and motor starters as required. Configurations that require separate analog controllers between the DDC panel, sensors, and actuators are not acceptable.

C. Direct Digital Control (DDC) Software

1. Contractor-furnished resident DDC panel firmware shall be the latest revision available (Rev 2.4 Apogee or higher).

2. Contractor shall furnish Program Language (PPCL) files, complete point database, and Apogee Graphic displays, as required to accomplish the Sequence of Operations, Alarming, and monitoring as described in the drawings, herein, and Attachments 1, 2, 3, and 4 at the end of this section.

D. Field Interface Panel (FIP)

1. Provide at each DDC panel location as required, a Field Interface Panel (FIP). FIP construction, key access, and finish shall match the DDC panel. Multiple enclosures are acceptable as necessary to provide required space.

2. Switches, relays, transformers, I-P transducers and other interface devices required between sensors, actuators, Motor Control Centers (MCC) and other system inputs and the DDC panels shall be housed in the FIP. No control devices except for sensors, E.P. switches, and VAV terminal controls shall be located and mounted outside the FIP.

2.2 FIELD EQUIPMENT

A. Sensors, controls, instrumentation, wiring, piping, and other materials shall be new and the best of their respective kinds, free from all defects, and be of the make, type, and quality herein specified and approved.

B. Analog sensors that require external signal conditioning shall have individual zero and span adjustments. Sensors shall be provided with the minimum range and maximum accuracy suitable for the service indicated. Transmitters shall be selected to be compatible with the medium to be monitored. Heating hot water sensors shall be rated (gage) at . Chilled water and condenser water sensors shall be rated at . Air side devices shall be rated to operate system static pressures up to and .

C. Temperature Sensors

1. Duct Temperature Sensor - Siemens Models 535-490 or 533-380, Minco, or equal, with linear precision resistance elements, range to , accuracy +/- 0.7°C over span, platinum element rated 100 W +/- 0.1 percent at 0°C, and linearity within +/- 0.25 percent. Provide 25 foot averaging elements when sensing temperature where stratified conditions necessitate an average reading for accuracy.

2. Room Temperature Sensor - Siemens Model 536-200, Minco, or equal,

with linear precision resistance elements, range to , accuracy +/- 0.3°C over span, platinum element rated 100 W +/- 0.1 percent at , and linearity within +/- 0.25 percent of span. For Siemens TEC applications, use Siemens space temperature sensor model 540-676CA.

3. Room Temperature Thermistor - Siemens 536-195, or equal, with to range, accuracy +/- at midrange, with metal base and cover.

4. Fluid Immersion Temperature Sensor - Siemens Models 536-767, Minco Bulletin RT-6, or equal, linear precision resistance elements, range - to for heating hot water, chilled water and condenser water, accuracy +/- over span, with compatible stainless steel insertion well.

5. Outside Air Temperature Sensor - Siemens 536-768 Minco, or equal, with protective mounting enclosure, to dc output, to range, accuracy +/- over span.

6. Transmitter for Temperature Sensors - Siemens, Minco, or equal, with to dc output over specified temperature range, 12 V dc or 35 V dc input, maximum loop resistance of 875 W at 26 V dc, warm-up drift +/- 0.1 percent of span at 24 V dc with loop resistance of 250 W, ambient temperature drift of +/- 0.004 percent from to , suitable for the specified sensing elements, with up to of (AWG 18) twisted shielded pair signal carrier allowable.

D. Static and Differential Pressure Sensor/Transmitter - Siemens,, Setra, Robinson-Halpern, or equal, low range differential pressure transducer, with a linear variable differential transformer (LVDT) type sensing element, internal signal conditioning, ranges as listed below, accuracy +/- 0.5 percent of full range (combing non-linearity, non-repeatability, and hysteresis), to dc output, 15 V dc to 35 V dc input, operating temperature range of - to , thermal zero shift and span shift +/- 0.01 percent per degree Celsius of full range output, NEMA, Type 4 G.E. Velox housing, maximum air pressure rating , with up to of (AWG 18) twisted shielded pair signal carrier allowed. Install on non-vibrating surface and run copper tubing to Dwyer No. A-301, or approved equal, static pressure tip in duct. Use maximum length of specified polyethylene tubing for connection at sensor. Furnish range for end-of-line supply duct static pressure.

E. Room Humidity Sensor / Transmitter - Siemens Model 534-635, Vaisala Model HMW 20U, or equal, range 0 to 99 percent RH, accuracy +/- 2 percent over entire range and +/- 2 percent from 0 to 80 percent RH, to dc output, 12 V dc to 35 V dc input, maximum 1 W consumption, maximum one minute response time, to operating temperature, with up to of (AWG 18) twisted shielded pair signal carrier allowable.

F. Current Sensors - Neilsen-Kuljian A200 series or equal, with jumpers to switch to lower range current sensing, loop-powered and fully isolated, 0 to 200 A and 20 Hz to 100 Hz sensing capability, 5 V dc to 40 V dc input, to dc output, accuracy +/- 1 percent and repeatability/linearity +/- 0.1 percent over the entire range, maximum response time to 99 percent of final value, - to operating temperature, flame-retardant case.

G. Differential Pressure Switches - Siemens, Dwyer Series 1800,

Cleveland or equal, bidirectional pressure switch, accuracy +/- 2 percent (combining non-linearity and non-repeatability), normally open or normally closed output, 10 A rated SPDT switch and screw terminals in electrical box with conduit connection, adjustable operation and UL listed. Adjustable range shall be for air filter switches and for supply fan high limit static pressure switches. Operating temperature range shall be - to . Install using Dwyer No. A-301, or approved equal, static pressure sensing tips.

H. Current-Operated Switches - Neilsen-Kuljian Model D150, or equal, current operated switch with adjustable 1 A to 300 A setpoint and 240 V ac, 1 A switching capability. Unit shall also have an LED for indicating switch status.

I. Water Flow Switches - McDonnell Miller FS7-4S, or equal, paddle-type screw-in flow switches rated for at . Wetted parts shall be stainless steel. Provide an adjustable sensitivity control with segmented paddle. Switch shall be SPDT (form "C" contact) rated for pilot duty at 125 VA, 115/230 V ac. Case construction shall be packless and shall be equipped with a pipe tap for conduit entry.

J. Line Voltage Thermostats - Siemens, Honeywell, Johnson Controls, or equal, with setpoint adjustable from to , deadband adjustable from to , auto-off-hand switch, rated switching capability at 120 V, SPDT snap switch, metal base and cover.

K. Control Valves

1. Control valves shall be proportioning with modulating plugs for equal percentage or linear flow characteristics. The valves shall be sized by the control manufacturer and be provided with actuators of sufficient power for the duty intended. Valve body and actuator selection shall be sufficient to handle system pressure and shall close against the differential pressures encountered. Body ratings shall be (gage) at . Valves shall shut tight against (gage) with actuator at maximum of modulating range. Where sequencing is required or possible, the actual spring range shall be such that no overlapping occurs. If spring shift causes an overlap, a pilot positioning operator shall be provided.

2. Control valves shall be sized to meet the flow and pressure drops for each application as shown on the schedules. Plug style valves shall close against flow.

3. Small valves (through) shall be constructed with a cast brass body and pipe thread ends. Trim shall consist of a removable cage providing valve stem guidance throughout the entire travel range. A stainless steel stem shall be provided. Bonnet cage, stem, and plug assembly shall be removable for servicing.

4. Valves range 65 mm and above in diameter shall be constructed with a cast iron body and have flanged connections. Valves shall have stainless steel stems and seats. Bonnet cage, stem, and plug assembly shall be removable for servicing.

L. Electronic Valve Actuator - Siemens 599 series or equal, with 0 to 26 V dc input, adjustable start of 0 to 10 V dc, adjustable span of 3 V dc to 16 V dc, and direct or reverse action selectable. Provide

visual or electronic travel indication and a manual override. Actuator shall have sufficient power to hold the valve's open-close position against the maximum differential pressure across the valve.

M. Pneumatic Damper Actuator - Siemens AP331, Johnson Controls, or equal, pneumatic damper operator of the synthetic elastomer diaphragm piston-type, or motorized damper operator, fully proportioning unless otherwise specified. The operator shall have ample power to overcome the friction of damper linkage and air side pressure acting on the damper blades. The damper operator mounting arrangement shall be outside the air stream wherever possible. The operator linkage arrangement shall permit normally open or normally closed positions of the damper as indicated. Provide one operator per maximum damper section. For damper sections less than equivalent diameter actuators may be used, provided they develop adequate torque.

N. Electric Damper Actuator - Siemens OpenAir or 338 series, Belimo, Binar, Intec, or equal of correct torque rating for application, rugged metal case rated NEMA 1, manual override capability, 0 to 10 V dc input signal, 0 to 26 V ac input.

O. Digital to Pneumatic Transducers - Siemens Model 531-990, PTM6.1PSI120-M, or equal, electronic to pneumatic transducers where required to convert analog outputs from the DDC panels to a (gage) to (gage) pneumatic signal for control of valve and damper operators. Unit shall have feedback feature to regulate output to +/- (gage) of desired pressure and accommodate setpoint changes as low as (gage).

P. Electro-Pneumatic Air Valve - Siemens 265-1001, ASCO No. 8320, or equal, two position electric to pneumatic devices capable of regulating a pneumatic signal from either a normally closed or normally open port. Select coil voltage as appropriate. Maximum air flow to (gage), maximum inlet pressure (gage), maximum differential pressure (gage), maximum air flow , Cv flow factor 0.06, voltage input 24 V ac to 480 V ac, and be UL and CSA approved.

Q. Room Air Thermostats - Siemens, Johnson T-4000 Series, or equal, with concealed adjustable setpoint, locking cover, and key operated for adjustment. Dials shall be calibrated in equal increments of temperature scale. Thermostats of minimal dimensions, rapid response, and of highest quality are required.

R. Volume Booster Relays - Siemens, Robertshaw Model R405-1, or equal, direct acting, proportioning type non-bleed relay with 1:1 ratio to be used for amplifying the volume of control air to final control devices and/or to advance or retard signals. A non-calibrated adjustment shall allow the output signal to lead or lag the input signal by up to (gage) in either direction. Volume booster output capacity shall be at least with air consumption less than .

S. Pressure Gauges - Ashcroft Type 1379, Weksler AA14, or equal, with stainless steel movement, phosphor bronze bourdon tube, die cast aluminum case with threaded ring, bottom connection, specified gauge cock and diameter dial. Range (gage) unless otherwise noted in Drawings.

T. Control Air Check Valve - Siemens 380-024, or equal. Capacity to at (gage) pressure drop, at (gage) pressure drop.

U. Flow Meters

1. Gas Flow Meters - Hoffer Turbine Flow Meter HO Series with HIT-2 Digital Flow Totalizer/Rate indicator, or equal, configured to provide to analog or digital pulse output. Open collector Pulse output shall be configured to be maximum 10 pulses per second, and the pulse duration shall be configured for a minimum of . Explosion-proof housing and capable of operating in a natural gas environment at operating temperatures from - to . Accuracy to within 0.15 percent of maximum flow rate to be measured. Meter shall be furnished with digital displays of gas consumption. Totalizer and flowmeter shall be furnished as a factory calibrated matched set.

2. Water Flow Meters - Hoffer Turbine Flow Meter HO Series with HIT-2 Digital Flow Totalizer/Rate indicator, or equal, configured to provide to analog or digital pulse output. Open collector Pulse output shall be configured to be maximum 10 pulses per second, and the pulse duration shall be configured for a minimum of . Shall have a NEMA 4X enclosure and be capable of operating in moist environments at operating temperatures from - to . Accuracy to within 0.15 percent of maximum flow rate to be measured. Meter shall be furnished with digital displays of water consumption. Totalizer and flowmeter shall be a factory calibrated matched set.

2.3 ELECTRICAL HARDWARE

A. Material and execution shall conform to Section 16000, Electrical.

B. Data Cable and Analog Signal Wires - Belden #8760, or equal, (AWG 18) tinned copper, polyethylene insulated, twisted pair, Beldfoil aluminum polyester shield, (AWG 20) stranded tinned copper drain wire, chrome PVC jacket.

C. Digital Signal Wire - Belden #8460, or equal, 0 (AWG 18) tinned copper, PVC insulated twisted pair. Shall pass VW-1 Vertical Wire Flame Test.

D. Electrical Control Relays/Sockets

1. IDEC RH2B-ULC-AC24V (or 120 V or 240 V), or equal, DPDT relay with energize/de-energize time, 1.2 VA rating for ac circuits, 0.9 W rating for dc circuits, Ag-CdO contact material, 50 MW maximum contact resistance, 100 MW minimum insulation resistance, and - to operating temperature.

2. IDED SH2B-05, or equal, snap-mount/surface-mount socket with screw terminals, hold-down wire clamps, and 300 V/10 A rating.

E. Electrical Control Accessories - Provide momentary relays, time delay relays, maintained relays, switches, pilot lights, and other accessories to meet the functional requirements of the specifications and as shown on the drawings.

F. Current Transformer Shorting Device - General Electric type PK test plug, Kele U3889 switch assembly, Bunchanan 3B106P 6-pole one-piece terminal block with shorting bar or equal. 600 V, 30 A rated. UL

listed.

G. Electrical Metering Watt/VAR Transducer

1. Watt or VAR transducer shall be Scientific Columbus XL or P series, Square D CLE-20000 series, or equal. Transducer shall be suitable for connections to three-phase, 3- or 4-wire system and shall be for use with current and potential transformers.

2. Transducer current input shall be 0 to 5 A ac with a maximum burden of 0.2 VA at 5 A per element. Voltage input burden shall not exceed 0.02 VA at 120 V ac per element. Auxiliary power input burden shall not exceed 6 VA. Operating humidity shall be 0 to 95 percent non-condensing.

3. Transducer output shall be 4 mA to 20 mA dc, accurate to +/- 0.35 percent of the rated output. Temperature effect on accuracy shall not exceed +/- 0.0075 percent per degree Celsius for watt or +/- 0.012 percent per degree Celsius for VAR. Maximum ripple peak shall be less than 0.25 percent of the rated output. Maximum response time for 99 percent of the measured value shall be less than 1 s.

4. Transducer shall be enclosed in an isolated case with a dielectric withstand to 1500 VRMS at 60 Hz and a surge withstand conforming to ANSI/IEEE C37.90.1.

5. Transducer shall be located to minimize moisture and temperature effects on sensitive components. Transducer shall be removable and shall be furnished with draw-out test plug or shunt switch to short out the input current loop and disconnect the input voltage when the transducer is removed for service. Metering accessories, such as current transformer, potential transformer, fuse, test plug, and enclosure, shall conform to Section 16000, Electrical.

H. Electrical Kilowatt-hour and/or Demand Meter - Compliance with FCC Class A, Part 15, Underwriters Laboratories, Inc., and California Weights and Measurements standards. Meter shall be suitable for connection to three-phase, 3- or 4-wire system, and shall be for use with current and potential transformers. Meter input voltage range shall be 120 V ac to 480 V ac. Input full load current shall be 5 A maximum. Current burden shall be 0.2 A or less. Operating frequency shall be 50 Hz to 60 Hz. Transient overload shall conform to AISC C37.90. Accuracy shall meet UL and ANSI C12.1. Meter output shall be 4 mA to 20 mA dc or digital pulses. Pulse output shall be configured to maximum of 10 pulses per second, and the pulse duration shall be minimum of . Meter shall be furnished with digital displays of kilowatt-hour consumption and kilowatt demand resetable via a switch or key.

I. Adjustable Frequency Drives

1. ABB, Danfoss, GE, or equal. Pulse width modulated (PWM) inverter designed for use on a standard NEMA Design B induction motor. The drive shall be designed specifically for variable torque applications. It is required that the drive manufacturer has an existing independent service organization. The adjustable frequency drives (AFDs) shall be solid state, with a Pulse Width

Modulated (PWM) output. The AFD package as specified herein shall be enclosed in a NEMA 1 enclosure, completely assembled and tested by the manufacturer. The AFD shall employ a full wave rectifier (to prevent input line notching), Integral Line Reactor(s), Capacitors, and Insulated Gate Bipolar Transistors (IGBT's) as the output switching device. The drive efficiency shall be 97% or better at full speed and full load. Fundamental power factor shall be 0.98 at all speeds and loads.

2. The drive(s) and all necessary controls as herein specified shall be supplied by the drive manufacturer. The manufacturer shall have been engaged in the production of this type of equipment for a minimum of ten years.

3. Testing: All printed circuit boards shall be completely tested and burned-in before being assembled into the completed AFD. The AFD shall then be subjected to a preliminary functional test, burn-in, and computerized final test. The burn-in shall be at 104 °F (), at full rated load, on a motor. Drive input power shall be continuously cycled for maximum stress and thermal variation. All testing and manufacturing procedures shall be ISO 9001 certified.

4. AFDs and options shall be UL listed as a complete assembly. AFD's that require the customer to supply external fuses for the AFD to be UL listed are not acceptable. AFDs and options shall be UL listed as a complete assembly.

5. Compliance to IEEE 519 - harmonic analysis for particular jobsite, including total harmonic voltage distortion and total harmonic current distortion. Input line filters shall be sized and provided as required by the AFD manufacturer to ensure compliance with IEEE standard 519 (latest version). If the voltage THD exceeds 5%, the AFD manufacturer shall recommend the additional equipment required to reduce the voltage THD to an acceptable level.

6. Serial communication: The AFD shall have an RS-485 port as standard. The standard protocol shall be Siemens Building Technologies FLN. Serial communication capabilities shall include, but not be limited to, run-stop speed set adjustment, proportional/integral/derivative PID control adjustments, current limit, and accel/decel time adjustments. The drive shall have the capability of allowing the DDC to monitor feedback such as process variable feedback, output speed/frequency, current (in amps), % torque, power (kW), kilowatt hours (resettable), operating hours (resettable), relay outputs, and diagnostic warning and fault information. Additionally, remote (LAN) VFD fault reset shall be possible. A minimum of 15 field parameters shall be capable of being monitored. The DDC system shall be able to monitor if the motor is running in the AFD mode or bypass mode (if bypass is specified) over serial communications. The AFD shall allow the DDC to control the drive's digital and analog outputs via the serial interface. The serial communications interface shall allow for DO (relay) control and AO (analog) control. This control shall be independent of any AFD function. The outputs can be used for modulating chilled water valves via the analog output, actuating a damper EP, etc. In addition, all drive digital and analog inputs shall be capable of being

monitored by the DDC system.

2.4 PNEUMATIC AIR PIPING

Provide pneumatic control devices to meet the functional requirements of the specifications and as shown on the Drawings. Pneumatic controls shall be the product of a single manufacturer unless special selections are required to meet functional or performance requirements.

Copper Tubing - ASTM B88, hard drawn deoxidized copper tubing, type K or L, with wrought copper solder joint fittings conforming to ANSI B16.22.

Plastic Tubing - Virgin polyethylene tubing, FR rated, tested in accordance with ASTM D1693 with minimum burst pressure of and minimum working pressure of at . Color coded twin-tube FR tubing with a protective polyvinyl covering shall be used for thermostat runs in concealed walls.

PART 3 EXECUTION

3.1 ELECTRICAL WORK

Necessary backboxes, pullboxes, connectors, and supports shall be furnished for a complete and working network of communications and control facilities.

The Contractor shall provide conduit and wire as necessary between the DDC panels and the motor control centers. Terminations shall have either tinned wire ends or shall use crimped-on lugs.

Conductors shall be continuous, from terminal to terminal, without splices.

Control and signal wiring shall be in conduits. Class 1 circuits (rated greater than or equal to 100 VA) shall be run in separate conduits from Class 2 circuits (rated less than 100 VA).

Wiring and terminal blocks shall be identified by labels, tags, or other permanent means. Markings shall clearly indicate the function and source of cable, wiring, and terminals. Junction boxes and conduit connectors for FMCS-related control wiring and field devices shall be painted Royal Blue, Fuller O'Brien No. RFK505-S4, or equal (submit color sample for approval) before installation.

3.2 CONTROL PIPING WORK

Provide pneumatic piping and connections to air mains as required for a complete and working system. New piping installations and air system accessories shall be furnished under this Section.

Pneumatic tubing shall be installed neatly. Tubing shall be run parallel to building lines. Bends shall be neat and symmetrical with no kinks. Tubing shall be clamped or strapped to the building structure or permanent hangers and supports at not more than 1200 mm intervals, or as shown on the Drawings.

Primary main air piping shall be hard copper tubing, sized for the air flow required or as shown on the Drawings. Branch lines in mechanical rooms, plenums, and exposed areas shall be copper, minimum outside diameter. Submit pipe sizes and calculations with shop drawings.

Polyethylene tubing may be used for VAV box and thermostat branch lines in ceilings and walls only. Polyethylene tubing shall be supported on ceiling wires at regular intervals with clamps and ties as near the slab above as possible, formed in bundles where practical, and run at right angles parallel to building lines.

Polyethylene tubing may be run in EMT to a junction box near the controlled device in mechanical rooms instead of copper tubing. Copper tubing shall be run from the junction box to the controlled device.

Polyethylene tubing may be used for connections inside panels. Color or number code the tubing for ease of tracing. Tubing shall be neatly run and bundled so as to not interfere with maintenance work inside panels.

Control air piping and tubing shall not run inside or across telephone or electrical room/closet.

3.3 FMCS CONTROL PROGRAMMING AND ALARM POINTS

Provide required hardware and programming to make operational the input and output points shown on the drawings, and any additional points required to accomplish the sequences, control modes, and monitoring specified. Complete point database shall include System point name, point name, configurations, interlocks, limits, and other data necessary to make the point functional in FMCS.

Commandable and alarmable points shall be programmed into dynamic graphic displays via Siemens Apogee software resident in the FMCS Server computer. Graphic displays shall be viewable and commandable from any FMCS Apogee server or client computer.

3.4 COORDINATION INSTRUCTIONS

DDC panel locations shall meet prior Government approval. Provide the quantity of panels most suitable for the system configuration being furnished. The assignment of points to panel locations is the responsibility of the Contractor. The control details on the drawings are intended to clarify the intent of the specifications. Wiring and piping shall be compatible with the system equipment furnished. Submittals and shop drawings shall show in detail the active wiring and piping details and interfaces.

Locations of sensors are diagrammatic; the Contractor is responsible for locating them properly to ensure accuracy and system performance.

Room thermostats and temperature sensors shall be mounted where shown on the drawings or where directed, approximately 1500 mm above the floor.

All other relays, switches, interface hardware, and miscellaneous control devices shall be enclosed in the Field Interface Panels (FIP) located adjacent to each DDC panel. No control devices shall be located at other locations except for thermostats, sensors, actuators, and fan coil controls. Sensors and actuators mounted in outside locations shall be enclosed in NEMA 3R weatherproof cabinets.

3.5 IDENTIFICATION AND TAGGING

Panels shall be provided with permanently attached labels that identify

names and functions in accordance with project nomenclature. Each smart panel such as an RBC, MBC and SCU shall be tagged with a 3-digit number equivalent to the first 3 characters of its point address. Each slave panel such as DPU, MPU, and TEC shall be tagged with a 6-digit number equivalent to the first 6 characters of its point address.

Field sensing devices, except room thermostats, shall be appropriately labeled in accordance with the appropriate function served by the device (e.g., temperature sensor monitoring supply air temperature of air handler 2 in a project shall be tagged as AH2 SA TEMP).

Labels used for panels and sensing devices shall be two-color engraved plastic with double-sided adhesive tape on the back of the label.

3.6 CALIBRATION

Sensors and other devices requiring calibration shall be calibrated in accordance with manufacturer's recommendations. Calibration logs shall be kept by the Contractor and made available to the COTR upon request. Upon request by the Government, provide personnel and instrumentation necessary for checking any of the calibration data. Recalibrate any device that fails to meet specified tolerances.

3.7 START-UP RESPONSIBILITY

This work is integrally related to the start-up and testing of HVAC systems. Keep abreast of the project schedules and provide start-up and testing when scheduled. Provide competent engineering and/or start-up personnel as necessary. If the system is not ready to perform automatically as intended when system start-up is scheduled, the Contractor shall make whatever arrangements are necessary to allow use of the HVAC systems at no additional cost.

During the start-up period, provide adequate testing and adjusting to obtain a properly functioning control system. Adjust control loops, setpoints, field devices, and software as required to meet the intent of these specifications to the satisfaction of the Government. Confirm control loop, setpoint, and other modifications with the COTR.

3.8 ACCEPTANCE TESTING

Final acceptance will be given after successful acceptance testing and the submission of Government approved as-built documentation. Acceptance testing shall not start until after completion of all start-up activities.

3.9 SEQUENCE OF OPERATION

Apply proportional (P), proportional plus integral (PI), or proportional plus integral plus derivative (PID) control loops to specified operating sequences that are appropriate to system operating requirements. Establish mode sequencing and conditioning statements as required and described in the sequences of operation. Review and modify the initial loop assignments and parameters as necessary to tune systems to satisfactory operation during and after initial start-up and testing.

The sequences of operation are shown on the Drawings. These sequences shall be adhered to. See the drawings for control diagrams and additional information. Control diagrams may not show all the devices required to produce these sequences. Provide additional control loops, relays,

sensors, restrictors, and other devices as necessary to meet the sequence of operation. The intent of these specifications is that control loops operate smoothly, on setpoint, without hunting or unnecessary cycling.

3.10 FMCS HARDWARE AND SOFTWARE CONVENTIONS

Work under this Section that pertains to the FMCS shall follow the guidelines set forth herein and those given in Attachment 1 at the end of this section.

ATTACHMENT 1
FACILITY MANAGEMENT CONTROL SYSTEM
INSTALLATION REQUIREMENTS

PART 1 - GENERAL

1.1 ATTACHMENT INCLUDES

Overview of NASA-Ames Facility Management Control System (FMCS)

Requirements for Hardware Installations

Requirements for Software Installations (Programming)

Coordination /Execution

1.2 RELATED DOCUMENTS

National Electric Code (NEC)

National Fire Code (NFC)

Siemens SCU Engineering Manuals

Siemens Apogee user manuals

1.3 GENERAL REQUIREMENTS FOR INSTALLATIONS

A. New installations shall follow manufacturer's (Siemens) most current specifications for System 600 equipment. Applicable construction codes and standards shall be followed in the installation.

B. All installations will occur at the NASA-Ames Research Center. Software installations shall occur at the FMCS Host computer.

C. Persons performing the installations shall have the following qualifications pertaining to the work they will provide:

1. For Hardware - At least two years of experience installing Direct Digital Control (DDC) equipment, including two projects in which Siemens Apogee Systems 600 panels were installed.

2. For Software - At least one year of experience installing Apogee System 600 software, including three projects in which Graphics, point database and PPCL files were installed on a networked Apogee system.

3. Personnel must be approved to work on the FMCS by the FMCS System Manager before installation.

D. Installations will be accomplished with the rest of the FMCS remaining on-line. Any work that may interface with day-to-day operations by NASA-Ames personnel assigned to the FMCS shall be scheduled with the FMCS System Manager before starting work.

1.4 SYSTEM OVERVIEW

A. SYSTEM FUNCTION

1. The NASA-Ames Facilities Management Control System (FMCS) is the only site-wide control system recognized by Ames. Its purpose is to provide for the remote control and monitoring of HVAC and other institutional equipment, and for the monitoring of critical environments Centerwide.

2. The FMCS is the only system recognized by the Ames Security Dispatch Office for alarm condition response. Other than fire and security alarms, only alarms received on the FMCS will warrant notification of on-site and off-site personnel and/or dispatching of maintenance/repair personnel 24 hours a day.

B. SYSTEM COMPONENTS

The FMCS at Ames is a configuration of Siemens Apogee System 600 hardware and software. The system front end is a Microsoft Windows NT based network of computers running Siemens Apogee software. Alarms under the FMCS are received by the Apogee server and in turn by the workstations attached to the server. The FMCS uses real time dynamic graphic displays for monitoring, control, report generation, and alarm acknowledgment functions.

C. CURRENT SYSTEM LAYOUT

1. The FMCS utilizes networks of digital programmable controllers located in buildings around the Center. The controller configuration in each building is dependent on the monitoring and control requirements. The controllers share information with all the other controllers on the network and the server. The controller point and program databases are entered, deleted, or modified through operator workstations attached to the server.

2. Currently the FMCS has been configured with four networks utilizing Stand-Alone Control Units (SCUs), Modular Building Controller (MBC), and Remote Building Controllers (RBCs) that interface with the server. The panels communicate via Apogee Protocol II. There are over 160 panels on the FMCS with a combined control/monitoring task of over 6,000 physical points.

PART 2 - PRODUCTS

2.1 HARDWARE

The controllers shall only be manufactured by Siemens, and shall be of the Apogee System 600 product line. This includes the Stand-Alone Control Unit (SCU), which is the basic element for every building configuration and the Modular Building Controller (MBC). SCU/MBCs required to monitor and control points within a building will be installed in the same building where the points reside.

Slave Panels - Every slave unit to the SCU, MBC, or RBC, such as the Digital Point Unit (DPU), Multipoint Unit (MPU), and Terminal Equipment Controller (TEC), shall be a Siemens Apogee compatible product.

Telecommunications - No panels capable of being connected to a FMCS P2 trunkline (BLN) shall be allowed to be installed Stand-Alone.

No panel to be connected to a FMCS P2 trunkline shall be without proper surge protection.

New panels shall be connected in a 4-wire true daisy-chain scheme to the existing FMCS P2 trunk network. No T-tap is allowed for adding new panels into the network. New panel addressing shall be approved by the FMCS System Manager before the start of work.

Power Requirements - FMCS panels will be placed on dedicated circuits separate from any other building equipment.

Multiple FMCS panels may be placed on one circuit that supplies each panel with the design power requirements of 3 A ac at 120 V ac.

Control transformers for Digital Output Points in FMCS panels and FIP equipment may be placed on circuit with FMCS panels (as long as power requirements are met).

The Contractor shall place labels on FMCS panels and control transformers indicating circuit breaker location.

A three-wire, earth ground circuit is required for FMCS panels. The ground wire shall be attached to the ground bus at the circuit breaker panel. Grounding by the conduit alone is not acceptable.

Device Wiring - Digital Output Points will be wired "Normally Closed" for equipment that will run in the event of a FMCS panel failure.
L. Alarmable Digital Input points shall be wired "Normally Closed" for their non-alarming state unless approved otherwise by the FMCS System Manager.

Analog Input and Telecommunications wiring will use white wire leads for positive terminals and black for common or signal terminals if Belden 8760 is used. If other colors are to be used, coordinate wiring convention with FMCS System Manager.

Shield wires for analog points and Trunk lines shall be taped back at the remote device.

Wiring shall be labeled and a listing of wire assignments given to the FMCS System Manager at completion of installation.

Wiring shall be continuous with no splices.

2.2 SOFTWARE

A. Host and SCU/MBC programming including, but not limited to, point database entry, graphic display entry, and PPCL control programming will be accomplished at the operator console in Building 510, Room 108A, FMCS Control Room, NASA-Ames Research Center, Moffett Field, California.

B. Point Database Files

1. Cabinet addressing assignments for SCUs, RBCs, and MBCs will be made by the FMCS System Manager.

2. Every point that has a physical termination shall be entered into the FMCS point database. Every point that does not have a physical termination (Virtual Point) but is required for operation shall be entered into the system. Alarm configuration and destinations will also be entered if the point is alarmable. Point names shall be descriptive of the point to which they are assigned. The Point names will always start with the building number where the point resides. The room where the point resides shall also be included in the name if applicable.

3. Any alarmable or commandable point shall appear on a dynamic graphic display. The graphic display will be diagrammatic of the equipment or space being monitored/controlled New building installations will require a package of graphics including the building footprint graphic and subsystem graphics. Subsystem graphics of air handlers, cooling plants, cooling towers, and heating plants will have the outside air temperature displayed.

C. PPCL control programming shall be fully commented, explaining what each group of related program lines is doing, especially if a predefined Equipment Sequence of Operation is being programmed. SCU/MBC/RBC programs will be optimized to minimize unnecessary network communications between the server and other SCUs/MBCs/RBCs on the network. Points involved in the program will be listed and defined at the beginning of the program. PPCL files written to control/monitor physical points shall reside in the same panel as the points. Subroutines should be used only when many redundant program lines would be needed otherwise. Actual point system names will be used in PPCL without use of aliases. There will be a limit of one program in each cabinet except where program size will adversely effect program timing and/or execution. Communication across trunks though the Apogee server is prohibited.

PART 3 - EXECUTION

3.1 GENERAL

Installation work will be coordinated with the FMCS System Manager.

When hardware is ready to be tied into FMCS network, the FMCS System Manager shall be contacted.

END OF ATTACHMENT

ATTACHMENT 2
FACILITY MANAGEMENT CONTROL SYSTEM
POINT DATABASE STANDARDS

PART 1 -GENERAL

1.1 CABINETS

Cabinets shall have a virtual point to be used for Node commanding.

1.2 SYSTEM NAMES

A. System Names shall be at least six and no more than ten characters.

B. For building numbers in the 200 series, the first two characters shall correspond to the reserved code letters (prefix) for each building a shown in the following table:

BLD#	PFX	BLD#	PFX	BLD#	PFX
N200	AA	N222	CC	N243	OD
N201	AB	N223	CD	N244	EE
N202	AC	N225	CF	N245	EF
N202A	KC	N225A	MF	N246	EG
N203	AD	N225B	TF	N247	EH
N204	AE	N226	CG	N248	EI
N204A	KE	N227	CH	N249	EJ
N205	AF	N227A	MH	N250	FA
N206	AG	N227B	TH	N251	FB
N206A	KG	N227C	YH	N252	FC
N207	AH	N227D	ZH	N253	FD
N207A	KH	N228	CI	N254	FE
N208	AI	N229	CJ	N255	FF
N209	AJ	N229A	MJ	N256	FG
N210	BA	N229B	TJ	N257	FH
N211	BB	N230	DA	N258	FI
N212	BC	N231	DB	N259	FJ
N213	BD	N232	DC	N260	GA
N214	BE	N233	DD	N261	GB
N215	BF	N233A	ND	N262	GC
N216	BG	N234	DE	N263	GD
N216A	LG	N234A	NE	N264	GE
N216B	SG	N235	DF	N265	GF
N217	BH	N236	DG	N266	GG
N217A	LH	N237	DH	N267	GH
N218	BI	N238	DI	N268	GI
N218A	LI	N239	DJ	N269	GJ
N219	BJ	N239A	NJ	N270	HA
N220	CA	N240	EA	N271	HB
N221	CB	N240A	OA	N272	HC
N221A	MB	N241	EB		
N221B	TB	N242	EC		
N221C	YB	N243	ED		

C. The next four to eight characters are used to define the point. Nodes are defined with SF## - where ## represents the Node.

D. For building numbers that are not in the 200 series, the first three

characters (derived from the building number) of the logical point names shall conform to the following derivation procedure:

1. Building numbers shall be of the 3-digit format. For building numbers with alphabet suffixes, drop the alphabet suffixes (e.g., Building 547E shall be represented as Building 547). For building numbers that are less than 3 digits, insert "0" or "00" in front of the building number to increase it to 3-digit (e.g., Building 1 shall be represented as Building 001).

2. The first digit of the 3-digit building number shall be dropped and replaced with a character as shown in the following table:

First Digit	Replace With	First Digit	Replace With
0	A	6	G
1	B	7	H
3	D	8	I
4	E	9	J
5	F		

(e.g., Building 547E is F47; Building 1 is A01.)

3. The last two digits of the building number shall remain the same.

E. The next three characters are used to define the point.

1.3 POINT DESCRIPTORS

A. Point Descriptors shall be 12 characters.

B. Use the following format: S. LLLLLL.PPP, where:

S = Status
- 0 for non-alarmable (Priority 0)
- M for Maintenance (Priority 4)
- C for Critical (Priority 3)

L = System Name (see above standards)

P = point type
- LAI for LAI points
- LAO for LAO points
- LDI for LDI points
- LDO for LDO points
- 2SL for LS2L points
- CTR for LCTLR points
- PAC for LPACI points
- VAO for virtual AO points
- VDO for virtual DO points

1.4 POINT NAMES (LONG NAMES)

A. One Point name shall be provided for the following equipment:

1. Air Conditioning Units

BLDAC#LOC

2. Air Handling Units

BLDAHU#TFLOC

3. Chillers

   BLDCHILLER#LOC

4. Chilled Water Pumps

   BLDCHWP#LOC

5. Boilers

   BLDTYPBOILER#LOC

6. Exhaust Fans

   BLDEXHFAN#LOC

7. Fan Coil Units

   BLDFC#LOC

8. Condenser Water Pumps

   BLDCWP#LOC

   Where:
   a. Characters that are not underlined do not change for each Building.
   b. BLD Building Number (e.g., 200, 243, ...)
   c. # Unit Number (e.g., 1, 2, 3, ...)
   d. T S for Supply, R for Return, E for Exhaust
   e. TYP HW for Hot Water, STM for Steam
   f. LOC Location (optional) may be substituted with unit type

   Note: The Username beginning with BLD is considered the Primary; whereas, the other is the Secondary

B. Siemens cabinet points shall have Point names in the format of:

   BLD CAB ADDRESS CABINET

   Where:
   BLD Building Number
   CAB Cabinet type (i.e. SCU, MBC, RCU, MPU, UC, ...)
   ADDRESS Cabinet address (through cabinet number for smart panels and device number for dumb panels)

C. All other points (including virtual points) shall have Point names in the format of:

   BLD SYSTEM DESC

   Where:
   BLD Building Number
   SYSTEM System that the point is associated to (i.e AHU1, AC1, BLR1, CHLR1, CLG TOWER 1, ...)
   DESC Point Description (i.e. RETURN TEMP, COLD DECK TEMP, HEATING VALVE, ALARM, FILTER, ROOM 115 TEMP, ON TIME, OFF TIME, SUPPLY TIME, SUPPLY TEMP SETPT, ...)

D. All points entered into the system will have the correct point destination configuration according to the alarm priority and type of alarm. Contact the FMCS Manager for additional information on destination designations.

END OF ATTACHMENT

ATTACHMENT 3
FACILITY MANAGEMENT CONTROL SYSTEM
PROGRAM STANDARDS

PART 1 - GENERAL

A COMMON SECTION shall precede each program that includes:

Building Number
Cabinet Address
Cabinet Location
Program History (includes Author, Date Created, Modifications)
A listing of the Resident Points being used and their functions

ALL PROGRAMMING shall be in a sectional format as follows:

Lines 0-199	Power up sequence, Node commanding
Lines 200-299	TOD Scheduling
Lines 300-349	Global assignments (Virtual)
Lines 350-499	Freeze Protection, Emergency Shutdown commands
Lines 500-3999	Air Handler Control/Monitoring
Lines 4000-4999	Air Conditioner Control/Monitoring
Lines 5000-5999	Boiler Control/Monitoring
Lines 6000-6999	Chiller Control/Monitoring
Lines 7000-8999	Special Equipment Control/Monitoring
Lines 9000-9999	Electrical and Gas Metering
Lines 10000-…	EOF Statement

COMMENT LINES shall precede each section to describe the Sequence of Operations.

SETPOINTS shall be soft-coded (Virtual points) to ease control changes.

DISABLE ALARMABILITY of points when their associated systems are "OFF", and use variable time delays to re-enable them (initial values of 30 minutes). Disabling/enabling of alarms be done by the use of enhanced alarming at the Apogee server.

NODE COMMANDING - Each cabinet's PPCL shall include a statement that looks at the previous Node to determine whether it is communicating or not. For example, IF (NODE8.EQ.FAILED) THEN ON (CDSF08) ELSE OFF (CDSF08). The first Node shall look at the last node on the trunk.

END OF ATTACHMENT

ATTACHMENT 4
FACILITY MANAGEMENT CONTROL SYSTEM
GRAPHICS STANDARDS

PART 1 - GENERAL

1.1 GENERAL

Each building shall have one main graphic, Floor plan graphics, Sequence of Operations graphics, and an auxiliary graphic for each HVAC system such as Hot Water System, Chilled Water System, each Air Handling Unit, each Air Conditioning Unit, and the Exhaust Air System. All new graphics installed shall follow the same conventions as the existing system graphics.

1.2 GRAPHIC NAMING

Graphic names are to be structured as in the following examples:

Main	xxxx.Building
Floor	xxxx.First.Floor.Plan
Sequence	xxxx.Sequence
HWS	xxxx.Hot.Water.System
CWS	xxxx.Chilled.Water.System
AHU#	xxxx.AHU#
AC#	xxxx.AC#
Exhaust	xxxx.Exhaust
Sump Pumps	xxxx.Sump.Pumps
In-Space Units	xxxx.ISU#
Misc. Equip.	xxxx.Misc.Equipment (to be used for all equipment not specified above only)

Where:
xxxx denotes the building number. This includes space for a suffix. Disregard the 4th x if there is no suffix in the building number as in N243, N202, etc.

1.3 COLOR USAGE

Background	White
Chillers	Green
Boilers	Red
Buildings	Photograph (if available)
Cooling Components (Coils, Valves, Tower, Water Lines)	Blue
Heating Components (Coils, Valves, Water Lines)	Red
Non-alarming Miscellaneous (Dampers, Switches)	Dark Gray
Alarming Miscellaneous (Fans, Pumps, Filters, Sensors)	Dynamic Color (red=off, green=on)
Link Symbol	Grey
Text	Black
Special Equipment Operation Information	Yellow
Control Panels	Dynamic Color

1.4 SYMBOL USAGE

Graphic shall use the standards, symbols, and backgrounds created in the Apogee server.

1.5 GRAPHIC ORGANIZATION

A. Each graphic shall have a title (with large lettering) consistent with its purpose displayed at the bottom center.

B. Each graphic (with the exception of the Sequence of Operations graphics) shall have a link associated to each of the other graphics (as well as text describing the link) for the same building on the left hand side of the screen. The Sequence of Operations Graphics shall have a link each for the Main building directory, Main site directory, and associated floor plan if applicable.. These are to be displayed from upper left to upper right, respectively.

C. Each graphic shall include any virtual setpoints associated with it. The OA temperature shall also be included.

D. The Main Graphic shall include the following information.

1. An overhead view of the building.

2. Representations of the control panels, their locations, and addresses.

3. Any points not associated with one of the other graphics (Sump Pumps, Power Consumption)

E. The Floor Plan Graphics shall include a Room Layout of each floor. The rooms are to be color coded to show which systems serve them. A Color Code Key is to be provided with these graphics. Room temperatures are to be displayed, if applicable. The Floor Plan Graphics shall be updated each time a new system is added to a building or the room layout has been modified.

F. The Sequence of Operations Graphics shall include a generalized description of the controls for each system in the building. Special equipment operation information shall be italicized and colored yellow.

END OF ATTACHMENT

SECTION 15990

TESTING, ADJUSTING AND BALANCING
12/01

PART 1 GENERAL

1.1 SUMMARY

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

1.2 REFERENCES

Associated Air Balance Council (AABC)

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

American Society of Heating Refrigerating, and Air Conditioning Engineers, Inc. (ASHRAE)

ASHRAE-05	Handbook, HVAC Applications (SI Edition)

American Society of Mechanical Engineers (ASME)

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

Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA)

SMACNA-93	HVAC Systems - Testing, Adjusting and Balancing

1.3 SUBMITTALS

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

SD-01, Data

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

SD-09, Reports

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

SD-13, Certificates

Certificates of Compliance shall be submitted by the Contractor

showing independent laboratory certification of test-apparatus calibration data, dated after the award of the contract.

1.4 GENERAL REQUIREMENTS

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

PART 2 PRODUCTS

Products are not required for this section.

PART 3 EXECUTION

3.1 WATER SYSTEMS TESTING

A. Before acceptance of the work, systems shall be tested in the presence of the COTR.

B. Tests shall be performed before insulation of surfaces, painting, and concealment of work. Systems containing repaired defects shall be retested to original criteria for acceptance, except when waived by the COTR.

C. Tests shall be hydrostatic, unless otherwise specified. Water used for testing shall be potable.

D. Government will supply testing water, but the Contractor shall provide for approved disposal of contaminated water.

E. Tests may be pneumatic when freezing conditions may occur and upon prior approval by the COTR. Only oil-free compressed air shall be used for testing.

F. Pneumatic testing shall include swabbing joints under a test pressure of with standard high-film-strength soap solution and observing for bubbles.

G. Contractor may conduct tests for its own purposes, but the acceptance test shall be conducted as specified herein.

H. If the test demonstrates that leakage rate exceeds specified limits, the sources of leakage shall be determined, defective materials and workmanship shall be repaired or replaced, and the system shall be retested until specified requirements are met.

I. Other than standard piping flanges, plugs, caps, and valves, only commercially manufactured expandable-elastomer plugs shall be used for sealing off piping for test purposes. Safe test-pressure rating of any plug used shall be not less than two times the actual test pressure being applied.

J. Precautions shall be taken to vent the expansive force of compressed air trapped during high-pressure hydrostatic testing to preclude injury and damage.

K. COTR may require the removal of system components, such as plugs or caps, to ascertain that the water has reached all parts of the system if purging or vent valves are not provided.

L. Piping system components such as valves shall be checked for functional operation under system test pressure. Components that could sustain damage due to test pressure shall be removed from piping systems before hydrostatic testing.

M. Leaking gasket joints shall be remade with new gaskets. Leaking copper joints shall be remade with new fittings and new tube ends.

N. Temperature of water used for testing shall not cause condensation on system surfaces.

O. Test media shall not be added to a system during a test for a period specified or to be determined by the COTR.

P. Duration of a test will be determined by the COTR and shall be for a minimum of 2 hours, with a maximum of 24 hours. Test may be terminated by direction of the COTR at any time during this period after it has been determined that the permissible leakage rate has not been exceeded.

Q. Test records of piping systems tests shall be prepared and maintained. Records shall show test personnel responsibilities, dates, test gage identification number, ambient and test water temperatures, pressure ranges, rate of pressure drop, leakage rates, and other system characteristics.

R. Test Gages - Test gages shall have a or larger dial, be accurate to +/- 0.5 percent of full-scale range, and have dial graduations and pointer width compatible with readability and one-half the accuracy extremes. Maximum permissible scale range for a given test shall be such that the pointer shall have a starting position at midpoint of the dial or within the middle third of the scale range. Certification of accuracy and correction table shall bear a date within 90 days before use, test gage number, and project number.

S. Test and Acceptance Criteria

1. Aboveground water systems shall be tested at and the applied test pressure shall be maintained without further addition of test media for not less than 2 hours. Maximum allowable pressure drop shall be , or as approved.

2. Underground rubber-jointed ferrous-pipe water systems shall be tested at and the applied test pressure shall be maintained for not less than 2 hours. Where no thrust blocks are to be provided, piping shall be tested at an approved pressure. After satisfactory hydrostatic testing, the piping shall be tested for leakage as follows:

a. Duration of each leakage test shall be not less than 2 hours. During the test, the main shall be subjected to pressure, based on the elevation of the lowest section under test and corrected to the elevation of the test gage.

b. Leakage is defined as the additional quantity of water supplied into the laid pipe, or any valved section thereof, that is necessary to maintain the specified leakage pressure after the pipe has been filled with water and the air expelled.

3. Maximum allowable leakage for the piping installation shall be indicated by not more than a 1 percent drop of total system pressure.

4. Hydrostatic tests shall be applied only to piping with concrete thrust blocking that has cured for a minimum of 7 days.

5. Backflow prevention devices in potable water systems and other water system devices shall be tested for proper functioning under conditions normal to their application.

3.2 AIR-HANDLING SYSTEMS TESTING

Structural integrity and leakage testing of air-handling systems shall be performed by system or by duct mains and branches.

Tests shall be performed before insulation of surfaces, painting, or concealment of work. Unless waived by the COTR, systems containing repaired defects shall be retested to original criteria for acceptance.

DUCT PRESSURE-VELOCITY CLASSIFICATION

DUCT CLASS	STATIC PRESSURE RATING (Pa)	PRESSURE	CLASS	VELOCITY (m/s)
High pressure	2500	Positive	A	10 Up
Medium pressure	1500	Positive	A	10 Up
Medium pressure	1000	Positive	A	10 Up
Medium pressure	750	Positive/ Negative	A	20 Down
Low pressure	500	Positive/ Negative		10 Down
Low pressure	250	Positive/ Negative		10 Down
Low pressure	125	Positive/ Negative		7.5 Down

Seal Class A: Seams, joints, fastener penetrations and connections sealed.

C. Low Pressure Duct Systems

1. Portions of systems shall be inspected and tested to positive or negative pressures, or both, whichever is normal to the portion of system under test, in accordance with the following:

a. There are no visible mechanical defects.

b. There is no audible leakage at any point when area ambient noise is at normal-occupancy level.

c. No leakage is perceptible to the hand, when placed within 150 mm of a joint.

2 Measured total system leakage shall not exceed 1 percent of total system cubic meter per second when tested in accordance with Paragraph 3.2.E, Leak Tests.

D. Medium/High Pressure Duct Systems

1. High-velocity, high-pressure duct systems shall be structurally tested at static pressures 50 percent in excess of total fan pressure. Leakage testing shall be at a pressure 25 percent higher than normal operating pressure and, in dual duct systems at maximum pressure at mixing box, when inlet valve is shut off. System will be acceptable provided:

a. There are no visible mechanical defects.

b. Measured total system leakage does not exceed 1 percent of total system cubic meter per second capacity when tested in accordance with Paragraph 3.2.E, Leak Test.

c. There is no audible leakage at any point when area ambient noise is at normal-occupancy level.

2. High-velocity, medium-pressure duct systems shall be structurally tested at static pressures 25 percent in excess of air-handling apparatus discharge pressure. Leakage testing shall be at a pressure 25 percent higher than normal operating pressure and, in dual-duct systems at maximum pressure at mixing box, when inlet valve is shut off. System will be acceptable provided:

a. There are no visible mechanical defects.

b. Measured total system leakage does not exceed 1 percent of total system cubic meter per second capacity when tested in accordance with Paragraph 3.2.E, Leak Test.

c. There is no audible leakage at any point when area ambient noise is at normal-occupancy level.

E. Leak Tests

1. Test apparatus and procedures shall be similar in all respects to those defined in SMACNA-93. Filtered blower inlet and automatic safety relief device shall be provided to protect system. Accuracy of measurement of leakage flow rate shall be certified to be within 1 percent of total system flow.

2. Test Apparatus - Test apparatus shall consist of:

a. A source of high pressure air - A portable rotary blower or tank type vacuum cleaner

b. A flow measuring device, usually an orifice assembly consisting of straightening vanes and an orifice plate mounted in a straight tube with properly located pressure taps. Each orifice assembly shall be accurately calibrated to its own calibration curve. Pressure and flow readings are usually taken with U-tube manometers.

3. Test Procedures

a. Test for audible leaks as follows:

1) Close off and seal openings in the duct section to be tested. Connect the test apparatus to the duct by means of a flexible duct section.

2) Start the blower with its control damper closed (some small blowers popularly used for testing ducts may damage the duct because they can develop pressures up to).

3) Gradually open the inlet damper until the duct pressure reaches 500 Pa in excess of designed duct operating pressure. Test pressure is read on manometer No. 1. Note that the pressure is indicated by the difference in level between the two legs of the manometer and not by the distance from zero to the reading on one leg only.

4) Survey joints for audible leaks. Mark each leak and repair after shutting down blower. Do not apply a retest until sealants have set.

b. After audible leaks have been sealed, the remaining leakage should be measured with the test apparatus orifice section as follows:

1) Start blower and open damper until duct pressure reaches 25 percent in excess of designed duct operating pressure.

2) Read the pressure differential across the office on manometer No. 2. Leakage rate in cubic meters per second is read directly from the calibration curve. If leakage does not occur, the pressure differential will be zero.

3) Total allowable leakage should not exceed 1 percent of the total system design air flow rate. When partial sections of the duct system are tested, the summation of the leakage for all sections shall not exceed the total allowable leakage.

4) If audible leaks have been corrected, it is unlikely that the measured leakage will exceed 1 percent of capacity. If it does, the leaks shall be located by careful listening or feeling along the joint.

5) It should be noted that even though a system may pass the measured leakage test, a concentration of leakage at one point may result in a noisy leak that shall be corrected.

F. Test Report Criteria -A test report shall be provided for each system tested, identified by system or section thereof, and containing leak-test curves for apparatus used and data pertinent to acceptance requirements.

3.3 AIR AND HYDRONIC SYSTEMS TESTING AND ADJUSTMENT

A. Operational balancing and adjustment of air-handling and hydronic systems shall be performed under the direction of an independent balancing agency whose field representative is a registered professional engineer. Work shall be done in accordance with ASHRAE-05, ABC MN-1 or SMACNA-93, where applicable, the requirements of the contract documents, and in the presence of the COTR.

B. Operational balancing and adjustment of air-handling and hydronic systems shall be done in accordance with SMACNA-93, the requirements of the contract documents, and in the presence of the COTR.

C. Government reserves the right to require recalibration of any or all test apparatus in accordance with the frequency recommended by the component manufacturer, or when reasonable doubt of accuracy exists.

D. Hydronic systems structural and leakage testing shall be performed in accordance with requirements specified in Paragraph 3.1, Water Systems Testing.

E. Air-handling systems structural and leakage testing shall be performed in accordance with requirements specified in Paragraph 3.2, Air-Handling Systems Testing.

F. Components of the various air systems shall be adjusted to operate within the design and operating characteristics published by the equipment manufacturer. Government will require the services of an authorized representative of the manufacturer if the Contractor is unable to adjust any equipment.

G. Equipment shall not be operated until properly lubricated and brought into specified service condition.

H. Air- and hydronic-system final adjustments shall be permanently marked to be readily restorable if disturbed.

I. Systems acceptance is predicated upon successful completion of specified work, receipt by the COTR of certified data summarizing the performance of all systems within design intent, and approval thereof. Data shall be arranged by system and identified by apparatus and item, using standard forms, where possible, and supplementing with reasonable facsimiles, where necessary.

J. Air-Handling Systems

1. Balancing, Adjustment and Acceptance Criteria.

a. Final volume conditions for all systems shall be within the following limits:

1) Air-handler delivery: + 10 percent, - 0 percent of design cubic meter per second at design temperature.

2) Primary air delivery: +/- 10 percent of design cubic meter per second at design temperature.

3) Air-handler delivery: + 5 percent, - 0 percent of design cubic meter per second at design temperature.

4) Primary air delivery: +/- 5 percent of design cubic meter per second at design temperature.

2. Balancing and Adjustment, Apparatus and Procedures

a. Balancing and adjustment apparatus and procedures shall be in accordance with AABC MN-1.

b. Balancing and adjustment apparatus and procedures shall be in accordance with ASHRAE-05 and AABC MN-1.

c. Instrumentation shall be provided to record air movement data, motor kilowatt input, and power factor. If motor identification plate current value is exceeded, the next size larger motor, starter, and wiring (if necessary) shall be provided.

3. Test Reports - Test reports shall be provided on all systems tested together with test-apparatus data and air diffusion device flow coefficients, and the following:

a. Air-handling apparatus data

b. Exhaust-fan data

c. Air-diffusion devices data

d. Duct-traverse data for the following:

1) Main supply duct

2) Main exhaust duct

3) Outside air- intake duct

4) Other ducts as indicated

e. Duct zone-traverse data for the following:

1) All zones

2) Air-handling apparatus

3) Air-diffusion devices data

4) Each main duct, exhaust duct, and outside intake data

f. Filter apparatus data, including visual condition, inlet pressure, and differential pressure for each filter installation

g. Coil data, including visual condition, inlet pressure, and differential pressure for each coil installation

h. Pressure at inlet to face zone duct on multizone units.

K. Hydronic Systems

1. System Balancing, Adjustment, and Acceptance Criteria - Systems final flow conditions shall be within the following limits:

a. Pump delivery: + 10 percent, - 0 percent of design liter per second at design temperature

b. Flow-station delivery: +/- 10 percent of design liter per second at design temperature

c. Pump delivery: + 5 percent, - 0 percent of design liter per second at design temperature

d. Flow station delivery: +/- 5 percent of design liter per second at design temperature.

2. Test Apparatus and Procedures

a. Test apparatus shall consist of devices required for hydronic system flow measuring and balancing including:

(1) Pressure gages and fittings

(2) Dry bulb thermometers

(3) Wet bulb thermometers

(4) Pyrometers

(5) Balancing-cock adjustment wrenches

(6) Differential-pressure gages or manometers

(7) Thermometer wells, where necessary for balancing, but where permanent installation of thermometers is not indicated or required

b. Complete air balance shall have been accomplished before water balance begins.

3. Hydronic Systems Preparation - Hydronic systems shall be prepared in the following manner:

a. Proper installation of valves and balancing devices shall be verified.

b. Valves shall be opened to full-open position, including coil-stop valves, bypass valves, and return-line balancing cocks.

c. Strainer screens shall be removed and cleaned.

d. Water in each system shall be examined to determine that it has been treated.

e. Rotation of pumps shall be checked only after obtaining approval.

f. Expansion tanks shall be checked to determine that they are not air-bound and that system is full of water.

g. Air vents shall be checked at high points to verify proper installation and operation.

h. Temperature controls shall be set so that coils are on full cooling. Automatic bypass valves at coils and liquid chiller should close. Follow the same procedure when balancing heating coils are set on full heating.

i. Water-circulating pumps shall be set to proper liter per second delivery.

j. Flow of chilled water through chillers shall be adjusted.

k. Water flow through convertors shall be adjusted.

l. Leaving-water and return-water temperatures through chiller and convertors shall be checked.

m. Water temperature shall be checked at inlet side of cooling and heating coils. Note rise or drop of temperature from source.

n. Next, each coil shall be balanced.

o. Upon completion of flow reading and adjustment of coils, settings shall be marked and data recorded.

p. After adjustment to coils have been made, settings at pumps, chiller, and converters shall be rechecked and readjusted if required.

q. Pressure drop through coils shall be measured at set flow rate on call for full cooling and on full heating.

r. Pressure drop across bypass valve shall be set to match coil full-pressure drop to prevent unbalanced flow conditions when coils are on full bypass.

s. Same procedure on chiller to adjust chiller bypass valves shall be followed.

t. Instrumentation shall be provided to record apparatus motor kilowatt input and power factor. If motor identification plate current capacity and larger starter is exceeded, next-size larger motor and wiring shall be provided, as necessary.

u. Cooling-water flow shall be checked.

4. Operational Test Report - Operational test report shall provide data on systems tested, test apparatus data, and orifice or Venturi data, and shall include:

a. For each heating and cooling element:

1) Inlet water temperature

2) Leaving water temperature

3) Inlet air temperature

4) Leaving air temperature

5) Pressure drop across each element

6) Pressure drop across bypass valve

7) Calculated and measured flow rates through coils and radiation elements.

b. For each pump, at balanced-condition suction and discharge pressures:

1) Flow rate

2) Mechanical specifications of unit

3) Rated and actual kilowatt input and power factor.

c. For each apparatus such as chiller, cooling tower, and converter:

1) Inlet water temperature

2) Leaving water temperature

3) Pressure drop across units

4) Calculated and measured waterflow

5) Mechanical specifications of units

6) Rated and actual kilowatt input and power factor for motors

7) Heating- and cooling-element data

8) Pump data.

L. System and Temperature-Control Adjustment - After balance and adjustment operations have been completed, the system shall be tested as a whole to see that components perform as an integral part of the system and that temperature and conditions are evenly controlled. Corrections and adjustment shall be made as necessary to meet the specified design requirements.

3.4 STEAM AND CONDENSATE SYSTEMS TESTING

A. Before acceptance of the work, completed systems shall be tested in the presence of the COTR.

B. System shall be subjected to pressure tests to determine structural integrity, and to operational and cyclic tests, as necessary, to determine that system functions and operates as required.

C. After pressure tests and cleaning operations have been satisfactorily completed, system components shall be adjusted for proper operation within the design and operating characteristics published by the component manufacturer. In addition to the services of an authorized representative of the manufacturer, the Government reserves the right to require the services of an authorized representative of a component manufacturer if the Contractor is unable to adjust a component. Contractor shall arrange for such services and defray the cost.

D. Test Duration

1. Duration of a test will be determined by the COTR.

2. A pressure test shall be held for a minimum of 2 hours and a maximum of 24 hours.

3. An operational test shall be held for a minimum of 6 hours and a maximum of 24 hours.

4. A test may be terminated by the COTR at any time after it has been determined that the system meets specified requirements.

E. Test Gages - Contractor's test gages shall conform to ASME B40.1 and shall have or larger dials. Maximum permissible scale range for a given test shall be such that the pointer shall have a starting position at midpoint of the dial or within the middle third of the scale range. Certification of accuracy and correction table shall bear a date within 90 days before use, test gage number, and project number.

F. Acceptance Pressure Testing

1. Testing shall take place during steady-state ambient temperature conditions.

2. Tests shall be hydrostatic unless otherwise specified.

3. Subject to prior approval, tests may be pneumatic when freezing conditions may occur. Personnel not directly involved in pneumatic testing of piping in excess of shall be evacuated from the area.

4. Pneumatic testing shall include swabbing joints under test pressure of with standard high-film-strength soap solution and observing for bubbles.

5. Tests of steam and condensate systems shall be made using potable water.

6. Compressed air used for steam and condensate systems pneumatic testing shall be oil-free.

7. Systems shall be tested at 1.5 times primary working steam pressure rating of system components, and the applied pressure shall be maintained without further addition of test media for not less than 1 hour. Maximum allowable pressure drop shall be , or as approved.

8. Contractor may conduct tests for its own purposes, but the acceptance test shall be conducted as specified herein.

9. If testing reveals that leakage exceeds specified limits, the leaks shall be isolated and repaired, defective materials shall be replaced where necessary, and the system shall be retested until specified requirements are met. Leaking gasket joints shall be remade with new gaskets and new flange bolting. Old gaskets and bolting shall be discarded. Leaking tubing joints shall be remade with new fittings and new tube ends.

10. Other than standard piping flanges, plugs, caps, and valves, only commercially manufactured expandable elastomer plugs shall be used for sealing off piping for test purposes. Safe test-pressure rating of any plug used shall be not less than two times the test pressure.

11. Precautions shall be taken when venting compressed air trapped during high-pressure hydrostatic testing to preclude injury and

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

12. Movement limiting provisions shall be used to protect expansion joints against overextension from system pressures.

13. Piping system components, such as valves, shall be checked for functional operation under system test pressure.

14. Piping shall be subjected to shock developed by a vigorously applied hammer, as directed by the COTR.

15. Temperature of water used for testing shall not cause condensation on system surfaces.

G. Operational Testing - System shall be cycled five times, from start to operating thermal conditions, to verify adequacy of construction, system controls, and component performance, unless otherwise approved.

3.5 DRAINAGE AND VENTING SYSTEM TESTING

Drainage and venting system piping shall be tested before the fixtures are installed. Soil and waste piping installed underground shall be tested before backfilling. Testing shall be applied to the system in its entirety or in sections. If the entire system is tested, openings in pipes, except the highest opening, shall be tightly closed and the system shall be filled with water to the point of overflow.

If the system is tested in sections, each opening, except the highest opening of the section under test, shall be tightly plugged and each section shall be filled and tested with not less than water pressure. In testing successive sections, at least the upper 3 m of the next preceding section shall be tested so that each joint or pipe in the system, except the uppermost , has been submitted to a test with not less than water pressure. Water shall be kept in the system, or the portion under test, for at least 15 minutes before the inspection starts. System shall be tight at all joints.

SECTION 16000

GENERAL ELECTRICAL
12/01

PART 1 GENERAL

1.1 SUMMARY

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

1.2 REFERENCES

American National Standards Institute (ANSI)

ANSI C80.3	Electrical Metallic Tubing

American Society for Testing and Materials (ASTM)

ASTM B3	Soft or Annealed Copper Wire

Institute of Electrical and Electronics Engineers, Inc. (IEEE)

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

National Electrical Manufacturers Association (NEMA)

NEMA 250	Enclosures for Electrical Equipment (100 Volts Maximum)
NEMA PB 1	Panelboards
NEMA WD 1	General Requirements for Wiring Devices

National Fire Protection Association (NFPA)

NFPA 70	National Electrical Code
NFPA 72	Fire Alarm System

Underwriters Laboratories Inc. (UL)

UL 489	Molded-Case Circuit Breakers and Circuit-Breaker Enclosures
UL 506	Specialty Transformers
UL 514A	Metallic Outlet Boxes
UL 797	Electrical Metallic Tubing

1.3 SUBMITTALS

Refer to Section 01300, Submittals. Submit the following:

SD-01, Data

Manufactures Catalog Data for electrical equipment and fixtures.

SD-04, As-Built Drawings

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

A013-8901-XR1 Ames Engineering Document Number System

NASA Ames Facility Engineering Branch AutoCAD Drawing Requirements dated 21 June 2000.

NASA Ames Facility Engineering Branch AutoCAD Drawing Revision Requirements dated 26 May 2000.

Instructions for completing and submitting an Engineering Change Order (ECO) Form.

Instructions for completing and submitting an Engineering Change Order (ECO) Form."

SD-06, Instructions

Manufacturer's Instructions for such items as control devices and transformers.

SD-07, Material

Material Schedule for materials not covered by SD-01.

SD-09, Reports

Test Reports on tests specified to be conducted by Contractor.

SD-13, Certificates

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

1.4 QUALITY ASSURANCE

Approval of materials and equipment will be based on UL, NEMA, ANSI, ASTM, NFPA, or other commercial standards.

Equipment design, fabrication, and installation - Unless indicated otherwise, comply with NFPA 70 and referenced codes and standards.

Do not cover up or enclose work until it has been inspected, tested, and approved. Uncover any work that is enclosed or covered up before being inspected and tested and, after work has been inspected and approved, restore to its original condition at no additional cost.

1.5 INTERPRETATION OF DRAWINGS AND SPECIFICATIONS

Design drawings are diagrammatic and do not indicate all offsets, bends, elbows, or other specific elements that may be required for proper installation of work. Accomplish such work at worksite. Provide additional bends, offsets, and conduit as required to complete work at no additional cost.

Locations of switches, receptacles, lights, motors, outlets, and other equipment indicated are approximate. Place such items so as to not interfere with ducts, piping, and equipment. Verify door swings so that light switches are properly located.

Equipment sizes shown on drawings are minimum unless otherwise indicated. Before installing any wire or conduit, obtain exact equipment requirements and install items such as wire, conduit, disconnect switches, motor starters, heaters, and circuit breakers of correct size for equipment actually installed; however, do not use wire and conduit sizes smaller than those indicated without written approval.

1.6 COORDINATION

Coordinate electrical work with work of other trades.

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

1.7 PREVENTION OF CORROSION

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

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

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

2.2 CONDUITS, RACEWAYS, AND FITTINGS

A. General

1. Use rigid steel conduit in conduit systems, except where otherwise indicated and where flexible conduit is required.

2. Conduit size: diameter minimum, except where specifically indicated smaller and for switch leg runs.

3. Rigid aluminum conduit is permitted instead of rigid steel conduit in sizes and larger for indoor locations.

4. Conduit and raceway runs concealed in or behind walls, above ceilings, or exposed on walls and ceilings or more above finished floors and not subjected to mechanical damage may be electrical metallic tubing.

5. Conduit, connectors, and fittings - Approved for installation of electrical conductors.

B. Rigid Metal Conduit - Use threaded fittings.

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

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

E. Flexible Metallic Conduit

1. Fittings - UL labeled.

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

2.3 WIRE AND CABLE

A. Building Wire

1. Conductors - Standard concentric stranded copper wire; minimum (AWG 12), except that (AWG 14) may be used for control wiring where indicated.

2. Building wire - Type THHN/THWN, insulation of PVC and nylon jacket, with a minimum temperature rating of .

B. Switchboard Wire - Use for instrument and control wiring on back of switchboards and hinged-front instrument panels; single-conductor, 600 V, flame- and heat-resistant insulated wire, minimum (AWG 14) with a minimum temperature rating of . Current and voltage transformer wire, 600 V or less - Type SIS, (AWG 12) unless otherwise indicated.

C. Power and Control Wire in Cable Trays - Type TC cable (approved for cable tray installation), 600 V, with current-carrying capacity as determined by NFPA 70.

D. Standard Flexible Multiconductor Cable - For control and power below 600 V; contains one (green) grounding conductor; thermosetting or thermoplastic overall jacket (Type SJ, SJO, SO, STO). Include white conductor for power neutral or grounded current-carrying conductor.

E. Splices and Connectors

1. Make splices in building wire (AWG 8) and smaller and multiple conductor cables with insulated Scotchlock, or equal, connectors or with indentor crimp-type connectors and compression tools.

2. Make splices in building wire (AWG 6) and larger and single-conductor cables with indentor crimp-type connectors and compression tools, or with bolted clamp-type connectors.

3. Wrap joints with an insulating tape that has an insulation and temperature rating equivalent to that of conductor. Make splices in rubber-insulted neoprene-jacketed wire and cables watertight.

4. Vinyl-plastic electrical insulating tape - Conform to UL, for intended application.

5. Use compression lug in terminations where indicated and for building wire (AWG 8) and larger.

2.4 FLUSH WIRING DEVICES

A. Wall Switches

1. Where two or more snap switches will be installed at same location, mount them in one-piece ganged switch boxes, with a gang cover plate.

2. Mount combination snap switch and single or duplex receptacles in two-gang switch boxes, with a combination two-gang cover plate.

B. Receptacles - Provide 20 A, 125 V ac, two-pole, three-wire, single or duplex grounded, conforming to 5-20R configuration in NEMA WD 1, except where specific-purpose, locking, or higher rated receptacles are indicated or specified.

C. Clock Outlets - Provide 15 A, 125 V ac, two-pole, three-wire, single polarized receptacle in a standard approved flush-mounted outlet box with a matching wall plate and a clock-mounting hook. Outlets - Recessed for plug caps that allow surface-mounted clocks to hang flush with finished wall.

D. Floor Outlets - Provide convenience outlets in floors for connection

to 120 V ac single-phase circuits, comprising single or duplex receptacles enclosed in floor boxes with cover plates especially approved for purpose.

E. Weatherproof Outlets - Provide convenience outlets in outdoor damp or wet locations for connection to 120 V ac single-phase circuits, comprising single or duplex receptacles enclosed in weatherproof outlet boxes, with gasketed cast-aluminum plates and spring-loaded hinged lift covers. Springs and hinge pins - Corrosion-resistant steel. Screws and spring covers - Chromium- or cadmium-plated brass. Use rubber or neoprene gaskets to provide a positive seal against weather.

F. Device Plates

1. Wall plates for flush snap switches and receptacles - Stainless steel, minimum thick, with beveled edges and a brushed satin finish.

2. Mounting screws - Stainless steel with oval countersunk heads finished to match plate.

G. Occupancy Sensors - Where shown on drawings, provide occupancy sensors (such as those supplied by The Watt Stopper, Inc. or equal) that automatically control lighting based on room occupancy. Sensors shall be UL and CUL listed with adjustable sensitivity and time delay.

2.5 BOXES AND FITTINGS

Boxes - Sufficiently large to accommodate conductors entering box, in accordance with NFPA 70, Article 370 and UL 514A. Boxes exposed to weather or in normally wet locations - Cast-metal with threaded hubs.

Outlet, switch, and junction boxes flush-mounted in walls or ceilings - Octagon, square, or rectangular-shaped gang boxes as appropriate, with extension rings and covers.

2.6 PANELBOARDS

Lighting and appliance branch circuit panelboards - Circuit-breaker type in accordance with NEMA PB 1. Circuit breakers - Bolted to bus; plug-in circuit breakers are not acceptable. Buses - Copper of the rating indicated, with main lugs or main circuit breaker as indicated.

Panelboards for use on grounded ac systems - Provide with a full-capacity isolated neutral bus and a separate grounding bus bonded to panelboard enclosure.

Panelboard enclosures - NEMA 250, Type 1, according to NEMA PB 1, unless otherwise indicated. Enclosure fronts - Provide latchable hinged doors (door-in-door construction).

2.7 CIRCUIT BREAKERS

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

2.8 LAMPS AND LIGHTING FIXTURES

Manufacturers and catalog numbers shown are indicative of general type desired, and are not intended to restrict selection to fixtures of any particular manufacturer. Fixtures with same salient features and equivalent light distribution and brightness characteristics, and of equal finish and quality, are acceptable. Provide lamps of proper type and wattage for each fixture. Fixtures require approval by COTR before purchase.

Ballasts - High power factor, energy efficient, UL listed, A-sound rated, with Class P terminal protective device for 120 V or 277 V operation as indicated, rapid-start fluorescent type. Fluorescent lamps - Standard reduced wattage type, General Electric Company Watt-Miser II or approved equal.

2.9 DRY-TYPE DISTRIBUTION TRANSFORMERS

General purpose, with 480 V primary windings, two-winding type, 60 Hz, self-coiled, conforming to UL 506. Provide primary windings with two 2.5 percent taps above and two below nominal voltage.

2.10 GROUNDING SYSTEM COMPONENTS

Ground Rods - Copper-clad or copper-coated steel rods, minimum diameter, minimum long per section until resistance to ground is 25 ohms or less. Rods - Rolled to a commercially round shape from welded copper-coated steel, with a hard, clean, and smooth continuous copper surface. Ground rods - Sectional with a cone-shaped point on the first section, and die-stamped near top with name or trademark of manufacturer and length of rod in meters.

Ground Wires - For substations, main panels and distribution points, and ground rod connections provide annealed bare copper ground wires conforming to ASTM B3, stranded, with 98 percent conductivity. Size of wire - As indicated and, if not indicated, in accordance with grounding requirements of NFPA 70.

Grounding Connectors - UL approved and labeled.

PART 3 EXECUTION

3.1 CONDUITS, RACEWAYS, AND FITTINGS

A. Enclose power, lighting, control power, emergency light, emergency power, and special-service systems in separate conduit or separate conduit systems. Install conduit and fittings in accordance with NFPA 70 and as specified herein.

B. Provide rigid steel conduit and raceway runs in or under concrete; in damp, corrosive, or outdoor locations; in hazardous areas; where subjected to mechanical damage; or where intended for conductors rated over 600 V. Paint conduit joints in corrosive areas with corrosion- or acid-inhibiting compounds.

C. For any run of EMT, intermediate, or rigid conduit between outlet and outlet, between fitting and fitting, between outlet and fittings, and for bends located immediately at outlet of fitting conform to NFPA 70. Ensure that installed conduit and fittings are free of dirt and

trash and are not deformed or crushed.

D. Install conduit with a minimum of of free air space separation from mechanical piping.

E. Install concealed conduit in finished areas. Install conduit passing through walls in sleeves.

F. Provide expansion fittings with flexible ground strap in conduit runs crossing building expansion joints.

G. Seal exposed ends of conduit without conductors with watertight caps or plugs. Provide bushings on open ends of conduit containing conductors. Provide insulated bushings for conduits containing (AWG 4) conductors or larger with an insulating ring as an integral part of bushing.

H. Install a nylon or polypropylene pull rope with a minimum tensile strength of 580 N in empty conduits.

I. Paint couplings, boxes, and conduit fittings on fire alarm systems with red paint and on FMCS with blue paint.

J. Support of Conduit

1. Clamp conduit securely and support at least every vertically and horizontally unless otherwise indicated. Support conduit in high vibration areas every , and in medium vibration areas every . Unless indicated otherwise, contact COTR for final verification of high and medium vibration areas. Fasten galvanized pipe straps to structure with bolts, screws and/or anchors. Do not use wooden masonry plugs.

2. Do not support conduit or boxes from T-bar ceiling wires.

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

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

K. Flexible Conduit

1. Make electrical connections to vibration-isolated equipment with flexible metallic conduit so as to not impair function of equipment.

2. Use flexible metallic conduit to connect recessed fixtures from outlet boxes in ceilings, metallic transformers, and other

approved assemblies.

3. Use liquid-tight flexible metallic conduits in wet and oily locations.

4. Provide sections of flexible steel conduit maximum 1.8 m long and install only in exposed or accessible locations. Ensure that interior surfaces of conduit are free from burrs and sharp edges that may cause abrasion of wire and cable coverings. Provide ends of flexible steel conduit with grounding bushings and approved fittings.

5. Use ground wires in flexible conduit for circuits. Flexible conduit is not considered to be a ground conductor.

L. Rigid Metal Conduit

1. Ends of conduit - Cut square, ream and threaded. Bring joints butt-to-butt in couplings. Make joints mechanically tight. Protect conduit against damage and entrance of water or foreign material during construction.

2. Make 90-degree bends of conduit larger than diameter with factory-made elbows. Provide long radius elbows for conduit larger than diameter. Make field-made bends and offsets with an approved hickey or conduit-bending machine. Make changes in direction of runs with symmetrical bends or cast-metal fittings.

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

4. Make conduit joints with tapered thread firmly set. Ream each length of conduit cut in field before installation. Where conduit is threaded in field, ensure that each threaded end consists of at least five full threads. Use corrosion-inhibitive compound on conduit threads in exterior areas.

5. Conduit stubbed-up through concrete floors for connections to free-standing equipment (except motor-control centers, cubicles, and other such items of equipment) - Provide with a flush coupling if floor slab is of sufficient thickness; if not, provide a floor box set flush with finished floor. Conduits installed for future use - Terminate with a coupling and plug set flush with floor, unless otherwise indicated.

M. Rigid PVC Conduit

1. Rigid PVC conduit for underground work - Encase in a red-dyed concrete envelope or bury directly as specified for underground ducts. Where suitable protection is provided, PVC may be run exposed (particularly in high corrosion areas).

2. Run continuous, bare, soft-drawn copper ground wire in conduit

with conductors, and solidly connect to ground at each end. Size ground wires in accordance with NFPA 70, Article 250.

3. Store rigid PVC conduit on a flat surface and protect from direct rays of sun.

N. EMT

1. Cut EMT square with hacksaw or three-wheel pipe cutter, and ream to remove burrs and rough surfaces.

2. Avoid field-made bends and offsets where possible but, where necessary, make bends with an approved hickey or conduit-bending machine. Make changes in direction of runs with symmetrical bends or approved metal fittings.

O. Flexible Metallic Conduit - Install only in exposed, accessible locations in accordance with NFPA 70, Article 350. Install grounding conductor (green) in all runs. Make connections to motors and vibrating equipment with flexible metallic conduit.

P. Any connection to alarm initiating devices shall be in accordance with NFPA 72.

3.2 INSTALLATION OF WIRING

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

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

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

Conductors up to and including (AWG 2) - Manufactured with colored insulating materials. Conductors larger than (AWG 2) - Ends identified with colored plastic tape in outlet, pull, or junction boxes. Identify control circuit conductors at each connection point.

Connectors and splices - Conform to UL and make in approved enclosures using solderless pressure connectors and vinyl-plastic electrical insulating tape. Thoroughly clean conductors and materials used in a splice, tap, or connection before makeup to ensure good electrical and mechanical connections. Provide conductor identification with each enclosure where a tap, splice, or termination is made and at equipment terminal of each conductor. Ensure that terminal and conductor identification match that shown on approved shop drawings. Hand lettering or marking is not acceptable. Properly identify control-circuit terminals of equipment by color-coded insulated conductors, number-coded plastic self-sticking printed markers, or permanently attached metal-foil markers. Cable fittings and insulating tape - UL labeled.

Where several feeders pass through a common pullbox, tag feeders to clearly indicate electrical characteristics, circuit number, and panel designation. Orient tags so as to be easily read.

3.3 BOXES AND FITTINGS

Install junction, pull, and outlet boxes where required and where indicated.

Furnish and install pullboxes where necessary in conduit system to facilitate conductor installation. For conduit runs longer than 30 m or with more than three right-angle bends, install a pullbox at a convenient intermediate location.

Securely mount boxes and enclosures to building structure, with supporting facilities independent of conduit entering or leaving boxes.

Use bonding jumpers around concentric or eccentric knockouts.

Approximate mounting heights of wall-mounted outlet and switch boxes, measured between bottom of box and finished floor, are as follows, except as otherwise indicated.

LOCATION	MOUNTING HEIGHT, mm
Receptacles in offices	380
Receptacles in corridors	380
Receptacles in shops	1060
Receptacles for clocks	2440
Switches for light control	1060
Thermostats	1060

Provide an identification plate marked DANGER: 480 VOLTS on outside of 480 V enclosures. Use white lettering on a red laminated plastic.

3.4 WIRING DEVICES

Install switches and receptacles so that, when device plates are applied, plates are aligned vertically to within .

Bond ground terminal of each flush-mounted receptacle to outlet box with an approved green bonding jumper.

Suitably label device plates and cover plates for receptacles and switches, showing circuit and panel numbers. Label - Plastic stick-on type, Dymo or equivalent.

3.5 LIGHTING FIXTURES

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

3.6 GROUNDING

Drive in ground rods so that top of rod is above grade.

Ensure that metallic raceway systems have electrical continuity with equipment individually, and are directly connected to building ground, independently of raceway system, as herein specified. Provide raceways

with appropriately sized green grounding conductors.

Connect encloses for panelboards individually and directly to building ground. Provide grounding conductor connected from building ground to a copper ground-bus terminal strip located in each panelboard.

Ground polarized receptacles, lighting fixtures, and equipment enclosures with an identified (green color) insulated conductor, minimum (AWG 12), connected to branch circuit ground-bus terminal strip. Ground-bus terminal strip in each panelboard enclosure - Isolated and independent of system neutral terminal strip.

Accomplish building and equipment grounding in accordance with NFPA 70.

3.7 FIELD TESTS

A. Wiring System Tests

1. After completion of installation and splicing, and before energizing conductors, conduct wire and cable continuity and insulation tests as specified herein.

2. Completely isolate wire and cable in each voltage classification from extraneous electrical connections at cable terminations and joints. Use substation and switchboard feeder breakers, disconnects in combination motor starters, circuit breakers in panel boards, and other disconnecting devices to isolate circuits under test.

3. Conduct insulation tests on circuits rated 480 V and less using a 500 V or 1 kV insulation-resistance test set. Minimum resistance between phase conductors, and between phase conductors and ground: 25 Mohms.

4. Conduct phase-rotation tests on three-phase circuits using a phase-rotation indicating instrument. Ensure that three-phase motors are rotating in proper direction, and that phase-sensitive equipment is phased properly for correct operation.

B. Grounding System Tests

1. Test grounding systems for ground resistance.

2. Perform ground resistance tests during dry weather and not sooner than 48 hours after rainfall. Conduct tests using ratio method that measures ratio of resistance to earth of an auxiliary test electrode to series resistance of electrode under test and a second auxiliary electrode. Perform measurements in accordance with IEEE 81, by the ratio ohmmeter and as specified herein.

3. Place auxiliary grounding electrodes in accordance with instrument manufacturer's recommendations, but minimum apart in accordance with IEEE 81.

C. Records

1. Record test readings, including method of testing and environmental conditions of test; submit to COTR.

2. Submit a certified record of ground-resistance tests on each driven ground-rod assembly and other grounding electrode, including number of rods driven and their depths at each location, to meet required resistance-to-ground measurements. Include a statement describing condition of soil at time of measurement. Identify location of each ground-rod assembly and other grounding electrodes by letter in alphabetical order, and key to record of ground-resistance tests.

3. Final acceptance depends upon successful performance of wire and cable under test. Do not energize any conductor until installation is approved.

DAVIS-BACON
WAGE DETERMINATION

GENERAL DECISION NO. CA200300029

Modification No. 12
Publication Date: 12/03/2004

NASA Ames Research Center
Mail Stop 213-13
Moffett Field, CA 94035-1000

GENERAL DECISION: **CA20030029** 12/03/2004 CA29

Date: December 3, 2004
General Decision Number: **CA20030029** 12/03/2004

Superseded General Decision Number: CA020029

State: California

Construction Types: Building, Heavy (Heavy, and Dredging) and Highway

Counties: Alameda, Calaveras, Contra Costa, Fresno, Kings, Madera, Mariposa, Merced, Monterey, San Benito, San Francisco, San Joaquin, San Mateo, Santa Clara, Santa Cruz, Stanislaus and Tuolumne Counties in California.

BUILDING CONSTRUCTION PROJECTS; DREDGING PROJECTS (does not include hopper dredge work); HEAVY CONSTRUCTION PROJECTS (does not include water well drilling); HIGHWAY CONSTRUCTION PROJECTS

Modification Number	Publication Date
0	06/13/2003
1	01/16/2004
2	02/13/2004
3	02/20/2004
4	03/19/2004
5	05/07/2004
6	07/02/2004
7	08/06/2004
8	08/13/2004
9	08/27/2004
10	09/03/2004
11	10/29/2004
12	12/03/2004

ASBE0016-004 07/01/2004

	Rates	Fringes
Asbestos Removal worker/hazardous material handler Includes preparation, wetting, stripping, removal, scrapping, vacuuming, bagging and disposing of all insulation materials from mechanical systems, whether they contain asbestos or not		
AREA 1	$ 26.15	4.17
AREA 2	$ 24.91	4.17

AREA DESCRIPTIONS

AREA 1: ALAMEDA, CONTRA COSTA, SAN FRANCISCO, SAN MATEO AND SANTA CLARA COUNTIES

AREA 2: CALAVERAS, FRESNO, KINGS, MADERA, MARIPOSA, MERCED, MONTEREY, SAN BENITO, SAN JOAQUIN, SANTA CRUZ, STANISLAUS AND TUOLUMNE COUNTIES

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* BOIL0549-001 10/01/2004

AREA 1: ALAMEDA, CONTRA COSTA, MONTEREY, SAN FRANCISCO, SAN MATEO, SANTA CLARA & SANTA CRUZ COUNTIES

AREA 2: REMAINING COUNTIES

	Rates	Fringes
Boilermaker		
Area 1	$ 35.09	15.61
Area 2	$ 34.59	15.61

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* BRCA0003-001 12/01/2004

	Rates	Fringes
Marble Finisher	$ 19.40	0.60

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* BRCA0003-003 08/01/2004

	Rates	Fringes
Marble mason	$ 37.79	12.86

BRCA0003-005 07/01/2004

	Rates	Fringes
Bricklayer		
Alameda, Contra Costa, San Benito, Santa Clara	$ 31.52	13.43
Calaveras, San Joaquin, Stanislaus, Toulumne	$ 27.50	12.00
Fresno, Kings, Madera, Mariposa, Merced	$ 26.70	12.80
Monterey, Santa Cruz	$ 29.33	14.83
San Francisco, San Mateo	$ 32.70	14.25

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* BRCA0003-008 07/01/2004

	Rates	Fringes
Terrazzo Finisher	$ 18.87	8.06
Terrazzo Worker	$ 33.80	11.50

BRCA0003-011 04/01/2004

AREA 1: Alameda, Contra Costa, Monterey, San Benito, San Francisco, San Mateo, Santa Clara, Santa Cruz

AREA 2: Calaveras, San Joaquin, Stanislaus, Tuolumne

AREA 3: Fresno, Kings, Madera, Mariposa, Merced

	Rates	Fringes
Tile Finisher		
Area 1	$ 18.87	8.06
Area 2	$ 18.69	8.19
Area 3	$ 18.38	7.39
Tile Layer		
Area 1	$ 35.09	9.29
Area 2	$ 30.89	9.64
Area 3	$ 26.28	8.64

CARP0022-001 08/01/2004

AREA 1: Alameda, Contra Costa, San Francisco, San Mateo, Santa Clara counties

AREA 2: Monterey, San Benito, Santa Cruz Counties

AREA 3: Calaveras, Fresno, Kings, Madera, Mariposa, Merced, San Joaquin, Stanislaus, Tuolumne Counties

	Rates	Fringes
Drywall Installers/Lathers:		
Area 1	$ 31.25	14.085
Area 2	$ 25.37	14.085
Area 3	$ 24.52	14.085
Drywall Stocker/Scrapper		
Area 1	$ 15.63	8.475
Area 2	$ 12.69	8.475
Area 3	$ 12.26	8.475

CARP0034-001 07/01/2004

	Rates	Fringes
Diver		
Diver standby	$ 33.89	17.175
Diver Tender	$ 32.89	17.175
Diver wet	$ 67.78	17.175

DEPTH PAY (Surface Diving):
050 to 100 ft $2.00 per foot
101 to 150 ft $3.00 per foot
151 to 220 ft $4.00 per foot

SATURATION DIVING RATES:
Standby rate shall apply until saturation starts. Once under pressure, the rate will be 6 time the Diver's 8 hour minimum standby rate (24 times straight time Diver pay rate); plus applicable rate for depth or pressure.

CARP0034-003 07/01/2004

	Rates	Fringes
Piledriver	$ 29.90	17.175

CARP0035-002 07/01/2004

AREA 1: Alameda, Contra Costa, San Francisco, San Mateo, Santa Clara counties

AREA 2: Monterey, San Benito, Santa Cruz Counties

AREA 3: Calaveras, Fresno, Kings, Madera, Mariposa, Merced, San Joaquin, Stanislaus, Tuolumne Counties

	Rates	Fringes
Carpenters:		
AREA 1:		
(1) Carpenter	$ 31.25	13.645
(2) Hardwood Floorlayer; Shingler; Power Saw Operator; Steel Scaffold & Steel Shoring Erector; Saw Filer	$ 31.40	13.645
(3) Bridge Builder	$ 31.25	13.645
(4) Millwright	$ 31.35	14.985
AREA 2: PROJECTS $50,000,000 & OVER		
(1) Carpenter	$ 28.87	13.645
(2) Hardwood Floorlayer; Shingler; Power Saw Operator; Steel Scaffold & Steel Shoring Erector; Saw Filer	$ 29.02	13.645
(3) Bridge Builder	$ 31.25	13.645
(4) Millwright	$ 31.35	14.985
AREA 2: PROJECTS UNDER $50,000,000		
(1) Carpenter	$ 25.37	13.645
(2) Hardwood Floorlayer; Shingler; Power Saw Operator; Steel Scaffold & Steel Shoring Erector; Saw Filer	$ 25.52	13.645
(3) Bridge Builder	$ 31.25	13.645
(4) Millwright	$ 27.87	14.985
AREA 3: PROJECTS $50,000,000 & OVER		
(1) Carpenter	$ 27.52	13.645
(2) Hardwood Floorlayer; Shingler; Power Saw Operator; Steel Scaffold & Steel Shoring Erector; Saw Filer	$ 27.67	13.645
(3) Bridge Builder	$ 31.25	13.645

(4) Millwright	$ 30.02	14.985
AREA 3: PROJECTS UNDER $50,000,000		
(1) Carpenter	$ 24.02	13.645
(2) Hardwood Floorlayer; Shingler; Power Saw Operator; Steel Scaffold & Steel Shoring Erector; Saw Filer	$ 24.17	13.645
(3) Bridge Builder	$ 31.25	13.645
(4) Millwright	$ 26.52	14.985

CARP0035-007 07/01/2004

AREA 1: Alameda, Contra Costa, San Francisco, San Mateo, Santa Clara counties

AREA 2: Monterey, San Benito, Santa Cruz Counties

AREA 3: Calaveras, Fresno, Kings, Madera, Mariposa, Merced, San Joaquin, Stanislaus, Tuolumne Counties

	Rates	Fringes
Modular Furniture Installer		
Area 1	$ 15.75	9.485
Installer I	$ 19.18	9.485
Installer II	$ 15.75	9.485
Lead installer	$ 22.63	9.985
Master Installer	$ 26.85	9.985
Area 2	$ 13.58	9.485
Installer I	$ 16.53	9.485
Installer II	$ 13.58	9.485
Lead Installer	$ 19.50	9.985
Master Installer	$ 23.13	9.985
Area 3	$ 12.81	9.485
Installer I	$ 15.58	9.485
Installer II	$ 12.81	9.485
Lead Installer	$ 18.38	9.985
Master Installer	$ 21.80	9.985

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* ELEC0006-001 12/01/2003

ALAMEDA, CONTRA COSTA, MONTEREY, SAN BENITO, SAN FRANCISCO, SAN MATEO, SANTA CLARA, AND SANTA CRUZ COUNTIES

	Rates	Fringes
Communications System		
Sound & Communications Installer	$ 24.57	3%+7.95
Sound & Communications Technician	$ 27.98	3%+7.95

SCOPE OF WORK: Including any data system whose only function is to transmit or receive information; excluding all other data systems or multiple systems which include control

function or power supply; inclusion or exclusion of terminations and testings of conductors determined by their function; excluding fire alarm work when installed in raceways (including wire and cable pulling) and when performed on new or major remodel building projects or jobs for which the conductors for the fire alarm system are installed in conduit; excluding installation of raceway systems, line voltage work, industrial work, life-safety systems (all buildings having floors located more than 75' above the lowest floor level having building access); excluding energy management systems.

FOOTNOTE: Fire alarm work when installed in raceways (including wire and cable pulling), on projects which involve new or major remodel building construction, for which the conductors for the fire alarm system are installed in the conduit, shall be performed by the inside electrician.

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* ELEC0006-007 06/01/2004

SAN FRANCISCO COUNTY

	Rates	Fringes
Electrician	$ 45.55	3%+14.685

ELEC0006-008 12/01/1999

CALAVERAS, MARIPOSA, MERCED, SAN JOAQUIN, STANISLAUS AND TUOLUMNE COUNTIES

	Rates	Fringes
Communications System Sound & Communications Installer	$ 18.72	3%+4.10
Sound & Communications Technician	$ 21.31	3%+4.10

SCOPE OF WORK: Including any data system whose only function is to transmit or receive information; excluding all other data systems or multiple systems which include control function or power supply; inclusion or exclusion of terminations and testings of conductors determined by their function; excluding fire alarm work when installed in raceways (including wire and cable pulling) and when performed on new or major remodel building projects or jobs for which the conductors for the fire alarm system are installed in conduit; excluding installation of raceway systems, line voltage work, industrial work, life-safety systems (all buildings having floors located more than 75' above the lowest floor level having building access); excluding energy management systems.

FOOTNOTE: Fire alarm work when installed in raceways (including wire and cable pulling), on projects which

involve new or major remodel building construction, for which the conductors for the fire alarm system are installed in the conduit, shall be performed by the inside electrician.

ELEC0100-002 06/01/2004

FRESNO, KINGS, AND MADERA COUNTIES

	Rates	Fringes
Electrician	$ 27.10	3%+10.85

ELEC0100-005 01/07/2004

FRESNO, KINGS, MADERA AND TULARE COUNTIES

	Rates	Fringes
Communications and Systems Installer	$ 21.47	3%+7.95

SCOPE OF WORK

Includes the installation testing, service and maintenance, of the following systems which utilize the transmission and/or transference of voice, sound, vision and digital for commercial, education, security and entertainment purposes for the following: TV monitoring and surveillance, background-foreground music, intercom and telephone interconnect, inventory control systems, microwave transmission, multi-media, multiplex, nurse call system, radio page, school intercom and sound, burglar alarms, and low voltage master clock systems.

A. SOUND AND VOICE TRANSMISSION/TRANSFERENCE SYSTEMS Background foreground musicc Intercom and telephone interconnect systems Telephone systems Nurse call systems Radio page systems School intercom and sound systems Burglar alarm systems Low voltage master clock systems Multi-media/multiplex systems Sound and musical entertainment systems RF systems Antennas and Wave Guide

B. FIRE ALARM SYSTEMS Installation, wire pulling and testing

C. TELEVISION AND VIDEO SYSTEMS Television monitoring and surveillance systems Video security systems, Video entertainment systems, Video educational systems, Microwave transmission systems CATV and CCTV

D. SECURITY SYSTEMS Perimeter security systems Vibration sensor systems Card access systems Access control systems Sonar/infrared monitoring equipment

E. COMMUNICATIONS SYSTEMS THAT TRANSMIT OR RECEIVE INFORMATION AND/OR CONTROL SYSTEMS THAT ARE INTRINSIC TO THE ABOVE LISTED SYSTEMS SCADA (Supervisory Control and Data Acquisition) PCM (Pulse Code Modulation) Inventory

Control Systems Digital Data Systems Broadband and Baseband and Carriers Point of Sale Systems VSAT Data Systems Data Communication Systems RF and Remote Control Systems Fiber Optic Data Systems

WORK EXCLUDED Raceway systems are not covered (excluding Ladder-Rack for the purpose of the above listed systems). Chases and/or nipples (not to exceed 10 feet) may be installed on open wiring systems. Energy management systems. SCADA (Supervisory Control and Data Acquisition) when not intrinsic to the above listed systems (in the scope). Fire alarm systems when installed in raceways (including wire and cable pulling) shall be performed at the electrician wage rate, when either of the following two (2) conditions apply:
1. The project involves new or major remodel building trades construction.
2. The conductors for the fire alarm system are installed in conduit.

ELEC0234-001 05/24/2004

MONTEREY, SAN BENITO AND SANTA CRUZ COUNTIES

	Rates	Fringes
Electrician	$ 32.81	3%+15.84

ELEC0302-001 06/01/2004

CONTRA COSTA COUNTY

	Rates	Fringes
Cable splicer	$ 46.42	3%+13.15
Electrician	$ 41.26	3%+13.15

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* ELEC0332-001 05/31/2004

SANTA CLARA COUNTY

	Rates	Fringes
Cable splicer	$ 48.21	3%+14.57
Electrician	$ 41.82	3%+14.57

FOOTNOTES: Work under compressed air or where gas masks are required, orwork on ladders, scaffolds, stacks, "Bosun's chairs," or other structures and where the workers are not protected by permanent guard rails at a distance of 40 to 60 ft. from the ground or supporting structures: to be paid one and one-half times the straight-time rate of pay. Work on structures of 60 ft. or over (as described above): to be paid twice the straight-time rate of pay.

ELEC0595-001 06/01/2004

ALAMEDA COUNTY

	Rates	Fringes
Cable splicer	$ 47.83	3.45%+16.15
Electrician	$ 38.00	3.8%+17.40

ELEC0595-002 12/01/2003

CALAVERAS AND SAN JOAQUIN COUNTIES

	Rates	Fringes
Electricians		
(1) TUNNEL WORK:		
Electrician	$ 30.13	7.5%+15.22
(2) ALL OTHER WORK:		
Electrician	$ 30.00	7.5%+15.22

ELEC0617-001 06/01/2004

SAN MATEO COUNTY

	Rates	Fringes
Electrician	$ 43.50	3%+13.66

ELEC0684-001 01/01/2004

MARIPOSA, MERCED, STANISLAUS AND TUOLUMNE COUNTIES

	Rates	Fringes
Cable splicer	$ 33.08	7%+10.40
Electrician	$ 30.07	7%+10.40

ELEC1245-001 06/01/2004

	Rates	Fringes
Line Construction		
(1) Lineman; Cable splicer	$ 35.01	4%+8.93
(2) Equipment specialist (operates crawler tractors, commercial motor vehicles, backhoes, trenchers, cranes (50 tons and below), and overhead and underground distribution line equipment)	$ 29.76	4%+8.25
(3) Groundman	$ 22.76	4%+8.25
(4) Powderman	$ 33.27	4%+8.29

ELEV0008-001 08/01/2001

	Rates	Fringes

Elevator Mechanic	$ 42.735	7.455

FOOTNOTE:
Vacation Pay: 8% with 5 or more years of service, 6% for 6 months to 5 years service.

Paid Holidays: New Years Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day and Friday after, and Christmas Day.

ENGI0003-005 06/16/2004

	Rates	Fringes
Power Equipment Operator		
AREA 1:		
GROUP 1	$ 34.49	15.19
GROUP 2	$ 32.96	15.19
GROUP 3	$ 31.48	15.19
GROUP 4	$ 30.10	15.19
GROUP 5	$ 28.83	15.19
GROUP 6	$ 27.51	15.19
GROUP 7	$ 26.37	15.19
GROUP 8	$ 25.23	15.19
GROUP 8-A	$ 23.02	15.19
AREA 2:		
GROUP 1	$ 36.49	15.19
GROUP 2	$ 34.96	15.19
GROUP 3	$ 33.48	15.19
GROUP 4	$ 32.10	15.19
GROUP 5	$ 30.83	15.19
GROUP 6	$ 29.51	15.19
GROUP 7	$ 28.37	15.19
GROUP 8	$ 27.23	15.19
GROUP 8-A	$ 25.02	15.19
Power Equipment Operators - All Cranes and Attachments:		
AREA 1: GROUP 1		
Cranes	$ 35.37	15.19
Oiler	$ 26.11	15.19
Truck crane oiler	$ 28.40	15.19
AREA 1: GROUP 2		
Cranes	$ 33.61	15.19
Oiler	$ 25.90	15.19
Truck crane oiler	$ 28.14	15.19
AREA 1: GROUP 3		
Cranes	$ 31.87	15.19
Hydraulic	$ 27.51	15.19
Oiler	$ 25.62	15.19
Truck crane oiler	$ 27.90	15.19
AREA 2: GROUP 1		
Cranes	$ 37.37	15.19
Oiler	$ 28.11	15.19
Truck crane oiler	$ 30.40	15.19
AREA 2: GROUP 2		
Cranes	$ 35.61	15.19
Oiler	$ 27.90	15.19

Truck crane oiler	$ 30.14	15.19
AREA 2: GROUP 3		
Cranes	$ 33.87	15.19
Hydraulic	$ 29.51	15.19
Oiler	$ 27.62	15.19
Truck crane oiler	$ 29.90	15.19
Power Equipment Operators - Piledrivers:		
GROUP 1		
Lifting devices	$ 35.71	15.19
Oiler	$ 26.45	15.19
Truck crane oiler	$ 28.73	15.19
GROUP 2		
Lifting devices	$ 33.89	15.19
Oiler	$ 26.18	15.19
Truck crane oiler	$ 28.48	15.19
GROUP 3		
Lifting devices	$ 32.21	15.19
Oiler	$ 25.96	15.19
Truck crane oiler	$ 28.19	15.19
GROUP 4	$ 30.44	15.19
GROUP 5	$ 27.80	15.19
GROUP 6	$ 25.57	15.19
Power equipment operators - steel erection:		
GROUP 1		
Cranes	$ 36.34	15.19
Oiler	$ 26.79	15.19
Truck crane oiler	$ 29.02	15.19
GROUP 2		
Cranes	$ 34.57	15.19
Oiler	$ 26.52	15.19
Truck crane oiler	$ 28.80	15.19
GROUP 3		
Cranes	$ 33.09	15.19
Hydraulic	$ 28.14	15.19
Oiler	$ 26.30	15.19
Truck crane oiler	$ 28.53	15.19
GROUP 4	$ 31.07	15.19
GROUP 5	$ 29.77	15.19
Power Equipment Operators - Tunnel and Underground Work:		
SHAFTS, STOPES, RAISES:		
AREA 1:		
GROUP 1	$ 30.59	15.19
GROUP 1-A	$ 33.06	15.19
GROUP 2	$ 29.33	15.19
GROUP 3	$ 28.00	15.19
GROUP 4	$ 26.86	15.19
GROUP 5	$ 25.72	15.19
SHAFTS, STOPES, RAISES:		
AREA 2:		
GROUP 1	$ 32.59	15.19
GROUP 1-A	$ 35.06	15.19
GROUP 2	$ 31.33	15.19
GROUP 3	$ 30.00	15.19
GROUP 4	$ 28.86	15.19

GROUP 5	$ 27.72	15.19
UNDERGROUND: AREA 1:		
GROUP 1	$ 30.49	15.19
GROUP 1-A	$ 32.96	15.19
GROUP 2	$ 29.23	15.19
GROUP 3	$ 27.90	15.19
GROUP 4	$ 26.76	15.19
GROUP 5	$ 25.62	15.19
UNDERGROUND: AREA 2:		
GROUP 1	$ 32.49	15.19
GROUP 1-A	$ 34.96	15.19
GROUP 2	$ 31.23	15.19
GROUP 3	$ 29.90	15.90
GROUP 4	$ 28.76	15.19
GROUP 5	$ 27.62	15.19

FOOTNOTE: Work suspended by ropes or cables, or work on a Yo-Yo Cat: $.60 per hour additional.

POWER EQUIPMENT OPERATOR CLASSIFICATIONS

GROUP 1: Operator of helicopter (when used in erection work); Hydraulic excavator, 7 cu. yds. and over; Power shovels, over 7 cu. yds.

GROUP 2: Highline cableway; Hydraulic excavator, 3-1/2 cu. yds. up to 7 cu. yds.; Licensed construction work boat operator, on site; Power blade operator (finish); Power shovels, over 1 cu. yd. up to and including 7 cu. yds. m.r.c.

GROUP 3: Asphalt milling machine; Cable backhoe; Combination backhoe and loader over 3/4 cu. yds.; Continuous flight tie back machine assistant to engineer or mechanic; Crane mounted continuous flight tie back machine, tonnage to apply; Crane mounted drill attachment, tonnage to apply; Dozer, slope brd; Gradall; Hydraulic excavator, up to 3 1/2 cu. yds.; Loader 4 cu. yds. and over; Long reach excavator; Multiple engine scraper (when used as push pull); Power shovels, up to and including 1 cu. yd.; Pre-stress wire wrapping machine; Side boom cat, 572 or larger; Track loader 4 cu. yds. and over; Wheel excavator (up to and including 750 cu. yds. per hour)

GROUP 4: Asphalt plant engineer/box person; Chicago boom; Combination backhoe and loader up to and including 3/4 cu. yd.; Concrete batch plant (wet or dry); Dozer and/or push cat; Pull-type elevating loader; Gradesetter, grade checker (GPS, mechanical or otherwise); Grooving and grinding machine; Heading shield operator; Heavy-duty drilling equipment, Hughes, LDH, Watson 3000 or similar; Heavy-duty repairperson and/or welder; Lime spreader; Loader under 4 cu. yds.; Lubrication and service engineer (mobile and grease rack); Mechanical finishers or spreader machine (asphalt, Barber-Greene and similar); Miller Formless M-9000 slope paver or similar; Portable crushing and screening plants; Power blade support; Roller operator, asphalt; Rubber-tired scraper, self-loading (paddle-wheels, etc.); Rubber- tired earthmoving equipment (scrapers); Slip form paver (concrete); Small tractor with

drag; Soil stabilizer (P & H or equal); Spider plow and spider puller; Tubex pile rig; Unlicensed constuction work boat operator, on site; Timber skidder; Track loader up to 4 yds.; Tractor-drawn scraper; Tractor, compressor drill combination; Welder; Woods-Mixer (and other similar Pugmill equipment)

GROUP 5: Cast-in-place pipe laying machine; Combination slusher and motor operator; Concrete conveyor or concrete pump, truck or equipment mounted; Concrete conveyor, building site; Concrete pump or pumpcrete gun; Drilling equipment, Watson 2000, Texoma 700 or similar; Drilling and boring machinery, horizontal (not to apply to waterliners, wagon drills or jackhammers); Concrete mixer/all; Person and/or material hoist; Mechanical finishers (concrete) (Clary, Johnson, Bidwell Bridge Deck or similar types); Mechanical burm, curb and/or curb and gutter machine, concrete or asphalt); Mine or shaft hoist; Portable crusher; Power jumbo operator (setting slip-forms, etc., in tunnels); Screed (automatic or manual); Self-propelled compactor with dozer; Tractor with boom D6 or smaller; Trenching machine, maximum digging capacity over 5 ft. depth; Vermeer T-600B rock cutter or similar

GROUP 6: Armor-Coater (or similar); Ballast jack tamper; Boom-type backfilling machine; Assistant plant engineer; Bridge and/or gantry crane; Chemical grouting machine, truck-mounted; Chip spreading machine operator; Concrete saw (self-propelled unit on streets, highways, airports and canals); Deck engineer; Drilling equipment Texoma 600, Hughes 200 Series or similar up to and including 30 ft. m.r.c.; Drill doctor; Helicopter radio operator; Hydro-hammer or similar; Line master; Skidsteer loader, Bobcat larger than 743 series or similar (with attachments); Locomotive; Lull hi-lift or similar; Oiler, truck mounted equipment; Pavement breaker, truck-mounted, with compressor combination; Paving fabric installation and/or laying machine; Pipe bending machine (pipelines only); Pipe wrapping machine (tractor propelled and supported); Screed (except asphaltic concrete paving); Self- propelled pipeline wrapping machine; Soils & materials tester; Tractor; Self-loading chipper; Concrete barrier moving machine

GROUP 7: Ballast regulator; Boom truck or dual-purpose A-frame truck, non-rotating - under 15 tons; Truck-mounted rotating telescopic boom type lifting device, Manitex or similar (boom truck) - under 15 tons; Cary lift or similar; Combination slurry mixer and/or cleaner; Drilling equipment, 20 ft. and under m.r.c.; Firetender (hot plant); Grouting machine operator; Highline cableway signalperson; Stationary belt loader (Kolman or similar); Lift slab machine (Vagtborg and similar types); Maginnes internal full slab vibrator; Material hoist (1 drum); Mechanical trench shield; Pavement breaker with or without compressor combination); Pipe cleaning machine (tractor propelled and supported); Post driver; Roller (except asphalt); Chip Seal; Self-propelled automatically applied concrete curing mahcine (on streets, highways, airports and canals); Self-propelled compactor (without dozer); Signalperson; Slip-form pumps (lifting device for concrete forms); Tie spacer; Tower mobile; Trenching machine, maximum

digging capacity up to and including 5 ft. depth; Truck- type loader

GROUP 8: Bit sharpener; Boiler tender; Box operator; Brakeperson; Combination mixer and compressor (shotcrete/gunite); Compressor operator; Deckhand; Fire tender; Forklift (under 20 ft.); Generator; Gunite/shotcrete equipment operator; Hydraulic monitor; Ken seal machine (or similar); Mixermobile; Oiler; Pump operator; Refrigeration plant; Reservoir-debris tug (self- propelled floating); Ross Carrier (construction site); Rotomist operator; Self-propelled tape machine; Shuttlecar; Self-propelled power sweeper operator (includes vacuum sweeper); Slusher operator; Surface heater; Switchperson; Tar pot firetender; Tugger hoist, single drum; Vacuum cooling plant; Welding machine (powered other than by electricity)

GROUP 8-A: Elevator operator; Skidsteer loader-Bobcat 743 series or smaller, and similar (without attachments); Mini excavator under 25 H.P. (backhoe-trencher); Tub grinder wood chipper

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ALL CRANES AND ATTACHMENTS

GROUP 1: Clamshell and dragline over 7 cu. yds.; Crane, over 100 tons; Derrick, over 100 tons; Derrick barge pedestal-mounted, over 100 tons; Self-propelled boom-type lifting device, over 100 tons

GROUP 2: Clamshell and dragline over 1 cu. yd. up to and including 7 cu. yds.; Crane, over 45 tons up to and including 100 tons; Derrick barge, 100 tons and under; Self-propelled boom-type lifting device, over 45 tons; Tower crane

GROUP 3: Clamshell and dragline up to and including 1 cu. yd.; Cranes 45 tons and under; Self-propelled boom-type lifting device 45 tons and under; Boom Truck or dual purpose A-frame truck, non-rotating over 15 tons; Truck-mounted rotating telescopic boom type lifting device, Manitex or similar (boom truck) over 15 tons;

PILEDRIVERS

GROUP 1: Derrick barge pedestal mounted over 100 tons; Clamshell over 7 cu. yds.; Self-propelled boom-type lifting device over 100 tons; Truck crane or crawler, land or barge mounted over 100 tons

GROUP 2: Derrick barge pedestal mounted 45 tons to and including 100 tons; Clamshell up to and including 7 cu. yds.; Self-propelled boom-type lifting device over 45 tons; Truck crane or crawler, land or barge mounted, over 45 tons up to and including 100 tons; Fundex F-12 hydraulic pile rig

GROUP 3: Derrick barge pedestal mounted under 45 tons; Self-

propelled boom-type lifting device 45 tons and under; Skid/scow piledriver, any tonnage; Truck crane or crawler, land or barge mounted 45 tons and under

GROUP 4: Assistant operator in lieu of assistant to engineer; Forklift, 10 tons and over; Heavy-duty repairperson/welder

GROUP 5: Deck engineer

GROUP 6: Deckhand; Fire tender

STEEL ERECTORS

GROUP 1: Crane over 100 tons; Derrick over 100 tons; Self-propelled boom-type lifting device over 100 tons

GROUP 2: Crane over 45 tons to 100 tons; Derrick under 100 tons; Self-propelled boom-type lifting device over 45 tons to 100 tons; Tower crane

GROUP 3: Crane, 45 tons and under; Self-propelled boom-type lifting device, 45 tons and under

GROUP 4: Chicago boom; Forklift, 10 tons and over; Heavy-duty repair person/welder

GROUP 5: Boom cat

TUNNEL AND UNDERGROUND WORK

GROUP 1-A: Tunnel bore machine operator, 20' diameter or more

GROUP 1: Heading shield operator; Heavy-duty repairperson; Mucking machine (rubber tired, rail or track type); Raised bore operator (tunnels); Tunnel mole bore operator

GROUP 2: Combination slusher and motor operator; Concrete pump or pumpcrete gun; Power jumbo operator

GROUP 3: Drill doctor; Mine or shaft hoist

GROUP 4: Combination slurry mixer cleaner; Grouting Machine operator; Motorman

GROUP 5: Bit Sharpener; Brakeman; Combination mixer and compressor (gunite); Compressor operator; Oiler; Pump operator; Slusher operator

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AREA DESCRIPTIONS:

POWER EQUIPMENT OPERATORS, CRANES AND ATTACHMENTS,TUNNEL AND UNDERGROUND [These areas do not apply to Piledrivers and Steel Erectors]

AREA 1: ALAMEDA, BUTTE, CONTRA COSTA, KINGS, MARIN, MERCED, NAPA, SACRAMENTO, SAN BENITO, SAN FRANCISCO, SAN JOAQUIN, SAN MATEO, SANTA CLARA, SANTA CRUZ, SOLANO, STANISLAUS, SUTTER, YOLO, AND YUBA COUNTIES

AREA 2 - MODOC COUNTY

THE REMAINING COUNTIES ARE SPLIT BETWEEN AREA 1 AND AREA 2 AS NOTED BELOW:

ALPINE COUNTY:
Area 1: Northernmost part
Area 2: Remainder

CALAVERAS COUNTY:
Area 1: Except Eastern part
Area 2: Eastern part

COLUSA COUNTY:
Area 1: Eastern part
Area 2: Remainder

DEL NORTE COUNTY:
Area 1: Extreme Southwestern corner
Area 2: Remainder

ELDORADO COUNTY:
Area 1: North Central part
Area 2: Remainder

FRESNO COUNTY
Area 1: Except Eastern part
Area 2: Eastern part

GLENN COUNTY:
Area 1: Eastern part
Area 2: Remainder

HUMBOLDT COUNTY:
Area 1: Except Eastern and Southwestern parts
Area 2: Remainder

LAKE COUNTY:
Area 1: Southern part
Area 2: Remainder

LASSEN COUNTY:
Area 1: Western part along the Southern portion of border with Shasta County
Area 2: Remainder

MADERA COUNTY
Area 1: Remainder
Area 2: Eastern part

MARIPOSA COUNTY
Area 1: Remainder

Area 2: Eastern part

MENDOCINO COUNTY:
Area 1: Central and Southeastern parts
Area 2: Remainder

MONTEREY COUNTY
Area 1: Remainder
Area 2: Southwestern part

NEVADA COUNTY:
Area 1: All but the Northern portion along the border of Sierra County
Area 2: Remainder

PLACER COUNTY:
Area 1: All but the Central portion
Area 2: Remainder

PLUMAS COUNTY:
Area 1: Western portion
Area 2: Remainder

SHASTA COUNTY:
Area 1: All but the Northeastern corner
Area 2: Remainder

SIERRA COUNTY:
Area 1: Western part
Area 2: Remainder

SISKIYOU COUNTY:
Area 1: Central part
Area 2: Remainder

SONOMA COUNTY:
Area 1: All but the Northwestern corner
Area 2: Reaminder

TEHAMA COUNTY:
Area 1: All but the Western border with mendocino & Trinity Counties
Area 2: Remainder

TRINITY COUNTY:
Area 1: East Central part and the Northeaster border with Shasta County
Area 2: Remainder

TULARE COUNTY;
Area 1: Remainder
Area 2: Eastern part

TUOLUMNE COUNTY:
Area 1: Remainder
Area 2: Eastern Part

ENGI0003-008 07/01/2004

	Rates	Fringes
Dredging: (DREDGING: CLAMSHELL & DIPPER DREDGING; HYDRAULIC SUCTION DREDGING:)		
AREA 1:		
(1) Leverman	$ 35.31	15.72
(2) Dredge Dozer; Heavy duty repairman	$ 30.35	15.72
(3) Booster Pump Operator; Deck Engineer; Deck mate; Dredge Tender; Winch Operator	$ 29.23	15.72
(4) Bargeman; Deckhand; Fireman; Leveehand; Oiler	$ 25.93	15.72
AREA 2:		
(1) Leverman	$ 37.31	15.72
(2) Dredge Dozer; Heavy duty repairman	$ 32.35	15.72
(3) Booster Pump Operator; Deck Engineer; Deck mate; Dredge Tender; Winch Operator	$ 31.23	15.72
(4) Bargeman; Deckhand; Fireman; Leveehand; Oiler	$ 27.93	15.72

AREA DESCRIPTIONS

AREA 1: ALAMEDA,BUTTE, CONTRA COSTA, KINGS, MARIN, MERCED, NAPA, SACRAMENTO, SAN BENITO, SAN FRANCISCO, SAN JOAQUIN, SAN MATEO, SANTA CLARA, SANTA CRUZ, SOLANO, STANISLAUS, SUTTER, YOLO, AND YUBA COUNTIES

AREA 2: MODOC COUNTY

THE REMAINGING COUNTIES ARE SPLIT BETWEEN AREA 1 AND AREA 2 AS NOTED BELOW:

ALPINE COUNTY:
Area 1: Northernmost part
Area 2: Remainder

CALAVERAS COUNTY:
Area 1: Remainder
Area 2: Eastern part

COLUSA COUNTY:
Area 1: Eastern part
Area 2: Remainder

ELDORADO COUNTY:
Area 1: North Central part
Area 2: Remainder

FRESNO COUNTY:

Area 1: Remainder
Area 2: Eastern part

GLENN COUNTY:
Area 1: Eastern part
Area 2: Remainder

LASSEN COUNTY:
Area 1: Western part along the Southern portion of border with Shasta County
Area 2: Remainder

MADERA COUNTY:
Area 1: Except Eastern part
Area 2: Eastern part

MARIPOSA COUNTY
Area 1: Except Eastern part
Area 2: Eastern part

MONTERREY COUNTY
Area 1: Except Southwestern part
Area 2: Southwestern part

NEVADA COUNTY:
Area 1: All but the Northern portion along the border of Sierra County
Area 2: Remainder

PLACER COUNTY:
Area 1: Al but the Central portion
Area 2: Remainder

PLUMAS COUNTY:
Area 1: Western portion
Area 2: Remainder

SHASTA COUNTY:
Area 1: All but the Northeastern corner
Area 2: Remainder

SIERRA COUNTY:
Area 1: Western part
Area 2: Remainder

SISKIYOU COUNTY:
Area 1: Central part
Area 2: Remainder

SONOMA COUNTY:
Area 1: All but the Northwestern corner
Area 2: Remainder

TEHAMA COUNTY:
Area 1: All but the Western border with Mendocino & Trinity Counties
Area 2: Remainder

TRINITY COUNTY:
Area 1: East Central part and the Northeastern border with Shasta County
Area 2: Remainder

TUOLUMNE COUNTY:
Area 1: Except Eastern part
Area 2: Eastern part

IRON0002-004 07/01/2004

	Rates	Fringes
Ironworkers:		
Fence Erector	$ 27.02	14.74
Ornamental, Reinforcing and Structural	$ 27.91	14.74

PREMIUM PAY:

$3.00 additional per hour at the following locations:

China Lake Naval Test Station, Chocolate Mountains Naval Reserve-Niland,
Edwards AFB, Fort Irwin Military Station, Fort Irwin Training Center-Goldstone, San Clemente Island, San Nicholas Island, Susanville Federal Prison, 29 Palms - Marine Corps, U.S. Marine Base - Barstow, U.S. Naval Air Facility - Sealey, Vandenberg AFB

$2.00 additional per hour at the following locations:

Army Defense Language Institute - Monterey, Fallon Air Base, Naval Post Graduate School - Monterey, Yermo Marine Corps Logistics Center

$1.00 additional per hour at the following locations:

Port Hueneme, Port Mugu, U.S. Coast Guard Station - Two Rock

LABO0036-001 07/01/2004

SAN FRANCISCO AND SAN MATEO COUNTIES:

	Rates	Fringes
Brick Tender	$ 26.62	11.34

FOOTNOTES: Underground work such as sewers, manholes, catch basins, sewer pipes, telephone conduits, tunnels and cut trenches: $5.00 per day additional. Work in live sewage: $2.50 per day additional.

LABO0036-002 07/01/2004

SAN FRANCISCO AND SAN MATEO COUNTIES:

	Rates	Fringes
Plasterer tender	$ 26.62	11.34

FOOTNOTES: Work on a suspended scaffold: $5.00 per day additional. Work operating a plaster mixer pump gun: $1.00 per hour additional.

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* LABO0067-002 12/01/2004

	Rates	Fringes
Asbestos Removal Laborer	$ 13.73	6.80

SCOPE OF WORK: Covers site mobilization; initial site clean-up; site preparation; removal of asbestos-containing materials from walls and ceilings; or from pipes, boilers and mechanical systems only if they are being scrapped; encapsulation, enclosure and disposal of asbestos-containing materials by hand or with equipment or machinery; scaffolding; fabrication of temporary wooden barriers; and assembly of decontamination stations.

LABO0067-006 07/01/2004

AREA "A" - ALAMEDA, CONTRA COSTA, SAN FRANCISCO, SAN MATEO AND SANTA CLARA COUNTIES

AREA "B" - CALAVERAS, FRESNO, KINGS, MADERA, MARIPOSA, MERCED, MONTEREY, SAN BENITO, SANTA CRUZ, SAN JOAQUIN, STANISLAUS AND TUOLUMNE COUNTIES

	Rates	Fringes
Laborer: Gunite		
ALAMEDA, CONTRA COSTA, SAN FRANCISCO, SAN MATEO AND SANTA CLARA COUNTIES		
Group 1	$ 23.60	10.93
GROUP 2	$ 23.10	10.90
GROUP 3	$ 22.51	10.93
GROUP 4	$ 22.39	10.93
AREA "A"		
GROUP 1	$ 23.60	10.93
GROUP 2	$ 23.10	10.93
GROUP 3	$ 22.51	10.93
GROUP 4	$ 22.39	10.93
AREA "B"		
GROUP 1	$ 22.60	10.93
GROUP 2	$ 22.10	10.93
GROUP 3	$ 21.51	10.93
GROUP 4	$ 21.39	10.93
CALAVERAS, FRESNO, KINGS, MADERA, MARIPOSA, MERCED, MONTEREY, SAN BENITO, SANTA CRUZ, SAN JOAQUIN, STANISLAUS AND TUOLUMNE		

COUNTIES		
GROUP 1	$ 22.60	10.93
GROUP 2	$ 22.10	10.93
GROUP 3	$ 21.51	10.93
GROUP 4	$ 21.39	10.93
Laborer: Wrecking, buildings and miscellaneous structures (WRECKING WORK)		
AREA "A"		
GROUP 1	$ 22.64	10.93
GROUP 2	$ 22.49	10.93
GROUP 3	$ 16.08	10.93
AREA "B"		
GROUP 1	$ 21.64	10.93
GROUP 2	$ 21.49	10.93
GROUP 3	$ 15.08	10.93
Laborers:		
AREA "A"		
Construction Specialist Group	$ 23.34	10.93
Group 1	$ 22.64	10.93
Group 1-a	$ 22.86	10.93
GROUP 1-c	$ 22.69	10.93
GROUP 1-e	$ 23.19	10.93
GROUP 1-f	$ 23.22	10.93
GROUP 1-g (Contra Costa County)	$ 22.84	10.93
GROUP 2	$ 22.49	10.93
GROUP 3	$ 22.39	10.93
GROUP 4	$ 16.08	10.93
AREA "B"		
Construction Specialist Group	$ 22.34	10.93
GROUP 1	$ 21.64	10.93
Group 1-a	$ 21.86	10.93
GROUP 1-c	$ 21.69	10.93
GROUP 1-e	$ 22.19	10.93
GROUP 1-f	$ 22.22	10.93
GROUP 2	$ 21.49	10.93
GROUP 3	$ 21.39	10.93
GROUP 4	$ 15.08	10.93
See groups 1-b and 1-d under laborer classifications.		
Landscape Laborer (GARDENERS, HORTICULTURAL & LANDSCAPE LABORERS)		
AREA "A"		
Establishment Warranty Period	$ 16.08	10.93
New Construction	$ 22.39	10.93
AREA "B"		
Establishment Warranty Period	$ 15.08	10.93
New Construction	$ 21.39	10.93

FOOTNOTES: Laborers working off or with or from bos'n chairs, swinging scaffolds, belts shall receive $0.25 per hour above the applicable wage rate. This shall not apply to

workers entitled to receive the wage rate set forth in Group 1-a below.

LABORER CLASSIFICATIONS

CONSTRUCTION SPECIALIST GROUP: Asphalt ironer and raker; Chainsaw; Laser beam in connection with laborers' work; Cast-in- place manhole form setter; Pressure pipelayer; Davis trencher - 300 or similar type (and all small trenchers); Blaster; Diamond driller; Multiple unit drill; Hydraulic drill

GROUP 1: Asphalt spreader boxes (all types); Barko, Wacker and similar type tampers; Buggymobile; Caulker, bander, pipewrapper, conduit layer, plastic pipelayer; Certified hazardous waste worker including Leade Abatement; Compactors of all types; Concrete and magnesite mixer, 1/2 yd. and under; Concrete pan work; Concrete sander; Concrete saw; Cribber and/or shoring; Cut granite curb setter; Dri-pak-it machine; Faller, logloader and bucker; Form raiser, slip forms; Green cutter; Headerboard, Hubsetter, aligner, by any method; High pressure blow pipe (1-1/2" or over, 100 lbs. pressure/over); Hydro seeder and similar type; Jackhammer operator; Jacking of pipe over 12 inches; Jackson and similar type compactor; Kettle tender, pot and worker applying asphalt, lay-kold, creosote, lime, caustic and similar type materials (applying means applying, dipping or handling of such materials); Lagging, sheeting, whaling, bracing, trenchjacking, lagging hammer; Magnesite, epoxyresin, fiberglass, mastic worker (wet or dry); No joint pipe and stripping of same, including repair of voids; Pavement breaker and spader, including tool grinder; Perma curb; Pipelayer (including grade checking in connection with pipelaying); Precast-manhole setter; Pressure pipe tester; Post hole digger, air, gas and electric; Power broom sweeper; Power tampers of all types (except as shown in Group 2); Ram set gun and stud gun; Riprap stonepaver and rock-slinger, including placing of sacked concrete and/or sand (wet or dry) and gabions and similar type; Rotary scarifier or multiple head concrete chipping scarifier; Roto and Ditch Witch; Rototiller; Sandblaster, pot, gun, nozzle operators; Signalling and rigging; Tank cleaner; Tree climber; Turbo blaster; Vibrascreed, bull float in connection with laborers' work; Vibrator; Hazardous waste worker (lead removal); Asbestos and mold removal worker

GROUP 1-a: Joy drill model TWM-2A; Gardner-Denver model DH143 and similar type drills; Track driller; Jack leg driller; Wagon driller; Mechanical drillers, all types regardless of type or method of power; Mechanical pipe layers, all types regardless of type or method of power; Blaster and powder; All work of loading, placing and blasting of all powder and explosives of whatever type regardless of method used for such loading and placing; High scalers (including drilling of same); Tree topper; Bit grinder

GROUP 1-b: Sewer cleaners shall receive $4.00 per day above Group 1 wage rates. "Sewer cleaner" means any worker who handles or comes in contact with raw sewage in small diameter sewers. Those who work inside recently active, large diameter sewers, and all recently active sewer manholes shal receive $5.00 per day above Group 1 wage rates.

GROUP 1-c: Burning and welding in connection with laborers' work; Synthetic thermoplastics and similar type welding

GROUP 1-d: Maintenance and repair track and road beds. All employees performing work covered herein shall receive $ .25 per hour above their regular rate for all work performed on underground structures not specifically covered herein. This paragraph shall not be construed to apply to work below ground level in open cut. It shall apply to cut and cover work of subway construction after the temporary cover has been placed.

GROUP 1-e: Work on and/or in bell hole footings and shafts thereof, and work on and in deep footings. (A deep footing is a hole 15 feet or more in depth.) In the event the depth of the footing is unknown at the commencement of excavation, and the final depth exceeds 15 feet, the deep footing wage rate would apply to all employees for each and every day worked on or in the excavation of the footing from the date of inception.

GROUP 1-f: Wire winding machine in connection with guniting or shot crete

GROUP 1-g, CONTRA COSTA COUNTY: Pipelayer (including grade checking in connection with pipelaying); Caulker; Bander; Pipewrapper; Conduit layer; Plastic pipe layer; Pressure pipe tester; No joint pipe and stripping of same, including repair of voids; Precast manhole setters, cast in place manhole form setters

GROUP 2: Asphalt shoveler; Cement dumper and handling dry cement or gypsum; Choke-setter and rigger (clearing work); Concrete bucket dumper and chute; Concrete chipping and grinding; Concrete laborer (wet or dry); Driller tender, chuck tender, nipper; Guinea chaser (stake), grout crew; High pressure nozzle, adductor; Hydraulic monitor (over 100 lbs. pressure); Loading and unloading, carrying and hauling of all rods and materials for use in reinforcing concrete construction; Pittsburgh chipper and similar type brush shredders; Sloper; Single foot, hand-held, pneumatic tamper; All pneumatic, air, gas and electric tools not listed in Groups 1 through 1-f; Jacking of pipe - under 12 inches

GROUP 3: Construction laborers, including bridge and general laborer; Dump, load spotter; Flag person; Fire watcher; Fence erector; Guardrail erector; Gardener, horticultural

and landscape laborer; Jetting; Limber, brush loader and piler; Pavement marker (button setter); Maintenance, repair track and road beds; Streetcar and railroad construction track laborer; Temporary air and water lines, Victaulic or similar; Tool room attendant (jobsite only)

GROUP 4: Final clean-up work of debris, grounds and building including but not limited to: street cleaner; cleaning and washing windows; brick cleaner (jobsite only); material cleaner (jobsite only). The classification "material cleaner" is to be utilized under the following conditions:
A: at demolition site for the salvage of the material.
B: at the conclusion of a job where the material is to be salvaged and stocked to be reused on another job.
C: for the cleaning of salvage material at the jobsite or temporary jobsite yard.

The material cleaner classification should not be used in the performance of "form stripping, cleaning and oiling and moving to the next point of erection".

GUNITE LABORER CLASSIFICATIONS

GROUP 1: Structural nozzle operator

GROUP 2: Nozzle operator (including gun, pot); Ground person

GROUP 3: Rebound

GROUP 4: Gunite laborer

WRECKING WORK LABORER CLASSIFICATIONS

GROUP 1: Skilled wrecker (removing and salvaging of sash, windows and materials)

GROUP 2: Semi-skilled wrecker (salvaging of other building materials)

GROUP 3: General laborer (includes all clean-up work, loading lumber, loading and burning of debris)

LABO0067-010 07/01/2004

	Rates	Fringes
Tunnel and Shaft Laborers:		
GROUP 1	$ 27.00	10.93
GROUP 2	$ 26.77	10.93
GROUP 3	$ 26.52	10.93
GROUP 4	$ 26.52	10.93
GROUP 5	$ 26.07	10.93
GROUP 6	$ 25.53	10.93

TUNNEL AND SHAFT CLASSIFICATIONS

GROUP 1: Diamond driller; Ground person; Gunite and shotcrete nozzle operator

GROUP 2: Rod person; Shaft work & raise (below actual or excavated ground level)

GROUP 3: Bit grinder; Blaster, driller, powder person - heading; Cherry picker operator - where car is lifted; Concrete finisher in tunnel; Concrete screed person; Grout pump operator and pot person; Gunite & shotcrete gun person & pot person; Header person; High pressure nozzle operator; Miner - tunnel, including top and bottom person on shaft and raise work; Nipper; Nozzle operator on slick line; Sandblaster - pot person

GROUP 4: Steel form raiser and setter; Timber person, retimber person (wood or steel or substitute materials therefore); Tugger (for tunnel laborer work); Cable tender; Chuck tender; Powder person - primer house

GROUP 5: Vibrator operator, pavement breaker; Bull gang - muckers, track person; Concrete crew - includes rodding and spreading

GROUP 6: Dump person (any method); Grout crew; Rebound person; Swamper

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LABO0073-003 07/01/2004

CALAVERAS, MARIPOSA, MERCED, SAN JOAQUIN, STANISLAUS AND TUOLUMNE COUNTIES:

	Rates	Fringes
Mason Tender (Brick).....	$ 23.84	7.36

LABO0073-005 07/01/2002

CALAVERAS, FRESNO, KINGS, MADERA, MARIPOSA, MERCED, SAN JOAQUIN, STANISLAUS AND TUOLUMNE COUNTIES:

	Rates	Fringes
Plasterer tender.....	$ 21.58	9.27

LABO0166-001 07/01/2002

ALAMEDA AND CONTRA COSTA COUNTIES:

	Rates	Fringes
Brick Tender.....	$ 22.90	10.06

FOOTNOTES: Work on jobs where heat-protective clothing is required: $2.00 per hour additional. Work at grinders: $.25 per hour additional. Manhole work: $2.00 per day additional.

LABO0166-002 07/01/2002

ALAMEDA AND CONTRA COSTA COUNTIES:

	Rates	Fringes
Plasterer tender		
Gun operator	$ 28.04	11.41
Plasterer tender	$ 27.29	11.41

LABO0185-001 07/01/2004

MONTEREY AND SAN BENITO COUNTIES:

	Rates	Fringes
Mason Tender (Brick)	$ 21.56	10.49

LABO0270-001 07/01/2004

SANTA CLARA & SANTA CRUZ COUNTIES

	Rates	Fringes
Mason Tender (Brick)		
Santa Clara	$ 24.32	9.28
Santa Cruz	$ 23.32	9.28

FOOTNOTE: $2.00 per hour for refactory work where heat-protective clothing is required.

LABO0270-004 08/04/2004

SANTA CLARA AND SANTA CRUZ COUNTIES

	Rates	Fringes
Plasterer tender	$ 23.29	12.11
All wood framed buildings five (5) stories or more includes all steel structures and all structures with metal studs	$ 23.29	12.11
All wood framed buildings four (4) stories or less and excludes steel structures, structures with metal studs	$ 21.29	12.11

LABO0294-001 07/01/2004

FRESNO, KINGS AND MADERA COUNTIES

	Rates	Fringes
Mason Tender (Brick)	$ 21.86	10.49

LABO0297-001 08/01/2004

MONTEREY AND SAN BENITO COUNTIES

	Rates	Fringes
Plasterer tender	$ 23.054	7.30

FOOTNOTE: Mixer person: $4.00 per day additional.

PAIN0016-001 07/01/2004

ALAMEDA, CONTRA COSTA, MONTEREY, SAN BENITO, SAN MATEO, SANTA CLARA, AND SANTA CRUZ COUNTIES

	Rates	Fringes
Painters:	$ 29.11	12.91

PREMIUMS:

EXOTIC MATERIALS - $0.75 additional per hour.
SPRAY WORK: - $0.50 additional per hour.
INDUSTRIAL PAINTING - $0.25 additional per hour
[Work on industrial buildings used for the manufacture and processing of goods for sale or service; steel construction (bridges), stacks, towers, tanks, and similar structures]

HIGH WORK:
over 50 feet - $2.00 per hour additional
100 to 180 feet - $4.00 per hour additional
Over 180 feet - $6.00 per houir additional

PAIN0016-003 08/01/2004

AREA 1: ALAMEDA, CONTRA COSTA, SAN FRANCISCO, SAN MATEO & SANTA CLARA COUNTIES

AREA 2: CALAVERAS, MARIPOA, MERCED, MONTEREY, SAN BENITO, SAN JOAQUIN, SANTA CRUZ, STANISLAUS & TUOLUMNE COUNTIES

	Rates	Fringes
Drywall Finisher/Taper		
Alameda, Contra Costa, San Francisco, San Mateo, Santa Clara Counties	$ 34.37	13.27
Area 1	$ 34.37	13.27
Area 2	$ 30.44	11.67

PAIN0016-008 07/01/2004

FRESNO, KINGS AND MADERA COUNTIES:

	Rates	Fringes

Painter
Brush and Roller.....$ 20.59 8.92

FOOTNOTES:
Drywall Taper and Lead Abaters receive $1.25 additional per hour. Sandblast & Spray receive $1.00 additional per hour. Paperhangers, and work over 30 feet (does not include work from a lift): $0.50 per hour additional.

PAIN0016-010 07/01/2004

FRESNO, KINGS, MADERA AND COUNTIES:

	Rates	Fringes
Soft Floor Layer.....	$ 20.18	7.39

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* PAIN0016-015 11/01/2004

CALAVERAS AND SAN JOAQUIN COUNTIES

	Rates	Fringes
Painter		
Brush.....	$ 25.32	10.25

FOOTNOTES:
Spray/Sandblast: $1.00 additional per hour.
Coal Tar/Exotic Materials: $1.75 additional per hour.
High Time: Steel construction workers working on erected steel construction, bridges, stacks, towers, tanks and similar structures, from 50 to 100 ft. above ground or mean water level: to be paid 1 hour per day additional; 100 to 180 ft 2 hours additionalpay per day; over 180 ft 3 hours additional pay per day. Exterior stage: Work on exterior stage 4-7 stories: to be paid 1/2 hr. per day additional. Work on exterior stage 8-11 stories: to be paid 1 hr. per day additional. Work on exterior stage 12 stories or higher: to be paid 1-1/2 hrs. per day additional. One story equals 10 ft.

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* PAIN0016-017 11/01/2004

MARIPOSA, MERCED, STANISLAUS & TOULUMNE COUNTIES

	Rates	Fringes
Painter		
Brush.....	$ 23.44	10.25

FOOTNOTES:
Spray/Sandblast: $1.00 additional per hour.
Coal Tar/Exotic Materials: $1.75 additional per hour.
High Time: Steel construction workers working on erected steel construction, bridges, stacks, towers, tanks and similar structures, from 50 to 100 ft. above ground or mean water level: to be paid 1 hour per day additional; 100 to

180 ft 2 hours additionalpay per day; over 180 ft 3 hours additional pay per day. Exterior stage: Work on exterior stage 4-7 stories: to be paid 1/2 hr. per day additional. Work on exterior stage 8-11 stories: to be paid 1 hr. per day additional. Work on exterior stage 12 stories or higher: to be paid 1-1/2 hrs. per day additional. One story equals 10 ft.

PAIN0016-022 07/01/2004

SAN FRANCISCO COUNTY

	Rates	Fringes
Painter	$ 32.73	12.91

PAIN0169-001 07/01/2004

FRESNO, KINGS, MADERA, MARIPOSA AND MERCED COUNTIES:

	Rates	Fringes
Glazier	$ 26.68	10.44

PAIN0169-005 07/01/2004

ALAMEDA AND CONTRA COSTA COUNTIES:

	Rates	Fringes
Glazier	$ 34.76	12.21

PAIN0169-009 07/01/2002

ALAMEDA AND CONTRA COSTA:

	Rates	Fringes
Shower Door Installer	$ 24.83	5.01+a

PAID HOLIDAYS: New Year's Day, President's Day, Memorial Day, Fourth of July, Labor Day, Thanksgiving Day, Day after Thanksgiving, and Christmas Day.

PAIN0718-002 07/01/2004

SAN FRANCISCO AND SAN MATEO COUNTIES:

	Rates	Fringes
Glazier	$ 33.26	13.71

PAIN0767-001 07/01/2004

CALAVERAS, SAN JOAQUIN, STANISLAUS AND TUOLUMNE COUNTIES:

	Rates	Fringes

Glazier.....$ 28.85 10.94

PAID HOLIDAYS: New Year's Day, Martin Luther King, Jr. Day, President's Day, Memorial Day, Independence Day, Labor Day, Veteran's Day, Thanksgiving Day, and Christmas Day.

FOOTNOTE: Employee rquired to wear a bod harness shall receive $1.50 per hour above the basic hourly rate at any elevation.

PAIN1176-001 06/26/2000

	Rates	Fringes
Parking Lot Striping/Highway Marking:		
GROUP 1	$ 22.84	6.91
GROUP 2	$ 22.45	6.91
GROUP 3	$ 19.51	6.91
GROUP 4	$ 22.15	6.91
Parking Lot, Game Court and Playground Installer	$ 19.51	6.91
Service Person (maintenance and repair of equipment)	$ 13.33	5.87

PARKING LOT STRIPING / HIGHWAY MARKING CLASSIFICATIONS

GROUP 1: STRIPER: Layout and application of painted traffic stripes and marking; hot thermo plastic; tape traffic stripes and markings

GROUP 2: TRAFFIC DELINEATING DEVICE APPLICATOR: Layout and application of pavement markers, delineating signs, rumble and traffic bars, adhesives, guide markers, other traffic delineating devices; includes all related surface preparation (sandblasting, waterblasting, grinding) as part of the application process

GROUP 3: TRAFFIC SURFACE ABRASIVE BLASTER: Removal of traffic lines and markings; preparation of surface for coatings and traffic control devices

GROUP 4: TRAFFIC PROTECTIVE DELINEATING SYSTEMS INSTALLER: Removes, relocates, installs permanently affixed roadside and parking delineation barricades, fencing, guard rail, cable anchor, retaining walls, reference signs, and monument markers

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* PAIN1237-003 06/01/2004

CALAVERAS; SAN JOAQUIN COUNTIES; STANISLAUS AND TUOLUMNE COUNTIES:

	Rates	Fringes

Soft Floor Layer	$ 26.16	8.67

PAIN1600-005 07/01/2004

ALAMEDA, CONTRA COSTA, MARIPOSA, MERCED, MONTEREY, SAN BENITO, SAN FRANCISCO, SAN MATEO, SANTA CLARA AND SANTA CRUZ COUNTIES

	Rates	Fringes
Soft Floor Layer	$ 34.80	11.73

PAIN1621-001 07/01/2004

MONTEREY, SAN BENITO, SANTA CLARA AND SANTA CRUZ COUNTIES:

	Rates	Fringes
Glazier	$ 34.67	12.30

PLAS0066-002 07/01/2003

ALAMEDA, CONTRA COSTA, SAN MATEO AND SAN FRANCISCO COUNTIES:

	Rates	Fringes
Plasterer	$ 30.86	13.80

PLAS0300-001 07/01/2004

	Rates	Fringes
Plasterer		
AREA 188: Fresno, Kings, Madera Counties	$ 24.28	10.20
Area 188-Fresno, Kings, Madera Counties	$ 24.28	10.20
AREA 224: San Benito, Santa Clara, Santa Cruz	$ 29.42	10.48
Area 224-San Benito, Santa Clara, Santa Cruz	$ 29.42	10.48
AREA 295: Calaveras & San Joaquin Couonties	$ 27.34	10.98
Area 295-Calaveras & San Joaquin Couonties	$ 27.34	10.98
AREA 337: Monterey County	$ 26.06	10.48
Area 337-Monterey County	$ 26.06	10.48
AREA 429: Mariposa, Merced, Stanislaus, Tuolumne Counties	$ 27.35	10.98
Area 429-Mariposa, Merced, Stanislaus, Tuolumne Counties	$ 27.35	10.98

PLAS0300-005 07/01/2004

	Rates	Fringes

Cement Mason	$ 28.13	9.33

PLUM0036-001 07/01/2004

AREA 1: CALAVERAS, MARIPOSA, MERCED, SAN JOAQUIN, STANISLAUS AND TUOLUMNE

AREA 2: FRENSO, KINGS AND MADERA COUNTIES

	Rates	Fringes
Plumber and steamfitter		
Area 1	$ 28.50	14.58
Area 2	$ 28.00	14.58

PLUM0036-004 07/01/2004

CALAVERAS, FRESNO, KINGS, MADERA, MARIPOOSA, MERCED, SANJOAQUIN, STANISLAUS, TUOLUMNE COUNTIES

	Rates	Fringes
BUILDING CONSTRUCTION		
PIPE TRADESMAN	$ 12.00	6.02

SCOPE OF WORK Installation of corrugated metal piping for drainage, as well as installation of corrugated metal piping for culverts in connection with storm sewers and drains; Grouting, dry packing and diapering of joints, holes or chases including paving over joints, in piping; Temporary piping for dirt work for building site preparation; Operating jack hammers, pavement breakers, chipping guns, concrete saws and spades to cut holes, chases and channels for piping systems; Digging, grading, backfilling and ground preparation for all types of pipe to all points of the jobsite; Ground preparation including ground leveling, layout and planting of shrubbery, trees and ground cover, including watering, mowing, edging, pruning and fertilizing, the breaking of concrete, digging, backfilling and tamping for the preparation and completion of all work in connection with lawn sprinkler and landscaping; Loading, unloading and distributing materials at jobsite; Putting away materials in storage bins in jobsite secure storage area; Demolition of piping and fixtures for remodeling and additions; Setting up and tearing down work benches, ladders and job shacks; Clean-up and sweeping of jobsite; Pipe wrapping and waterproofing where tar or similar material is applied for protection of buried piping; Flagman

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PLUM0036-009 07/01/2004

MONTEREY AND SANTA CRUZ COUNTIES

	Rates	Fringes
Plumber and steamfitter	$ 32.10	14.58

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* PLUM0038-001 07/01/2004

SAN FRANCISCO COUNTY

	Rates	Fringes
Plumber		
(1) Work on wooden frame structures 5 stories or less excluding high-rise buildings and commercial work such as hospitals, prisons, hotels and schools.	$ 33.60	21.03
(2) All other work.....	$ 42.00	22.50

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* PLUM0038-005 07/01/2004

SAN FRANCISCO COUNTY

	Rates	Fringes
Landscape/Irrigation Fitter....	$ 30.25	12.38

PLUM0159-001 07/01/2004

CONTRA COSTA COUNTY:

	Rates	Fringes
Plumber and steamfitter		
Construction of motels under 4 stories.....	$ 28.26	12.74
All other work.....	$ 36.06	19.25

PLUM0342-001 07/01/2004

ALAMEDA & CONTRA COSTA COUNTIES

	Rates	Fringes
Pipefitter		
CONTRA COSTA COUNTY.....	$ 36.51	21.09
Plumber, Pipefitter, Steamfitter		
ALAMEDA COUNTY.....	$ 36.51	21.09

PLUM0355-004 07/01/2004

ALAMEDA, CALAVERAS, CONTRA COSTA, FRESNO, KINGS, MADERA, MARIPOSA, MERCED, MONTEREY, SAN BENITO, SAN JOAQUIN, SAN MATEO, SANTA CLARA, SANTA CRUZ, STANISLAUS, AND TUOLUMNE COUNTIES:

	Rates	Fringes
Underground Utility Worker /Landscape Fitter.....	$ 22.75	7.25

PLUM0393-001 07/01/2004

SAN BENITO AND SANTA CLARA COUNTIES

	Rates	Fringes
Plumber/Pipefitter	$ 44.01	14.43

PLUM0467-001 07/01/2004

SAN MATEO COUNTY

	Rates	Fringes
Plumber/Pipefitter/Steamfitter		
(1) Refrigeration & Air Conditioning	$ 43.90	14.61
(2) All Other Work	$ 42.65	14.31

ROOF0027-002 07/01/2004

FRESNO, KINGS, AND MADERA COUNTIES

	Rates	Fringes
Roofer	$ 23.05	7.30

FOOTNOTE: Work with pitch, pitch base of pitch impregnated products or any material containing coal tar pitch, on any building old or new, where both asphalt and pitchers are used in the application of a built-up roof or tear off: $2.00 per hour additional.

ROOF0040-002 08/01/2004

SAN FRANCISCO & SAN MATEO COUNTIES:

	Rates	Fringes
Roofer	$ 24.27	13.20

ROOF0081-001 08/01/2003

ALAMEDA AND CONTRA COSTA COUNTIES:

	Rates	Fringes
Roofer	$ 24.35	11.60

ROOF0081-004 08/01/2001

CALAVERAS, MARIPOSA, MERCED, SAN JOAQUIN, STANISLAUS AND TUOLUMNE COUNTIES:

	Rates	Fringes

Roofer	$ 19.80	6.15

ROOF0095-002 08/01/2004

MONTEREY, SAN BENITO, SANTA CLARA, AND SANTA CRUZ COUNTIES:

	Rates	Fringes
Roofer		
Journeyman	$ 28.68	9.79
Kettleman (2 kettles), Bitumastic Enameler, Coal Tar, Pitch & Mastic	$ 30.68	9.79

SFCA0483-001 08/01/2001

ALAMEDA, CONTRA COSTA, SAN FRANCISCO, SAN MATEO AND SANTA CLARA COUNTIES:

	Rates	Fringes
Sprinkler Fitter (FIRE)	$ 36.59	11.20

SFCA0669-011 04/01/2004

CALAVERAS, FRESNO, KINGS, MADERA, MARIPOSA, MERCED, MONTEREY, SAN BENITO, SAN JOAQUIN, SANTA CRUZ, STANISLAUS AND TUOLUMNE COUNTIES:

	Rates	Fringes
Sprinkler Fitter (FIRE)	$ 27.35	10.95

SHEE0104-001 07/01/2004

	Rates	Fringes
Sheet metal worker		
(1) Work on projects with an HVAC contract price of $270,000 equipped with packaged units or a unitary system; Also, tenant completion work extending from an existing trunk line or an existing water or air loop to registers and/or diffusers; Also, remodel or add-on contracts on existing facilities providing the contract price is $165,000 or less; Also, architectural sheet metal contracts of $100,000 or less; Also, pre-engineered and pre-		

manufactured siding

ALAMEDA AND CONTRA COSTA COUNTIES	$ 31.44	18.41
MONTEREY & SAN BENITO COUNTIES	$ 30.86	15.91
MONTEREY, SAN BENITO & SANTA CRUZ COUNTIES	$ 30.86	15.91
SAN MATEO COUNTY	$ 34.83	16.07
SANTA CLARA COUNTY	$ 38.50	17.18

(1) Work on projects with an HVAC contract price of $270,000 equipped with packaged units or a unitary system; Also, tenant completion work extending from an existing trunk line or an existing water or air loop to registers and/or diffusers; Also, remodel or add-on contracts on existing facilities providing the contract price is $165,000 or less; Also, architectural sheet metal contracts of $150,000 or less; Also, pre-engineered and pre-manufactured siding

ALAMEDA AND CONTRA COSTA COUNTIES	$ 31.44	18.44
SAN MATEO COUNTY	$ 34.83	16.10
SANTA CLARA COUNTY	$ 36.29	15.37

(2) Work with an HVAC contract price of $80,000 or less; Also, tenant completion work providing the contract price is $80,000 or less; Also, remodel or add-on contracts on existing facilities providing the contract price is $50,000 or less; Also, architectural sheet metal contracts of $100,000 or less; Also, pre-engineered and pre-manufactured siding

SAN FRANCISCO COUNTY	$ 36.81	17.03

(3) All other work

ALAMEDA AND CONTRA COSTA COUNTIES	$ 37.12	18.63
MONTEREY & SAN BENITO COUNTIES	$ 30.86	16.45
SAN FRANCISCO COUNTY	$ 37.58	18.16
SAN MATEO COUNTY	$ 38.27	17.28
SANTA CLARA COUNTY	$ 38.50	17.21

SANTA CRUZ COUNTY.....	$ 32.48	14.83

SHEE0104-015 07/01/2004

ALAMEDA, CONTRA COSTA, MONTEREY, SAN BENITO, SAN FRANCISCO, SAN MATEO, SANTA CLARA AND SANTA CRUZ COUNTIES:

	Rates	Fringes
Sheetmetal Worker		
Metal Decking and Siding only.....	$ 30.41	16.13

SHEE0162-001 07/01/2004

CALAVERAS AND SAN JOAQUIN COUNTIES:

	Rates	Fringes
Sheet metal worker.....	$ 27.03	13.22

SHEE0162-003 07/01/2004

MARIPOSA, MERCED, STANISLAUS AND TUOLUMNE COUNTIES:

	Rates	Fringes
Sheet metal worker (Excluding metal deck and siding).....	$ 28.46	14.45

SHEE0162-004 07/01/2004

FRESNO, KINGS, AND MADERA COUNTIES:

	Rates	Fringes
Sheet metal worker.....	$ 28.81	14.99

SHEE0162-013 07/01/2004

CALAVERAS, FRESNO, KINGS, MADERA, MARIPOSA, MERCED, SAN JOAQUIN, STANISLAUS AND TUOLUMNE COUNTIES:

	Rates	Fringes
Sheet metal worker (Metal decking and siding only).....	$ 32.50	14.04

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* TEAM0094-001 07/01/2004

	Rates	Fringes
Truck drivers:		
GROUP 1.....	$ 23.08	15.04
GROUP 2.....	$ 23.38	15.04
GROUP 3.....	$ 23.68	15.04
GROUP 4.....	$ 24.03	15.04

GROUP 5.....$ 24.38 15.04

FOOTNOTES:

Articulated dump truck; Bulk cement spreader (with or without auger); Dumpcrete truck; Skid truck (debris box); Dry pre-batch concrete mix trucks; Dumpster or similar type; Slurry truck: Use dump truck yardage rate.

Heater planer; Asphalt burner; Scarifier burner; Industrial lift truck (mechanical tailgate); Utility and clean-up truck: Use appropriate rate for the power unit or the equipment utilized.

TRUCK DRIVER CLASSIFICATIONS

GROUP 1: Dump trucks, under 6 yds.; Single unit flat rack (2-axle unit); Nipper truck (when flat rack truck is used appropriate flat rack shall apply); Concrete pump truck (when flat rack truck is used appropriate flat rack shall apply); Concrete pump machine; Fork lift and lift jitneys; Fuel and/or grease truck driver or fuel person; Snow buggy; Steam cleaning; Bus or personhaul driver; Escort or pilot car driver; Pickup truck; Teamster oiler/greaser and/or serviceperson; Hook tender (including loading and unloading); Team driver; Tool room attendant (refineries)

GROUP 2: Dump trucks, 6 yds. and under 8 yds.; Transit mixers, through 10 yds.; Water trucks, under 7,000 gals.; Jetting trucks, under 7,000 gals.; Single-unit flat rack (3-axle unit); Highbed heavy duty transport; Scissor truck; Rubber-tired muck car (not self-loaded); Rubber-tired truck jumbo; Winch truck and "A" frame drivers; Combination winch truck with hoist; Road oil truck or bootperson; Buggymobile; Ross, Hyster and similar straddle carriers; Small rubber-tired tractor

GROUP 3: Dump trucks, 8 yds. and including 35 yds.; Transit mixers, over 10 yds.; Water trucks, 7,000 gals. and over; Jetting trucks, 7,000 gals. and over; Vacuum trucks under 7500 gals. Trucks towing tilt bed or flat bed pull trailers; Lowbed heavy duty transport; Heavy duty transport tiller person; Self- propelled street sweeper with self-contained refuse bin; Boom truck - hydro-lift or Swedish type extension or retracting crane; P.B. or similar type self-loading truck; Tire repairperson; Combination bootperson and road oiler; Dry distribution truck (A bootperson when employed on such equipment, shall receive the rate specified for the classification of road oil trucks or bootperson); Ammonia nitrate distributor, driver and mixer; Snow Go and/or plow

GROUP 4: Dump trucks, over 35 yds. and under 65 yds.; Water pulls - DW 10's, 20's, 21's and other similar equipment when pulling Aqua/pak or water tank trailers; Helicopter pilots (when transporting men and materials); Lowbedk Heavy Duty Transport up to including 7 axles; DW10's, 20's, 21's and other similar Cat type, Terra Cobra, LeTourneau Pulls, Tournorocker, Euclid and similar type equipment when

pulling fuel and/or grease tank trailers or other miscellaneous trailers; Vacuum Trucks 7500 gals and over and truck repairman

GROUP 5: Dump trucks, 65 yds. and over; Holland hauler; Low bed Heavy Duty Transport over 7 axles

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WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

In the listing above, the "SU" designation means that rates listed under the identifier do not reflect collectively bargained wage and fringe benefit rates. Other designations indicate unions whose rates have been determined to be prevailing.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

* an existing published wage determination
* a survey underlying a wage determination
* a Wage and Hour Division letter setting forth a position on a wage determination matter
* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an

interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

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END OF GENERAL DECISION

STANDARD FORM 24

BID BOND

BID BOND *(See instruction on reverse)*	DATE BOND EXECUTED *(Must not be later than bid opening date)*	OMB NO.: 9000-0045

Public reporting burden for this collection of information is estimated to average 25 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to the FAR Secretariat (MVR), Federal Acquisition Policy Division, GSA, Washington, DC 20405.

PRINCIPAL *(Legal name and business address)*	TYPE OF ORGANIZATION *("X" one)* ☐ INDIVIDUAL ☐ PARTNERSHIP ☐ JOINT VENTURE ☒ CORPORATION STATE OF INCORPORATION

SURETY(IES) *(Name and business address)*

PENAL SUM OF BOND					BID IDENTIFICATION	
PERCENT OF BID PRICE	AMOUNT NOT TO EXCEED				BID DATE	INVITATION NO.
	MILLION(S)	THOUSAND(S)	HUNDRED(S)	CENTS	FOR *(Construction, Supplies,or Services)*	

OBLIGATION:

We, the Principal and Surety(ies) are firmly bound to the United States of America (hereinafter called the Government) in the above penal sum. For payment of the penal sum, we bind ourselves, our heirs, executors, administrators, and successors, jointly and severally. However, where the Sureties are corporations acting as co-sureties, we, the Sureties, bind ourselves in such sum "jointly and severally" as well as "severally" only for the purpose of allowing a joint action or actions against any or all of us. For all other purposes, each Surety binds itself, jointly and severally with the Principal, for the payment of the sum shown opposite the name of the Surety. If no limit of liability is indicated, the limit of liability is the full amount of the penal sum.

CONDITIONS:

The Principal has submitted the bid identified above.

THEREFORE:

The above obligation is void if the Principal - (a) upon acceptance by the Government of the bid identified above, within the period specified therein for acceptance (sixty (60) days if no period is specified), executes the further contractual documents and gives the bond(s) required by the terms of the bid as accepted within the time specified (ten (10) days if no period is specified) after receipt of the forms by the principal; or (b) in the event of failure to execute such further contractual documents and give such bonds, pays the Government for any cost of procuring the work which exceeds the amount of the bid.

Each Surety executing this instrument agrees that its obligation is not impaired by any extension(s) of the time for acceptance of the bid that the Principal may grant to the Government. Notice to the surety(ies) of extension(s) are waived. However, waiver of the notice applies only to extensions aggregating not more than sixty (60) calendar days in addition to the period originally allowed for acceptance of the bid.

WITNESS:

The Principal and Surety(ies) executed this bid bond and affixed their seals on the above date.

PRINCIPAL

SIGNATURE(S)	1. *(Seal)*	2. *(Seal)*	3. *(Seal)*	*Corporate Seal*
NAME(S) & TITLE(S) *(Typed)*	1.	2.	3.	

INDIVIDUAL SURETY(IES)

SIGNATURE(S)	1. *(Seal)*	2. *(Seal)*
NAME(S) *(Typed)*	1.	2.

CORPORATE SURETY(IES)

SURETY A	NAME & ADDRESS		STATE OF INC.	LIABILITY LIMIT ($)
	SIGNATURE(S)	1.	2.	*Corporate Seal*
	NAME(S) & TITLE(S) *(Typed)*	1.	2.	

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Previous edition is usable

STANDARD FORM 24 (REV. 10-98)
Prescribed by GSA - FAR (48 CFR) 53.228(a)

SURETY B	NAME & ADDRESS		STATE OF INC.	LIABILITY LIMIT ($)	*Corporate Seal*
	SIGNATURE(S)	1.	2.		
	NAME(S) & TITLE(S) *(Typed)*	1.	2.		
SURETY C	NAME & ADDRESS		STATE OF INC.	LIABILITY LIMIT ($)	*Corporate Seal*
	SIGNATURE(S)	1.	2.		
	NAME(S) & TITLE(S) *(Typed)*	1.	2.		
SURETY D	NAME & ADDRESS		STATE OF INC.	LIABILITY LIMIT ($)	*Corporate Seal*
	SIGNATURE(S)	1.	2.		
	NAME(S) & TITLE(S) *(Typed)*	1.	2.		
SURETY E	NAME & ADDRESS		STATE OF INC.	LIABILITY LIMIT ($)	*Corporate Seal*
	SIGNATURE(S)	1.	2.		
	NAME(S) & TITLE(S) *(Typed)*	1.	2.		
SURETY F	NAME & ADDRESS		STATE OF INC.	LIABILITY LIMIT ($)	*Corporate Seal*
	SIGNATURE(S)	1.	2.		
	NAME(S) & TITLE(S) *(Typed)*	1.	2.		
SURETY G	NAME & ADDRESS		STATE OF INC.	LIABILITY LIMIT ($)	*Corporate Seal*
	SIGNATURE(S)	1.	2.		
	NAME(S) & TITLE(S) *(Typed)*	1.	2.		

INSTRUCTIONS

1. This form is authorized for use when a bid guaranty is required. Any deviation from this form will require the written approval of the Administrator of General Services.

2. Insert the full legal name and business address of the Principal in the space designated "Principal" on the face of the form. An authorized person shall sign the bond. Any person signing in a representative capacity (e.g., an attorney-in-fact) must furnish evidence of authority if that representative is not a member of the firm, partnership, or joint venture, or an officer of the corporation involved.

3. The bond may express penal sum as a percentage of the bid price. In these cases, the bond may state a maximum dollar limitation (e.g., (e.g., 20% of the bid price but the amount not to exceed _____ dollars).

4. (a) Corporations executing the bond as sureties must appear on the Department of the Treasury's list of approved sureties and must act within the limitation listed therein. where more than one corporate surety is involved, their names and addresses shall appear in the spaces (Surety A, Surety B, etc.) headed "CORPORATE SURETY(IES)." In the space designed "SURETY(IES)" on the face of the form, insert only the letter identification of the sureties.

(b) Where individual sureties are involved, a completed Affidavit of Individual surety (Standard Form 28), for each individual surety, shall accompany the bond. The Government may require the surety to furnish additional substantiating information concerning its financial capability.

5. Corporations executing the bond shall affix their corporate seals. Individuals shall execute the bond opposite the word "Corporate Seal"; and shall affix an adhesive seal if executed in Maine, New Hampshire, or any other jurisdiction requiring adhesive seals.

6. Type the name and title of each person signing this bond in the space provided.

7. In its application to negotiated contracts, the terms "bid" and "bidder" shall include "proposal" and "offeror."

DD FORM 2051

REQUEST FOR ASSIGNMENT OF A COMMERCIAL AND GOVERNMENT ENTITY (CAGE) CODE

REQUEST FOR ASSIGNMENT OF A COMMERCIAL AND GOVERNMENT ENTITY *(CAGE)* CODE

(See Instructions on Reverse)

Form Approved
OMB No 0704-0225
Expires Apr 30, 1995

Public reporting burden for this collection of information is estimated to average 7 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing the collection of information. Said comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Department of Defense, Washington Headquarters Services, Directorate for Information on Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302; and to the Office of Management and Budget, Paperwork Reduction Project (0704-0225), Washington, D.C. 20503. Please DO NOT RETURN your form to either of these addresses. Send complete form to address on reverse.

SECTION A - TO BE COMPLETED BY INITIATOR

1. REQUESTING GOVERNMENT AGENCY/ACTIVITY

a. NAME	b. ADDRESS *(Street, City, State, and Zip Code)*
NASA Ames Research Center	M/S 213-13, Moffett Field, CA 94035-1000

2. TYPE CODE REQUESTED *(X one)*		3. EXCEPTION CODES	
	a. TYPE A		a. CAO
X	b. TYPE F		b. ADP

4. INITIATOR

a. TYPED NAME *(Last, First, Middle Initial)*	b. OFFICE SYMBOL	c. SIGNATURE	d. TELEPHONE NO.
Chapman, Ameka A.	JAZ	Ameka Chapman	650-604-0976

SECTION B - TO BE COMPLETED BY FIRM TO BE CODED

1. FIRM

a. NAME *(Include Branch of, Division of, etc.)*	b. ADDRESS *(Street, City, State and Zip Code)*
c. CAGE CODE *(If previously assigned)*	

2. IF FIRM PREVIOUSLY OPERATED UNDER OTHER NAME(S) OR OTHER ADDRESS(ES) SPECIFY THE PREVIOUS NAME(S) AND/OR ADDRESS(ES) *(Use separate sheet of paper, if necessary)*

3. PARENT COMPANY AND AFFILIATED FIRMS (X *one, and complete as applicable)*

	a. NONE
	b. CURRENTLY AFFILIATED WITH OTHER FIRMS *(List name(s) and address(es) of such firms on a separate sheet of paper)*
	c. PREVIOUSLY AFFILIATED WITH OTHER FIRMS *(List name(s) and address(es) of such firms on a separate sheet of paper)*

4. PRIMARY BUSINESS CATEGORY *(X one)*		5. DISADVANTAGED SMALL BUSINESS STATUS *(X one)*		6. NUMBER OF EMPLOYEES
	a. MANUFACTURER		a. APPROVED BY SMALL BUSINESS ADMINISTRATION (SBA) FOR SECTION 8(a) PROGRAM	7. WOMAN OWNED BUSINESS (X one)
	b. DEALER/DISTRIBUTOR			a. YES / b. NO
	c. CONSTRUCTION FIRM			
	d. SERVICE COMPANY		b. OTHER DISADVANTAGED SMALL BUSINESS FIRM	8. STANDARD INDUSTRIAL CLASSIFICATION (SIC) CODE(S)
	e. SALES OFFICE			
	f. OTHER *(specify)*		c. NOT DISADVANTAGED SMALL BUSINESS FIRM	a. PRIMARY
				b. OTHER *(Specify)*

9. REMARKS

TIN:

10. FIRM OFFICIAL President

a. TYPED NAME *(Last, First, Middle Initial)*	b. DATE SIGNED *(YYMMDD)*	c. SIGNATURE	d. TELEPHONE

DD FORM 2051, JUN 90 (EG) ***Previous editions are obsolete*** Designed using Microsoft Word, SA-ECRC, Apr 95

INSTRUCTIONS FOR COMPLETING DD FORM 2051

GENERAL NOTE FOR PERSONNEL PREPARING OR PROCESSING THIS REPORT

Coding must be as indicated in the instructions. In cases where specific coding instructions are provided, reference must be made to the Department of Defense Manual for Standard Data Elements, DoD 5000. 12-M. Noncompliance with either the coding instructions contained herein or those published in referenced manual will make the organization which fails to comply responsible for required concessions in data base communication.

SPECIFIC INSTRUCTIONS

SECTION A - TO BE COMPLETED BY THE INITIATING GOVERNMENT ACTIVITY

Item 1: Self-explanatory.

Item 2: Mark the type of code being requested.

a. Type A - Manufacturers Code which is used in the Federal Catalog System to identify a certain facility at a specific location which is a possible source for the manufacture and/or design control of items catalogued by the Federal Government; or,

b. Type F - Non-manufacturers Code which is required for identifying an organization/function in MILSCAP. These are assigned to contractors which are non-manufacturers or are manufacturers not qualifying for a Type A Code.

Item 3: If applicable, enter the exception DoD Activity Address Code for the Servicing Contract Administration Office (CAO) or ADP point.

Item 4: Self-explanatory.

SECTION B- TO BE COMPLETED BY THE FIRM TO WHICH THE CODE WILL BE ASSIGNED

Items I a and I b: Self-explanatory.

Item I c: If a CAGE Code (Type A or Type F) was previously assigned, enter it in this block.

Item 2: Self-explanatory.

Item 3: If a block other than "none" is marked, identify the Parent company by a (P) beside the firm name.

SECTION B - (Continued)

Item 4: Self-explanatory.

Item 5: A disadvantaged business is defined as a firm that is 51% or more, owned, controlled, and operated by a person(s) who is socially and economically disadvantaged. "Controlled" is defined as exercising the power to make policy decisions. "Operated" is defined as actively involved in the day-to-day management of the firm.

Item 6: Enter the number of employees. This number should include the employees of all affiliates.

Item 7: A woman-owned business is defined as a firm that is 51%, or more, controlled and operated by a woman or women. "Controlled" and "Operated" are defined in Item 5.

Item 8: The SIC Code is a Government Index used to identify business activity and indicates the function (manufacturer, wholesaler, retailer, or service) and the line of business in which the company is engaged. If multiple SIC Codes, indicate the primary first, next important, etc.

Items 9 and 10: Self-explanatory.

NOTE: When any future changes are made to the coded facility; i.e., name change, location change, business sold or operations discontinued, etc., written notification stating the appropriate change should be sent to:

Commander
Defense Logistics Services Center
ATTN: DLSC-FBA
Federal Center
74 Washington N.
Battle Creek, MI 49017-3084