

INFORMATION TO OFFERORS OR QUOTERS

OMB Control No.: 2700-0042

Exp. Date: N/A

Solicitation Number: RFO2-38072
 Sealed Bid (IFB) MidRange (RFO)
 Negotiated (RFQ) Negotiated (NRA)
 Negotiated (RFP)

Issuing Office:

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

Point of Contact: NO COLLECT CALLS ACCEPTED

Name: Teresa Marshall
Mail Stop: 213-13
Telephone: (650) 604-5257
Fax: (650) 604-4984

Item(s) to Be Acquired:

**REPAIR ROOF AND HVAC, BUILDINGS 200 AND 201
AT NASA AMES RESEARCH CENTER**

This Solicitation Is:

- Unrestricted--Full and Open Competition
 Set-Aside 100% for Small Business Labor Surplus Area Concerns
 a combination Small Business/Labor Surplus Area Set-Aside
 Hubzone Business

- 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.
 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.
 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

SOLICITATION, OFFER, AND AWARD <i>(Construction, Alteration, or Repair)</i>	1. SOLICITATION NO. RFO2-38072 (TAM)	2. TYPE OF SOLICITATION <input type="checkbox"/> SEALED BID <input checked="" type="checkbox"/> NEGOTIATED (BVS)	3. DATE ISSUED 12/11/2003	PAGE OF PAGES 1 of 3
	IMPORTANT - The "offer" section on the reverse must be fully completed by offeror.			

4. CONTRACT NO.	5. REQUISITION/PURCHASE REQUEST NO. FEF	6. PROJECT NO.
7. ISSUED BY National Aeronautics and Space Administration Ames Research Center Attn: M/S 213-13 Moffett Field, CA 94035-1000	CODE	8. ADDRESS OFFER TO National Aeronautics and Space Administration Ames Research Center Attn: M/S 213-13, Building 213, Room 216 Moffett Field, CA 94035-1000
9. FOR INFORMATION CALL:	A. NAME Teresa Marshall	B. TELEPHONE NO. (Include area code) (NO COLLECT CALLS) (650)-604-5257 EMAIL ADDRESS: Teresa.A.Marshall@ 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: REPAIR ROOF AND HVAC, BUILDINGS 200 AND 201

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 – I13
Section J. List of Attachments	Page J1
Section K. Representations, Certifications, and Other Statements of Offerors	Pages K1 – K10
Section L. Instrs., Conds., and Notices to Offerors	Pages L1 – L12
Section M. Evaluation Factors for Award	Page M1 – M2

THIS PROCUREMENT IS 100% SET-ASIDE FOR HUBZONE BUSINESS CONCERNS.

A PRE-BID CONFERENCE & CONDUCTED SITE TOUR IS SCHEDULED FOR 10:00 A.M., ON DECEMBER 23, 2003 AT AMES RESEARCH CENTER, BUILDING N213, ROOM 204A. THE ESTIMATED MAGNITUDE OF THIS PROJECT IS BETWEEN \$1,000,000 AND \$5,000,000.

11. The Contractor shall begin performance within 10 calendar days and complete it within 210 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.) <input checked="" type="checkbox"/> YES <input type="checkbox"/> 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 13, 2004. 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.

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

31C. AWARD DATE

BY

NOTE:

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

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

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 SCHEDULESECTION 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.

<u>Item No.</u>	<u>Description</u>	<u>Quantity</u>	<u>Unit</u>
1	All work identified in this solicitation except work identified as options, See Specification Section 01000, Paragraph 1.1.1	1	JB
2	All work identified as Optional Bid Item 1 includes the work shown on the Building N201 contract drawings G00, A01, A02, A03, M01, M02, M03, M04, E01 & E02, and the contract specifications. Major work elements include: Removal of all existing mechanical and electrical system components and other items on the roof of Building N201 to accommodate installation of new roof insulation and new roofing membrane. Installation of new roof access hatch. Installation of new roof scuppers. Installation of all new roof insulation and new roofing membrane and associated blocking and flashing. Reinstallation of mechanical and electrical system components and other items on the roof of Building N201 to return systems to a fully operational condition. (End of clause)	1	JB

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—
- (1) 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 reinspection 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 (1) 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 the following:

(i) Phase A: 189 calendar days after the effective date of the Notice to Proceed for all work required by the base offer item; and

(ii) Phase B: 210 calendar days after the effective date of the Notice to Proceed for all work required in the option item, if exercised by the Government.

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 following amounts for each calendar day of delay for until the work is completed or accepted.

(i) Phase A	\$707.00
(ii) Phase B	\$707.00

(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 TIME EXTENSIONS (FAR 52.211-13) (SEP 2000)

Time extensions for contract changes will depend upon the extent, if any, by which the changes cause delay in the completion of the various elements of construction. The change order granting the time extension may provide that the contract completion date will be extended only for those specific elements related to the changed work and that the remaining contract completion dates for all other portions of the work will not be altered. The change

order also may provide an equitable readjustment of liquidated damages under the new completion schedule.

(End of clause)

F.5 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.

<u>Item/Report</u>	<u>Delivery Date</u>	<u>Qty</u>	<u>Recipient</u>
--------------------	----------------------	------------	------------------

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

1852.204-74	MAY 2002	CENTRAL CONTRACTOR REGISTRATION
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 15 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	----	----	10 percent

than its own forces			
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 CLAUSESSECTION 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	DEC 2001	DEFINITIONS (ALTERNATE 1) (MAY 2001)
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
52.215-8	OCT 1997	ORDER OF PRECEDENCE-UNIFORM CONTRACT FORMAT
52.219-3	JAN 1999	NOTICE OF TOTAL HUBZONE SET-ASIDE
52.219-8	OCT 2000	UTILIZATION OF SMALL BUSINESS CONCERNS
52.219-9	OCT 2002	SMALL BUSINESS SUBCONTRACTING PLAN WITH ALTERNATE I (JAN 1999 (applicable if contract is over \$1 million)
52.219-14	DEC 1996	LIMITATIONS ON SUBCONTRACTING
52.219-16	JAN 1999	LIQUIDATED DAMAGES SUBCONTRACTING PLAN (applicable if contract is over \$1 million)
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	APR 1998	POLLUTION PREVENTION AND RIGHT-TO- KNOW INFORMATION
52.223-6	MAY 2001	DRUG-FREE WORKPLACE
52.223-14	JUN 2003	TOXIC CHEMICAL RELEASE REPORTING
52.225-13	JUN 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
52.232-23	JAN 1986	ASSIGNMENT OF CLAIMS
52.232-27	FEB 2002	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
52.244-2	AUG 1998	SUBCONTRACTS (required if contract is over \$500,000)
52.246-21	MAR 1994	WARRANTY OF CONSTRUCTION (ALTERNATE I) (APR 1984)
52.248-3	FEB 2000	VALUE ENGINEERING--CONSTRUCTION
52.249-2	SEP 1996	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
1852.219-74	SEP 1990	USE OF RURAL AREA SMALL BUSINESSES (applicable if contract is over \$1 million)
1852.219-75	MAY 1999	SMALL, SMALL DISADVANTAGED, AND WOMEN-OWNED SMALL BUSINESS SUBCONTRACTING REPORTING (applicable if contract is over \$1 million)
1852.219-76	JUL 1997	NASA 8 PERCENT GOAL
1852.228-75	OCT 1988	MINIMUM INSURANCE COVERAGE
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)

I.3 TYPE OF CONTRACT (FAR 52.216-1) (APR 1984)

The Government contemplates award of a firm fixed price contract resulting from this solicitation.

(End of provision)

I.4 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 contract award. 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)

I.5 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.6 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

19.6%

Goals for Female
Participation for
Each Trade

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.7 52.225-9 BUY AMERICAN ACT-CONSTRUCTION MATERIALS (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, the District of Columbia, and outlying areas.

(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			
<u>Construction Material Description</u>	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Price (Dollars)*</u>
<i>Item 1:</i>			
Foreign construction material	_____	_____	_____
Domestic construction material	_____	_____	_____
<i>Item 2:</i>			
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.9 UTILIZATION OF INDIAN ORGANIZATIONS AND INDIAN-OWNED ECONOMIC ENTERPRISES (FAR 52.226-1) (JUNE 2000)

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

"Indian" means any person who is a member of any Indian tribe, band, group, pueblo, or community that is recognized by the Federal Government as eligible for services from the Bureau of Indian Affairs (BIA) in accordance with 25 U.S.C. 1452(c) and any "Native" as defined in the Alaska Native Claims Settlement Act (43 U.S.C. 1601).

"Indian organization" means the governing body of any Indian tribe or entity established or recognized by the governing body of an Indian tribe for the purposes of 25 U.S.C., chapter 17.

"Indian-owned economic enterprise" means any Indian-owned (as determined by the Secretary of the Interior) commercial, industrial, or business activity established or organized for the purpose of profit, provided that Indian ownership constitutes not less than 51 percent of the enterprise.

"Indian tribe" means any Indian tribe, band, group, pueblo, or community, including native villages and native groups (including corporations organized by Kenai, Juneau, Sitka, and Kodiak) as defined in the Alaska Native Claims Settlement Act, that is recognized by the Federal Government as eligible for services from BIA in accordance with 25 U.S.C. 1452(c).

"Interested party" means a prime contractor or an actual or prospective offeror whose direct economic interest would be affected by the award of a subcontract or by the failure to award a subcontract.

(b) The Contractor shall use its best efforts to give Indian organizations and Indian-owned economic enterprises (25 U.S.C. 1544) the maximum practicable opportunity to participate in the subcontracts it awards to the fullest extent consistent with efficient performance of its contract.

(1) The Contracting Officer and the Contractor, acting in good faith, may rely on the representation of an Indian organization or Indian-owned economic enterprise as to its eligibility, unless an interested party challenges its status or the Contracting Officer has independent reason to question that status. In the event of a challenge to the representation of a subcontractor, the Contracting Officer will refer the matter to the--

U.S. Department of the Interior

Bureau of Indian Affairs (BIA)

Attn: Chief, Division of Contracting and

Grants Administration

1849 C Street, NW,

MS-2626-MIB

Washington, DC 20240-4000.

The BIA will determine the eligibility and notify the Contracting Officer. No incentive payment will be made within 50 working days of subcontract award or while a challenge is pending. If a subcontractor is determined to be an ineligible participant, no incentive payment will be made under the Indian Incentive Program.

(2) The Contractor may request an adjustment under the Indian Incentive Program to the following:

- (i) The estimated cost of a cost-type contract.**
- (ii) The target cost of a cost-plus-incentive-fee prime contract.**
- (iii) The target cost and ceiling price of a fixed-price incentive prime contract.**
- (iv) The price of a firm-fixed-price prime contract.**

(3) The amount of the adjustment to the prime contract is 5 percent of the estimated cost, target cost, or firm-fixed-price included in the subcontract initially awarded to the Indian organization or Indian-owned economic enterprise.

(4) The Contractor has the burden of proving the amount claimed and must assert its request for an adjustment prior to completion of contract performance.

(c) The Contracting Officer, subject to the terms and conditions of the contract and the availability of funds, will authorize an incentive payment of 5 percent of the amount paid to the subcontractor. The Contracting Officer will seek funding in accordance with agency procedures.

(End of clause)

I.10 BID GUARANTEE (FAR 52.228-1) (SEP 1996)

- (a) Failure to furnish a bid guarantee in the proper form and amount, by the time set for opening of bids, may be cause for rejection of the bid.
- (b) The bidder shall furnish a bid guarantee in the form of a firm commitment, *e.g.*, bid bond supported by good and sufficient surety or sureties acceptable to the Government, postal money order, certified check, cashier's check, irrevocable letter of credit, or, under Treasury Department regulations, certain bonds or notes of the United States. The Contracting Officer will return bid guarantees, other than bid bonds-
- (1) To unsuccessful bidders as soon as practicable after the opening of bids; and
 - (2) To the successful bidder upon execution of contractual documents and bonds (including any necessary coinsurance or reinsurance agreements), as required by the bid as accepted.
- (c) The amount of the bid guarantee shall be 20 percent of the bid price or \$3,000,000, whichever is less.
- (d) If the successful bidder, upon acceptance of its bid by the Government within the period specified for acceptance, fails to execute all contractual documents or furnish executed bond(s) within 10 days after receipt of the forms by the bidder, the Contracting Officer may terminate the contract for default.
- (e) In the event the contract is terminated for default, the bidder is liable for any cost of acquiring the work that exceeds the amount of its bid, and the bid guarantee is available to offset the difference.

(End of provision)

I.11 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.12 SHARED SAVINGS (NASA 1852.243-71) (MAR 1997)

(a) The Contractor is entitled, under the provisions of this clause, to share in cost savings resulting from the implementation of cost reduction projects which are presented to the Government in the form of Cost Reduction Proposals (CRP) and approved by the Contracting Officer. These cost reduction projects may require changes to the terms, conditions or statement of work of this contract. Any cost reduction projects must not change the essential function of any products to be delivered or the essential purpose of services to be provided under the contract.

(b) Definitions:

(1) Cost savings, as contemplated by this clause, means savings that result from instituting changes to the covered contract, as identified in an approved Cost Reduction Proposal.

(2) Cost Reduction Proposal (CRP) - For the purposes of this clause, a Cost Reduction Proposal means a proposal that recommends alternatives to the established procedures and/or organizational support of a contract or group of contracts. These alternatives must result in a net reduction of contract cost and price to NASA. The proposal will include technical and cost information sufficient to enable the Contracting Officer to evaluate the CRP and approve or disapprove it.

(3) Covered contract - As used in this clause, covered contract means the contract, including unexercised options but excluding future contracts, whether contemplated or not, against which the CRP is submitted.

(4) Contractor implementation costs - As used in this provision, contractor implementation costs, or "implementation costs", shall mean those costs which the Contractor incurs on covered contracts specifically in developing, preparing, submitting, and negotiating a CRP, as well as those costs the Contractor will incur on covered contracts to make any structural or organizational changes in order to implement an approved CRP.

(5) Government costs - As used in this provision, the term Government costs means internal costs of NASA, or any other Government agency, which result directly from development and implementation of the CRP. These may include, but are not limited to, costs associated with the administration of the contract or with such contractually related functions such as testing, operations, maintenance and logistics support. These costs also include costs associated with other Agency contracts (including changes in contract price or cost and fee) that may be affected as a result of the implementation of a CRP. They do not include the normal administrative costs of reviewing and processing the Cost Reduction Proposal.

(c) General. The Contractor will develop, prepare and submit CRPs with supporting information, as detailed in paragraph (e) of this clause, to the Contracting Officer. The CRP will describe the proposed cost reduction activity in sufficient detail to enable the Contracting Officer to evaluate it and to approve or disapprove it. The Contractor shall share in any net cost savings realized from approved and implemented CRPs in accordance with the terms of this clause. The Contractor's actual percentage share of the cost savings shall be a matter for negotiation with the Contracting Officer, but shall not, in any event, exceed 50 percent of the total cost savings recognized by the Contracting Officer. The Contractor may propose changes in other activities that impact performance on its contract, including Government and other Contractor operations, if such changes will optimize cost savings. A Contractor shall not be entitled to share, however, in any cost savings that are internal to the Government, or which result from changes made to any contracts to which it is not a party even if those changes were proposed as a part of its CRP. Early communication between the Contractor and the Government is encouraged. The communication may be in the form of a concept paper or preliminary proposal. The Government is not committed to accepting any proposal as a result of these early discussions.

(d) Computation of cost savings. The cost savings to be shared between the Government and the Contractor will be computed by the Contracting Officer by comparing a current estimate to complete (ETC) for the covered contract, as structured before implementation of the proposed CRP, to a revised ETC which takes into account the implementation of that CRP. The cost savings to be shared shall be reduced by any cost overrun, whether experienced or projected, that is identified on the covered contract before implementation of the CRP. Although a CRP may result in cost savings that extend far into the future, the period in which the Contractor may share in those savings will be limited to no more than five years. Implementation costs of the Contractor must be considered and specifically identified in the revised ETC. The Contracting Officer shall offset Contractor cost savings by any increased costs (whether implementing or recurring) to the Government when computing the total cost savings to be shared. The Contractor shall not be entitled, under the provisions of this clause, to share in any cost reductions to the contract that are the result of changes stemming from any action other than an approved CRP. However, this clause does not limit recovery of any such reimbursements that are allowed as a result of other contract provisions.

(e) Supporting Information. As a minimum, the Contractor shall provide the following supporting information with each CRP:

- (1) Identification of the current contract requirements or established procedures and/or organizational support which are proposed to be changed.
- (2) A description of the difference between the current process or procedure and the proposed change. This description shall address how proposed changes will meet NASA requirements and discuss the advantages and disadvantages of the existing practice and the proposed changes.
- (3) A list of contract requirements which must be revised, if any, if the CRP is approved, along with proposed revisions. Any changes to NASA or delegated contract management processes should also be addressed.

(4) Detailed cost estimates which reflect the implementation costs of the CRP.

(5) An updated ETC for the covered contract, unchanged, and a revised ETC for the covered contract which reflects changes resulting from implementing the CRP. If the CRP proposes changes to only a limited number of elements of the contract, the ETCs need only address those portions of the contract that have been impacted. Each ETC shall depict the level of costs incurred or to be incurred by year, or to the level of detail required by the Contracting Officer. If other CRPs have been proposed or approved on a contract, the impact of these CRPs must be addressed in the computation of the cost savings to ensure that the cost savings identified are attributable only to the CRP under consideration in the instant case.

(6) Identification of any other previous submissions of the CRP, including the dates submitted, the agencies and contracts involved, and the disposition of those submittals.

(f) Administration.

(1) The Contractor shall submit proposed CRPs to the Contracting Officer who shall be responsible for the review, evaluation and approval. Normally, CRPs should not be entertained for the first year of performance to allow the Contracting Officer to assess performance against the basic requirements. If a cost reduction project impacts more than a single contract, the Contractor may, upon concurrence of the Contracting Officers responsible for the affected contracts, submit a single CRP which addresses fully the cost savings projected on all affected contracts that contain this Shared Savings Clause. In the case of multiple contracts affected, responsibility for the review and approval of the CRP will be a matter to be decided by the affected Contracting Officers.

(2) Within 60 days of receipt, the Contracting Officer shall complete an initial evaluation of any proposed cost reduction plan to determine its feasibility. Failure of the Contracting Officer to provide a response within 60 days shall not be construed as approval of the CRP. The Government shall promptly notify the Contractor of the results of its initial evaluation and indicate what, if any, further action will be taken. If the Government determines that the proposed CRP has merit, it will open discussions with the Contractor to establish the cost savings to be recognized, the Contractor's share of the cost savings, and a payment schedule. The Contractor shall continue to perform in accordance with the terms and conditions of the existing contract until a contract modification is executed by the Contracting Officer. The modification shall constitute approval of the CRP and shall incorporate the changes identified by the CRP, adjust the contract cost and/or price, establish the Contractor's share of cost savings, and incorporate the agreed to payment schedule.

(3) The Contractor will receive payment by submitting invoices to the Contracting Officer for approval. The amount and timing of individual payments will be made in accordance with the schedule to be established with the Contracting Officer. Notwithstanding the overall savings recognized by the Contracting Officer as a result of an approved CRP, payment of any portion of the Contractor's share of savings shall not be made until NASA begins to realize a net cost savings on the contract (i.e., implementation, startup and other increased costs resulting from the change have been offset by cumulative cost savings). Savings associated with unexercised options will not be paid unless and until the contract options are exercised. It shall be the responsibility of the Contractor to provide such justification as the Contracting Officer deems necessary to substantiate that cost savings are being achieved.

(4) Any future activity, including a merger or acquisition undertaken by the Contractor (or to which the Contractor becomes an involved party), which has the effect of reducing or reversing the cost savings realized from an approved CRP for which the Contractor has received payment may be cause for recomputing the net cost savings associated with any approved CRP. The Government reserves the right to make an adjustment to the Contractor's share of cost savings and to receive a refund of moneys paid if necessary. Such

adjustment shall not be made without notifying the Contractor in advance of the intended action and affording the Contractor an opportunity for discussion.

(g) Limitations. Contract requirements that are imposed by statute shall not be targeted for cost reduction exercises. The Contractor is precluded from receiving reimbursements under both this clause and other incentive provisions of the contract, if any, for the same cost reductions.

(h) Disapproval of, or failure to approve, any proposed cost reduction proposal shall not be considered a dispute subject to remedies under the Disputes clause.

(i) Cost savings paid to the Contractor in accordance with the provisions of this clause do not constitute profit or fee within the limitations imposed by 10 U.S.C. 2306(d) and 41 U.S.C. 254(b).

(End of clause)

I.13 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

(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)

[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. Specification No. 322774P**
- 2. General Wage Decision No. CA20030029 dated June 13, 2003.**
- 3. Standard Form 24; Bid Bond**

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

- 1. 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

Solicitation NAS2-38072

Name of Offeror: _____

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

(a) The offeror certifies that:

(1) 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:

(1) 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)(1) 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)(1) 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)(1) through (a)(3) above; and

(iii) As an agent, has not personally participated, and will not participate, in any action contrary to subparagraph (a)(1) 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—

(1) 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 52.204-5 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 COMMERCIAL AND GOVERNMENT ENTITY (CAGE) CODE REPORTING (ARC 52.204-93) (JAN 1999)

(a) The Offeror is requested to enter its CAGE code on its offer in the same block with its name and address. The CAGE code must be for that particular name and address, not for a parent or other corporate affiliation. Identify this number as a CAGE code by using the term CAGE prior to the number.

(b) If the Offeror does not have a CAGE code, the Contracting Officer will request one from the Defense Logistics Information Service (DLIS). Information about CAGE codes may be obtained from the following URL: <http://www.dlis.dla.mil/>. The Offeror shall complete Section B of the DD Form 2051, "Request for Assignment of a Commercial and Government Entity (CAGE) Code," attached to this solicitation, and submit it to the Contracting Officer. The Contracting Officer will complete Section A and forward the form to DLIS. Upon receipt, the Contracting Officer will notify the Offeror of its assigned CAGE code.

(c) The Offeror must not delay submission of the offer pending receipt of a CAGE code.

(End of provision)

K.7 CERTIFICATION REGARDING DEBARMENT, SUSPENSION, PROPOSED DEBARMENT, AND OTHER RESPONSIBILITY MATTERS (FAR 52.209-5) (DEC 2001)

(a)(I) 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 statutes 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)(I)(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.8 SMALL BUSINESS PROGRAM REPRESENTATIONS (FAR 52.219-1) (APR 2002)
ALTERNATE I (APR 2002)**

(a)(1) The North American Industry Classification System (NAICS) code for this acquisition is 238220.

(2) The small business size standard is \$12,000,000.00.

(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 is, 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 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 of ownership, 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 is, is not a joint venture that complies with the requirements of 13 CFR Part 126, and the representation in paragraph (b)(4)(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.

(5) [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.

(c) Definitions.

"Small business concern," as used in this provision, 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.

"Women-owned small business concern," as used in this provision, means a small business concern--

(1) Which 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, 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)

K.9 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
<input type="checkbox"/> 50 or fewer	\$1 million or less
<input type="checkbox"/> 51 – 100	\$1,000,001 - \$2 million
<input type="checkbox"/> 101 – 250	\$2,000,001 - \$3.5 million
<input type="checkbox"/> 251 – 500	\$3,500,001 - \$5 million
<input type="checkbox"/> 501 – 750	\$5,000,001 - \$10 million
<input type="checkbox"/> 751 – 1,000	\$10,000,001 - \$17 million
<input type="checkbox"/> Over 1,000	Over \$17 million

(End of provision)

K.11 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.12 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.13 COMPLIANCE WITH VETERANS' EMPLOYMENT REPORTING REQUIREMENTS (52.222-38) (DEC 2001)

COMPANY'S NAME: _____

AUTHORIZED COMPANY
OFFICIAL'S NAME: _____

SIGNATURE: _____

DATE: _____

By submission of its offer, the offeror represents that, if it is subject to the reporting requirements of 38 U.S.C. 4212(d) (i.e., the VETS-100 report required by Federal Acquisition Regulation clause 52.222-37, Employment Reports on Disabled Veterans and Veterans of the Vietnam Era), it has submitted the most recent report required by 38 U.S.C. 4212(d).

(End of provision)

K.14 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.

K.15 CERTIFICATION OF TOXIC CHEMICAL RELEASE REPORTING (FAR 52.223-13) (JUN 2003)

(a) Submission of this certification is a prerequisite for making or entering into this contract imposed by Executive Order 12969, August 8, 1995.

(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 under section 313(c) of EPCRA, 42 U.S.C. 11023(c);

(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 Standard Industrial Classification Code (SIC) major groups 20 through 39 or their corresponding North American Industry Classification System (NAICS) sectors 31 through 33; 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) (JUN 1999)

(a) The offeror shall enter, in the block with its name and address on the cover page of its offer, the annotation "DUNS" followed by the DUNS number 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 Information Services.

(b) If the offeror does not have a DUNS number, it should contact Dun and Bradstreet directly to obtain one. A DUNS number will be provided immediately by telephone at no charge to the offeror. For information on obtaining a DUNS number, the offeror, if located within the United States, should call Dun and Bradstreet at 1-800-333-0505. The offeror should be prepared to provide the following information:

- (1) Company name.
- (2) Company address.
- (3) Company telephone number.
- (4) Line of business.
- (5) Chief executive officer/key manager.
- (6) Date the company was started.
- (7) Number of people employed by the company.
- (8) Company affiliation.

(c) Offerors located outside the United States may obtain the location and phone number of the local Dun and Bradstreet Information Services office from the Internet home page at <http://www.customerservice@dnb.com>. If an offeror is unable to locate a local service center, it may send an e-mail to Dun and Bradstreet at globalinfo@mail.dnb.com.

(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 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)

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

L.6 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 nonresponsive 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.

L.8 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.9 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 23, 2003
Time: 10:00 AM
Location: Building N213, Conference Room 204A
Ames Research Center
Moffett Field, CA 94035-1000

(End of provision)

All personnel planning to attend the site visit must contact Teresa Marshall at Teresa.A.Marshall@nasa.gov no later than 5:00 pm on December 22, 2003, to obtain clearance to the center. Provide names of representatives, firm name, and identify residency or citizenship. A visitor's pass must be obtained at the Front Gate Pass Office to obtain access to the compound. Picture identification is required.

L.10 OMBUDSMAN (NASA 1852.215-84) (JUN 2000)

(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. Thomas J. Moyles, Director of Center Operations, Mailstop 200-9, Moffett Field, CA 94035-1000, (650) 604-5073, fax (650) 604-0031, Thomas.Moyles@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 202-358-0422, facsimile 202-358-3083, e-mail, sthompson1@hq.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.11 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.12 PROTESTS TO NASA (NASA 1852.233-70) (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.13 MAGNITUDE OF REQUIREMENT (NASA 1852.236-74) (DEC 1988)

The Government estimated price range of this project is between \$1,000,000.00 and \$5,000,000.00.

(End of provision)

L.14 INSTRUCTIONS TO OFFERORS-COMPETITIVE ACQUISITION (FAR 52.215-1) (MAY 2001)

(a) Definitions. As used in this provision-

"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 envelopes or packages (i) addressed to the office specified in the solicitation, and (ii) showing the 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 outermost 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 authorized by 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 date stamp of that installation on the proposal wrapper, other documentary evidence of receipt 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 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, 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) The Government may disclose the following information in postaward debriefings to other offerors:

- (i) The overall evaluated cost or price and technical rating of the successful offeror;
- (ii) The overall ranking of all offerors, when any ranking was developed by the agency during source selection;
- (iii) A summary of the rationale for award; and
- (iv) For acquisitions of commercial items, the make and model of the item to be delivered by the successful offeror.

(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.15 INFORMATION REQUIRED TO BE SUBMITTED BY OFFERORS

a. The offerors technical proposal shall be limited to 30 single sided, 8-1/2 by 11 inch pages of text with 12 point font or larger. The page limitation does not include the Standard Form 1442, Solicitation, Offer, and Award; the construction schedule; or letters of commendation or recommendation. If the technical proposal exceeds the stated page limitation, only the first 30 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 reviewed, evaluated and given a "rating" by a Technical Evaluation Team. The proposal should address the BVS value characteristics in the following format:

a. TECHNICAL SUBMITTAL REQUIREMENTS:

(1) **PAST PERFORMANCE:** Provide specific examples that demonstrate successful past performance on projects of similar scope and complexity within the last three (3) years. Provide up to six (6) representative 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 contract amount:

Original contract completion date:

Actual or projected contract completion date:

Explain why the original contract completion date was exceeded:

Percentage of Completion and Current Price:

Percentage amount that the completion cost exceeded the award amount:

Performance evaluation rating received:

Involvement of proposed key personnel and subcontractors:

Project description:

Briefly describe the similarities between this project and the scope of work required by this solicitation:

Discuss any major problems encountered and how they were resolved:

List any awards or recommendations received:

(a) 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 including- mechanical, electrical, structural, roofing and control systems.

Company name (offeror and all proposed subcontractors):

Company's principal officer:

Company address:

Company phone number:

Company E-mail address:

Companies principal business (mechanical, electrical, roofing, etc):

Number of years the company has been in their principal business:

Total 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. Offeror shall include on their organizational chart the name and contractor license number for the company they are proposing for the lead and asbestos abatement work.

(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) PROJECT SCHEDULE: 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, equipment procurement, 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 each of the major work phases.

(4) UTILIZATION OF SMALL BUSINESS: 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. The offeror shall include the cost to provide a field office and the associated home office support for the entire contract performance period listed in Paragraph 1.a.(3) Project Schedule. Included in these costs shall be home office overhead, field office overhead, project management, superintendence, quality control, scheduling, and all personnel and resources associated with the contract work.

(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 Option 1

L.17 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 pursuant to NFS Part 1871, *MidRange Procurement Procedures*, which seeks to select an offer based on the best combination of price and qualitative (technical) merit of the offers submitted and reduce the administrative burden on the offerors and the Government.

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. 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 (technical) merit if the price (or cost) differential between it and other offers warrants doing so.

The following value characteristics establish what the Government considers to be valuable in an offer. All offers will be judged against these value characteristics. Cost and technical will be considered approximately equal in importance and the value characteristics are approximately equal in weight.

a. **Technical Evaluation Factor:** The following value characteristics are applicable to this procurement:

(1) **PAST PERFORMANCE:** This BVS value characteristic will evaluate the performance of the offeror on recent projects of similar scope and complexity. Recent projects are defined as current ongoing 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 offer. The government will review the proposals along with information from other sources including references, customers, government agencies, and other sources deemed appropriate during the evaluation of this BVS.

(2) **PROJECT TEAM AND ORGANIZATION:** This BVS value characteristic evaluates the experience and qualifications of the offeror and their proposed project team – the offeror’s project manager and site superintendent; and the offeror’s mechanical, electrical, structural, roofing, and control systems subcontractors. This BVS value characteristic will also evaluate the licensing of the abatement subcontractor. The offeror’s site superintendent should have extensive experience coordinating the work between mechanical, electrical, structural, roofing and control system trades. The offeror shall utilize the proposed personnel and subcontractors to work on this contract in their proposed positions.

(3) **PROJECT SCHEDULE:** This BVS value characteristic evaluates the offeror’s proposed project schedule to determine if it demonstrates that the offeror has a clear understanding of the project’s phasing and construction requirements as outlined in Specification Section 01000, Paragraph 1.7, Work Scheduling.

(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 OPTIONS (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]

SPECIFICATION NO. 322774P

**SPECIFICATIONS
FOR
REPAIR ROOF AND HVAC, BUILDINGS N200 AND N201
AT
NASA AMES RESEARCH CENTER
MOFFETT FIELD, CALIFORNIA**



NASA Ames Research Center
Mail Stop 213-13
Moffett Field, CA 94035-1000

RFO2-38072

PROJECT TABLE OF CONTENTS

DIVISION 01 - GENERAL REQUIREMENTS

01000 GENERAL REQUIREMENTS
01100 SAFETY PROVISIONS
01115 OPTIONS
01300 SUBMITTALS
01400 QUALITY CONTROL
01500 ENVIRONMENTAL COMPLIANCE AND POLLUTION PREVENTION

DIVISION 02 - SITE CONSTRUCTION

02050 ALTERATIONS, DEMOLITION, AND REMOVAL
02080 ASBESTOS ABATEMENT
02090 LEAD PAINT ABATEMENT/DEMOLITION

DIVISION 05 - METALS

05120 STRUCTURAL STEEL

DIVISION 06 - WOOD AND PLASTICS

06100 ROUGH CARPENTRY

DIVISION 07 - THERMAL AND MOISTURE PROTECTION

07220 ROOF AND DECK INSULATION
07500 BUILT-UP BITUMINOUS ROOFING
07600 FLASHING AND SHEETMETAL

DIVISION 09 - FINISHES

09920 ARCHITECTURAL PAINTING

DIVISION 15 - MECHANICAL

15003 GENERAL MECHANICAL PROVISIONS
15050 BASIC MECHANICAL MATERIALS AND METHODS
15072 VIBRATION ISOLATION FOR AIR CONDITIONING EQUIPMENT
15083 DUCT INSULATION
15085 PIPING INSULATION
15136 CHILLED WATER PUMPING PACKAGE
15628 AIR-COOLED WATER CHILLERS
15720 AIR HANDLING UNITS
15762 AIR COILS
15815 LOW PRESSURE DUCTWORK
15870 POWER ROOF VENTILATORS
15900 TEMPERATURE CONTROLS
15990 TESTING, ADJUSTING AND BALANCING

DIVISION 16 - ELECTRICAL

16003 GENERAL ELECTRICAL PROVISIONS
16050 BASIC ELECTRICAL MATERIALS AND METHODS
16145 STANDARD WIRING SYSTEMS
16225 MOTORS
16286 OVERCURRENT PROTECTIVE DEVICES
16446 PANELBOARDS

-- End of Project Table of Contents --

SECTION TABLE OF CONTENTS

DIVISION 01 - GENERAL REQUIREMENTS

SECTION 01000

GENERAL REQUIREMENTS

PART 1 GENERAL

- 1.1 SCOPE
 - 1.1.1 Perform roofing and HVAC modifications in Building N200 and N201.
 - 1.1.2 Metric Units
- 1.2 REQUIRED DRAWINGS
- 1.3 SUBMITTALS
- 1.4 SECURITY
- 1.5 HOURS OF WORK
- 1.6 OCCUPANCY OF PREMISES
- 1.7 WORK SCHEDULING

PART 2 PRODUCTS

- 2.1 NEW MATERIALS
 - 2.1.1 SHIPMENTS

PART 3 EXECUTION

- 3.1 TEMPORARY FACILITIES
- 3.2 PROTECTION OF EXISTING SYSTEMS
- 3.3 UTILITY OUTAGES AND CONNECTIONS
- 3.4 PROGRESS CONTROLS
 - 3.4.1 Project Meetings
 - 3.4.2 Construction Schedule
 - 3.4.3 Progress Reports
 - 3.4.4 Progress Payments
- 3.5 PROJECT CLOSEOUT
 - 3.5.1 Closeout Submittals
 - 3.5.2 Restoration and Final Cleaning
 - 3.5.3 Final Acceptance

-- End of Section Table of Contents --

SECTION 01000

GENERAL REQUIREMENTS

PART 1 GENERAL

1.1 SCOPE

The work to be performed under this contract consists of providing the labor, equipment, and materials to complete the above-titled project in accordance with the required drawings, these specifications, and the contract clauses. The work includes:

- 1.1.1 Perform roofing and HVAC modifications in Building N200 and N201.
- a. Demolish existing roofing and provide new roofing for Buildings N200 and N201.
 - b. Demolish existing HVAC equipment, ducting, and piping on the roof of Building N200.
 - c. Provide new HVAC equipment, ducting, and piping on the roof of Building N200.
 - d. Remove and reinstall existing equipment where indicated.
 - e. Provide a screen on N200 roof to cover equipment.
 - f. Provide FMCS monitoring for roof mounted equipment.
 - g. Provide electrical power to roof mounted equipment.
 - h. Provide temporary ventilation for the basement of Building N200.

1.1.2 Metric Units

This project has been designed completely in metric units. The construction is to be in metric units with dimensions as shown on the drawings. Materials and products are to be metric units unless specifically noted otherwise. All inspections will take place in metric; shop drawings must be submitted with metric dimensions.

One free copy of GSA Metric Design will be provided to any bidder who requests a copy. This document is for information only and has no contractual bearing on the project.

1.2 REQUIRED DRAWINGS

Five sets of drawings, and specifications will be furnished to the Contractor without charge. One copy of a NASA or Ames publication will be furnished upon specific request. Other reference publications will not be furnished.

Dimensions of existing facilities shall be field checked for accuracy by the Contractor, who shall determine exact dimensions for proper fit. Drawings shall not be construed as being detailed work drawings.

1.3 SUBMITTALS

At the pre-construction conference, the Contractor shall submit to the Contracting Officer:

SD-01, Data

List of Key Personnel

List of Subcontractors and Suppliers

SD-07, Schedules

Submittal Schedule

SD-08, Work Plan

Safety Plan

1.4 SECURITY

At all times while on government property, the Contractor, subcontractors, their employees and agents shall wear badges issued by NASA Security, located in Building 26. Each individual will be required to sign personally for the badge. The Contractor will be held accountable for these badges and shall return them to the Contracting Officer immediately after completion of the work; failure to do so may delay final payment.

1.5 HOURS OF WORK

Normal hours for work shall be from 7 a.m. to 5 p.m. Monday thru Friday, excluding federal holidays. Requests for additional work hours require written approval from the Contracting Officer seven (7) days in advance. The Contractor, subcontractors, and their employees shall not remain on-site beyond the approved hours of work.

Work shall be performed with minimum disruption to existing operations in the affected buildings.

Contractor shall identify in advance the overtime required for the air conditioning and lighting system and obtain Government approval prior to any shutdown of existing systems.

1.6 OCCUPANCY OF PREMISES

The Government will occupy and use the facilities within the areas of work during the entire construction period. The Contractor shall provide and coordinate controls for the abatement of dust, noise and inconvenience to Government personnel during the work.

Before work is started, the Contractor shall arrange with the Contracting Officer a sequence of work, means of access, space for material and equipment storage, and use of approaches, corridors and stairways.

1.7 WORK SCHEDULING

The anticipated date for the issuance of the notice to proceed is 10 to 15 calendar days after contract award. Upon issuance of the notice to proceed, the contractor shall start Work Phase A.

Work Phase A includes the submission, and government approval of all equipment, and material submittals; scaled fabrication shop drawing and equipment installation submittals; required submittal calculations, and detailed Facilities Management Control System (FMCS) drawings as required by the contract documents.

Work Phase A includes measuring the air flow at all supply and return air grills/registers/diffusers throughout the building, and at all roof supply, return and exhaust air penetrations. Testing shall be in accordance with Specification Section 15990. This baseline airflow measurement submittal shall be submitted to the government for review and approval.

Work Phase A includes the submission and government approval of all plans and schedules (e.g. lead abatement, asbestos abatement, safety, construction schedule, etc.) required by the contract.

Work Phase A includes the ordering and delivery to Ames Research Center of all contract required air handling units, exhaust fans, equipment curbs and supports, mechanical equipment, electrical equipment, and FMCS control system equipment required by the contract. Only equipment and material that have government approved submittals shall be delivered to Ames Research Center.

Work Phase A includes the installation and functional testing of the temporary supply and exhaust air fans, and temporary supply and exhaust air ducting which will provide ventilation air to the basement during construction.

Work Phase A includes all required lead and asbestos abatement work required by the contract to facilitate the weekend Work Phase B demolition work.

Work Phase A includes providing a suitable capacity storage container(s) to drain the chilled water if the water must be contained as required by Section 01500, Environmental Compliance and Pollution Prevention. To facilitate demolition, the contractor shall familiarize himself with the locations of all equipment shutoff valves, electrical switches and breakers, and FMCS controls several weeks in advance of the scheduled start of Work Phase B.

Work Phase A includes erecting temporary scaffolding with stairs at the northeast side (laydown/storage area) of Building N200 for roof access during construction. Scaffolding shall be self-supporting for vertical and lateral motion without any attachment to the building. Contractor shall install a temporary platform with steps and railing on the building roof adjacent to the scaffold, and provide a railing and walkway between the platform and scaffold to prevent any contact with the roof parapet. No attachment shall be made to any part of the roof parapet.

Work Phase B shall start after the government approves that all Work Phase A tasks have been satisfactorily completed. Work Phase B shall start and end during the weekend following a 112 day period after issuance of the notice to proceed. Equipment shutdown and removal shall start at 7:00 a.m. Saturday and be completed by 11:59 p.m. Sunday. Contractor shall not remove from operation any Building N200 mechanical, electrical, control system, or fire alarm system before the start of Work Phase B.

Work Phase B work not completed by 11:59 p.m. Sunday shall be completed only during a subsequent weekend. Removal of material from the roof shall be done concurrently with the material removal schedule listed in Work Phase C. The Contractor shall perform all demolition work required to be done during Work Phase B that will produce excessive noise to the building occupants only during a weekend. These tasks include but are not limited to saw cutting of ducts, pipes, duct and equipment supports, etc.

Work Phase B work includes the removal of all roof mounted mechanical, electrical, and control equipment required by the contract for Building N200. Contractor shall remove from the roof all mechanical equipment, including air handling units, air cooled chiller, pumps, exhaust fans, equipment supports, air ducts and supports, piping and supports, electrical equipment and supports, and roof mounted FMCS control system controls, wiring, and conduit designated for removal by the contract.

Work Phase B includes the connection of the temporary supply and exhaust fan ducts to the building ducts serving the basement. Both fans shall be operational and fresh air supplied to, and exhausted from the basement of Building N200 before the start of Work Phase C.

Work Phase C includes the removal of two layers of roofing, roof insulation, roof curbs, and flashing required by the contract for Building N200. This work shall start at 7:00 a.m. Monday following the completion of Work Phase B. The contractor shall use a crane, not a chute to remove demolition material from the roof. Use of the crane is restricted to the weekends between 7:00 a.m. Saturday and 5:00 p.m. Sunday to remove material from the roof. All loose roofing and other material temporarily stored on the roof awaiting weekend removal, shall be covered securely with a tarp and shall be stored in piles not exceeding 100 kg/sq meter (20 psf) until removal.

Work Phase D runs concurrent with Work Phase C and the work includes the installation of new roofing, roof insulation, mechanical, electrical, and the FMCS control system required by the contract for Building N200. Work Phase D also starts at 7:00 a.m. Monday following the completion of Work Phase B and shall be substantially complete 49 calendar days after the start of Work Phase D. Use of the crane is also restricted to the weekends between 7:00 a.m. Saturday and 5:00 p.m. Sunday to convey new roofing, mechanical, electrical, or structural material to the roof.

Work Phase D includes the removal of the temporary basement supply and exhaust air fans and the reconnection of the new air handling unit AH-1 to the duct penetrations serving the basement. AH-1 shall be successfully function tested and the government shall approve the hydronic balance report for the complete chilled water system before the temporary fans are removed. The removal of the temporary fans and connection of AH-1 shall be restricted to a weekend between 7:00 a.m. Saturday and 5:00 p.m. Sunday.

Work Phase D shall be substantially complete when the roofing, roof flashing, duct flashing, roof screen, roof drains, roof overflow drains, mechanical and electrical systems are determined by the government to be installed, and operate satisfactorily in accordance with the contract documents. The air balancing shall be substantially complete when the supply, return, and exhaust air flow measurements at each roof penetration match the baseline values within the limits specified in Specification Section 15990. The chilled water balancing shall be substantially complete when the complete chilled water system flow measurements are in accordance with the contract documents. The FMCS system shall be substantially

complete when all FMCS system hardware and software is installed, tested, and found to be in compliance with the contract requirements, and the control system functions in accordance with the contract requirements in the fully automatic mode of operation.

Work Phase E (Contract Option 1) includes the work to remove and replace the roofing, roof drains, roof hatch, and exhaust fans required by the contract for Building N201. This work shall start when the new roof installation on Building N200, (excluding the N200 mechanical, electrical, and FMCS system installation work) is determined by the government to be substantially complete. The work on Building N201 shall be substantially complete 28 calendar days after the completion of Work Phase D.

Work Phase E crane operation shall be limited to the weekends between 7:00 a.m. Saturday and 5:00 p.m. Sunday. All loose roofing material temporarily stored on the roof awaiting weekend removal, shall be covered securely with a tarp and shall be stored in piles not exceeding 100 kg/sq meter (20 psf) until removal.

PART 2 PRODUCTS

2.1 NEW MATERIALS

All equipment and materials incorporated into the work by the Contractor shall be new, first-class, and delivered in the original unopened containers, except as otherwise specified.

2.1.1 SHIPMENTS

Shipments shall be addressed to the Contractor who shall be responsible for their receipt, unloading, handling, and storage at the site. The Government will not accept deliveries on behalf of the Contractor or his subcontractors or assume responsibility for the security of materials, equipment, or supplies delivered to the site.

PART 3 EXECUTION

3.1 TEMPORARY FACILITIES

The Contractor shall install and maintain temporary utilities required for construction, and remove them upon completion of the work. Materials may be new or used, and shall be adequate for their intended usage. They shall not create unsafe conditions, nor violate applicable codes and standards.

The Government will furnish required water and electricity (120v/1Ph and 220v/3Ph). Connections, distribution and lighting shall be furnished by the Contractor.

The Contractor shall provide and maintain temporary sanitary facilities, and remove them at the completion of the work. Construction personnel shall not use existing plumbing facilities.

Signs necessary to expedite deliveries, maintain traffic flow, promote safety, and prevent interference with Government operations shall be provided by the Contractor. Advertisement signs shall not be erected.

The Contractor's trailers and sheds shall be placed at least 10 meters from existing structures, unless they are of non-combustible construction.

3.2 PROTECTION OF EXISTING SYSTEMS

The Contractor shall provide temporary coverings to protect existing surfaces and equipment when work is being done in adjacent areas. Damaged systems, surfaces, and equipment shall be repaired at the Contractor's expense.

When work is being done on roof-top equipment, the roofing shall be protected with minimum 13 mm plywood around the work area and from the access point to work areas. Material shall be placed on plywood or dunnage, not directly on roofing.

Existing utilities and safety systems shall be protected from damage. Utilities and safety systems damaged by the Contractor shall be repaired at the Contractor's expense. Utilities not previously identified to the Contractor, which he encounters in the field, shall be reported to the Contracting Officer immediately. The Contractor shall also record these on the "As-Built" drawings.

3.3 UTILITY OUTAGES AND CONNECTIONS

Utility outages shall be requested in writing to the Contracting Officer four (4) days prior to the desired date of the outage.

3.4 PROGRESS CONTROLS

3.4.1 Project Meetings

The Contractor shall attend a pre-construction conference, scheduled by the Contracting Officer. 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.

The Contractor shall participate in progress meetings on a weekly or other basis, as scheduled by the Contracting Officer. Discussion shall include: submittals; progress; material delivery; potential delays; interfaces; problems; quality control; and safety.

The Contractor shall promptly report to the Contracting Officer construction problems or design deficiencies encountered.

3.4.2 Construction Schedule

Within 15 days of the notice to proceed, and before any progress payment will be considered, the Contractor shall submit construction schedule, in two copies, for approval by the Contracting Officer.

The construction schedule shall incorporate all the stated requirements for Work Phase A, B, C, D & E described in Item 1.7, Work Scheduling.

The schedule shall be drawn or plotted, showing activity numbers and descriptions, start and finish dates, and total float; as well as the subcontractor responsible, dollar amounts associated with each of material, labor, and equipment, and crew size.

The construction schedule shall include all significant design, submittal, fabrication, procurement and work activities; plus any constraints, outside of this contract which may impact work on the contract. Work

activities longer than 10 working days shall be subdivided into phases/areas of work.

Update the schedule in one reproducible and two copies when activities vary from those shown on the approved schedule.

The schedule shall be an accurate representation of the manner in which the Contractor is performing the work. If circumstances indicate that progress is one week or more behind the contract completion, the Contractor shall revise the schedule and his work plan, to eliminate or minimize delays to contract completion. Schedules showing the project being completed in less time than specified will not be accepted.

3.4.3 Progress Reports

The Contractor shall submit monthly progress reports to the Contracting Officer, along with any progress payment request. The report shall address: Progress made during the period; Comments on activities which are behind schedule, including reasons, the impact on the overall schedule, and mitigating actions taken or planned; discussion of any current or anticipated problems, technical or scheduling; and other appropriate comments.

3.4.4 Progress Payments

If requested by the Contractor, the Government may make progress payments, provided that: a Construction schedule is received, approved, and updated by the Contractor; other submittals are received in a timely manner; and logs and marked prints are properly maintained. The amount of any progress payment will be based on the agreed work status and the agreed cost breakdown of the contract bid proposal.

3.5 PROJECT CLOSEOUT

Prior to the Contract Completion Date, accomplish the following:

3.5.1 Closeout Submittals

Provide Operation & Maintenance Manuals, As-Built Drawings, Certificates of Compliance and Guarantees, per Section 01300, "Submittals."

3.5.2 Restoration and Final Cleaning

Existing work cut, drilled, altered, or removed by the Contractor shall be reinstalled or repaired to match the surrounding work. Work remaining in place, damaged, or defaced during construction shall be restored to preconstruction conditions.

Clean interior and exterior exposed surfaces by removing stains, foreign substances, and temporary labels and restraints. Remove construction debris. Remove potential blockages, from channels, gutters and drainpipe. Clean plumbing fixtures to sanitary conditions.

3.5.3 Final Acceptance

Upon completion of all contract work and notification by the Contractor that the work is complete, the Contracting Officer will conduct a pre-final inspection; noting any discrepancies, uncompleted work, etc. on a "Punchlist"; which will be provided to the Contractor. If necessary,

revisions to the punchlist may be made before the final inspection. When the Contractor has completed all items on the punchlist, the Contracting Officer will conduct the final inspection. If acceptable, a notice of acceptance will be issued to the Contractor, and release of any retention will be made.

Neither notice of acceptance nor final payment shall constitute waiver of any guarantee or warranty under the contract.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 01 - GENERAL REQUIREMENTS

SECTION 01100

SAFETY PROVISIONS

PART 1 GENERAL

- 1.1 SCOPE
- 1.2 REFERENCES
- 1.3 SUBMITTALS
- 1.4 GENERAL RESPONSIBILITIES
 - 1.4.1 General
 - 1.4.2 Visitor Control
 - 1.4.3 Communication
 - 1.4.4 Superintendence by Contractor
- 1.5 FIRST AID FACILITIES
- 1.6 NON-COMPLIANCE

PART 2 SPECIFIC REQUIREMENTS

- 2.1 SAFETY PLAN
- 2.2 SAFETY CLEARANCE PERMITS
- 2.3 HOLD OFF AND SPECIAL CONDITIONS TAGS
- 2.4 REPORTS AND RECORDS
 - 2.4.1 Toolbox Meeting Reports
 - 2.4.2 Accident Reports
- 2.5 SAFETY INSPECTION

PART 3 EXECUTION

- 3.1 GENERAL SAFETY RULES
- 3.2 FIRE PREVENTION AND PROTECTION
- 3.3 SPILL PREVENTION, CONTROL, AND REPORTING
- 3.4 FACILITY CLOSURE OR OBSTRUCTION
- 3.5 ELECTRICAL SAFETY
- 3.6 WELDING, FLAME CUTTING, AND MELTING
- 3.7 ASBESTOS
 - 3.7.1 New Materials
 - 3.7.2 Encountering Asbestos
- 3.8 LEAD

-- End of Section Table of Contents --

SECTION 01100

SAFETY PROVISIONS

PART 1 GENERAL

1.1 SCOPE

The provisions of this section apply to all work conducted at Moffett Field, under this contract, including all subcontract work.

1.2 REFERENCES

The Contractor is required to conform to applicable local, state, and national government regulations, including, but not limited to the references noted below.

CODE OF FEDERAL REGULATIONS (CFR)

29 CFR PART 1926

Safety and Health Standards for the Construction Industry

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION AMES HANDBOOK (NASA AHB)

NASA AHB 1700.1

1986, August

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 30

Flammable and Combustible Liquids

Hazardous Materials Storage Ordinance

1.3 SUBMITTALS

The Contractor is required to submit the following, in accordance with the provisions noted in Part 2, below.

SD-18, Records

Toolbox Safety Meeting Reports, weekly.

Accident Reports & Records, as required.

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

SD-08, Work Plan

Safety Plan

1.4 GENERAL RESPONSIBILITIES

1.4.1 General

The Contractor is responsible for taking adequate safety and health measures to insure a safe, healthy environment for her employees, those of

subcontractors, and for other workers in the area, as well as for bystanders and visitors.

1.4.2 Visitor Control

The Contractor shall comply with procedures prescribed, by the Contracting Officer, for control and safety of visitors to the site.

1.4.3 Communication

The Contractor shall familiarize her employees and subcontractors with all safety requirements, shall enforce them; and shall advise the Contracting Officer of any special safety restrictions that she has established, so that Government personnel can be made aware of them.

1.4.4 Superintendence by Contractor

The contractor, or a superintendent appointed by her and approved by the Contracting Officer, shall give her personal, on site superintendence to the Safety Plan, while any work is in progress.

1.5 FIRST AID FACILITIES

Contractor shall 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 thru Friday, between 7:30 a.m. and 4:30 p.m., for emergency care.

1.6 NON-COMPLIANCE

The Contracting Officer 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. The Contractor shall, upon receipt of such notice, immediately take corrective action. If the Contractor fails or refuses to take prompt corrective action, the Contracting Officer may invoke the "Suspension of Work" provision of the contract, may contact the Contractor's insurance carrier, and/or may invoke whatever other rights are available to the Government under the terms and conditions of this contract, to remedy such failure or refusal.

PART 2 SPECIFIC REQUIREMENTS

2.1 SAFETY PLAN

The Contractor shall submit a Safety Plan to the Contracting Officer for approval before any field work may proceed. This Safety Plan will consist of the Contractor's standard "Injury and Illness Prevention Program", modified and/or supplemented as necessary for specific project requirements. The Safety Plan shall include, as a minimum, the following:

Safety program objectives.

Responsibilities of contractor's key personnel.

Rules for safe practices, complying with references above.

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

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

Accident reporting procedures.

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

Procedures for securing work areas & protecting personnel in the event of an accident, emergency or disaster.

2.2 SAFETY CLEARANCE PERMITS

A specific, written permit is required before conducting operations involving any of the following dangerous operations. The Contractor shall insure that no such work is conducted prior to obtaining the permit, and that all provisions of the permit are met. Contact the Contracting Officer at least 24 hours in advance, to obtain the required permit. The granting of a permit in no way relieves the Contractor of responsibility for any injury or damage which might result from her operation. The granting of these permits may be contingent upon restricted areas or hours of operation or special safety requirements; the Contractor shall comply with these requirements at no additional cost to the Government.

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

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

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 a safe working environment. The Contractor is required to ALWAYS HONOR THESE TAGS. The lives of workers may depend on it. If the contractor needs to have a tag removed or believes that one should be applied, she must contact the Contracting Officer's Technical Representative (COTR). The COTR shall coordinate with the facilities maintenance branch 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

2.4.1 Toolbox Meeting Reports

The Contractor shall conduct weekly toolbox safety meetings with all employees and subcontractors and shall provide a copy of the minutes of these meetings to the Contracting Officer.

2.4.2 Accident Reports

The Contractor shall immediately make an oral report to the Contracting Officer of any accident which results in one of the following: fatality; disabling or lost-time injury; injury requiring medical treatment; property contamination; or property loss of \$25,000 or more. A written report shall be submitted to the Contracting Officer within 5 days of each incident. The report shall include 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.

2.5 SAFETY INSPECTION

The Contractor's operations are always subject to inspection by the Government's construction safety engineer and by its site superintendent. The Contractor shall comply with reasonable requests of these individuals, as relates to safety. If the contractor believes any request of these individuals to be outside the scope of her contract, she shall immediately notify the Contracting Officer of this fact. The Contracting Officer will make a determination on the issue, and give appropriate direction to the Contractor. The direction of the Contracting Officer shall be followed.

PART 3 EXECUTION

3.1 GENERAL SAFETY RULES

The Contractor is required to adhere to the following safety rules, in addition to the requirements of Cal/OSHA and other laws and regulations.

Ladders shall be tied off and/or braced, to prevent movement. Workers shall not stand on any of the top three rungs of a ladder.

When an area is designated by the Contracting Officer or her representative as a hard hat area, the Contractor shall insure that all employees wear an approved hard hat at all times.

Tools, equipment, etc. shall be raised or lowered by means of a bucket and/or rope. At no time shall employees throw or drop items from one level to another.

The Contractor shall, at all times, provide a clean work area, and free and clear emergency egress ways. Debris shall be removed from the site, and the area swept, daily.

All employees shall be provided with, and shall use safety clothing and equipment appropriate to the work they are performing, including, but not limited to: goggles or face shields, protective garments, ear protection, safety shoes, and safety belts. It is particularly important to insure that persons employed in cutting, chipping, burning, and similar operations use proper eye protection.

3.2 FIRE PREVENTION AND PROTECTION

The Contractor shall provide, maintain, and keep available on-site at least two fire extinguishers. During welding and torch cutting work, the extinguishers shall be in the immediate vicinity of the work.

Flammable liquids shall be stored and handled in accordance with the

Flammable and Combustible Liquids Code, NFPA 30.

Open fires or salamanders shall not be permitted in construction areas.

Smoking is prohibited in all trailers and buildings located on Government property.

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

Gas bottles shall be stored upright, and shall be secured top and bottom to prevent accidental tipping.

3.3 SPILL PREVENTION, CONTROL, AND REPORTING

Spill cleanup materials (such as rags or absorbents) shall be maintained at the project site and be readily accessible. Releases shall be immediately contained and measures implemented as required to prevent leaks and spills from entering storm drain. Washing spilled materials into streets, gutters, and storm drains is prohibited.

All releases of hazardous materials to the environment shall be contained and safely disposed of in an appropriate manner. Spills to unpaved surfaces in excess of one ounce shall be reported to Ames Code DQH. Dial 911 from any NASA phone to request assistance if the spill can not be cleaned up safely by trained personnel, or if the spilled material escapes to the environment.

Personnel containing spills or conducting cleanup of small spills shall have received training per 29 CFR PART 1926 and Title 8 Section 5192.

3.4 FACILITY CLOSURE OR OBSTRUCTION

The Contractor shall take steps to insure that any closure or obstruction of streets, walks or other facilities is adequately barricaded, that warning signs and lights (at night) are provided, and that the closure or obstruction is of the minimum practical duration.

3.5 ELECTRICAL SAFETY

Before working on any electrical equipment or circuit, it shall be properly grounded, and unless prior written approval has been given otherwise, it shall be disconnected from the power source, and tagged/locked out.

Portable electric tools shall be protected with standard 3-prong grounding plugs or be double-insulated, and shall be unplugged when not in use.

Ground fault interrupters shall be used on all temporary electrical lines and cables, including extension cords; temporary wiring and cables shall be routed 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. The main panel shall also be identified to the effect that the circuit is no longer in use.

3.6 WELDING, FLAME CUTTING, AND MELTING

During flame cutting and welding, the Contractor shall take care and

provide protection to prevent splatter from damaging facilities or causing fire. When these operations are performed above or below ground level, at least one Contractor employee shall stand by at the ground, with firefighting equipment, ready to give assistance in an emergency. The Contractor shall provide shields, fire blankets, and other protection devices to protect persons and property adjacent to the area of work.

3.7 ASBESTOS

3.7.1 New Materials

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

3.7.2 Encountering Asbestos

Asbestos abatement shall be performed in accordance with Section 02080 of the Specifications.

3.8 LEAD

All existing painted structural and miscellaneous steel 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 by the Contractor, in addition to the requirements of NASA AHB 1700.1. Lead paint abatement shall be provided in accordance with Section 02090 of the Specifications.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 01 - GENERAL REQUIREMENTS

SECTION 01300

SUBMITTALS

PART 1 GENERAL

- 1.1 SUMMARY
- 1.2 SUBMITTALS
- 1.3 PREPARATION
 - 1.3.1 Marking
 - 1.3.2 Drawing Format
 - 1.3.3 Data Format
- 1.4 SUBMISSION REQUIREMENTS
 - 1.4.1 Schedules
 - 1.4.2 Drawings Submittals
 - 1.4.3 Data Submittals
 - 1.4.4 Samples
- 1.5 GOVERNMENT'S REVIEW
 - 1.5.1 Review Notations
 - 1.5.2 Sample Approval
- 1.6 PROGRESS SCHEDULE
 - 1.6.1 Bar Chart or Net Work Analysis Chart

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

-- End of Section Table of Contents --

SECTION 01300

SUBMITTALS

PART 1 GENERAL

1.1 SUMMARY

Requirements of this Section apply to all sections of the specifications.

All Submittals shall be made in SI (metric) units.

1.2 SUBMITTALS

Submittal Description (SD): Drawings, diagrams, layouts, schematics, descriptive literature, illustrations, schedules, performance and test data, and similar materials to be furnished by the Contractor explaining in detail specific portions of the work required by the contract.

The following items, are descriptions of data to be submitted for the project. The requirements to actually furnish the applicable items will be called out in each specification.

SD-01 Data

Submittals which provide calculations, descriptions, or other documentation regarding the work. Data composed of catalog cuts, brochures, circulars, specifications and product data, and printed information in sufficient detail and scope to verify compliance with requirements of the contract documents.

Spare Parts Data shall indicate manufacturer's name, part number, nomenclature, and stock level required for maintenance and repair. List those items that may be standard to the normal maintenance of the system.

Design calculations, mix design analyses, or other data, written in nature, and pertaining to a part of the work.

SD-04 Drawings

Submittals which graphically show relationship of various components of the work, schematic diagrams of systems, detail of fabrications, layout of particular elements, connections, and other relational aspects of the work.

As-Built Drawings shall be submitted under the following criteria: In order to minimize the time for final payment at the completion of the project, the Contractor shall update the as-built drawings every month with the Contracting Officer's authorized representative. This update will be a part of "the monthly request for payment meeting," and payment--or a portion of the payment, including final payment--may be withheld until the as-built drawings have been updated, and accepted by the Contracting Officer.

After completion of all construction and before final payment is made under this contract, the Contractor shall provide the Contracting

Officer with one complete set of AutoCAD compatible CAD drawings with all changes clearly identifiable on the computer screen along with one hard copy of the same (with advance permission given by the Contracting Officer).

SD-06 Instructions

Preprinted material describing installation of a product, system, or material, including special notices and material safety data sheets, if any concerning impedances, hazards, and safety precautions.

Preventative Maintenance and Inspection schedules shall be submitted by the Contractor with instructions that state when systems should be retested.

Schedule shall define the anticipated length of each test, test apparatus, number of personnel identified by responsibility, and a testing validation procedure permitting the record operation capability requirements. Each test feature; e.g., liter per second, rpm, kilopascal, shall have a sign off blank for the Contractor and Contracting Officer. A remarks column of the testing validation procedure shall include references to operating limits of time, pressure, temperature, volume, voltage, current, acceleration, velocity, alignment, calibration, adjustments, cleaning, or special system notes. Procedures for preventative maintenance, inspection, adjustment, lubrication and cleaning necessary to minimize corrective maintenance and repair shall be delineated.

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

Posted Instructions shall be submitted by the Contractor with labels, signs, and templates of operating instructions that are required to be mounted or installed on or near the product for normal, safe operation.

SD-07 Schedules

Tabular list of data or tabular list including location, features, or other pertinent information regarding products, materials, equipment, or components to be used in the work.

SD-08 Statements

A document, required of the Contractor, or through the Contractor by way of a supplier, installer, manufacturer, or other Lower Tier Contractor, the purpose of which is to further the quality or orderly progression of a portion of the work by documenting procedures, acceptability of methods or personnel, qualifications, or other verification of quality.

Work Plan: Detailed procedures defining the Contract's provisions for construction activity, including equipment techniques used and protection controls.

Demolition Plan: Detailed procedures defining the Contractor's provisions for construction activity.

Safety Plan: Detailed procedures defining the Contractor's provisions for accident prevention and health protection; of his workers, subcontractors, and government workers; and describing actions taken in case of accident.

Quality Assurance Plan

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

SD-09 Reports

Reports of inspections and laboratory tests, including analysis and interpretation of test results. Each report shall be properly identified. Test methods used and compliance with recognized test standards shall be described.

Testing must have been within three years of the date of award of this contract.

Where required in other sections of the contract documents also provide a written report which includes the findings of a test required to be performed by the Contractor on an actual portion of the work or prototype prepared for this project before it is shipped to the job site. Report must be signed by an authorized official of a testing laboratory and must state the test results; and indicate whether the material, product, or system has passed or failed the test.

Provide reports where required in other sections of the contract documents which includes the findings of tests made at the job site, in the vicinity of the job site, or on a sample taken from the job site, on a portion of the work, during or after installation. Report must be signed by an authorized official of a testing laboratory or agency and must state the test results; and indicate whether the material, product, or system has passed or failed the test. Submittals shall include list of all test equipment used, including manufacturer, model number, and serial number.

SD-13 Certificates

Statements signed by responsible officials of a manufacturer of a product, system, or material attesting that the product, system or material meet specified requirements. Statements must be dated after the award of this contract, name the project, and list the specific requirements which it is intended to address.

SD-14 Samples

Samples, including both fabricated and unfabricated physical examples of materials, products, and units of work as complete units or as portions of units of work.

Samples of the available choice of colors, textures, and finishes of a product or material, presented over a substrates identical in texture to that proposed for the work.

SD-19 Operation and Maintenance Manuals

Data intended to be incorporated in an operations and maintenance manual.

Contractor shall submit 3 copies of the project operation and maintenance manuals 30 days prior to testing the system involved. Data shall be updated and resubmitted for final approval no later than 30 days prior to contract completion.

Manuals shall include an illustrated parts breakdown to facilitate procurement of replacement parts. Manuals shall be edited to limit data to model(s) and equipment configuration actually delivered.

Operation and Maintenance Manuals shall be consistent with the manufacturer's standard brochures, schematics, printed instructions, general operating procedures, and safety precautions. Information shall be bound in manual format and grouped by technical sections. Test data shall be legible and of good quality. Pages for vendor data and manuals shall have 10 millimeter holes and be bound in 3-ring, loose-leaf binders. Data shall be organized by separate index and tabbed sheets, in a loose-leaf binder. Binder shall lie flat with printed sheets that are easy to read. Caution and warning indications shall be clearly labeled.

Where available, technical manuals shall be provided in electronic format.

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

1.3 PREPARATION

1.3.1 Marking

Permanent marking shall be provided on each submittal to identify it by contract number; transmittal date; Contractor's, Subcontractor's, and supplier's name, address(es) and telephone number(s); submittal name; submittal number (submittals shall be sequentially numbered); specification section number or drawing reference; and similar information to distinguish it from other submittals. Submittal identification shall include space to receive the review action by the Contracting Officer.

1.3.2 Drawing Format

Drawing submittals shall be prepared on reproducible sheets, not less than 210 by 297 millimeter nor larger than 841 by 1189 millimeter in size, except for full size patterns or templates. Drawings shall be prepared to accurate size, with scale indicated, unless other form is required. Drawing reproducible shall be suitable for microfilming and reproduction. They shall be of a quality to produce clear, distinct lines and letters. Drawings shall have dark lines on a white background.

Copies of each drawing shall have the following information clearly marked thereon:

- a. Job name, which shall be the general title of the contract drawings.
- b. Date of the drawings and revisions.
- c. Name of Contractor.
- d. Name of Subcontractor.
- e. Name of the item, material, or equipment detailed thereon.
- f. Number of the submittal (e.g., first submittal, etc.) in a uniform location adjacent to the title block.
- g. Government contract number shall appear in the margin, immediately below the title block.
- h. Drawings shall be numbered in logical sequence. The Contractor may use his own number system.

1.3.3 Data Format

Required data submittals for each specific material, specification section, or system shall be collected into a single submittal and marked for choices, options, and portions applicable to the submittal. Marking of each copy of product data submitted shall be identical. Partial submittals will not be accepted.

1.4 SUBMISSION REQUIREMENTS

1.4.1 Schedules

Within 15 days of notice to proceed, the Contractor shall provide, for approval by the Contracting Officer

- a. Schedule of shop drawings and technical product and material submittals required by the specifications and drawings. Schedule shall indicate the specification or drawing reference requiring the submittal; the "SD" number and identifying title of the submittal; the Contractor's anticipated submission date and the approval need date. Include in the schedule, other submittals required under the contract and indicate the contract requirement reference; the type or title of the submittal; the Contractor's anticipated submission date and the approved need date (if approval is required).

1.4.2 Drawings Submittals

One translucent reproducible copy and 4 blackline or blue-line opaque print(s) of each drawing shall be submitted. 2 prints, marked with review notations by the Contracting Officer, will be returned to the Contractor.

1.4.3 Data Submittals

Five complete sets of indexed and bound product data shall be submitted. Two sets, marked with review notations by the Contracting Officer, will be

returned to the Contractor.

1.4.4 Samples

One set of identified samples shall be submitted. A copy of the transmittal form, marked with review notations including selections by the Contracting Officer, will be returned to the Contractor. Samples will not be returned.

1.5 GOVERNMENT'S REVIEW

1.5.1 Review Notations

Contracting Officer will review submittals and samples and provide pertinent notation within 10 working days after date of submission. Submittals will be returned to the Contractor with the following notations:

- a. Submittals marked "approved" authorize the Contractor to proceed with the work covered.
- b. Submittals marked "approved as noted" authorize the Contractor to proceed with the work covered provided he takes no exception to the corrections. Notes shall be incorporated prior to submission of the final submittal.
- c. Submittals marked "return for correction" require the Contractor to make the necessary corrections and revisions and to re-submit them for approval in the same routine as before, prior to proceeding with any of the work depicted by the submittal.
- d. Submittals marked "not approved" or "disapproved" indicate noncompliance with the contract requirements and shall be re-submitted with appropriate changes. No item of work requiring a submittal shall be accomplished until the submittals are approved or approved as noted.
- e. Contractor shall make corrections required by the Contracting Officer. If the Contractor considers any correction or notation on the returned submittals to constitute a change to the contract drawings or specifications; notice as required under the clause entitled, "Changes" shall be given to the Contracting Officer. Approval of the submittals by the Contracting Officer shall not be construed as a complete check, but will indicate only that the general method of construction and detailing is satisfactory. Contractor shall be responsible for the dimensions and design of connection details and construction of work. Failure to point out deviations may result in the Government requiring rejection and removal of such work at the Contractor's expense.
- f. If changes are necessary to approved submittals, the Contractor shall make such revisions and submission of the submittals in accordance with the procedures above. No item of work requiring a submittal change shall be accomplished until the changed submittals are approved.

1.5.2 Sample Approval

Variations from contract requirements shall be specifically pointed out in transmittal letters. Failure to point out deviations may result in the

Government requiring rejection and removal of such work at no additional cost to the Government.

Samples of various materials or equipment delivered on the site or in place may be taken by the Contracting Officer for testing. Samples failing to meet contract requirements will automatically void previous approvals. Contractor shall replace such materials or equipment to meet contract requirements.

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

1.6 PROGRESS SCHEDULE

1.6.1 Bar Chart or Net Work Analysis Chart

Contractor shall:

- a. Submit the progress chart, for approval by the Contracting Officer, within 15 calendar days of issuance of a notice to proceed. Submit 3 copies.
- b. Prepare the progress chart in the form of a bar chart, network analysis chart or comparable format acceptable to the Contracting Officer.
- c. Include no less than the following information on the progress chart:
 - (1) Break out by major headings for primary work activity with separate cost for labor and materials and equipment.
 - (2) A line item break out under each major heading sufficient to track the progress of the work.
 - (3) A line item showing contract finalization task which includes punch list, clean-up and demolition, and final construction drawings.
 - (4) A materials bar and a separate labor bar for each line item. Both bars will show the scheduled percentage complete for any given date within the contract performance period. Labor bar will also show the number of men (man-load) expected to be working on any given date within the contract performance period.
 - (5) Separate line items for mobilization, submittal preparation and review, drawing submittal and approval. (These items are to show no associated costs.)
 - (6) The estimated cost and percentage weight of total contract cost for each material and labor bar on the chart.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 01 - GENERAL REQUIREMENTS

SECTION 01400

QUALITY CONTROL

PART 1 GENERAL

- 1.1 SUMMARY
- 1.2 SUBMITTALS
- 1.3 METRIC EDUCATION

PART 2 PRODUCTS

- 2.1 GENERAL
- 2.2 TRANSPORTATION, HANDLING AND STORAGE

PART 3 EXECUTION

- 3.1 GENERAL
- 3.2 CONTRACTOR QUALITY CONTROL
 - 3.2.1 Purchase Control and Receiving Inspection
 - 3.2.2 Non-Conformance Control
 - 3.2.3 Inspection and Test Plan
 - 3.2.4 Inspection and Test Procedures
 - 3.2.5 Training and Certification
 - 3.2.6 Calibration Program
 - 3.2.7 Qualification of Procedures
 - 3.2.8 Drawing and Change Control
- 3.3 GOVERNMENT INSPECTIONS/TESTS
- 3.4 STERILIZATION OF ALL PIPING
- 3.5 HOLD POINT OF INSPECTIONS/TESTS
 - 3.5.1 Inspections
 - 3.5.2 Tests
- 3.6 REPORTING
- 3.7 CORRECTIVE ACTION

-- End of Section Table of Contents --

SECTION 01400

QUALITY CONTROL

PART 1 GENERAL

1.1 SUMMARY

The requirements of this Section apply to all work done under this contract. All work shall be accomplished in accordance with professionally recognized standards for building construction. In addition to the codes and standards specified in the drawings.

1.2 SUBMITTALS

Submit the following in accordance with Section 01300, "Submittals":

SD-09, Test Reports

Factory Tests

SD-13, Certificates

Certificates of Compliance

SD-08, Work Plan

Quality Control Plan Submitted within 30 days of the Notice to Proceed, and before any off-site or on-site fabrication or installation is begun. This plan shall detail means for complying with the provisions of Part 3, below.

1.3 METRIC EDUCATION

The Contractor is to provide training guides and measuring tools to his employees to aid them in using metric measurements. Dual scale tapes are acceptable, but all correspondence is to be in SI units.

PART 2 PRODUCTS

2.1 GENERAL

Per clause 52.236-5, materials and equipment to be provided under this contract shall be new, first-class, standard catalogue products of manufacturers regularly engaged in the manufacture of these products. Where two or more units of the same equipment class are furnished, the equipment shall be from the same manufacturer and shall be interchangeable.

2.2 TRANSPORTATION, HANDLING AND STORAGE

The manufacturer shall package material requiring protection in sturdy containers. Protection shall include vapor sealants for products sensitive to moisture or exposure. Material handling equipment shall be selected with the express purpose of minimal damage to existing work and new material.

The Contractor shall store supplies, material, and equipment so as to

properly protect and preserve these items. If the Contracting Officer determines that property is not adequately protected by the Contractor, such property may be protected by the Government and the cost thereof may be charged to the Contractor.

PART 3 EXECUTION

3.1 GENERAL

Quality Control, including inspections and tests required by these specifications, shall be entirely the Contractor's responsibility. The Contractor shall submit the records of such tests and inspections to the Contracting Officer, at least 24 hours in advance of incorporation of the materials and/or equipment in the project.

Government inspection shall in no way replace Contractor inspection or otherwise relieve the Contractor of his responsibility to furnish an acceptable end item. Government inspection shall not be used by the Contractor as evidence of effective inspection by himself or subcontractors.

3.2 CONTRACTOR QUALITY CONTROL

The Contractor shall maintain an approved quality control system. This shall include the following:

3.2.1 Purchase Control and Receiving Inspection

A system documenting procurement to drawings, specifications and approved submittals; certified testing by suppliers; and inspection by the Contractor to procurement records and contract requirements. A receiving inspection record shall accompany each delivery to the construction site. A copy of the shipping receipt/packing slip for each item delivered to the site shall be submitted to the Contracting Officer prior to payment for the items.

3.2.2 Non-Conformance Control

A system documenting the handling, recording, identification, disposition, and reporting of non-conforming components and materials. A non-conformance report shall be submitted to the Government for each item found to be not in conformance with requirements--irrespective of the disposition of the non-conforming article.

3.2.3 Inspection and Test Plan

A plan, identifying tests required for each specific material, component, or item of work, and the records and reports to be made.

3.2.4 Inspection and Test Procedures

Procedures for each inspection/test, giving methods, records, reports, and identifying the organization conducting each.

3.2.5 Training and Certification

Procedures, records, and control for all inspectors and workers for which certification, licensing, or other formal qualification is required.

3.2.6 Calibration Program

A system for identifying calibration requirements, including methods for scheduling, conducting, and documenting required calibrations.

3.2.7 Qualification of Procedures

A means for identifying, conducting, testing, and recording the qualification of test and work procedures (including welding).

3.2.8 Drawing and Change Control

A means for insuring that all affected persons and organizations receive changes in a timely manner, and that only the latest version of drawings and specifications is used.

3.3 GOVERNMENT INSPECTIONS/TESTS

Tests conducted by the Contractor will be witnessed by the Government. At least 48 hours notice shall be given the Government, and at least 2 hours shall be allowed for Government inspection, prior to any test, on site.

The Government may assess a reinspection fee for each reinspection if the work is not complete and ready for inspection at the time for which the inspection is called, or if corrections called for on previous inspections have not been made at the time for which the reinspection is called. This is applicable to all inspections and tests to be conducted by or witnessed by the Government. The reinspection fee shall be \$50.00 per hour (1/2 hour minimum).

The Government reserves the right to inspect at the source, supplies or services not manufactured or performed within the Government's facility, including those at Subcontractor or Vendor facilities. The Contractor shall notify the Contracting Officer at least 48 hours in advance of commencement of contract work at off-site facilities; and 48 hours in advance of each in-house inspection or test, so that the Government may witness it.

3.4 STERILIZATION OF ALL PIPING

Required of all piping before connection to existing systems.

3.5 HOLD POINT OF INSPECTIONS/TESTS

The Contractor shall schedule required inspections/tests with the Contracting Officer at least 48 hours in advance, and shall provide opportunity, access, and samples required. Other required inspections and tests are listed in the various technical sections of this specification.

3.5.1 Inspections

The following are required hold points for inspections to be made by the Government. At least four hours shall be allowed for Government inspection at each of these hold points.

BOLTING/WELDING. Performed after bolts are tightened & welds are made, but before touch-up painting or covering of these.

SURFACE PREPARATION. Performed after preparation for painting has

been made, but before setup for painting.

3.5.2 Tests

The following items are required hold points for tests to be made by the Contractor and witnessed by the Government. At least 48 hours notice shall be given the Government before each of these tests.

HYDROTESTING. Required of all piping, before covering or connection to existing systems.

3.6 REPORTING

Any discrepancies noted by the Government will be forwarded to the Contractor on the "Inspection Report" within one working day of completion of the test/inspection. The Contractor shall return these forms after noting the corrective action to be taken.

Reports on tests conducted by the Contractor, test procedures and inspection records shall be submitted to the Government within one working day of the test's completion, regardless of test results.

3.7 CORRECTIVE ACTION

The Contractor shall promptly correct deficiencies or conditions which have resulted or could result in the submission to the Government of materials and services which do not conform to:

The contract requirements.

The provisions of the specifications.

Inspections and tests required by the contract.

Other inspections and tests required to substantiate conformance.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 01 - GENERAL REQUIREMENTS

SECTION 01500

ENVIRONMENTAL COMPLIANCE AND POLLUTION PREVENTION

PART 1 GENERAL

- 1.1 SUMMARY
- 1.2 REFERENCES
- 1.3 SUBMITTALS
- 1.4 GENERAL RESPONSIBILITIES
- 1.5 DEFINITIONS

PART 2 MATERIALS

- 2.1 AIR QUALITY
 - 2.1.1 Adhesives and Sealants
 - 2.1.2 Architectural Coatings
 - 2.1.3 Spray Paints
- 2.2 STORAGE AREAS
 - 2.2.1 Hazardous Materials Storage
 - 2.2.2 Staging Area
 - 2.2.3 Refuse Bins
 - 2.2.4 Landscaping
 - 2.2.5 Granular Material Storage
 - 2.2.6 Site Inspections
- 2.3 CHEMICAL USAGE AND HANDLING
 - 2.3.1 Reclamation of Equipment Containing Hazardous Material Residues
 - 2.3.2 Disposal of Non-Hazardous Waste Containing Hazardous Material Residue
 - 2.3.3 Labeling

PART 3 OPERATIONS

- 3.1 WASTEWATER APPLICATION
 - 3.1.1 Wastewater Discharge / Disposal
- 3.2 TRAINING REQUIREMENTS
- 3.3 SITE OPERATIONS AND MAINTENANCE
 - 3.3.1 Equipment Fueling and Maintenance
 - 3.3.2 Paint Clean Up
 - 3.3.2.1 Water Based Paints
 - 3.3.2.2 Oil Based Paints
 - 3.3.3 Reclaimed Water
 - 3.3.4 Draining Piping and Equipment
- 3.4 ELECTRICAL
 - 3.4.1 Fluorescent Light Tubes and PCB Light Ballast
- 3.5 SPILL PREVENTION, CONTROL, AND REPORTING
- 3.6 LEAD ABATEMENT
- 3.7 ASBESTOS ABATEMENT
- 3.8 CONTRACTOR DISPOSAL
 - 3.8.1 Hazardous Waste Manifest
 - 3.8.2 Disposal
 - 3.8.3 Treatment, Storage, And Disposal Facility List

- 3.8.4 Hazardous Waste Transportation
- 3.8.5 Containerized Hazardous Waste
- 3.8.6 Bulk Hazardous Waste

-- End of Section Table of Contents --

SECTION 01500

ENVIRONMENTAL COMPLIANCE AND POLLUTION PREVENTION

PART 1 GENERAL

1.1 SUMMARY

The pollution prevention and environmental compliance provisions described in this section apply to all work conducted on Ames Research Center and Moffett Federal Airfield under this contract. The requirements in this section are in addition to those in the detailed sections.

1.2 REFERENCES

The Contractor is required to conform to the applicable local, state, and federal environmental regulations including references listed below. The Contractor shall use the latest issue of the referenced document in effect at the date of performance this contract, unless otherwise noted. The publications listed below form a part of this section to the extent referenced:

BAY AREA AIR QUALITY MANAGEMENT DISTRICT (BAAQMD)

BAAQMD Regulation 8, Rule 3	VOC Content, Architectural Coating Limits
BAAQMD Regulation 8, Rule 29 Operations.	VOC Content, Coatings for Aerospace
BAAQMD Regulation 8, Rule 48 Coating Limits	VOC Content, Industrial Maintenance
BAAQMD Regulation 8, Rule 49	VOC Content, Aerosol Coatings
BAAQMD Regulation 8, Rule 51	Volatile Organic Compounds, Adhesives and Sealants

CODE OF FEDERAL REGULATIONS (CFR)

29 CFR 1910.120	Emergency Response Awareness Level/Operators Training
29 CFR 1910.1200	Hazard Communication Training
40 CFR 112	Oil Pollution Prevention
40 CFR 66265.16	Generator Training
49 CFR	Transportation

CALIFORNIA CODE OF REGULATIONS (CCR)

CCR Title 22	Section 66260 Hazardous Waste Management
--------------	--

NASA POLICY AND PLANS

* SWPP Ames Storm Water Pollution Prevention Plan (SWPP)

*

SANTA CLARA COUNTY

* NS-517.31 Santa Clara County Hazardous Materials Storage Permit Ordinance

*

1.3 SUBMITTALS

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

SD-01 Data

Wastewater discharge permit applications, at least 14 days prior to 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.

MSDSs of proposed coating and/or adhesive materials for approval, prior to bringing these materials on-site.

SD-08 Statements

Hazardous Waste Disposal Subcontractors prior to project proposed commencement.

Hazardous Waste Profiles, and supporting analytical data prior to disposal.

SD-18 Records

Training records, prior to project commencement and personnel changes.

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

Spill Cleanup Records, as necessary.

1.4 GENERAL RESPONSIBILITIES

The Contractor shall conduct all 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 California Health and Safety Code Chapter 6.95 any material that poses a significant present or potential hazard to human health and safety or to the environment if released into the work place or the environment. Common examples are: oil, fuel, soil contaminated with petroleum hydrocarbons greater than 150 parts per million

(ppm), caustic and acid cleaners, mineral spirits, petroleum distillate based solvents, oil based paints, aerosol spray paints, coolants and antifreeze, 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 light ballasts, oil etc.

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

PART 2 MATERIALS

2.1 AIR QUALITY

All 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).

2.1.1 Adhesives and Sealants

All 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.

2.1.2 Architectural Coatings

All architectural coatings and paints shall conform with BAAQMD Regulation 8, Rule 3 for VOC Content - Architectural Coating Limits, and BAAQMD Regulation 8, Rule 48 for Industrial Maintenance Coating for VOC content limits.

2.1.3 Spray Paints

All spray paints shall conform to BAAQMD Regulation 8, Rule 29 for Aerospace Operations and BAAQMD Regulation 8, Rule 49 - Aerosol Coatings, for VOC content limits.

2.2 STORAGE AREAS

2.2.1 Hazardous Materials Storage

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. All hazardous materials shall be handled in a manner which minimizes the potential for releases. Adequate spill response equipment shall be readily available.

Hazardous materials and hazardous wastes shall be labeled, handled properly, and stored in secondary containment. Secondary containment shall be of adequate size and compatible with materials stored. Storage areas shall be properly labeled and secured.

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

2.2.2 Staging Area

In accordance with the Clean Water Act and Ames SWPP, to the maximum extent practicable, the staging area must be located away from storm drain inlets, gutters, drainage ditches, and creeks.

2.2.3 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.

2.2.4 Landscaping

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

2.2.5 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.

2.2.6 Site Inspections

In accordance with Santa Clara County Hazardous Materials Storage Permit Ordinance No. NS-517.31 Ames Industrial Storm Water Discharge, the project site and all hazardous materials storage areas shall be inspected weekly by the Government to ensure compliance. The Contractor shall implement corrective actions to the satisfaction of the Contracting Officer.

2.3 CHEMICAL USAGE AND HANDLING

Hazardous materials shall be used only as described on the Material Safety Data Sheets and product labels. 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.

2.3.1 Reclamation of Equipment Containing Hazardous Material Residues

The Contractor shall disclose to the facility to which equipment containing hazardous material residues are shipped for reclamation (i.e. electrical wire wrapped with asbestos, electrical panels containing asbestos, etc.)

The disclosure shall be documented on the Bill of Lading or by other written means.

2.3.2 Disposal of Non-Hazardous Waste Containing Hazardous Material Residue

The Contractor shall disclose to the facility to which equipment, containing hazardous material residues are shipped for disposal. (i.e. steel coated with lead paint, etc.) The disclosure shall be documented on the Bill of Lading or by other written means. Supporting analytical data shall be included to document the material is not a hazardous waste.

2.3.3 Labeling

All 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.

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 must have a completed hazardous waste accumulation label.

PART 3 OPERATIONS

3.1 WASTEWATER APPLICATION

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 discharge application is required before discharging wastewaters to the sanitary sewer system from project activities such as saw cutting coolant water, cleaning operations, decontamination water, water removed from vaults, etc.

The Contractor shall complete and submit a "Request for Incidental Sewer Discharge" application to the Contracting Officer at least 14 work days prior to the planned discharge. The request shall include the estimated discharge volume, discharge rate, source of the wastewater and the duration of discharge.

3.1.1 Wastewater Discharge / Disposal

With the exception of groundwater from excavations, all wastewater from Contractor operations shall be containerized by the Contractor until the Contractor is notified the discharge has been approved.

The Contractor shall record and submit all information specified in the discharge application issued to the project including 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).

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

3.2 TRAINING REQUIREMENTS

All personnel handling hazardous materials must 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 job site.

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

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

3.3 SITE OPERATIONS AND MAINTENANCE

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

3.3.1 Equipment Fueling and Maintenance

Equipment fluid changes and fueling shall be conducted over drip pans to prevent spilled materials from contacting the ground surface. All other maintenance and repairs of Contractor equipment is prohibited on-site.

3.3.2 Paint Clean Up

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

3.3.2.1 Water Based Paints

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 which 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.

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 Section 3.10.

3.3.2.2 Oil Based Paints

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

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

3.3.3 Reclaimed Water

The Contractor shall use reclaimed water for dust control and other construction site operations unless an exception is granted by the Contracting Officer. Reclaimed water is available at no cost from a hydrant located on Moffett Federal Airfield, approximately 100 meters west of the intersection of Macon Road and Fifth Avenue.

3.3.4 Draining Piping and Equipment

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.

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

The Government will obtain the necessary sanitary sewer discharge permit(s) if the discharge is sewerable. Non-sewerable water that is not a hazardous waste, shall be treated to a level to allow discharge to the sanitary sewer or managed and disposed of properly. Hazardous waste shall be disposal of properly - not treated on-site.

Disposal of drained fluid and all associated costs shall be by the Contractor in accordance with Paragraph 3.10, "CONTRACTOR DISPOSAL".

3.4 ELECTRICAL

3.4.1 Fluorescent Light Tubes and PCB Light Ballast

All fluorescent light tubes and PCB ballasts shall be boxed and properly labeled.

Tubes and Ballasts shall be properly disposed of by the Contractor in accordance with paragraph 3.10, "CONTRACTOR DISPOSAL".

3.5 SPILL PREVENTION, CONTROL, AND REPORTING

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. All 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, storm or sewer drains shall immediately be reported.

Dial 911 from any NASA phone to request assistance if the spill cannot be cleaned up safely by the Contractor's trained personnel.

3.6 LEAD ABATEMENT

Refer to the Lead Abatement Specifications.

3.7 ASBESTOS ABATEMENT

Refer to the Asbestos Abatement Specifications.

3.8 CONTRACTOR DISPOSAL

Hazardous wastes generated 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 work site 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 Contracting Officer. 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.

3.8.1 Hazardous Waste Manifest

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.

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

3.8.2 Disposal

The Contractor shall perform all disposal services in compliance with 49 CFR. The Contractor shall meet the removal and disposal time frames established by law.

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 TSDF's are in compliance with all applicable federal, state, and local regulations.

3.8.3 Treatment, Storage, And Disposal Facility List

The Contractor shall provide a list of storage and disposal facilities (TSDF) which 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 Contracting Officer.

3.8.4 Hazardous Waste Transportation

Certified Waste Haulers shall be utilized. All Government directed waste must be transported to the disposal facility or interim storage facility without delay, in accordance with Department of Transportation (DOT) and EPA regulations. The Contractor shall notify the Government if ten (10) days or more have elapsed during shipment.

3.8.5 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.

3.8.6 Bulk Hazardous Waste

Bulk hazardous waste shipments must be weighed to confirm shipping weight.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 02 - SITE CONSTRUCTION

SECTION 02050

ALTERATIONS, DEMOLITION, AND REMOVAL

PART 1 GENERAL

- 1.1 SUMMARY
- 1.2 SUBMITTALS
- 1.3 TEMPORARY PROTECTION

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

- 3.1 DISCONNECTING EXISTING UTILITIES
- 3.2 REMOVAL
 - 3.2.1 Scrap Metal
 - 3.2.2 Building Materials
 - 3.2.3 Mechanical Piping, Equipment and Fixtures
 - 3.2.4 Electrical Wiring, Equipment, and Fixtures
- 3.3 DISPOSAL
- 3.4 ALTERATION

-- End of Section Table of Contents --

SECTION 02050

ALTERATIONS, DEMOLITION, AND REMOVAL

PART 1 GENERAL

1.1 SUMMARY

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

1.2 SUBMITTALS

Submit the following in accordance with Section 01300, "Submittals":

SD-01, Data

Survey data of areas to be demolished.

SD-08, Work Plan

SD-18, Records

Record of existing conditions prior to starting of work.

1.3 TEMPORARY PROTECTION

The Contractor's work shall not degrade the appearance or condition of buildings and facilities adjacent to the work. Contractor shall provide protection of persons and property throughout the progress of the work. The Contractor shall provide temporary coverings to protect existing, finished surfaces and equipment when work is being done in adjacent areas.

Dust and dirt rising during demolition operations shall be effectively controlled by water sprinkling or other approved method.

The Contractor shall provide temporary enclosures and partitions, prior to starting work, to protect personnel and existing materials, finishes, equipment, and building components from damage by weather and construction operations; to protect from noise, and to prevent unauthorized entry.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 DISCONNECTING EXISTING UTILITIES

Prior to the start of work, utilities serving each area of alteration or removal will be shut off by the Government and shall be disconnected and sealed by the Contractor.

The Contractor shall install temporary utility services before disconnecting existing utilities. He shall maintain the temporary services during the period of construction, and remove them only after permanent utilities have been installed and tested, and are in operation.

3.2 REMOVAL

3.2.1 Scrap Metal

Scrap metal shall be stockpiled in designated areas, according to type of metal.

Scrap metal shall become the Contractor's property and shall be removed from the site as it accumulates.

3.2.2 Building Materials

Concrete shall be demolished and disposed of. Provide square, straight edges where existing concrete adjoins new work and other locations. Protect reinforcement where indicated; otherwise, it shall be cut off flush with face of concrete.

Masonry shall be demolished and disposed of.

When approved, flame-cutting torches may be used where other methods of dismantling are not practical.

Light-gage metal items, such as metal gutters, roofing and siding, and similar items, shall be salvaged unless designated as scrap metal.

Carpentry: Lumber, millwork items, and finished boards, except those that are unfit for reuse, shall be salvaged.

Gypsum board, fiberboard, and other composition sheathing boards shall be classified as debris.

Bolts, nuts, washers, timber connectors, and other rough hardware shall be classified as debris.

Roofing demolition shall be in accordance with specification Section 07500.

3.2.3 Mechanical Piping, Equipment and Fixtures

Mechanical hardware, equipment, and fixtures shall be disconnected at the nearest convenient connection to existing services that are to remain; salvaged as a unit with its valves and normal auxiliary equipment; listed, indexed, tagged, and stored.

Water, dirt, dust, and foreign matter shall be removed from units. Piping and fixtures shall be drained. Openings shall be sealed with caps, plates, or plugs.

Motors attached by flexible connections shall be secured to the unit.

Lubricating systems shall be charged with the proper oil or grease.

Piping shall be disconnected at unions, flanges and valves, and fittings to reduce the pipe into straight lengths for practical storage. Salvaged piping shall be stored according to size and type. Ends of remaining piping shall be capped and sealed.

Prefabricated supports, hangers, plates, valves, and specialty items shall be boxed according to size and type.

Piping not designated for salvage, or not reusable, shall be considered as scrap metal.

Ductwork shall be classified as scrap metal.

Motors and machinery shall be salvaged. Auxiliary units and accessories shall be salvaged and boxed and stored with the main unit.

3.2.4 Electrical Wiring, Equipment, and Fixtures

Unless otherwise noted, electrical items shall be removed and disposed of.

Primary, secondary, control, communication, and signal circuits shall be disconnected at the point of attachment to their distribution system.

Luminaires: Fluorescent luminaire ballasts containing PCB's shall be removed from luminaire, bagged, boxed labeled and turned over to the Contracting Officer. Contracting Officer shall be given notice prior to the delivery of the ballasts by the Contractor.

Fluorescent lamp: Fluorescent lamps shall be removed from the luminaire boxed and turned over to the Contracting Officer. Contracting Officer shall be given notice prior to the delivery of the fluorescent lamps by the Contractor.

3.3 DISPOSAL

Debris, rubbish, scrap, and other nonsalvageable materials resulting from removal operations shall be legally disposed of off Government property, and materials shall not be stored on the project site.

Discarded materials shall be recycled to the maximum extent practicable.

Burning of materials structures is prohibited on Government property.

3.4 ALTERATION

Where required to patch or extend existing construction, such alteration work shall match existing exposed surface materials in finish, color, texture and pattern. Cutting, patching, repairing and other alteration work shall be done by mechanics skilled in the particular trade or work required.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 02 - SITE CONSTRUCTION

SECTION 02080

ASBESTOS ABATEMENT

PART 1 GENERAL

- 1.1 SUMMARY
- 1.2 REFERENCES
- 1.3 SUBMITTALS
- 1.4 NOTICES
- 1.5 PERMITS AND LICENSES
- 1.6 CAUTION SIGNS AND LABELS

PART 2 PRODUCTS

- 2.1 WORK CLOTHING
- 2.2 MISCELLANEOUS EQUIPMENT

PART 3 EXECUTION

- 3.1 REQUIREMENTS BY TYPE OF OPERATION
- 3.2 PREPARATION
- 3.3 WORK AREA ISOLATION
 - 3.3.1 Regulated Area
 - 3.3.2 Negative Pressure Enclosure
- 3.4 DECONTAMINATION
- 3.5 AIR MONITORING
- 3.6 REMOVAL
- 3.7 CLEANUP
- 3.8 DISPOSAL

-- End of Section Table of Contents --

SECTION 02080

ASBESTOS ABATEMENT

PART 1 GENERAL

1.1 SUMMARY

The performing Contractor shall furnish all 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.

All 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.

1.2 REFERENCES

The performing Contractor shall abide by the provisions and recommendations of:

CODE OF FEDERAL REGULATIONS (CFR)

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

29 CFR PART 1910 General Industry Safety and Health Standards

CODE OF FEDERAL REGULATIONS (CFR)

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

CALIFORNIA HEALTH AND WELFARE AGENCY

Title 26, Division 21.5 Proposition 65

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

29 CFR PART 1926

.1101(p)(3); Notwithstanding the "start-up dates" given in all methods of compliance, respiratory protection, hygiene facilities and practices, communications of hazards, housekeeping, and designation and training requirements specified in 29 CFR PART 1926.1101 are a part of this specification and must be followed.

1.3 SUBMITTALS

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

SD-04, Drawings

Of work areas including clean room/change area, shower, equipment room, work area, emergency routing, and areas to be modified.

SD-06, Instructions

Manufacturer's Instructions for:

encapsulation products
adhesives
wetting agents

SD-18, Records

Documented proof that the employees have had the required training.

Documented proof that the on-site supervisor meets the criteria for a "competent person" of 29 CFR PART 1926.1101.

Statement by the performing Contractor of the name and location of the proposed disposal site.

Copy of notifications per paragraph entitled "Notices"

Copy of all applicable permits and licenses (per paragraph entitled "Permits & Licenses")

Copy of respirator program in compliance with 29 CFR PART 1910.134 and Title 8, Div 1, Ch 4, Subchapter 4.

Copy of medical certification of physical examination on all employees engaged in the operation clearly showing medical qualification for both asbestos-related work and wearing of a respirator.

Copies of Contractor-performed air monitoring tests shall be submitted within two working days of the sampling.

Upon completion of work, submit originals of strip chart record of "negative-air pressure" meter.

Upon completion, copy of all manifests for asbestos-containing waste.

SD-20, 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.

Copy of initial exposure assessment, if required to support the work plan.

Copy of evaluation and certification of any alternative control methods proposed, including the license number(s) of the certifier.

The Contractor shall submit the following per Section 01300, "Submittals":

1.4 NOTICES

The following written notifications shall be made by the Contractor at

least 10 days prior to starting work.

California Occupational Safety and Health Administration
1900 S. Norfolk, Suite 215
San Mateo, CA 94403

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 CONTRACTORS LICENSE, (if applicable)

CALIFORNIA GENERAL CONTRACTOR'S LICENSE or CALIFORNIA SPECIALTY CONTRACTOR'S LICENSE

1.6 CAUTION SIGNS AND LABELS

The Contractor shall 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.

The Contractor shall 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.

Caution labels shall be provided affixed to all bags and containers and other products which are to be filled with asbestos waste material.

PART 2 PRODUCTS

2.1 WORK CLOTHING

The performing Contractor shall provide for each person present at the jobsite (workers, supervisors, inspectors, and others) work clothing consisting of full body disposable coveralls, appropriate footwear, disposable head covers, protective gloves, and respirators. Other safety clothing shall be available as appropriate.

2.2 MISCELLANEOUS EQUIPMENT

Air purifying equipment shall be used when necessary and shall be a type such as the High Efficiency Particulate Air Filtrations Systems, Electronic Precipitators, or a system approved by OSHA. Show flow rate (cfm) and efficiency at 5 microns and 1 micron if available.

All vacuum cleaners used shall be equipped with HEPA filters.

PART 3 EXECUTION

3.1 REQUIREMENTS BY TYPE OF OPERATION

All operations shall be performed 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 Contracting Officer prior to beginning work.

All operations shall use the respiratory protection at least as stringent as specified by 29 CFR PART 1926.1101(h). In addition, all Class I removal and bagging operations shall be performed by employees wearing a powered air purifying respirator (PARR), as a minimum. Employees engaged in Class II removal and bagging operations, and those engaged in all waste-handling and clean up operations, shall wear half-mask respirators, as a minimum.

3.2 PREPARATION

If impermeable dropcloths are required, then prior to beginning work, all furniture and equipment shall be removed from the work area or completely enclosed by 4 mil polyethylene sheeting, securely taped in place with duct tape. Draping and taping of piping is also required.

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 heating and ventilating ducts, skylights, doors, windows, and lighting with polyethylene taped securely in place. Care must be taken in sealing off lighting fixtures to avoid burning or melting the plastic sheeting. The use of facility air handling systems shall be discontinued within the regulated area throughout the abatement operation. All electrical power in the area (except that entering by means of GFCI-protected circuits) shall be disconnected and tagged off.

3.3 WORK AREA ISOLATION

3.3.1 Regulated Area

The performing Contractor shall establish the work area as a regulated area. For those operations which require it, this shall be the negative pressure enclosure; for other operations, this shall be by means of suitable demarcation.

Outside work clothes, except respirators, shall be removed in the regulated area prior to departure from this area. No smoking, eating, or drinking shall take place in the regulated area. Work footwear shall remain inside the regulated area until completion of the job, unless thoroughly washed inside and out.

3.3.2 Negative Pressure Enclosure

Exits and emergency exits from the enclosure shall be clearly marked.

The enclosure shall be evacuated to maintain an average negative pressure of 0.1 mm of water within the enclosure. At no time shall the negative pressure fall below 0.5 mm of water. This shall be demonstrated by employment of an electronic negative pressure recorder, calibrated within the manufacturer's recommended limits, which will record the pressure difference continuously on chart paper. The paper shall be signed and dated by the supervisor daily. The recorder shall be continuously

functioning throughout the abatement operation. The Government shall check the negative pressure with a calibrated magnehelic. If this shows a vacuum of less than 0.5 mm of water, work shall be stopped and corrective action taken.

3.4 DECONTAMINATION

Decontamination of personnel shall be performed in accordance with 29 CFR PART 1926.1101(j).

Procedures shall be written and distributed for evacuation of injured workers. Aid for a seriously injured worker will not be delayed for reasons of decontamination. The procedure shall be submitted to the Contracting Officer for approval.

All containers shall be sealed, labeled, and cleaned on the outside 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 8 m or 1 m² of material, the Contractor shall provide perimeter air monitoring as required by 29 CFR PART 1926.1101, g.(4)(ii)(B). The air sampling limit that will be imposed will be 0.01 fiber/cc (PCM) or 70 structures/mm² (TEM), and isolation will be improved and maintained to achieve this level.

If, at any time, the air samples inside the work area exceed the limit allowed by the respirators being employed by the workers, the work will stop immediately and air cleaning and surface cleaning procedures will be employed. If the air levels exceed this limit in the work area three times, Type C respirators (air supplied) will be required of all workers entering the work area.

For Class I abatement jobs involving more than 8 m or 1 m² of material, the Government shall provide clearance air sampling as required by 29 CFR PART 1926.1101, g.(4)(ii)(B). Samples shall confirm decontamination of work area should be collected within 48 hours after completion of all cleaning work. the number of samples taken will be determined by the Contracting Officer.

3.6 REMOVAL

Removal of asbestos containing material shall be accomplished as specified by 29 CFR PART 1926.1101(g).

If pipes, valves, or structural members that are covered with ACM are to be removed as units, these units shall be wetted and double wrapped with polyethylene sheeting. The polyethylene sheeting shall be securely sealed with duct tape and labeled.

3.7 CLEANUP

Following removal work, but prior to removal of barriers, all asbestos-containing waste shall be properly packaged in double containers, labeled, and removed from the work area to the holding area or hazardous waste container. The entire area shall be wet-cleaned or HEPA vacuumed,

and the Contracting Officer shall be notified that it is ready for inspection. Upon approval by the Contracting Officer of the cleaning, all structural and mechanical surfaces from which insulation has been removed shall be sprayed with a fine, lock-down spray of encapsulant. Any secondary barriers or protective coverings will be removed prior to clearance testing.

For full-scale, Class I abatement, and interior Class II ACM removal operations, when the encapsulant has dried, the Government shall conduct aggressive post-abatement air sampling. If the results are satisfactory (less than 70 structures/mm²), approval will be granted to remove the barriers and enclosures. All barriers and enclosures, and all cleaning materials shall be packaged and disposed as hazardous waste. After removal of the barriers, the surfaces covered by them shall be wet-cleaned or HEPA vacuumed.

3.8 DISPOSAL

All asbestos-containing waste, friable and non-friable, containing more than 1% asbestos, shall be considered as, and treated as hazardous waste.

All asbestos-containing materials, and all materials contaminated during operations, shall be sealed in double-containers. The inner container shall be a 6-mil polyethylene bag (or wrapping). The outer container may be an additional bag or wrapping or a sealed drum. The outer container must be cleaned and labeled (per 40 CFR PART 262, Title 26, Secs 22-66261 et seq, and other applicable regulations) before removal from the equipment room or work area.

Clean, sealed 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 60 days. The holding area will be prominently marked, and waste containers will be covered with plastic sheeting and protected from damage.

All 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 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 the Government. All asbestos materials and miscellaneous debris in sealed drums shall be transported to the designated disposal site per EPA 40 CFR PART 61, SUBPART M guidelines. Labels and all necessary signs shall be per EPA 40 CFR PART 61, SUBPART M, OSHA 29 CFR PART 1910.1001, "Asbestos".

--End of Section--

SECTION TABLE OF CONTENTS

DIVISION 02 - SITE CONSTRUCTION

SECTION 02090

LEAD PAINT ABATEMENT/DEMOLITION

PART 1 GENERAL

- 1.1 SUMMARY
- 1.2 REFERENCES
- 1.3 SUBMITTALS
- 1.4 QUALIFICATIONS AND TRAINING

PART 2 PRODUCTS

- 2.1 WORK CLOTHING
- 2.2 MISCELLANEOUS EQUIPMENT

PART 3 EXECUTION

- 3.1 REQUIREMENTS BY TYPE OF OPERATION
- 3.2 WORK AREA ISOLATION
 - 3.2.1 Exterior Work
- 3.3 DECONTAMINATION
- 3.4 AIR MONITORING
- 3.5 CLEANUP
- 3.6 DISPOSAL

-- End of Section Table of Contents --

SECTION 02090

LEAD PAINT ABATEMENT/DEMOLITION

PART 1 GENERAL

1.1 SUMMARY

The performing 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, manual sanding, use of heat guns, caustic strippers, and power-tool cleaning with dust collection system. Abrasive blasting, water blasting, and power-tool cleaning without dust collection systems shall not be used on this project, unless otherwise specified. Torch-cutting, burning, and welding within 6 inches of a lead-based painted surface are prohibited.

All 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.

1.2 REFERENCES

The performing Contractor shall abide by the provisions and recommendations of:

US DEPARTMENT OF LABOR, OCCUPATIONAL SAFETY AND HEALTH
ADMINISTRATION (OSHA)

CFR 29 PART 1926.62

Safety and Health Standards for the
Construction Industry-Lead

CFR 29 1910

Safety and Health Standards for General
Industry

US ENVIRONMENTAL PROTECTION AGENCY (EPA)

CFR 40 PART 50.12

National Primary and Secondary Ambient Air
Quality Standards for Lead

BAY AREA AIR QUALITY MANAGEMENT DISTRICT (BAAQMD)

Regulation 11, Rule 1

Lead

1.3 SUBMITTALS

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

SD-04 Drawings

Of work areas including change area, shower if any, equipment room, work area, emergency routing, and areas to be modified.

SD-06 Instructions

Manufacturer's Instructions for any caustic strippers and neutralizers to be employed.

SD-08 Work Plan

Written compliance program per CFR 29 PART 1926.62(e)(2), and an initial determination of exposure assessment per CFR 29 PART 1926.62(d).

SD-18 Records

Documented proof that the employees have had required training

Copy of notification to EPA, Bay Area Air Quality Management District, and/or Cal/OSHA, if applicable.

Copy of all applicable permits and licenses.

Copy of respirator program in compliance with CFR 29 1910 and Title 8, Div 1, Ch 4, Subchapter 4.

The Contractor shall submit the following, per Section 01300, "Submittals".

Copy of medical certification of physical examination on all employees engaged in the operation, clearly showing medical qualification for both lead-related work and wearing of a respirator, if applicable.

Copies of Contractor-performed personal air monitoring tests shall be submitted within two working days of the sampling.

Copy of Contractor-performed risk assessment, per CFR 29 PART 1926.62(d), to be approved by Contracting Officer before any reduction in controls.

1.4 QUALIFICATIONS AND TRAINING

The supervisor for the Contractor actually performing the work must be a "competent person", as defined by CFR 29 PART 1926.62(b).

Each worker must have received training per CFR 29 PART 1926.62(l), including the wearing and fitting of respirators.

PART 2 PRODUCTS

2.1 WORK CLOTHING

The Contractor shall 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 or sneakers, protective gloves, and respirators. Other safety clothing shall be available as appropriate.

2.2 MISCELLANEOUS EQUIPMENT

Vacuum cleaners shall be a type such as the High Efficiency Particulate Air.

PART 3 EXECUTION

3.1 REQUIREMENTS BY TYPE OF OPERATION

Use of caustic strippers shall be in strict accordance with the approved manufacturer's instructions, including all recommended precautions. Caustic strippers will not be allowed to be used in occupied buildings except after-hours. If used, ventilation will be provided by the Contractor to remove all fumes and odors prior to the start of the following work day. Use of strippers containing volatile organic compounds shall be in accordance with BAAQMD Regulation 11, Rule 1.

All other operations shall use the respiratory protection at least as stringent as specified by CFR 29 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 the Contracting Officer.

3.2 WORK AREA ISOLATION

The Contractor shall establish the work area as a regulated area, with signage per CFR 29 PART 1926.62(m) and Proposition 65. In addition to isolation required by OSHA, the following procedures will be used.

3.2.1 Exterior Work

The work area is defined as the work surface and an area extending 20 feet from that surface in all directions (but not including the building interior), also included is projection of that area down to the ground. The Contractor may reduce the size of the work area by installing dust-tight tarpaulins to divide the work area from the exterior. The work area specifically includes the dumpster or other container in which unwrapped debris is to be placed and the path to that container.

The work area shall be isolated from other exterior areas by suitable demarcation, including signage. If exterior work is to require less than one day, the demarcation may be by means of sawhorse barriers and caution tape. Otherwise, temporary 6-foot high cyclone fence shall be used.

If the Government or unprotected contractor employees are to remain in the building during work covered by this section, all entrances and operable windows into the work area shall be sealed with one layer of 6-mil plastic.

Otherwise, doors into the work area shall be closed and locked (with signs) to separate the work area from the building. All HVAC inlets in the work area shall be sealed with one layer of 6-mil plastic. All mechanical and electrical equipment shall be moved or covered in plastic.

The ground and all landscaping shall be covered by one layer of 6 mil plastic, to and secured to the building wall. Ladders and scaffolding shall not be placed directly on the plastic, rather they shall be placed on boards or plywood on top of the plastic. Plastic shall be securely ballasted or anchored to prevent lifting by the wind.

No work shall be performed in winds exceed 20 mph, nor if rain is imminent. All plastic shall be HEPA vacuumed at the close of each shift and prior to shutting down for weather.

3.3 DECONTAMINATION

Protective clothing shall be provided by the Contractor in accordance with CFR 29 PART 1926.62(g).

Decontamination of personnel shall be performed in accordance with CFR 29 PART 1926.62(i).

The Contractor shall provide and post in the clean room, the decontamination and work procedures to be used by all workers and visitors.

Procedures shall be written and distributed 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 Contracting Officer for approval.

The containers shall be sealed and cleaned on the outside 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 OSHA and Cal/OSHA regulations and standards of good practice in worker protection. The Government may conduct area air monitoring, at its sole discretion. The techniques employed shall be consistent with regulator requirements.

All air monitoring sites will be coordinated with the performing Contractor and selected by the Contracting Officer's representative. The air sampling limit that will be imposed will be the BAAQMD "ambient" standard.

If any test shows the air samples inside the work area exceed the TWA allowed by the respirators being employed by the workers, the respiratory protection will be increased and additional controls will be instituted.

3.5 CLEANUP

Following removal work, but prior to removal of barriers, all waste containers shall be sealed and cleaned. The entire work area shall be HEPA vacuumed and the Contracting Officer shall be notified that it is ready for inspection. The Contracting Officer, or her representative, shall conduct a visual inspection to assure that the area is clean. If the results are satisfactory, approval will be granted to remove the barriers and enclosures. After removal of the barriers, the surfaces covered by them shall be wet-cleaned or HEPA vacuumed.

The Government may elect to perform wipe samples at its sole discretion. If the results are unsatisfactory (greater than 2mg/m²) for tables, desks and similar surfaces (greater than 8mg/m²) for floors and other surfaces) the Contractor must re-clean the entire area to pass this wipe test.

If the Contractor's operations contaminate surrounding soil, she shall be required to restore the site to pre-existing conditions

3.6 DISPOSAL

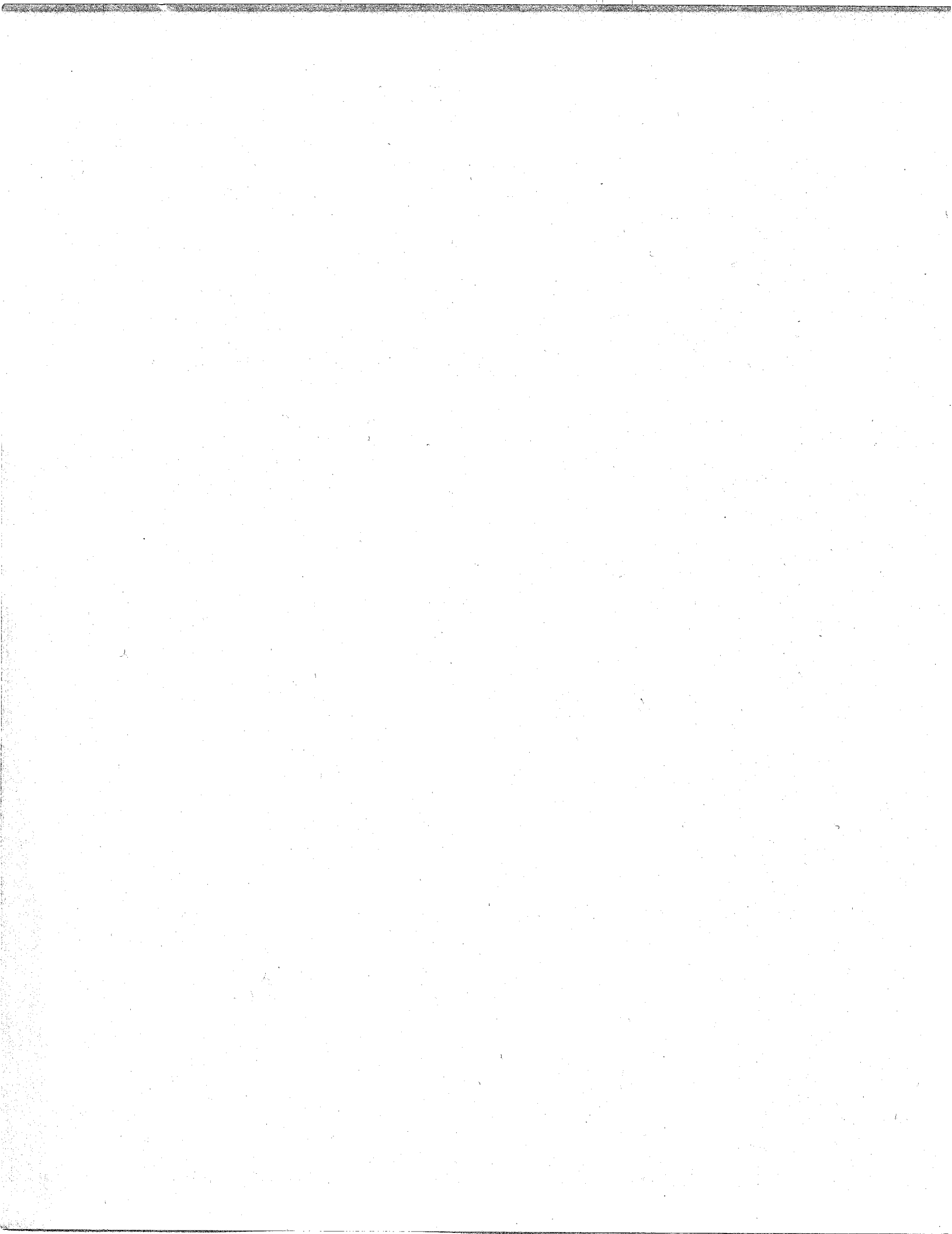
All dust, chips, and abrasive and contaminated soil shall be contained, removed from the surroundings, and disposed of by the Contractor as hazardous waste, unless the Contractor provides testing and certification by

an independent testing agency which demonstrates that it is not classified as hazardous. Workers loading or unloading hazardous waste shall wear NIOSH approved respirators.

Other debris is unlikely to be considered as hazardous, and may be disposed as construction debris, transported in a covered container. All plastic, suits, and other protective material must be HEPA vacuumed prior to disposal.

The Contractor shall be fully responsible for the disposal of waste in an approved landfill in accordance with the rules and regulations of the California Department of Toxic Substance Control, the regional water quality control board, and any other applicable agency. Removal of hazardous waste from the site shall be by a licensed hazardous waste hauler, and the manifest shall be signed by the Government. All hazardous debris shall be transported to the designated disposal site per EPA CFR 40 PART 50.12 SUBPART M guidelines.

-- End of Section --



SECTION TABLE OF CONTENTS

DIVISION 05 - METALS

SECTION 05120

STRUCTURAL STEEL

03/03

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 QUALIFICATIONS FOR STRUCTURAL STEEL WORK
- 1.4 QUALIFICATIONS FOR WELDING WORK
- 1.5 FABRICATION REQUIREMENTS
 - 1.5.1 Tolerances
 - 1.5.2 Connections
 - 1.5.3 Column Bases and Bearing Plates
- 1.6 BONDING AND GROUNDING
- 1.7 DRAINAGE HOLES
- 1.8 DRAWINGS

PART 2 PRODUCTS

- 2.1 STRUCTURAL STEEL
 - 2.1.1 Carbon Grade Steel
- 2.2 STRUCTURAL TUBING
- 2.3 STEEL PIPE
- 2.4 LOW-CARBON STEEL THREADED FASTENERS
- 2.5 HIGH-STRENGTH THREADED FASTENERS
- 2.6 WELDING MATERIALS
- 2.7 PROTECTIVE COATING
- 2.8 BEDDING MATERIALS
 - 2.8.1 Shrink-Resistant Grout
 - 2.8.2 Cement Grout
 - 2.8.3 Mixing Water
 - 2.8.4 Epoxy-Resin Grout

PART 3 EXECUTION

- 3.1 GENERAL
- 3.2 ERECTING EQUIPMENT
- 3.3 ANCHOR BOLTS
- 3.4 SETTING COLUMN BASES AND BEARING PLATES
- 3.5 FIELD ASSEMBLY
- 3.6 TOUCHUP PAINTING
- 3.7 INSPECTION AND ACCEPTANCE PROVISIONS
 - 3.7.1 Inspection and Tests
 - 3.7.2 Inspection of Welding
 - 3.7.3 Inspection of High-Strength Bolted Connections

-- End of Section Table of Contents --

SECTION 05120

STRUCTURAL STEEL

03/03

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

- AISC 316 (1989; 9th Ed) Manual of Steel Construction, Allowable Stress Design
- AISC 317 (1992) Manual of Steel Construction, Volume II, Connections
- AISC 326 (1983; 8th Ed) Detailing for Steel Construction
- AISC M014 (1984; 1st Ed) Engineering for Steel Construction a Source Book on Connections

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

- ANSI B18.22.1 (1975; R 1998) Plain Washers
- ANSI B18.22M (1981; R 2000) Metric Plain Washers

AMERICAN WELDING SOCIETY (AWS)

- AWS A2.4 (1993) Standard Symbols for Welding, Brazing and Nondestructive Examination
- AWS D1.1/D1.1M (2002) Structural Welding Code - Steel

ASTM INTERNATIONAL (ASTM)

- ASTM A 123/A 123M (2002) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
- ASTM A 153/A 153M (2001a) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
- ASTM A 307 (2000) Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
- ASTM A 325 (2000) Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
- ASTM A 325M (2000) Standard Specification for High

	Strength Bolts for Structural Steel Joints (Metric)
ASTM A 36/A 36M	(2001) Standard Specification for Carbon Structural Steel
ASTM A 500	(1993) Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A 53	(1999; Rev B) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
ASTM A 572/A 572M	(1994; Rev C) Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Steels of Structural Quality
ASTM B 695	(1991) Coatings of Zinc Mechanically Deposited on Iron and Steel
ASTM C 1107	(2002) Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-Shrink)
ASTM C 150	(2002) Standard Specification for Portland Cement
ASTM C 404	(1997) Standard Specification for Aggregates for Masonry Grout
ASTM C 658	(1993) Chemical-Resistant Resin Grouts for Bricks or Tile
ASTM D 2939	(1994) Emulsified Bitumens Used as Protective Coatings
ASTM E 164	(1994; Rev A) Ultrasonic Contact Examination of Weldments
ASTM E 709	(2001) Standard Guide for Magnetic Particle Examination

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC Paint 25	(1991) Paint Specification No. 25, Red Iron Oxide, Zinc Chromate, Raw Linseed Oil and Alkyd Primer (Without Lead and Chromate Pigments)
SSPC SP 10	(2000) Joint Surface Preparation, Standard Near-White Metal Blast Cleaning (NACE No. 2)

1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01300,

"Submittal Procedures," in sufficient detail to show full compliance with the specification:

SD-01 Data

Manufacturer's catalog data shall be submitted for the following items:

- Bolts and Nuts
- Washers
- Primer
- Welding Electrodes and Rods
- Shrink-Resistant Grout
- Epoxy-Resin Grout
- Cement Grout

SD-04 Shop Drawings

Fabrication Drawings for the following items shall be submitted in accordance with paragraph entitled, "Drawings," of this section.

- Structural Steel
- Accessories

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

SD-13 Certificates

Welding Procedures and certificates for Welder Qualifications shall be submitted in accordance with paragraph entitled, "Qualifications for Welding Work," of this section.

Certificates shall be submitted for the following items showing conformance with the referenced standards contained in this section.

- Structural Steel
- Washers
- Bolts and Nuts
- Primer
- Welding Electrodes and Rods
- Shrink-Resistant Grout
- Epoxy-Resin Grout
- Cement Grout

1.3 QUALIFICATIONS FOR STRUCTURAL STEEL WORK

Structural steel fabrication and erection shall be performed by an organization experienced in structural steel work of equivalent magnitude.

Structural steel fabricator shall be certified by AISC to perform structural steel work at level II.

1.4 QUALIFICATIONS FOR WELDING WORK

Welding Procedures shall be in accordance with AWS D1.1/D1.1M.

Certificates for Welder Qualifications shall include the type of welding and positions each operator is qualified for, the code and procedure qualified under, date qualified, and the firm and individual certifying the qualification tests.

Welders shall be certified to have been qualified by tests in accordance with AWS D1.1/D1.1M or under an equivalent approved qualification test.

In addition, tests shall be performed on test pieces in positions and with clearances equivalent to those actually encountered. If a test weld fails to meet requirements, an immediate retest of two test welds shall be made and each test weld shall pass. Failure in the immediate retest will require that the welder be retested after further practice or training and that a complete new set of test welds be made.

1.5 FABRICATION REQUIREMENTS

AISC 316 and AISC 303 shall govern all work.

Design of members and connections for any portion of the structure not indicated shall be completed by the fabricator and indicated on detail drawings.

Substitution of sections or modification of details, or both, and the reasons for the action shall be submitted with the detail drawings for approval.

Structural steel shall be fabricated and assembled in the shop to the greatest extent possible. Parts not assembled in the shop shall be secured by bolts for shipment.

Shop splices of members between field splices will be permitted only where indicated. Splices not indicated must be approved. Field splices in compound joints will not be permitted.

1.5.1 Tolerances

Tolerances in fabrication and erection shall be in accordance with AISC 303.

1.5.2 Connections

One-sided or other types of eccentric connections will not be permitted, unless indicated in detail and approved.

Shop connections shall be welded.

Field connections shall be bolted, except where welded connections are indicated, as follows:

High-strength threaded fasteners shall be used for bolted connections, except where otherwise specified.

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.

High-strength bolting shall conform to AISC 317 and shall be friction-type connections as modified by the bonding and grounding requirements.

Holes shall be cut, drilled, or punched at right angles to the surface of the metal and shall not be made or enlarged by burning. Holes in base or bearing plates shall be drilled. Holes shall be clean-cut without torn or ragged edges. Outside burrs resulting from drilling or reaming operation shall be removed with a tool making a 1.6 millimeter bevel.

Bolts shall be inserted into holes without damaging thread. Bolt heads shall be protected from damage during driving. Bolt heads and nuts shall rest squarely against the metal. Where bolts are to be used on beveled surfaces having slopes greater than 1 in 20 with a plane normal to the bolt axis, beveled washers shall be provided to give full bearing to the head or nut.

Low carbon steel threaded fasteners shall be of length that will extend through, but not more than 7 millimeter beyond, the nuts. Bolt heads and nuts shall be drawn tight against the work with a suitable wrench not less than 380 millimeter long. Bolt heads shall be tapped with a hammer while the nut is being tightened. Nuts shall be locked after tightening. Where self-locking nuts are not furnished, bolt threads shall be upset.

1.5.3 Column Bases and Bearing Plates

Column bases shall be provided under columns.

Bearing plates shall be provided under beams, resting on concrete roof decks.

Column bases shall be milled and attached to columns as indicated.

1.6 BONDING AND GROUNDING

Where indicated, bonding of joints and connections shall be accomplished as specified in Section 16065, "Secondary Grounding." In friction-type joints, faying surfaces shall be clean and abrasive-blasted to near-white metal. Faying surfaces shall be coated to avoid crevice corrosion.

1.7 DRAINAGE HOLES

Adequate drainage holes shall be drilled to eliminate water traps. Hole diameter shall be 13 millimeter and location shall be shown on the detail drawings. Hole size and location shall not affect structural integrity.

1.8 DRAWINGS

Fabrication Drawings for Structural Steel and Accessories shall be in accordance with AISC 316, AISC 326 and AISC M014. Drawings shall show standard welding symbols in accordance with AWS A2.4.

Installation Drawings for structural steel units shall indicate the members and connection areas not to be painted, sequence of erection, and detailed sequence of welding including each welding procedure. Shoring and temporary bracing shall be designed and sealed by a registered professional engineer and provided for record purposes.

PART 2 PRODUCTS

2.1 STRUCTURAL STEEL

2.1.1 Carbon Grade Steel

Carbon grade steel shall conform to ASTM A 36/A 36M.

2.2 STRUCTURAL TUBING

Structural tubing shall conform to ASTM A 500, Grade B.

2.3 STEEL PIPE

Steel pipe shall conform to ASTM A 53, Type E, Grade B.

2.4 LOW-CARBON STEEL THREADED FASTENERS

Bolts and Nuts shall conform to ASTM A 307, galvanized according to ASTM A 153/A 153M for galvanized members.

Round washers shall be plain, conforming to ANSI B18.22.1, galvanized according to ASTM A 153/A 153M for galvanized members.

2.5 HIGH-STRENGTH THREADED FASTENERS

High-strength Washers, Bolts and Nuts shall conform to ASTM A 325M. Galvanize according to ASTM A 153/A 153M for galvanized members.

2.6 WELDING MATERIALS

Welding materials, to include Welding Electrodes and Rods, shall conform to AWS D1.1/D1.1M.

2.7 PROTECTIVE COATING

Steelwork shall be shop primed with red oxide Primer in accordance with SSPC Paint 25. Steel equipment supports not noted to be galvanized shall receive a top coat of paint.

Steelwork shall be hot dipped galvanized as indicated in accordance with ASTM A 123/A 123M. Abraded surfaces and cut ends of galvanized members shall be touched up with zinc-dust, zinc-oxide primer, or an approved galvanizing repair compound.

Steelwork embedded in concrete shall be coated with a bituminous mastic conforming to ASTM D 2939.

2.8 BEDDING MATERIALS

2.8.1 Shrink-Resistant Grout

Shrinkage-resistant grout shall be a premixed and packaged ferrous aggregate grouting compound conforming to ASTM C 1107.

2.8.2 Cement Grout

Portland cement grout shall conform to ASTM C 150, Type I.

Aggregate for cement grout shall be clean, sharp, uniformly graded natural abrasive conforming to ASTM C 404, Size No. 2.

2.8.3 Mixing Water

Water shall be potable.

2.8.4 Epoxy-Resin Grout

Epoxy-Resin grout shall conform to ASTM C 658.

PART 3 EXECUTION

3.1 GENERAL

Erection of structural steel shall be in accordance with the AISC 303, with modifications and additional requirements as specified.

3.2 ERECTING EQUIPMENT

Equipment shall be suitable and safe for workers.

3.3 ANCHOR BOLTS

Bolts and other connections between structural steel and foundations or existing structural steel shall be performed as part of the work.

Bolts and anchors shall be accurately located and built into connecting work and shall be preset by the use of templates or other methods as may be required to locate bolts and other connections.

3.4 SETTING COLUMN BASES AND BEARING PLATES

Loose and attached column base plates and bearing plates for beams and similar structural members shall be aligned with wedges or shims and shall be bedded with damp-pack bedding. Installation of base and bearing plates shall be as follows:

Concrete bearing surfaces shall be cleaned free of laitance, dirt, oil, grease, and other foreign material. Concrete surfaces shall be roughened, but not enough to interfere with placing bedding. Bottom surface of base or bearing plates shall be cleaned free of dirt, oil, grease, and other foreign materials.

Space between top of bearing surface and bottom of base or bearing plate shall be approximately 1/24 of the width of the base or bearing plate but not less than 13 millimeter for base or bearing plates that are less than 300 millimeter wide. Base or bearing plate shall be supported and aligned on steel wedges or shims.

Bedding shall be a mix composed of the specified shrinkage-resistant grout and enough water to provide a flowable mixture without segregation or bleeding.

Forms shall be provided to retain bedding until sufficiently hard to support itself.

Installation requirements shall be in accordance with the epoxy-resin grout manufacturer's printed installation instructions and as approved.

3.5 FIELD ASSEMBLY

Structural steel frames shall be assembled to lines and elevations indicated. Various members forming parts of a completed frame or structure after being assembled shall be aligned and adjusted before being fastened. Fastening of splices of compression members shall be done after abutting surfaces have been brought completely into contact. Bearing surfaces and surfaces that will be in permanent contact shall be cleaned before members are assembled.

Splices will be permitted only where indicated. Erection bolts used in welded construction shall be removed and the holes shall be filled with plug welds.

Bracing, adequacy of temporary connections and supports, alignment, and removal of paint on surfaces adjacent to field welds shall be as specified in AISC 303.

Welding for re-drilling will not be permitted. Holes shall not be enlarged more than 1.6 millimeter larger than the specified hole size without approval of the Contracting Officer.

3.6 TOUCHUP PAINTING

After erection of structural steel, the Contractor shall touch up bolt heads and nuts, field welds, and abrasions in the shop coat. Touchup and repair shall be accomplished as soon as possible after the damage or installation has occurred.

Surfaces shall be degreased, as required, prior to subsequent surface preparation. Degreasing shall be accomplished by steam cleaning or washing with a solution of trisodium phosphate in water, followed by a fresh water rinse. Cuts, welds, and large damaged areas shall be abrasive blasted to near white SSPC SP 10. Blasting abrasive shall be per linear 25 millimeter. When abrasive blasting is prohibited or impractical, mechanical cleaning by needle gun or abrasive disks or wheels shall be used. Minor abrasions and scars where extensive rusting has not occurred shall be rendered clean and dry and touched up without further surface preparation. Repair coating shall be applied within 6 hours after surface preparation or before rusting or re-contamination occurs. Touchup and repair material shall be the same inorganic zinc coating as applied in the shop. Application shall be by airless or conventional spray. Compressed air used for blasting and coating application shall be free of moisture and oil. Manufacturer's recommended procedures shall be followed.

3.7 INSPECTION AND ACCEPTANCE PROVISIONS

3.7.1 Inspection and Tests

Inspection by the Contractor shall include proper preparation, size, gaging location, and acceptability of welds; identification marking; operation and current characteristics of welding sets in use; and calibration of wrenches for high-strength bolts.

3.7.2 Inspection of Welding

Inspection of welding shall be performed in accordance with AWS D1.1/D1.1M, Section 6, "Inspection," and as follows:

Magnetic particle inspection of the welds shall conform to ASTM E 709.

Ultrasonic inspection of the welds shall conform to ASTM E 164.

Shop and Field Welds: 100% visual inspection; welds larger than 6 mm
- magnetic particles, complete penetration well - ultrasonic test.

3.7.3 Inspection of High-Strength Bolted Connections

Inspection of high-strength bolted connections shall be performed in accordance with AISC 317.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 06 - WOOD AND PLASTICS

SECTION 06100

ROUGH CARPENTRY

03/03

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 DELIVERY, HANDLING, AND STORAGE

PART 2 PRODUCTS

- 2.1 WOOD MATERIALS
 - 2.1.1 General Requirements
 - 2.1.2 Structural Framing Materials
 - 2.1.3 Preservative Treated Lumber
- 2.2 ANCHORAGE AND FASTENER MATERIALS
 - 2.2.1 Nails and Staples
 - 2.2.2 Bolts, Nuts and Screws
 - 2.2.3 Bar or Strap Anchors

PART 3 EXECUTION

- 3.1 INSTALLATION
 - 3.1.1 General
 - 3.1.2 Blocking, Cant Strips, and Nailers

-- End of Section Table of Contents --

SECTION 06100

ROUGH CARPENTRY

03/03

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

- ANSI B18.22.1 (1975; R 1998) Plain Washers
ANSI B18.22M (1981; R 2000) Metric Plain Washers

AMERICAN WOOD PRESERVERS BUREAU (AWPB)

- AWPB LP 2 (1988) Softwood Lumber, Timber and Plywood Pressure Treated with Water-Borne Preservatives for Aboveground Use

AMERICAN WOOD-PRESERVERS' ASSOCIATION (AWPA)

- AWPA A3 (2000) Determining Penetration of Preservatives and Fire Retardants
AWPA C1 (2000) All Timber Products - Preservative Treatment by Pressure Processes
AWPA C20 (1993) Structural Lumber - Fire-Retardant Treatment by Pressure Processes
AWPA C27 (1993) Plywood - Fire-Retardant Treatment by Pressure Processes
AWPA P5 (2001) Standards for Waterborne Preservatives
AWPA P8 (1991) Oil-Borne Preservatives

ASME INTERNATIONAL (ASME)

- ASME B18.2.1 (1981; R 1992) Square and Hex Bolts and Screws, Including Hex Cap and Lag Screws (Inch Series)
ASME B18.2.3.8M (1981; R 1991) Metric Hex Lag Screws
ASME B18.6.1 (1981; R 1991) Wood Screws (Inch Series)

ASTM INTERNATIONAL (ASTM)

- ASTM A 307 (2000) Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength

ASTM A 36/A 36M	(2001) Standard Specification for Carbon Structural Steel
ASTM A 525	(1993) Standard Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process
ASTM A 525M	(1991; Rev A) Standard Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process (Metric)
ASTM D 2016	(1974; R 1983) Moisture Content of Wood
ASTM E 84	(2001) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM F 568M	(1998) Standard Specification for Carbon and Alloy Steel Externally Threaded Metric Fasteners

INDUSTRIAL FASTENERS INSTITUTE (IFI)

IFI 502	(1982) Metric Tapping Screws
---------	------------------------------

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS FF-B-588	(Rev D) Bolt, Toggle; and Expansion Sleeve, Screw
FS FF-N-105	(Rev B; Int Am 4) Nails, Brads, Staples, and Spikes: Wire, Cut, and Wrought
FS FF-S-325	(Int Amd 3) Shield, Expansion; Nail, Expansion; and Nail, Drive Screw (Devices, Anchoring, Masonry)
FS TT-W-571	(Rev J) Wood Preservation: Treating Practices

WEST COAST LUMBER INSPECTION BUREAU (WCLIB)

WCLIB Std 17	(1991) Standard Grading Rules for West Coast Lumber
--------------	---

WESTERN WOOD PRODUCTS ASSOCIATION (WWPA)

WWPA-01	(1991) Western Lumber Grading Rules 91
---------	--

1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01300, "Submittal Procedures," in sufficient detail to show full compliance with the specification:

SD-09 Test Reports

Tests for Moisture Content of wood shall be in accordance with

ASTM D 2016, Method B, Electronic Moisture Meter Method. Material tested shall be the same material proposed for use in the project. Moisture test shall be dated no earlier than 3 months prior to the delivery of lumber materials. An additional test report will be required if the materials species or stress grade changes.

Fire-Retardant-Treated Lumber shall be according to the paragraph entitled, "Fire-Retardant-Treated Lumber," of this section.

SD-13 Certificates

Certificates shall be submitted for the following items showing conformance with the referenced standards contained in this section. Certificates for wood-framing materials, shall include grade, species and moisture.

Framing Materials
Anchorage and Fastener Materials
Preservative Treated Lumber

1.3 DELIVERY, HANDLING, AND STORAGE

Wood materials shall be securely bundled and shipped with adequate moisture-resistant covers to preclude damage by weather or handling during delivery, when stored, and during construction.

Wood materials that must be stored outdoors before immediate use shall be placed in orderly piles and stored on blocks above ground. Lumber shall be stored in stacks with provision for air circulation within stacks. Material shall be protected from the elements with moisture-resistant covers.

PART 2 PRODUCTS

2.1 WOOD MATERIALS

2.1.1 General Requirements

Each piece of framing lumber, board lumber, and plywood shall bear the trademark and grade identification of the manufacturer's association or the authorized inspection bureau under rules of which the lumber is manufactured and graded.

Softwood lumber shall be seasoned S4S and kiln-dried or air-dried to the specified Moisture Content. Dressed sizes shall conform to NIST PS 20.

Structural framing lumber shall be stress graded, with each piece being rated for strength and stamped to indicate the grade and fiber stress in bending; or it shall be certified with manufacturer's certificate of inspection.

Moisture content shall conform to the rules of the lumber association or the inspection bureau under which the lumber is graded but shall not exceed 15 percent for boards and dimensional lumber 50 millimeter or less in thickness.

2.1.2 Structural Framing Materials

Boards, dimension lumber, and timbers - Douglas Fir-Larch (as defined by UBC) unless otherwise indicated, graded in accordance with NGLA, WCLIB, or WWRA rules.

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

2.1.3 Preservative Treated Lumber

The following wood members shall be pressure-preservative treated in accordance with FS TT-W-571 or AWPB LP 2. Each piece shall bear the AWPB stamp, indicating point of treatment, preservative symbol, symbol of standard, date of treatment, and moisture content after treatment:

Nailers that are set into, or are in contact with, concrete or masonry

Blocking and nailers for roof deck, sub fascia members, roof cants and saddles

Preservative shall be either water-borne, conforming to AWPA P5, or oil-borne conforming, to AWPA P8.

Nailers to receive membrane waterproofing shall be treated with a water-borne preservative to eliminate preservative bleed-through at nails.

Wood treated with oil-borne preservatives shall be clean, free from surface oil, and properly seasoned for use.

Wood treated with water-borne preservatives shall be air-dried or kiln-dried to reduce maximum moisture content to 15 percent.

2.2 ANCHORAGE AND FASTENER MATERIALS

2.2.1 Nails and Staples

Nails, staples, and tacks shall conform to FS FF-N-105.

Nails for roof blocking, cants, and nailers shall be galvanized.

Power-driven staples shall be galvanized Type III, Style 3.

2.2.2 Bolts, Nuts and Screws

Bolts and nuts shall be carbon steel, galvanized, conforming to ASTM F 568M, Class 4, 8 or less.

Wood screws shall be carbon steel, galvanized, conforming to IFI 502.

Lag screws or lag bolts shall be commercial steel, galvanized, conforming to ASME B18.2.3.8M.

Expansion shields, expansion nails, and drive screw devices shall conform to FS FF-S-325.

Toggle bolts shall conform to FS FF-B-588.

Washers shall be carbon steel, galvanized, general assembly purpose type, conforming to ANSI B18.22M.

2.2.3 Bar or Strap Anchors

Bar or strap anchors shall be steel conforming to ASTM A 36/A 36M. Hot-dip galvanized coating shall be in accordance with ASTM A 525M, Z275.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 General

Washers shall be provided under bolt heads or nuts in contact with wood. Lumber shall be bored to receive bolts.

Nailers and blocking shall be furnished in lengths that minimize joints.

3.1.2 Blocking, Cant Strips, and Nailers

Nailing strips, blocking and cant strips shall be continuous, cut with square ends and in maximum practical lengths.

Wood cant strips shall be not less than 100 millimeter long and set at projections through the roof deck, expansion joints, and fascias.

Perimeter roof blocking, nailers, and cants shall be groove-cut to provide ventilation for insulation. Groove cuts shall be matched for continuity or new vent grooves cut when wide vents are built of more than one width of wood.

Bottom half of nailers shall be cut to provide a net open area equivalent to 10 percent of the edge face.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 07 - THERMAL AND MOISTURE PROTECTION

SECTION 07220

ROOF AND DECK INSULATION

PART 1 GENERAL

- 1.1 SUMMARY
- 1.2 REFERENCES
- 1.3 SUBMITTALS
- 1.4 QUALIFICATIONS FOR ROOF AND DECK INSULATION WORK
- 1.5 DELIVERY AND STORAGE OF MATERIALS

PART 2 PRODUCTS

- 2.1 THERMAL INSULATION (OR UNDERLAYMENT) MATERIALS
 - 2.1.1 Insulation Types
 - 2.1.2 Insulation Thickness
 - 2.1.3 Base Sheet
- 2.2 FASTENING MATERIALS
 - 2.2.1 Polyisocyanurate Insulation
- 2.3 BITUMINOUS PLASTIC CEMENT
- 2.4 CANTS

PART 3 EXECUTION

- 3.1 GENERAL REQUIREMENTS
- 3.2 PREPARATION
 - 3.2.1 Protection of Property
 - 3.2.2 Preparation of Surfaces
- 3.3 APPLICATION
 - 3.3.1 General Procedures
 - 3.3.2 Heating Bitumens
 - 3.3.3 Insulation Application
 - 3.3.4 Tapered Roof Insulation and Insulation Crickets
 - 3.3.5 Drain Sumps

-- End of Section Table of Contents --

SECTION 07220

ROOF AND DECK INSULATION

PART 1 GENERAL

1.1 SUMMARY

- a. Rigid thermal insulation shall be hot mopped to concrete roof structure. Installation shall consist of 58 mm of polyisocyanurate insulation as initial layer with 19 mm of expanded perlite protection board as the top layer. Tapered perlite boards then applied where necessary to achieve designated slopes and crickets. See architectural drawings and details for specific locations.

1.2 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 1289	(2001) Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
ASTM C 208	(1995; R 2001) Standard Specification for Cellulosic Fiber Insulating Board
ASTM C 209	(1998) Standard Test Methods for Cellulosic Fiber Insulating Board
ASTM C 726	(2000a) Standard Specification for Mineral Fiber Roof Insulation Board
ASTM C 728	(1997e1) Standard Specification for Perlite Thermal Insulation Board
ASTM D 1227	(1995; R 2000) Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing
ASTM D 2178	(1997a) Standard Specification for Asphalt Glass Felt Used in Roofing and Waterproofing
ASTM D 2822	(1991; R 1997e1) Standard Specification for Asphalt Roof Cement
ASTM D 4586	(2000) Standard Specification for Asphalt Roof Cement, Asbestos Free
ASTM D 312	(2000) Standard Specification for Asphalt Used in Roofing
ASTM D 41	(1994; R 2000e1) Standard Specification for Asphalt Primer Used in Roofing,

Dampproofing, and Waterproofing

ASTM E 96

(2000e1) Standard Test Methods for Water Vapor Transmission of Materials

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS SS-S-200

(Rev E; Am 2) Sealants, Joint, Two-Component, Jet-Blast-Resistant, Cold-Applied, for Portland Cement Concrete Pavement

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:

Thermal Insulation Materials
Vapor Barriers
Fastening Materials
Bituminous Plastic Cement

SD-04 Drawings

Submit complete installation shop drawings, drawn to scale, for the tapered roof insulation system.

SD-06 Instructions

Manufacturer's Instructions for the following items shall indicate fastener and adhesive instructions for each type of installation.

Vapor Barrier
Roof Insulation

SD-09 Reports

Test Reports for water resistance and permanence shall be submitted for Vapor Barriers.

SD-13 Certificates

Certificates of Compliance for the following items shall exactly identify each item by the designation that will appear on the packaging for that item. Certificates shall be submitted for all materials that are identified by a referenced specification.

Expanded-Perlite Roof Insulation
Polyisocyanurate Roof Insulation
Expansion Joint Filler Strips
Compound
Polyvinylchloride Sheet Vapor Barrier

Base Sheet
Asphalt Primer
Steep Asphalt
Bituminous Plastic Cement
Asphalt-Base Emulsion
Perlite Rigid Insulation
Fiberboard Rigid Insulation

SD-14 Samples

Contractor shall submit the following samples:

Three of each type of Fastener.

Three 1 liter containers of Adhesives.

Three pieces, full thickness by 300 millimeter the width of roll of Vapor Barrier and Insulation (or underlayment).

After approval, full-sized samples may be used in the construction, provided each sample is clearly identified and its location recorded.

1.4 QUALIFICATIONS FOR ROOF AND DECK INSULATION WORK

Roof and deck insulation shall be performed by Contractor personnel certified as qualified by the insulation manufacturer to install their products.

1.5 DELIVERY AND STORAGE OF MATERIALS

Materials shall be delivered to the project site in their original, unopened packages or containers bearing labels identifying the manufacturer's name, brand name, material, and other information.

Materials shall be stored in their original, unbroken packages or containers in a weathertight and dry area and protected from damage until needed for use.

PART 2 PRODUCTS

2.1 THERMAL INSULATION (OR UNDERLAYMENT) MATERIALS

2.1.1 Insulation Types

Roof insulation shall be an assembly of the following materials and compatible with attachment methods for the specified insulation and roof membrane:

- a. Polyisocyanurate Board: ASTM C 1289 Type II, Fibrous felt or glass mat membrane both sides, except minimum compressive strength shall be 140 kPa (20 psi). Board shall be 1219 x 2438mm (4x8 feet).
- b. Expanded perlite protection board/insulation, rigid type, shall conform to ASTM C 728 with a maximum thermal conductance value of 2.73 W/square meter degree centigrade. 1.22 meters by 1.22 meters (4x4 feet) maximum board size.

2.1.2 Insulation Thickness

- a. Polyisocyanurate Insulation: $C=0.16$, $R=6.25$ (per inch of material). The minimum thickness of flat stock Polyisocyanurate insulation shall be 58 mm (2-5/16-inch).
- b. Expanded perlite protection board/insulation, rigid type, shall conform to ASTM C 728 with a maximum thermal conductance value of 2.73 W/square meter degree centigrade. 1.22 meters by 1.22 meters (4x4 feet).

2.1.3 Base Sheet

Base sheet shall be asphalt impregnated glass-fiber felt, conforming to ASTM D 2178.

2.2 FASTENING MATERIALS

2.2.1 Polyisocyanurate Insulation

Prior to setting polyisocyanurate insulation over concrete, use primer.

Asphalt primer shall be a low VOC primer and shall conform to ASTM D 41 and the requirements of the Bay Area Air Quality Management District.

2.3 BITUMINOUS PLASTIC CEMENT

Plastic cement shall conform to ASTM D 4586 Type II.

2.4 CANTS

Provide preformed cants, perlite based and fire resistant, 102 mm x 102 mm minimum. Cants shall reduce the angle covered into two equal angles. The face of the cant strip shall have an angle of 45 degrees and vertical height of 102 mm (4 inches). Perlite shall conform to ASTM C 728.

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

Contractor shall verify that work of other trades that penetrates roof decks or that requires men and equipment to traverse a roof deck has been completed.

Contractor shall examine deck surfaces for inadequate anchorage, foreign material, moisture, and unevenness which would prevent the execution and quality of application of underlayment or roof insulation system as specified.

Check roof deck surfaces for defects before work is started. Correct defects and inaccuracies in roof deck surface to eliminate poor drainage, and hollow and low spaces.

Contractor shall not proceed with underlayment or insulation application until defects are corrected.

Insulation shall be installed such that inclement weather will not damage or wet the insulation material.

Starting work designates acceptance of the surfaces by the Contractor.

Underlayment or insulation material shall be cut and fit as necessary to fully insulate small areas and to accommodate piping, scuttles, skylights, vents, and other construction penetrating the insulation material.

3.2 PREPARATION

3.2.1 Protection of Property

Flame-heated equipment shall be located and used so it will not endanger the structure or other materials on the site or adjacent property. Fire extinguishers of an appropriate approved type shall be provided and maintained by the Contractor.

Flame-heated equipment shall not be placed on the roof of any structure.

Before starting work, paving and faces of building walls adjacent to hoist and kettles shall be protected and this protection maintained for duration of work.

3.2.2 Preparation of Surfaces

Surfaces on which thermal insulation materials are to be applied shall be clean, smooth, dry, and free from projections which might puncture the vapor barriers. Condition of surfaces shall be inspected and approved prior to the start of roof insulation work.

3.3 APPLICATION

3.3.1 General Procedures

Underlayment or insulation installation shall be continuous, with all operations proceeding together.

Before cessation of work on each working day or when work is interrupted due to rainfall or other causes, the roof shall be sealed against intrusion of water. Insulation or underlayment shall not be left exposed during rainfall or overnight.

Traffic over partially or completely finished underlayment or insulation shall be only on planks, or on plywood not less than 16 millimeter thick and 600 millimeter wide.

Materials temporarily stored on the roof shall be distributed to stay within the live-load limits of the roof, which is 670 Pascal. Ample bases shall be provided under equipment to distribute the weight to conform to the live-load limits.

3.3.2 Heating Bitumens

Asphalt shall be heated and applied at its respective Equiviscous Temperature (EVT) plus or minus 14 degrees C.

Contractor shall provide thermostatic controls and visible thermometer on the kettle and shall maintain them in working order and keep them calibrated.

Foreman shall carry immersion thermometers accurate within plus or minus

1 degrees C and shall frequently check temperatures. If the temperature of the bitumens in the applicators is below specified amounts, removal and replacement of the effected roofing shall be required.

3.3.3 Insulation Application

Insulation shall be installed in accordance with the manufacturer's requirements and as specified below. Method of holddown used by the manufacturer in areas subject to hurricane velocity winds shall be subject to approval prior to installation.

Minimum total thickness shall be 77 mm. Total nominal thickness shall be installed in 2 or more layer(s), except at crickets which shall be built-up per manufacturer's requirements. No more insulation shall be installed at one time than can be protected from wetting or other damage by installation of roofing membranes on the same day or prior to rain or dew.

Layer to receive the roofing membrane shall be installed with longitudinal joints parallel to the short dimension of the roof. Joints shall be staggered in each layer. First layer and between layers shall be solid-mopped. Membrane shall be laid with edges in moderate contact, but not forced into place. No gap larger than 6 mm (1/4 inch) shall exist. Wherever the spacing exceeds this, fill the openings with insulation materials. Step in each insulation board to assure complete bonding to substrate. Insulation boards with broken corners or that display cupping or warping shall not be used, and shall be replaced at no additional cost to the Government. End joints shall be staggered. Cut insulation to fit neatly to perimeter blocking and around penetrations through roof.

Joints of insulation board shall be taped, if required by manufacturers of insulation and roofing.

Temporary water cutoffs shall be installed at the completion of each day's work and removed upon resumption of work.

Glaze (flood-mop) roof where exposed to weather overnight.

At Concrete Decks, using concrete primer, prime deck and allow to dry. embed 58 mm polyisocyanurate insulation into mopping of hot bitumen in accordance with insulation manufacturer's instructions. Embed layer of 19 mm perlite protective board and tapered perlite insulation in mopping of hot bitumen, staggering joints from first layer.

3.3.4 Tapered Roof Insulation and Insulation Crickets

Install tapered insulation and insulation crickets on the building/roof areas indicated. Install the insulation base layer and subsequent layers following the installation procedures in hot asphalt as specified above. Install insulation boards in strict accordance with approved shop drawing. Tapered insulation and insulation crickets shall provide positive slope to drainage points.

3.3.5 Drain Sumps

Utilize perlite cants and filler pieces to provide 762 mm square drain sumps at roof drain locations. Step taper the surrounding insulating system down to roof locations. Set in hot asphalt. Cut insulation boards true with mitered corners to provide smooth, uniform transitions for roof

membranes and drain flashings.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 07 - THERMAL AND MOISTURE PROTECTION

SECTION 07500

BUILT-UP BITUMINOUS ROOFING

PART 1 GENERAL

- 1.1 SUMMARY
- 1.2 Related Sections
- 1.3 REFERENCES
- 1.4 SUBMITTALS
- 1.5 DELIVERY, STORAGE, AND HANDLING
- 1.6 SAMPLES AND TESTING
- 1.7 QUALIFICATIONS FOR ROOFING WORK
- 1.8 SYSTEM PERFORMANCE
- 1.9 REGULATORY REQUIREMENTS
- 1.10 PRE-INSTALLATION CONFERENCE
- 1.11 ENVIRONMENTAL REQUIREMENTS

PART 2 PRODUCTS

- 2.1 GENERAL
- 2.2 FIBERGLASS FELTS
- 2.3 FIBERGLASS BASE SHEET
- 2.4 ASPHALT
- 2.5 ASPHALT PRIMER
- 2.6 ASPHALT ROOF CEMENT
- 2.7 SURFACING
 - 2.7.1 CAP SHEET
 - 2.7.2 MINERAL GRANULES
- 2.8 BASE FLASHING SHEET
- 2.9 CANTS
- 2.10 SEALANT
- 2.11 PROTECTIVE WALKWAY PADS
- 2.12 ROOF DRAINS AND ACCESSORIES
- 2.13 MODIFIED BITUMEN MEMBRANE FLASHING ADHESIVE
- 2.14 GLASS FABRIC

PART 3 EXECUTION

- 3.1 SYSTEM DESCRIPTION
- 3.2 SUMMARY OF MINIMUM MATERIAL WEIGHTS (PER 10 SQ. METER, 100 SQ. FT.)
 - 3.2.1 Over Concrete Deck
- 3.3 DEMOLITION
- 3.4 EXAMINATION AND VERIFICATION
- 3.5 PREPARATION
- 3.6 PROTECTION
- 3.7 APPLICATION
 - 3.7.1 General
 - 3.7.2 Membrane Application
 - 3.7.3 FLASHING AND ACCESSORIES
 - 3.7.4 Mineral Surfaced Cap Sheet Surfacing
 - 3.7.5 Roof Drains

- 3.8 WALKWAY PADS
- 3.9 FIELD TESTING OF ROOF CUTOUT SAMPLES
 - 3.9.1 Roof Cutout Samples
 - 3.9.2 Testing Procedures
 - 3.9.3 Field Flood Test of Completed Roofing Assembly
- 3.10 CLEANING

-- End of Section Table of Contents --

SECTION 07500

BUILT-UP BITUMINOUS ROOFING

PART 1 GENERAL

1.1 SUMMARY

Work under this section includes the removal of existing roof membrane; installation of built-up roofing with mineral surfaced cap sheet surfacing; installation of base flashing; cleaning of roof drain system; new galvanized sheet metal pipe jacks and lead plumbing vent flashing; replacement of all roof drain and roof drain strainer assemblies, installation of new overflow scuppers; and installation of new galvanized sheet metal.

1.2 Related Sections

01300	Submittals
01400	Quality Control
02050	Alterations, Demolition and Removal
02080	Lead Paint Abatement/Demolition
07600	Flashing and Sheet Metal

1.3 REFERENCES

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

AMERICAN SOCIETY OF TESTING AND MATERIALS (ASTM)

ASTM C 208	(1995, R2001) Standard Specification for Cellulosic Fiber Insulating Board
ASTM C 726	(2000) Standard Specification for Mineral Fiber Roof Insulation
ASTM C 728	(1997e1) Standard Specification for Perlite Thermal Insulation Board
ASTM C 920	(2002) Standard Specification for Elastomeric Joint Sealants
ASTM D 5	(1997) Standard Test Method for Penetration of Bituminous Material
ASTM D 36	(2000) Standard Specification for Softening Point of Bitumen (Ring-and-Bell Apparatus)
ASTM D 41	(1994, R 2000e1) Standard Specification for Asphalt Primer Used in Roofing, Damp-Proofing, and Waterproofing
ASTM D 92	(2002) Standard Test Method for Flash and Fire Points by Cleveland Open Cup
ASTM D 312	(2000) Standard Specification for Asphalt

Used in Roofing

ASTM D 515	(1998) Standard Specification for Asphalt Plank
ASTM D 1668	(1997a) Standard Specification for Glass Fabrics (Woven and Treated) for Roofing and Waterproofing
ASTM D 2178	(1997a) Standard Specification for Asphalt Glass Felt Used in Roofing and Waterproofing
ASTM D 3909	(1997b) Standard Specification for Asphalt Roll Roofing (Glass Felt) Surfaced With Mineral Granules
ASTM D 4586	(2000) Standard Specification for Asphalt Roof Cement, Asbestos Free
ASTM D 4601	(1998) Standard Specification for Asphalt-Coated

1.4 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 for each product proposed. (Include all fastener types.)

SD - 04, Drawings

Installation Drawings, including roof plan and all details of flashings at penetrations, roof edges, insulation, crickets slope transitions, drains, HVAC ducts, conduits, pipes, and items supported on roofing. Submit details of roofing at the roof hatch, equipment cubs/supports, vents and roof drains.

SD - 06, Instructions

Manufacturer's Installation Instructions shall be submitted for the following items:

Roofing
Flashing
Accessories

SD - 08, Statements

List of Applicator's references and documentation of experience per paragraph 1.6 below.

SD - 13, Certificates

Submit four (4) copies of the manufacturer's material and systems

warranty and Contractor's warranty for the entire assembly.

SD - 21, Delivery Dockets

Bill of lading for asphalt materials showing EVT, FP, and FBT.

1.5 DELIVERY, STORAGE, AND HANDLING

All roofing materials shall be on the project site before on-site work is begun.

Materials shall be delivered to the site in the manufacturer's unbroken labeled packages. Felt rolls shall be labeled to indicate grade, weight, and type of saturant. Original packaging shall not be disturbed until materials are to be applied. Liquid materials shall be used directly from the fully labeled cans in which they were shipped by the manufacturer. Only approved roofing materials may be brought to or stored at the site.

Roofing materials shall be stored and protected from contact with soil; also protect against weather and moisture. Felt rolls and roll roofing shall be stacked on end and stored in an area maintained at no lower temperature than 10 degrees C (50 degrees F) for at least 24 hours before laying.

Not more than a 1-day supply of insulation or felts shall be stored on the roof at any time. This 1-day supply shall be stacked on pallets and completely covered with plastic sheet whenever work is interrupted or when there is precipitation of any kind. Plastic sheeting shall be securely fastened to the pallets so as to be completely weather-tight. Materials not so protected shall be permanently removed from the site.

Materials temporarily stored on the roof shall be distributed to stay within the indicated live-load limits of the roof construction. Ample bases shall be provided under equipment to distribute the weight to conform to these live-load limits. Storage locations shall be submitted for approval by the Contracting Officer or his designated representative.

1.6 SAMPLES AND TESTING

Cutout sampling of the membrane will be accomplished when specified. Refer to Paragraph 3.9 of this section.

1.7 QUALIFICATIONS FOR ROOFING WORK

The roofing installer shall be a company which specializes in applying bituminous roofing with minimum five years of documented experience. The roofing installer shall be accepted by the approved material manufacturer, as a certified applicator.

Work in this section shall conform to NRCA Roofing and Waterproofing Manual, the manufacturer's written instructions, and this specification. This specification will take precedence where any requirements between instructions differ.

The applicator shall submit a list with a minimum of ten (10) projects of similar size and type of construction.

1.8 SYSTEM PERFORMANCE

The roofing system shall be in accordance with FM uplift for Class 1, I-90; UL Class A fire resistance tested assembly; Class A Fire Resistance Classification; and Fed Specs HH - I - 526, ASTM C 726.

1.9 REGULATORY REQUIREMENTS

All work shall conform to the 2001 California Building Code for roof assembly and fire hazard requirements.

All work shall conform to applicable jurisdictional requirements and regulations including federal, state, county and the Ames Research Center Permit Board.

All work shall conform to the following regulatory agencies' regulations:

Bay Area Air Quality Management District
OSHA
EPA
Santa Clara County
Ames Research Center

1.10 PRE-INSTALLATION CONFERENCE

There shall be a pre-roofing conference with the Contracting Officer and his designated representative to ensure the following:

A clear understanding of the specifications,

An on-site inspection and acceptance of the roofing substrate and pertinent structural details relating to the roofing system, and coordination of the work of the various trades involved in providing the roofing system and other components secured to the roof.

The conference shall be attended by the Contractor, the roofing foreman, mechanical and electrical foremen (all personnel directly responsible for the installation of the roof and insulation, flashing, sheet metal work, and rooftop equipment) and the roofing materials manufacturer. Conflicts shall be resolved and confirmed in writing.

Provide all manufacturers literature and submittals for review and obtain approval of all submittals a minimum of ten (10) days prior to pre-roofing conference.

1.11 ENVIRONMENTAL REQUIREMENTS

Do not apply permanent roofing repairs during inclement weather.

Do not apply roofing repairs to damp surfaces.

PART 2 PRODUCTS

2.1 GENERAL

Only submitted and approved materials shall be utilized.

No products utilized within this project may contain asbestos.

A single source manufacturer of sheet and bitumen materials or all products in the roofing system approved and guaranteed by a single manufacturer.

2.2 FIBERGLASS FELTS

Fiberglass felts shall conform to ASTM D 2178, Type VI, Table 1 and 2.

2.3 FIBERGLASS BASE SHEET

Fiberglass base sheet shall be 12.7 kilograms asphalt impregnated glass fiber, and conform to ASTM D 4601, Type II, non-perforated, FM approval, UL classified.

2.4 ASPHALT

Asphalt shall conform to ASTM D 312, Type IV.

The following information shall be printed on all asphalt packages or bills of lading delivered to the job site:

The softening point (SP) range determined in accordance with ASTM D 312 and ASTM D 36.

The flash point (FP) determined by ASTM D 92 (Actual for specific run).

The equiviscous temperature (EVT) range.

The finished blowing temperature (FBT)

Minimum penetration at 0C, 199 grams, 60 seconds for asphalt which has been oven-aged at 204C for 5 hours shall be not less than 3 when tested in accordance with ASTM D 5. This shall also be the minimum penetration for any asphalt sample taken from the roof or from a test cut.

2.5 ASPHALT PRIMER

Asphalt primer shall be in accordance with ASTM D 41.

2.6 ASPHALT ROOF CEMENT

Asphalt roof cement for miscellaneous applications as specified shall conform to ASTM D 4586, Type II, specifically formulated for vertical surfaces and built-up bituminous flashings.

2.7 SURFACING

2.7.1 CAP SHEET

Mineral surfaced SBS modified asphalt sheet produced for surfacing applications. Construction shall consist of SBS bitumen surrounding an inner layer of fiberglass mat reinforcement. Sheet shall have the following minimum properties:

Thickness	4 mm
SBS rubber content	12% minimum
Elongation @ -18°C (0°F)	MD 3.5%
	CD 3.5%
Flexibility to -15°C (5°F)	No cracks

Tensile Strength (Machined)	52.2 kilograms
Tensile Strength (Cross Machine)	45.4 kilograms
FM approval rating	Class 1 & I60
Reinforcement	Fiberglass 115 gr/sq.ft.
UL fire rating	A

2.7.2 MINERAL GRANULES

Granules for aggregate surfacing shall be siliceous mineral granules. Granules shall be free of fines and dust. Color of granules shall match that of cap sheet.

2.8 BASE FLASHING SHEET

SBS modified asphalt sheet produced for base flashing applications. Construction shall consist of SBS bitumen surrounding 2 inner layers of fiberglass and polyester mats. Opposed surface to have mineral surface. Ungranulated base flashing sheets shall be surfaced with a white colored mineral surfaced SBS modified asphalt cap sheet. Sheet shall have the following minimum properties:

Thickness	4 mm
SBS rubber content	12% minimum
Elongation @ -18 (C) (0 (F)	MD 3.5% CD 3.5%
Flexibility to -15 (C) (5 (F)	No cracks
Tensile Strength (Machined)	52.2 kilograms
Tensile Strength (Cross Machine)	45.4 kilograms
FM approval rating	Class 1 & I-60
Reinforcement	Dual layers Fiberglass
UL fire rating	A
Mineral Surface Color	White

2.9 CANTS

Cants shall be perlite based and fire resistant, 102 mm x 102 mm minimum, and shall reduce the angle covered into two equal angles. Cants shall conform to ASTM C 728.

2.10 SEALANT

Sealant shall be single component polyurethane sealant conforming to ASTM C 920. Manufacturer shall be Sonneborn "Sonolastic" NP-1, Sikaflex 1a or approved equal.

2.11 PROTECTIVE WALKWAY PADS

Walkway pad shall be 13 mm thick, reinforced 915 mm X 1830 mm panels conforming to ASTM D 517. The walkway pad shall be manufactured by APOC, "Deck Top", or approved equal. If selected manufacturer's walkway pads are a different size, coverage and layout shall still match roof plans.

2.12 ROOF DRAINS AND ACCESSORIES

Remove all existing roof drain bowl and strainer assemblies and provide and install new retrofit type stainless steel roof drain bowl and strainer assemblies. The new retrofit roof drains shall be the proper size to fit tightly into the existing roof drain leader pipes.

New retrofit roof drain bowl and strainer assemblies shall be Thaler Metal Industries Model RD-38SS-RR stainless steel or approved equal. New retrofit roof drain bowl and strainer assemblies shall be installed in accordance with the manufacturer's recommendations.

All connectors shall be provided and installed in accordance with 2001 California Building Code and 2001 California Plumbing Code requirements.

2.13 MODIFIED BITUMEN MEMBRANE FLASHING ADHESIVE

Flashing adhesive for application of SBS modified bitumen flashing sheets shall conform to ASTM D 4586, Type II, modified bitumen flashing adhesive trowel grade, formulated specifically for vertical surfaces and for adhering modified bituminous flashings.

2.14 GLASS FABRIC

All glass fabric installed at top terminations of roofing membrane behind metal flashings shall be ASTM D 1668, Type I, 400 mm width (16 inches), woven fabric asphalt saturated.

PART 3 EXECUTION

3.1 SYSTEM DESCRIPTION

Roofing System: 4 ply fiberglass felt (base sheet plus 3 plies), with Type III "steep" hot asphalt and SBS modified cap sheet surfacing.

3.2 SUMMARY OF MINIMUM MATERIAL WEIGHTS (PER 10 SQ. METER, 100 SQ. FT.)

3.2.1 Over Concrete Deck

Asphalt mopping on concrete to receive insulation	11 kg
Polyisocyanurate insulation	30 kg
Asphalt mopping on insulation board	11 kg
Protective board	45 kg
Asphalt mopping on protective board	11 kg
Asphalt-saturated base roofing felt	5 kg
Asphalt mopping on base roofing felt	11 kg
Asphalt-saturated roofing felt	5 kg
Asphalt mopping on roofing felt	11 kg
Asphalt-saturated roofing felt	5 kg
Asphalt mopping on roofing felt	11 kg
Asphalt-saturated roofing felt	5 kg
Asphalt surface mopping on roofing felt	14 kg
SBS modified mineral surfaced cap sheet	<u>41 kg</u>
Approximate Total Weight	216 kg

3.3 DEMOLITION

Thoroughly remove old roof plies, all existing insulation, flashing materials, old mastic, roof drain bowls, etc. before application of new materials. Thoroughly broom clean all areas prior to installing the new work.

Remove debris from the roof using buckets or debris boxes or containers (use of chutes shall not be permitted to be used under this contract).

Under no circumstances may debris be thrown from roof areas.

All debris must be placed in closed containers and removed from the job site daily.

Remove asbestos and lead in accordance with Sections 02080 and 02090.

3.4 EXAMINATION AND VERIFICATION

All surfaces to which the roofing is to be applied shall be examined to assure that their condition is satisfactory for application of the roofing system. Particular attention shall be paid to the requirements listed herein. All defects that will adversely affect proper application of the roofing system shall be corrected. Do not start work until unsatisfactory conditions are corrected.

The Contractor shall verify that work of other trades that penetrates the roof deck or that requires men and equipment to traverse the roof deck has been completed.

All drains, curbs, cants, roof penetrating components, and equipment supports shall be in place. The drain body must be recessed so that the clamping ring is flush with or below the roof surface. The Contractor shall ensure walls and vertical surfaces to receive base flashing and counter flashing will permit base flashing heights of 200 mm (8 inches) minimum above finished roof surface.

The Contractor shall ensure all joints and openings are sealed to prevent bitumen drippage down into the building or down exterior walls and fascia.

Verify that the substrate (concrete deck and parapet) is free of depressions, waves, or projections, sharp changes in elevations, and properly sloped to the roof drains. Verify that the new insulation is properly bonded/attached to deck (roof Section No. 2), per Section 07220 of these specifications. Bring any unacceptable conditions immediately to the attention of the Contracting Officer.

The Contractor shall also examine deck surfaces and treated wood nailers for inadequate anchorage, foreign material, moisture, and any unevenness that would prevent the execution and quality of application of built-up roofing system as specified.

Starting work designates acceptance of the surfaces by the Contractor.

3.5 PREPARATION

Disconnect roof mounted mechanical equipment, such as fans, air conditioners, and HVAC units and remove curbs or other areas, for the proper installation of the roof system, prior to application of the new membrane. Remove all equipment identified on the drawings. Qualified California State licensed contractors shall disconnect and re-connect the equipment after application of membrane. The Contracting Officer shall be advise of the schedule of such disconnected equipment. The Contractor shall inventory, with the Contracting Officer, affected roof mounted equipment prior to removal and test after re-installation for proper function with the Contracting Officer. The Contractor shall bring to the attention of the Contracting Officer any defective equipment, prior to removal of the equipment. Failure to do so shall indicate all equipment is functioning in a proper manner. Equipment damaged during roof

operations shall be replaced under this contract with no increase in contract price.

After roof surface is completed, new or existing units shall be reset in proper locations, with all mechanical, electrical, and sheet metal connections completed by qualified personnel. Change in height of equipment may be required. All adjustments, and their cost shall be included in bid price.

Priming of Surfaces: Prime all concrete/masonry surfaces to receive roofing materials with the specified primer at a rate of 4 liter per 10 square meter and allow to dry prior to the installation of roofing. Flanges of metal gravel stops, edging strips, lead, flashing collars, and accessories shall be primed and allowed to dry thoroughly prior to stripping into the roofing system.

Heating of asphalt: All kettles and tankers shall have a full-time operator and shall have operable, accurate thermometers, monitored on a continuing basis to maintain the following temperatures for the asphalt. Maximum asphalt temperature shall be within 14 degrees C plus or minus of the Equiviscous temperature. The Contractor shall use sealed tar pots to minimize the likelihood of tar fumes entering adjacent buildings.

If conditions are uncovered or created which would be detrimental to the proper application of specified work, immediately notify the Contracting Officer of these conditions for resolution.

Do not dilute primers, roofing cements, coatings, or sealants. Keep containers closed except when removing materials from them. Do not allow mixing of various bitumen classes through mixing of kettle remains.

Roof collars or other metal flashing or counter flashing shall be removed and new metal collars and flashings shall be installed in their place.

Installer shall notify the Contracting Officer of any discrepancies between plans, specifications, and field conditions.

3.6 PROTECTION

Protect building surfaces against damage from roofing work. Flame-heated equipment shall be located and used so it will not endanger the structure, other materials on the site, landscaping or adjacent property. Provide fire extinguishers of size and type required by local, state, and federal agencies; two at each kettle, tanker, and site of hot asphalt application on the roof.

Before the start of work, the paving and the face of the building walls adjacent to the hoist and kettles shall be protected with polyethylene tarpaulins and this protection shall be maintained for the duration of work.

Flame-heated equipment shall not be placed on the roof of any structure.

Prevent debris and dust from spreading due to windy conditions. Use a crane or hoist to lower debris to the ground (use of chutes shall not be permitted to be used under this contract). Clean up debris on a daily basis. Keep grounds and landscaping clean at all times.

If debris boxes are used, they shall be placed in locations as

designated by the Contracting Officer. Contractor shall be responsible for removal of boxes promptly after loading.

The Contractor shall be responsible for all damage to exterior and interior finishes, equipment, and property during construction due to failure to install proper dust, debris, and moisture protection.

3.7 APPLICATION

3.7.1 General

Comply with current specifications of the manufacturer for workmanship, materials, and handling and/or as detailed herein, whichever is more stringent shall apply.

Roofing installation shall be continuous, with all operations proceeding together. The base sheet and specified plies of felt shall be installed shingle-fashion as a single composite operation. The application of the complete roofing system shall be finished in one operation. Phased construction shall not be permitted.

Before cessation of work on each working day or when work is interrupted due to rainfall or other causes, the roof shall be sealed against intrusion of water. The base sheet shall be brought to the edge of the insulation, dams shall be installed, and exposed felts shall be effectively glazed with a coat of hot bitumen squeegee-applied at a rate of 4 to 5 kilograms per 10 square meter. Insulation or unglazed felts shall not be left exposed during rainfall or overnight.

Roofing shall not be applied when ambient temperature is below 10 degrees C.

Bitumen quantities specified for laminating insulation, for attaching base sheets, for laminating successive plies of felts, or for flood coating shall be regarded as square meter by square meter minimums, not as averages for areas.

Debris shall be removed from the roof at the end of each work day.

Work roofing felts into the asphalt as it is applied. No more pressure is required than that exerted by the weight of the brooming tool. Do not allow felt to touch felt, even at roof edges or over cants. Remove and replace all sheets which are not fully and continuously bonded or which have inadequate mopping along end and side laps. Plies are to extend 50 mm above the top edge of cant strips.

Do not allow wrappers and packaging materials to be included in the roof system.

Storage, walking, wheeling, or trucking will not be permitted directly on new roof surfaces. Smooth, clean board or plank runways and platforms not less than 16 mm thick and 610 mm wide shall be provided near supports as necessary to distribute weight. Equipment for roofing work shall be rubber tired.

Do not use oil or other lubricants which are incompatible with roofing materials on the wheels of roofing equipment. Replace any roofing which contacts any such lubricants.

Care shall be taken to prevent asphalt and/or debris from entering the

roof drains or conductors.

Contractor will assume cost of cleaning drains and conductors.

3.7.2 Membrane Application

Equiviscous Temperature, 174 - 202 degrees C, at Point of Application shall be no more or less than 11 degrees C from bitumen rating indicated on bitumen container label.

Provide bitumen stops at roof edges and at openings to prevent spillage of asphalt. Form bitumen stops with one 305 mm wide strip of plying felt. Strip shall be set in a coating of asphalt roof cement with one half of the width overhanging the edge of the roof or opening. Where nailers are provided, nail the strips with roofing nails spaced 305 mm on center in addition to embedding in asphalt roof cement. Secure with roofing nails spaced 75 mm on center.

Starting at the low point, solid mop base sheet over protective board with 11 kilograms of hot asphalt per 10 square meters of base sheet. Lap each sheet 50 mm minimum over the underlying sheet. Lap ends shall be 76 mm (3 inches) minimum. Base sheets shall be installed free of wrinkles, ridges, bulges, etc. It may be necessary to relax the base sheet prior to application in order to avoid wrinkles and ridges. All plies shall be lightly broomed.

Starting at the low point, apply three (3) plies of felts in a continuous operation in shingle fashion over the base sheet with hot-moppings of bitumen as specified herein. Provide starter sheets of felt to maintain the specified number of plies of felt throughout the roofing. Provide end laps of not less than 130 mm and staggered a minimum of 915 mm. Apply felts at right angles to the roof slope so that the direction of flow of water is over and not against the laps. Extend felts approximately 50 mm above the tops of cant strips and fasten approximately 205 mm on center. Trim felts to a neat fit around vent pipes, and other projections through the roof. All plies must be broomed.

Hot-mopping of Plying Felts: Apply the felts immediately following the application of the hot asphalt. Working ahead with the asphalt shall not be permitted. When the felts come in contact with asphalt, the asphalt shall be completely fluid with mop temperatures within the specified EVT range. After embedding felts in hot asphalt, immediately broom or squeegee felts to eliminate all trapped air and voids. Roofing membrane shall be free of all voids, wrinkles, kinks, and fishmouths. All plies must be broomed.

Asphalt Mopping: Apply nominal 11 kilograms (25 pounds) of asphalt per 10 square meter (100 square feet) of ply - no more or less than 11-14 kilograms per 10 square meter.

Install two plies membrane and bitumen glaze coat for cut-off at end of day's operation. Glaze coat of hot bitumen shall be squeegee-applied at a rate of 4 to 5 kilograms per 10 square meter. Remove cut-off before resuming roofing.

Valley Application: Roofing shall be applied at valleys and waterways in the following manner:

Felt plies shall continue across valleys and terminate 305 mm from the

valley. Exposed laps shall terminate on a line 305 mm from, and parallel to, the waterway/valley. Two plies of felt, 230 and 305 mm wide, and shall be successively applied over each felt line of the termination.

If the application can be completed without wrinkles, buckles, or fishmouths, and if side laps do not face the 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, valleys shall be reinforced with one ply of felt, 915 mm (36 inches) wide, centered on the valley gutter and laid in a solid mopping of asphalt over the top of all ply sheets.

Mechanical Application: When mechanical roofing application equipment is used, planks, plywood, or other approved protection shall be placed over the roof insulation or the roofing. Traffic shall be confined to the protected area. Felt machines shall contain a sufficient quantity of bitumen at the proper temperature to ensure no voids in the bitumen.

3.7.3 FLASHING AND ACCESSORIES

Provide built-up bituminous flashing in the angles formed where the roof deck abuts walls, curbs, pipes, and other vertical surfaces and where necessary to make work weather-tight. Flashing shall be installed after all plies of roofing have been applied.

All other flashing not specifically detailed herein will be applied in accordance with manufacturer's specifications and be approved by the Contracting Officer.

Bituminous base flashing: Base flashing shall consist of materials listed in the products section. All plies shall be smoothed and pressed firmly into place so that a uniformly attached and completely laminated membrane results. Embed no less than one ply of fiberglass felt (reinforcing ply) into a solid mopping of asphalt. If manufacturer requires more than one ply, then their documents shall govern. Over the previously installed ply(s), apply the modified bitumen flashing sheet. All plies are to be installed by first mopping the substrate and then back mopping sheet. Flashing sheets may be installed in maximum of 2438 mm sections. Immediately after installing sheets, broom and rub in each ply so that no voids are present. No voids will be allowed within the base flashings. Remove all areas of base flashing with voids and reinstall so that no voids are present. Plies shall extend not less than 153 mm over the roofing membrane beyond the toe of the cant and not less than 205 mm or more than 305 mm above the roof surface. Ends of felts shall be lapped not less than 153 mm and shall be sealed watertight with bituminous plastic cement. End laps shall be staggered. Top edges of base flashing system shall be nailed to nailers, or other surfaces, with large head roofing nails spaced not more than 153 mm on center such that fasteners are not exposed when counter flashing or metal cap is installed.

Base flashing corners shall be constructed so that they are completely watertight. Bottom ply shall be cut, fingered and laminated with hot asphalt in both directions around corners. Top ply shall be cut, fingered and laminated around the corner in one direction with the succeeding sheet cut flush with the corner.

Vertical base flashing laps, including corners, shall be stripped in with one ply of asphalt saturated fabric mesh set in and coated with modified bitumen flashing cement. Coat fabric mesh, 150mm (6 inches) wide, at vertical laps with the specified coating by brush. Apply two coats at a rate of 3 mm (1 gallon per 100 square feet) per coat.

All unprotected base flashings and areas 3-coarsed shall receive two coats of the specified reflective coating at a rate of 4 liters per 10 square meters (1 gallon per 100 square feet).

Metal Flashing: Prime surface of metal to receive stripping plies. Allow primer to dry before proceeding. Set flanges of sheet metal work to be incorporated into roofing system in a uniform coating of asphalt roof cement not less than 7 mm thick over finished membrane. Nail metal flanges 75 mm on center staggered. Apply two stripping plies over metal flange with hot asphalt. Extend felts 153 and 230 mm, respectively, beyond the edges of the flanges and onto the roofing membrane as detailed.

3.7.4 Mineral Surfaced Cap Sheet Surfacing

Do not start cap sheet application until field inspection and testing has been completed and any directed repairs completed.

Surface of roofing membrane must be free of moisture, foreign material, oil, grease, dirt and other debris before start of surface materials application.

Starting at low point, apply cap sheet over and parallel to the underlying roofing and lap, so that the flow of water is over or parallel to, but never against the laps.

Cut the cap sheet into lengths no longer than 3658 mm in length and stack to relax prior to installation. Apply one layer of mineral cap sheet to cover all the roof membrane. The side laps shall be 102 mm and the end laps a minimum of 153 mm. Apply a solid even coat of asphalt at a rate of 14 kilograms per 10 square meter. Back mop the side and end laps, then flop each sheet in position. Lightly broom into asphalt to provide full adhesion to the membrane beneath. Asphalt temperature at the time the cap sheet is placed shall be as recommended by the manufacturer or a minimum of 17 degrees C above the EVT. Asphalt shall slightly extrude from the laps but excessive asphalt runs or splashes shall be immediately covered using mineral granules. Extend cap sheet to a minimum of 50 mm above the cant strip or top of curbs.

3.7.5 Roof Drains

Buildings N200 and N201: Remove all existing roof drain bowls and strainers. Provide and install new retrofit type roof drain bowls and strainers and connect retrofit roof drain assembly piping to existing roof drain leader piping. The Contractor shall verify the size of the existing roof drain leader pipes in the field and shall match the new retrofit roof drain pipe sizes to match the existing pipes. New retrofit roof drain bowl and strainer assemblies shall be Thaler Metal Industries Model RD-38SS-RR or contracting officer approved equal with stainless steel roof drain bowl, strainer and outlet pipe. The Thaler roof drain assembly shall be provided and installed with the EPDM "super seal" gasket which provides a seal between the roof drain leader pipe and the new roof drain bowl outlet pipe. Installation of the retrofit roof drain bowl and strainer assembly

shall be in accordance with the manufacturer's instructions. The Contractor shall submit product information sheets of the retrofit roof drain bowl and strainer assembly and installation details for review and for contracting officer approval.

All layer of roofing plies shall extend into the outlet base except the cap sheet.

Apply a 762 mm (square piece of 2 kilograms lead flashing set into a solid 7 mm thick bed of asphalt roof cement and centered onto the drain. Whenever drain and overflow are in close proximity, the lead flashing shall extend a minimum of 380 mm out from the center of the drain and overflow in all directions. Remove lead over center of drain. Cover the entire lead flashing, using one layer of ply sheet set in hot asphalt. Extend this layer a minimum of 102 mm beyond the lead flange. Apply a second layer of ply sheet set in hot asphalt to cover the first layer and extend beyond onto the roof membrane a minimum of 102 mm. Install the mineral cap sheet into the drain base. Install the clamping ring and bolt into position while the sheet is still hot. Tighten the bolts to hold all layers onto the outlet base, but not so as to cut any of the layers. If clamp ring is installed to cold roof system, warm roof to make pliable, then tightened clamp ring.

After 72 hours, re-tighten all bolts. Re-tighten all bolts once again in seven days.

Clear drain plumbing from roof top to point where drain plumbing exits building.

3.8 WALKWAY PADS

Install specified walkway pads in locations identified on the roof plan. Walkway pads shall be set in mastic over cap sheet. Where the drawings show walkway pads at valleys, provide a 100 mm minimum gap between walkway pads centered on the line of the roofing valley to accommodate drainage.

3.9 FIELD TESTING OF ROOF CUTOUT SAMPLES

3.9.1 Roof Cutout Samples

After completion of the application of the roofing felts, but prior to the application of the cap sheet, not less than two samples cutouts of the roofing shall be taken from the deck for each 465 square meter sections (50 squares) or less at locations directed by the Government Inspector. Cutout samples shall be visually examined for free water between plies or skips in bitumen application between plies and then weighed to determine the total amount of bitumen used, exclusive of the cap sheet. Samples shall be 300 X 300 mm. Thickness and weight of the sample shall be as specified for the applicable condition.

At the discretion of the field inspector, roof samples 102 X 1016 mm running perpendicular to the direction of roofing felts may be taken to visually examine lap splices and to determine weight.

The sample-cutting device shall be square and of the proper size to cut a sample. The device may be a self-cutting type or a metal template capable of being secured to the roof for use with a sharp roofing knife. Cutting edges of the device or knife shall be kept clean by washing in a proper solvent after each cut.

Weight of the sample shall not be less than the scheduled weight in paragraph 3.2 multiplied by the actual area of the sample.

The complete sampling operation, except weighing, shall be performed without additional cost to the Government. The scales to weigh the samples will be furnished by the Contracting Officer.

The scales for weighing will be portable, graduated, and accurate to 14 grams.

If the test results indicate quantitative or qualitative deficiencies, the following procedure shall be automatically invoked:

Four locations peripheral to the original location of the deficient cut and approximately 3048 mm (10 feet) there from shall be designated. Additional cuts shall be taken at these locations to determine whether the deficiency was strictly a local or whether a larger area was involved. The Contractor shall be responsible for the costs of this testing. The Contractor shall repair the roof as specified at no additional cost to the Government.

Free water between plies or the absence of bitumen between plies shall be cause for removal of the affected portions of the roof and their replacement in dry condition. Where only bitumen deficiencies are found, the deficient areas shall have an additional ply of felt applied in a full mopping of bitumen. Correction of the above deficiencies shall be made at no additional cost to the Government.

Immediately after being weighed, the sample shall be replaced and tapped into position in the cutout area, which meanwhile has been flooded with hot bitumen; the area shall then be covered with three (3) plies of felt hot mopped in place, with the first ply overlapping the cutout area 75 mm on all sides and each succeeding ply overlapping the preceding ply 75 mm on all sides.

Whenever sample is removed for laboratory testing or otherwise not available to reset into sampled area, apply equal number of ply sheets and asphalt (or roof cement) into the roof area.

Proceed to repair as outlined above.

3.9.2 Testing Procedures

The 300 X 300 mm remaining sample(s) will be quantitatively tested to determine compliance with the quantitative requirements of these specifications. Qualitative tests of any of the components may also be made.

If test results show compliance with the requirements of these specifications, the Government will pay for the testing. If the test results indicate quantitative or qualitative deficiencies, the following procedure shall be automatically invoked:

The Contractor shall pay for the test that revealed the deficiency. Four locations peripheral to the original location of the deficient cut and approximately 3048 mm there from shall be designated. Additional cuts shall be taken at these locations to determine whether the deficiency was strictly a local or whether a larger area was

involved. The Contractor shall be responsible for the costs of this testing. The Contractor shall repair the roof as specified at no additional cost to the Government.

After an area of deficiency has been identified, an application of additional finish sheet and flashing, an application flood, or both, will be required, depending upon the nature and magnitude of the deficiencies.

3.9.3 Field Flood Test of Completed Roofing Assembly

After each major area, as defined in Section 01000 is completed and cured, a flood test of that area shall be performed and observed by the Contracting Officer. Each test shall include flooding of each area with one inch of water for 24 hours. Test shall only be done after membrane and related water proofing have cured for 24 hours. Test shall be sequenced so that the beginning of the 24 hours test occur between 8:00 a.m. and 10:00 a.m. Any leaks occurring shall be promptly fixed, at no additional cost to the Government, and the area re-tested using the same procedure.

3.10 CLEANING

Remove bituminous markings from finished surfaces.

In areas where finished surfaces are soiled by asphalt or any other source of soiling caused by work of this section, consult manufacturer of surfaces for cleaning advice and conform to their documented instructions.

Repair or replace defaced or disfigured finishes caused by work of this section.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 07 - THERMAL AND MOISTURE PROTECTION

SECTION 07600

FLASHING AND SHEETMETAL

PART 1 GENERAL

- 1.1 SUMMARY
- 1.2 REFERENCES
- 1.3 SUBMITTALS
- 1.4 GENERAL REQUIREMENTS

PART 2 PRODUCTS

- 2.1 SHEETMETAL MATERIALS
 - 2.1.1 Lead
 - 2.1.2 Galvanized Steel
 - 2.1.3 Corrosion-Resistant Steel
 - 2.1.4 Minimum Dimensions and Thicknesses
- 2.2 CEMENTS AND SEALING COMPOUNDS
 - 2.2.1 Bituminous Plastic Cement
 - 2.2.2 Sealing Compound
- 2.3 SOLDER MATERIALS
- 2.4 FASTENERS
- 2.5 MISCELLANEOUS COMPONENTS

PART 3 EXECUTION

- 3.1 GENERAL
 - 3.1.1 Fastening Methods
 - 3.1.2 Seams
 - 3.1.3 Provisions for Expansion and Contraction
 - 3.1.4 Dissimilar Metals
- 3.2 FLASHING
 - 3.2.1 Reglets and Flashing Receivers
 - 3.2.2 Base Flashing
 - 3.2.3 Cap and Counter Flashing
 - 3.2.4 Edge Strips
 - 3.2.5 Flashing at Roof Penetrations and Equipment Supports
- 3.3 EDGE FLASHING
- 3.4 CLEANING

-- End of Section Table of Contents --

SECTION 07600

FLASHING AND SHEETMETAL

PART 1 GENERAL

1.1 SUMMARY

- a. Galvanized Sheet Metal
 - 1. Edge flashing
 - 2. Roof flashing at penetrations
 - 3. Counter flashing
 - 4. Mechanical curb flashing
 - 5. Duct penetration flashing

- b. Stainless Steel

1.2 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- | | |
|-------------------|--|
| ASTM A 167 | (1992) Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip |
| ASTM A 526/A 526M | (1990) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Commercial Quality |
| ASTM B 32 | (1989) Specification for Solder Metal |
| ASTM B 749 | (1991) Standard Specification for Lead and Lead Alloy Strip, Sheet and Plate Products |
| ASTM C 920 | (1987) Standard Specification for Elastomeric Joint Sealants |
| ASTM D 4586 | (1993) Standard Specification for Asphalt Roof Cement, Asbestos Free |

AMERICAN WELDING SOCIETY (AWS)

- | | |
|----------|--|
| AWS D1.1 | (1992) Structural Welding Code - Steel |
|----------|--|

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

- | | |
|------------|---|
| SMACNA-02 | (1987; 4th Ed) Architectural Sheet Metal Manual |
| SMACNA-02A | (1980; 5th Ed) Architectural Sheet Metal |

Specifications

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

Fabrication Drawings for the following items shall include material, description, and thickness.

Flashing
Sheet Metal
Accessories

SD-04 Drawings

Installation Drawings shall indicate location, dimensions, configuration, construction details, type of seams and fastening method for the following items:

Flashing
Sheet Metal
Accessories
Overflow Scuppers

SD-13 Certificates

Certificates of Compliance for the following items shall be submitted showing conformance with referenced standards contained in this section.

Stainless Steel Sheetmetal
Aluminum Sheetmetal
Lead Sheetmetal
Galvanized Steel Sheetmetal
Copper Sheetmetal
Fasteners
Solder Materials
Cements
Sealing Compounds

1.4 GENERAL REQUIREMENTS

PART 2 PRODUCTS

2.1 SHEETMETAL MATERIALS

2.1.1 Lead

Lead flashing and lead washers shall conform to ASTM B 749, weighing 20 kilogram per square meter.

2.1.2 Galvanized Steel

Galvanized steel sheet shall conform to ASTM A 526/A 526M, regular

coating, designation Z90.

2.1.3 Corrosion-Resistant Steel

Corrosion-resistant steel shall be chromium-nickle steel conforming to ASTM A 167, Type 301, 302, 204, or 316, No. 2D finish, annealed temper as required for the end use.

2.1.4 Minimum Dimensions and Thicknesses

Materials shall be in accordance with SMACNA-02A and shall be not less than the following minimum thicknesses and weights.

<u>ITEM</u>	<u>CORROSION RESISTANT STEEL THICKNESS MILLIMETER</u>	<u>GALVANIZED STEEL THICKNESS MILLIMETER</u>	<u>LEAD, KG PER SQUARE METRE</u>
Building expansion joints, cap	----	0.70	---
Bellows or flanges, U-type	----	0.70	---
Scupper linings	3.0	---	---
Flashings			
Base	0.48	0.85	14.6
Cap, roof penetration cap flashing, equipment and structural supports, pitch pans	0.48	0.70	12.2
Through-wall, above roof line, including coping and parapet	----	0.70	12.2
Cleats, 50 by 75 millimeter	0.55	0.70	---
Edge strips, 32 millimeter wide	0.70	1.0	---
Reglets	----	0.70	---
Cap flashing receivers	0.48	0.55	---

2.2 CEMENTS AND SEALING COMPOUNDS

2.2.1 Bituminous Plastic Cement

Bituminous plastic cement shall be an asphaltic-base material conforming to ASTM D 4586, compatible with the roofing asphalts and asphalt primer.

2.2.2 Sealing Compound

Sealing compound shall be gun grade, one -component, nonsag, elastomeric, conforming to ASTM C 920. Base material shall be polysulfide, resistant to 50-percent joint movement.

Aluminum-seam sealant shall be as recommended by the aluminum manufacturer.

2.3 SOLDER MATERIALS

Solder and flux shall meet the requirements of ASTM B 32. Solder shall be SN50.

2.4 FASTENERS

All fasteners shall be stainless steel.

2.5 MISCELLANEOUS COMPONENTS

Metal scupper linings conforming to details included in construction Drawings shall be provided through wall and roof openings. Linings shall be projected beyond walls at overflow openings. Surfaces to receive linings shall be coated with bituminous cement.

PART 3 EXECUTION

3.1 GENERAL

Sheetmetal work shall conform to drawing details and to the applicable plate number and design and installation recommendations of SMACNA-02A. Finished sheetmetal installation shall be free from water leakage.

Surfaces to receive sheetmetal work shall be clean, smooth, dry, and free from defects and projections which might affect the work. Surfaces shall be plumb and true to a tolerance of not more than 13 millimeter in 12.2 meter, with no dips, waves, or uneven surfaces exceeding 3.2 millimeter in 3050 millimeter in any direction. Lines, arises, and angles shall be sharp and uniform. Exposed edges of sheetmetal shall be folded back to form a 13 millimeter wide hem on the concealed side.

3.1.1 Fastening Methods

Fasteners shall be concealed. Only one edge shall be nailed to permit freedom of expansion perpendicular to the line of nailing. Nails shall be spaced at not more than 75 millimeter on center. Nails shall penetrate backing by not less than 25 millimeter.

Cleats shall be used for securing edges of sheetmetal members over 300 millimeter wide and at other designated locations. Cleats shall be fastened with two nails and the end folded over the nails. Other end of the cleat shall be locked into the seam or the folded edge of member being fastened. Cleats shall be spaced at not more than 300 millimeter on

center.

Screws shall be fitted with neoprene washers to protect surface of metal sheet and provide a watertight connection.

3.1.2 Seams

Seams and lock joint construction shall conform to SMACNA-02, SMACNA-02A Plates 99 and 100.

Seams shall be straight and uniform in height, width, and finish as follows:

Flat-lock seams shall be not less than 19 millimeter wide.

Lap seams, when soldered, shall finish not less than 25 millimeter wide.

Lap seams, not soldered, shall overlap not less than 75 millimeter.

Joints, seams, and connections of aluminum shall be welded except where a screw or riveted and hard-setting sealant connection is indicated.

Loose-lock expansion seams shall be not less than 75 millimeter wide and shall provide for not less than a 25 millimeter movement within the joint. Joint shall be completely filled with the specified sealant applied at not less than 3.2 millimeter bed thickness.

Flat seams shall be made in the direction of flow. Seams not soldered shall be completely filled with plastic cement.

Surfaces to be joined by soldering shall be cleaned, pretinned, heated, fluxed, and sweat-soldered through the full contact area in accordance with the best standards of practice in modern sheet metal shops. Flux residue and foreign matter shall be removed after soldering. Soldered surfaces shall be rinsed with water and wiped clean.

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 D1.1.

3.1.3 Provisions for Expansion and Contraction

Expansion-joint configuration shall conform to the drawing details and to SMACNA-02A.

3.1.4 Dissimilar Metals

Dissimilar metals shall be isolated from each other by painting with bituminous paint.

3.2 FLASHING

3.2.1 Reglets and Flashing Receivers

Reglets and flashing receivers shall conform to details included in Construction Drawings.

3.2.2 Base Flashing

Metal base flashings shall conform to details included in the Construction drawings. Metal base flashing shall be installed where the roof abuts vertical surfaces, in valleys, at ridges, and where the roof slope changes.

Flashing shall extend not less than 200 millimeter up vertical surfaces.

3.2.3 Cap and Counter Flashing

Metal cap or counter flashing shall be installed 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 shall conform to details in Construction Drawings.

Flashing shall be formed in 3050 millimeter lengths, except where shorter pieces are required; end joints shall be lapped not less than 75 millimeter. Joints shall not be soldered.

3.2.4 Edge Strips

Edge trim strips shall have a formed drip edge.

3.2.5 Flashing at Roof Penetrations and Equipment Supports

Metal flashing conforming to SMACNA-02A, and details in Construction Drawings shall be installed where piping, conduit, or equipment supports penetrate roof surfaces.

Single-pipe vents shall be flashed with lead flashing or a two-piece formed-metal housing of the specified sheetmetal, installed as indicated in SMACNA-02A.

3.3 EDGE FLASHING

Edge flashing fascias shall be installed at edges of roofs. Configuration shall conform to SMACNA-02A and details in Construction Drawings.

3.4 CLEANING

Exposed sheetmetal work shall be cleaned of all surface contaminants and imperfections at completion of installation.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 09 - FINISHES

SECTION 09920

ARCHITECTURAL PAINTING

03/03

PART 1 GENERAL

- 1.1 SUBMITTALS
- 1.2 CONTRACTOR PERSONNEL QUALIFICATION
- 1.3 DELIVERY, HANDLING, AND STORAGE

PART 2 PRODUCTS

- 2.1 MANUFACTURER'S AND MATERIALS
 - 2.1.1 Coatings

PART 3 EXECUTION

- 3.1 GENERAL
- 3.2 PROTECTION OF FACILITIES
- 3.3 SURFACE PREPARATION
 - 3.3.1 General Requirements
 - 3.3.2 Ferrous Metal
 - 3.3.3 Galvanized Steel
 - 3.3.4 Aluminum
 - 3.3.5 Concrete
- 3.4 MIXING AND APPLICATION
 - 3.4.1 General Procedures
 - 3.4.2 Procedures
- 3.5 ACCEPTANCE PROVISIONS
 - 3.5.1 Inspection
 - 3.5.2 Correction
- 3.6 PROTECTION
- 3.7 PAINT SCHEDULE

-- End of Section Table of Contents --

SECTION 09920

ARCHITECTURAL PAINTING

03/03

PART 1 GENERAL

1.1 SUBMITTALS

The following shall be submitted in accordance with Section 01300, "Submittal Procedures," in sufficient detail to show full compliance with the specification:

SD-01 Product Data

Manufacturer's catalog data shall be submitted for the following items. Data shall include detailed analysis of each coating material required, with constituents measured as percentages of the total weight of coating.

Inhibitive Metal Primer
Pigmented Sealer
Alkali Resistant Primer
Enamel Undercoat
Acrylic Latex

SD-06 Manufacturer's Instructions

Manufacturer's instructions shall be submitted for architectural coatings including details of thinning, mixing, handling, and application, in accordance with paragraph entitled, "General," of this section.

SD-13 Certificates

A Safety Plan shall be submitted in accordance with paragraph entitled, "General," of this section.

SD-14 Samples

Manufacturer's Standard Color Charts shall be submitted in accordance with paragraph entitled, "Manufacturer's and Materials," of this section.

1.2 CONTRACTOR PERSONNEL QUALIFICATION

Personnel assigned to the work shall be certified by the Contractor to have had adequate previous experience in the successful application of paints and coatings similar to those specified.

1.3 DELIVERY, HANDLING, AND STORAGE

Materials shall be delivered in their original, unbroken containers bearing the manufacturer's name and product identification. Containers breached by rough handling shall be removed from the site, together with their contents.

Paint materials, thinners, and cleaners shall be stored in tightly closed containers in a covered, well-ventilated area where they will not be exposed to excessive heat, sparks, flame, or direct sunlight. Water-based materials shall be protected against freezing.

PART 2 PRODUCTS

2.1 MANUFACTURER'S AND MATERIALS

Manufacturer's Standard Color Charts shall be submitted showing manufacturer's recommended finish colors. Three color chips of each color and gloss scheduled shall also be submitted.

The following products are those of Kelly-Moore Paint Company (www.kellymoore.com). Other paint manufacturers' products of equal quality will be considered when submitted and approved by the Contracting Officer.

2.1.1 Coatings

Elastomeric coating on concrete parapets - #1128 Kel-Seal Acrylic Terpolymer Coating

Primer on ductwork and galvanized metal - #1722 Kel-Guard Galvanized Iron Primer

Primer on factory painted metal components - #1711 Kel-Guard White Rust Inhibitive Primer

Paint coating on factory painted metal components, ductwork and galvanized metal - #1245 Acry-Velvet Acrylic Low Sheen Finish.

Sealing surface cracks in the existing concrete parapet and in existing concrete roof deck that are larger than .8mm, #1108 Kel-Seal Elastomeric Sealant

PART 3 EXECUTION

3.1 GENERAL

A Safety Plan shall be submitted for architectural coating systems in accordance with OSHA regulations.

Manufacturer's recommendations for surface preparation, thinning, mixing, handling, and application shall be considered a part of this specification.

3.2 PROTECTION OF FACILITIES

Contractor shall remove and reinstall or provide acceptable protection for hardware, accessories, lighting and electrical components, factory-finished materials, plumbing fixtures and fittings, and any other materials that may become splattered or damaged by the painting work.

3.3 SURFACE PREPARATION

3.3.1 General Requirements

Surfaces shall be clean, dry, and free from contaminants and foreign matter. Mildew and chalking shall be removed and the surface thoroughly

sterilized. Chipped, peeling, or blistered paint shall be removed and the surface spot primed. Hard glossy surfaces shall be dulled and roughened to ensure proper adhesion.

3.3.2 Ferrous Metal

Surfaces shall be free from dirt, oil, grease, wax, and other contaminants. Heavy rust and loose mill scale shall be removed by hand, power tool, or blast cleaning.

3.3.3 Galvanized Steel

Surfaces shall be cleaned of all contaminants using a solvent such as lacquer thinner or xylol.

After cleaning, the surface shall be etched with a phosphoric acid pre-treatment solution.

3.3.4 Aluminum

Surfaces shall be clean, dry, and free from oil and grease. Minor oxide film and corrosion shall be removed by hand or power tool cleaning.

3.3.5 Concrete

Surfaces shall be free from dirt, oil, grease, wax, form-release compounds, laitance, and other contaminants. Large cracks, voids, and other major surface imperfections shall be filled with mortar.

3.4 MIXING AND APPLICATION

3.4.1 General Procedures

No exterior painting shall be allowed in rainy weather or when rain is imminent. No paints or coatings shall be applied when the temperature or humidity is outside the limits recommended by the manufacturer.

Paints and coatings shall be applied by brush, roller, or airless spray.

Each coat of material applied shall be free from runs, sags, bubbles, foreign contaminants, variations in color, gloss, and texture, dry overspray, brush and roller marks, holidays (missed areas), or other evidence of poor application.

Paints and coatings shall be thoroughly worked into corners and crevices.

Newly painted surfaces shall be adequately protected from damage.

3.4.2 Procedures

There shall be at least 2 coats of paint applied in accordance with the manufacturer's instructions.

Coatings shall be applied as follows:

Material shall be thoroughly stirred to produce a uniform mixture.

Material shall be thinned for workability and improved spray characteristics, but only according to the manufacturer's instructions.

Each coat shall be applied uniformly at the minimum wet-film thickness specified by the manufacturer.

Special attention shall be given when coating sharp edges, corners, and crevices to ensure complete coverage.

Finish coats shall show good hiding characteristics and uniform appearance.

3.5 ACCEPTANCE PROVISIONS

3.5.1 Inspection

Contractor shall provide qualified personnel for inspection of his work to ensure that the requirements of this section have been fulfilled.

3.5.2 Correction

Spot-painting to correct damaged surfaces will be allowed only when touchup area blends into the surrounding finish. Otherwise, the entire area shall be recoated. Touchup shall be accomplished using the same method of application as was used to apply the original material.

3.6 PROTECTION

"WET PAINT" signs shall be posted to indicate newly painted surfaces.

3.7 PAINT SCHEDULE

Concrete parapets - Elastomeric coating shall be applied to all concrete parapets; The elastomeric coating shall consist of a primer coat of #1128 Kel-Seal Acrylic Terpolymer Coating and as a finish coat a second coat of #1128 Kel-Seal Acrylic Terpolymer.

The Centra Formawall dimension series factory insulated flat steel screen panels indicated on drawing sheets A1, A3 and A4, shall receive a factory applied Duragard Plus System consisting of one coat 0.8 mil Primer coat on both sides, one coat of 0.8 mil Polyvinylidene Fluoride Coat, and one coat of 0.8 mil Polyvinylidene clear coat, color and texture shall match the existing concrete walls, low sheen. Contractor shall provide a submittal of one 300 mm x 300 mm painted panel sample for Government approval.

All Ductwork and all galvanized metal surfaces (other than the steel screen panels and conduit) shall be painted with a primer coat of #1722 Kel-Guard Galvanized iron Primer, and two coats of #1245 Acry-Velvet Acrylic Low Sheen Finish paint.

Factory painted metal components and shop primed metal items (other than the steel screen panels) shall be field painted with one coat of primer #1711 Kel-Guard White Rust Inhibitive Primer and one coat of #1245 Acry-Velvet Acrylic Low Sheen Finish paint.

All metal surfaces other than galvanized or factory painted items shall receive one coat of primer #1711 Kel-Guard White Rust Inhibitive Primer and two coats of #1245 Acry-Velvet Acrylic Low Sheen Finish paint.

All new metal items on the roof except the aluminum pipe insulation jacketing, copper pipe, and galvanized conduit shall be painted as

specified above. Items to be painted include all sheet metal, structural steel, piping, miscellaneous steel, pump pad, pumps, air handling units, chiller, fans, motors, tanks, equipment, panels, pull boxes, enclosures, roof screen supports, conduit supports, pipe supports, duct supports, equipment supports, conduit fittings for fire alarm and FMCS conduit.

-- End of Section --



SECTION TABLE OF CONTENTS

DIVISION 15 - MECHANICAL

SECTION 15003

GENERAL MECHANICAL PROVISIONS

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS (Not Applicable)
- 1.3 COORDINATION
- 1.4 MECHANICAL SYSTEMS IDENTIFICATION
 - 1.4.1 Identification Tags
 - 1.4.2 Service Labeling
- 1.5 COLOR CODING
- 1.6 APPROVAL REQUIREMENTS
- 1.7 PREVENTION OF CORROSION
- 1.8 OZONE DEPLETING SUBSTANCES USED AS REFRIGERANTS
- 1.9 USE OF OZONE DEPLETING SUBSTANCES, OTHER THAN REFRIGERANTS

PART 2 PRODUCTS

- 2.1 IDENTIFICATION PLATES
- 2.2 ANCHOR BOLTS
- 2.3 SEISMIC ANCHORAGE
- 2.4 PAINTING

PART 3 EXECUTION

- 3.1 INSTALLATION
- 3.2 EQUIPMENT PADS
- 3.3 EQUIPMENT LEVELING
- 3.4 CUTTING AND PATCHING
- 3.5 CLEANING
- 3.6 FIELD TESTING AND TEST EQUIPMENT

-- End of Section Table of Contents --

SECTION 15003

GENERAL MECHANICAL PROVISIONS

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A13.1 (1981; R 1993) Scheme for the Identification of Piping Systems

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 123 (1989; Rev A) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM B 766 (1986; R 1993) Standard Specification for Electrodeposited Coatings of Cadmium

CODE OF FEDERAL REGULATIONS (CFR)

40 CFR (1994) Protection of Stratospheric Ozone

MILITARY STANDARDS (MIL-STD)

MIL-STD 101 (Rev B) Color Code For Pipelines and For Compressed Gas Cylinders

SHEET METAL AND AIR CONDITIONING CONTRACTORS NATIONAL ASSOCIATION (SMACNA)

SMACNA-08 (1991, 1st Ed.) Seismic Restraint Manual Guidelines for Mechanical Systems (Available only from 401 Shatto Place, No. 101, Los Angeles, CA 90020) Sheet Metal Industry Fund (SMIF)

UNDERWRITERS LABORATORIES (UL)

UL 6 (1993; 10th Ed) UL Standard for Safety - Rigid Metal Conduit

UL-02 (1995) Building Materials Directory

1.2 SUBMITTALS (Not Applicable)

Submittals shall be in accordance with Section 01300.

1.3 COORDINATION

Contractor shall coordinate the work of the different trades so that

interference between piping, equipment, structural, and electrical work will be avoided. All necessary offsets in piping and all fittings, etc., required to install the work properly shall be furnished complete in place at no additional cost to the Government.

1.4 MECHANICAL SYSTEMS IDENTIFICATION

1.4.1 Identification Tags

Identification tags made of brass or aluminum indicating function of a control or similar component shall be installed on such system devices. Tags shall be 50 millimeter in diameter and marking shall be stamped.

Equipment shall be provided with metal identification tags displaying an equipment designation number matching drawing or control diagram designation.

Tags shall be wired to valve or equipment items with No. 12 AWG 2 millimeter diameter corrosion-resistant steel wire.

1.4.2 Service Labeling

All piping, including that concealed in accessible spaces; exposed, bare and painted; and insulated, shall be labeled to designate service. Each label shall include an arrow or arrows to indicate flow direction. Labels and valve tag schedule shall be in accordance with the typical examples below:

<u>SERVICE</u>	<u>LABEL AND TAG DESIGNATION</u>
Cold potable water	COLD POT. WATER
Chilled water-supply	CHILLED WATER-SUPPLY
Chilled water-return	CHILLED WATER-RETURN
Control and instrument air	CONTROL AND INSTR.
Condensate drain	COND. DRAIN

Similar services with different temperatures or pressures shall be identified. Where pressures may exceed 860 kilopascal, the maximum system pressure shall be included in the label.

Piping shall be labeled and arrowed in accordance with the following:

Each point of entry and exit of pipe passing through walls

Each change in direction, i.e., elbows, tees

In congested or hidden areas and at all access panels at each point required to clarify service or indicated hazard.

In long straight runs, labels shall be located at distances within eyesight of each other but in no case shall the distance between labels exceed 20 meter. All labels shall be visible and legible from the primary service and operating area.

Labels shall be made of self-sticking, plastic film designed for permanent installation.

1.5 COLOR CODING

Color coding of all piping systems shall be in accordance with ANSI A13.1.

1.6 APPROVAL REQUIREMENTS

Except as otherwise specified, approval of materials and equipment will be based on manufacturer's published data.

Where materials and equipment are specified to conform to the standards of the Underwriters Laboratories, the label of or listing with reexamination in UL-02, and UL 6 will be acceptable as sufficient evidence that the items conform to Underwriters Laboratories requirements. In lieu 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 the items have been tested and that the units conform to the specified requirements. Methods of testing used by the specified agencies shall be outlined.

Where materials or equipment are specified to be constructed or tested, or both, in accordance with the standards of the American Society for Testing and Materials (ASTM), the American Society of Mechanical Engineers (ASME), or other standards, a manufacturer's certificate of compliance of each item will be acceptable as proof of compliance.

Conformance to such agency requirements does not relieve the item from compliance with other requirements of these specifications.

1.7 PREVENTION OF CORROSION

Metallic materials shall be protected against corrosion. Equipment enclosures shall be given rust-inhibiting treatment and standard finish by the manufacturer. Aluminum shall not be used in contact with earth, and where connected to dissimilar metal, shall be protected 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 corrosion-resistant steel or nonferrous materials shall be hot-dip galvanized in accordance with ASTM A 123 for exterior locations and cadmium-plated in conformance with ASTM B 766 for interior locations.

1.8 OZONE DEPLETING SUBSTANCES USED AS REFRIGERANTS

Releases of Ozone Depleting Substances (ODS) during repair, maintenance, servicing or disposal of appliances containing ODS's will be minimized by complying with all applicable sections of 40 CFR Part 82 Subpart F. Any person conducting repair, maintenance, servicing or disposal of appliances owned by NASA comply with the following:

No Class I or Class II substances used as a refrigerant may be knowingly vented or otherwise released into the environment.

No appliances may be opened without meeting the requirements of 40 CFR Part 82.156 Subpart F, regarding required practices regarding evacuation and collection of refrigerant, and 40 CFR Part 82.158 Subpart F, regarding standards of recycling and recovery equipment.

No work may be conducted on appliances containing refrigerant except by persons who comply with 40 CFR Part 82.161 Subpart F, regarding technician certification.

In addition, copies of all applicable certifications must be provided to the Contracting Officer at least 10 working days prior to initiating maintenance, repair, servicing, dismantling or disposal of appliances, including:

Proof of Technician Certification

Proof of Equipment Certification, if recovery or recycling equipment is to be provided by the Contractor

Proof of availability of certified recovery or recycling equipment, if equipment is to be provided by the Contractor

1.9 USE OF OZONE DEPLETING SUBSTANCES, OTHER THAN REFRIGERANTS

The use of Class I or Class II ODS's listed as nonessential in 40 CFR Part 82.66 Subpart C is prohibited. These prohibited materials and uses include:

Any plastic party spray streamer or noise horn which is propelled by a chlorofluorocarbon

Any cleaning fluid for electronic and photographic equipment which contains a chlorofluorocarbon, including liquid packaging, solvent wipes, solvent sprays, and gas sprays

Any plastic flexible or packaging foam product which is manufactured with or contains a chlorofluorocarbon, including, open cell foam, open cell rigid polyurethane poured foam, closed cell extruded polystyrene sheet foam, closed cell polyethylene foam and closed cell polypropylene foam except for flexible or packaging foam used in coaxial

Any aerosol product or other pressurized dispenser which contains a chlorofluorocarbon, except for those listed in 40 CFR Part 82.66 Subpart C.

A waiver may be requested should a programmatic or facility requirement dictate that a prohibited material is necessary to achieve project goals. A waiver request must be submitted in writing to the Test Operations and Institutional Safety Branch. The waiver will be evaluated and dispositioned by a Hazardous Materials Review subcommittee.

PART 2 PRODUCTS

2.1 IDENTIFICATION PLATES

In addition to standard manufacturer's identification plates, engraved laminated phenolic identification plates shall be provided for each piece of mechanical equipment. Identification plates shall designate the function of the equipment. Designation shall be submitted with the shop drawings.

Identification plates shall be three layers, black-white-black, engraved to show white letters on black background. Letters shall be upper case. Identification plates 40 millimeter high and smaller shall be 1.6

millimeter thick, with engraved lettering 3 millimeter high; identification plates larger than 40 millimeter high shall be 3 millimeter thick, with engraved lettering of suitable height. Identification plates 40 millimeter high and larger shall have beveled edges. Identification plates shall be installed using a compatible adhesive.

2.2 ANCHOR BOLTS

Anchor bolts shall be provided for equipment placed on concrete equipment pads or on concrete slabs. Bolts shall be of the size and number recommended by the equipment manufacturer and shall be located by means of suitable templates. Installation of anchor bolts shall not degrade the surrounding concrete.

2.3 SEISMIC ANCHORAGE

Equipment shall be anchored in accordance with applicable seismic criteria for the area and as defined in SMACNA-08.

2.4 PAINTING

Equipment units shall be painted in accordance with MS MIL-T-704 or in accordance with approved equipment manufacturer's standards unless specified otherwise.

PART 3 EXECUTION

3.1 INSTALLATION

Materials and equipment shall be installed in accordance with the requirements of the contract drawings and approved recommendations of the manufacturers. Installation shall be accomplished by workers skilled in this type of work. Installation shall be made so that there is no degradation of the designed fire ratings of walls, partitions, ceilings, and floors. 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 3 feet. The area in front of all access doors to electrical circuits shall be clear the minimum distance to energized circuits as specified in OSHA Standard, part 1910.333 (Electrical-Safety Related work practices) and an additional 3 feet. 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 and safely viewed by people in the area.

3.2 EQUIPMENT PADS

Equipment pads shall be provided and shall be of the material and dimensions shown or, if not shown, they shall conform to the shape of each piece of equipment served with a minimum 100 millimeter margin around the equipment and supports. Equipment bases and foundations, when constructed of concrete or grout, shall cure a minimum of 14 days before being loaded.

3.3 EQUIPMENT LEVELING

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 procuring organization 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.

3.4 CUTTING AND PATCHING

Contractor shall install his work in such a manner and at such time as will require a minimum of cutting and patching of the building structure.

Holes in exposed locations, in or through existing floors, shall be drilled and smoothed by sanding. Use of a jackhammer shall not be permitted.

Holes through masonry walls to accommodate sleeves shall be made with an iron pipe masonry core saw.

3.5 CLEANING

Exposed surfaces of piping and equipment that have become covered with dirt, plaster, or other material during handling and construction shall be thoroughly cleaned before such surfaces are prepared for final finish painting or are enclosed within the building structure.

Before final acceptance, mechanical equipment, including piping, ducting, and fixtures, shall be clean and free from dirt, grease, and finger marks.

3.6 FIELD TESTING AND TEST EQUIPMENT

All field testing specified in the Division 15 mechanical specification shall be made with test equipment specifically designed and calibrated for the purpose. Test equipment used shall be calibrated and certified by an approved testing laboratory. Date of last calibration and certification shall not be more than 90 days old at the time of field testing.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 15 - MECHANICAL

SECTION 15050

BASIC MECHANICAL MATERIALS AND METHODS

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 GENERAL REQUIREMENTS
- 1.3 SUBMITTALS

PART 2 PRODUCTS

- 2.1 PIPE AND FITTINGS
 - 2.1.1 Type BCS, Black Carbon Steel - Chilled Water
 - 2.1.2 Type CPR, Copper - Condensate and Domestic Water
 - 2.1.2.1 Type CPR-A, Copper Above Ground
- 2.2 Air Vents
- 2.3 Dielectric Connections
- 2.4 Flexible Metallic Pipe
- 2.5 Thermometers
- 2.6 PRESSURE GAGES
- 2.7 STRAINERS
- 2.8 VALVES
 - 2.8.1 Ball and Butterfly Valves
 - 2.8.2 Drain, Vent, and Gage Cocks
 - 2.8.3 Gate Valves (GAV)
 - 2.8.4 Check Valves
- 2.9 BACKFLOW PREVENTION DEVICES
- 2.10 MISCELLANEOUS MATERIALS
 - 2.10.1 Bolting
 - 2.10.2 Elastomer Calk
 - 2.10.3 Escutcheons
 - 2.10.4 Flashing
 - 2.10.5 Flange Gaskets
 - 2.10.6 Pipe Thread Compounds
- 2.11 SUPPORTING ELEMENTS
 - 2.11.1 Building Structure Attachments
 - 2.11.1.1 Anchor Devices, Concrete and Masonry
 - 2.11.1.2 C-Clamps
 - 2.11.2 Horizontal Pipe Attachments
 - 2.11.2.1 Single Pipes
 - 2.11.3 Vertical Pipe Attachments
 - 2.11.4 Hanger Rods and Fixtures

PART 3 EXECUTION

- 3.1 PIPE INSTALLATION
- 3.2 VALVES
- 3.3 SUPPORTING ELEMENTS INSTALLATION
- 3.4 PENETRATIONS
- 3.5 SLEEVES
- 3.6 ESCUTCHEONS

3.7 DISINFECTION

-- End of Section Table of Contents --

SECTION 15050

BASIC MECHANICAL MATERIALS AND METHODS

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 6/A 6M	(2001) Standard Specification for General Requirements for Rolled Structural Steel Bars
ASTM A 126	(1993) Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
ASTM A 234/A 234M	(1995; Rev A) Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures
ASTM A 53	(1995) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
ASTM A 278	(1993) Standard Specification for Gray Iron Castings for Pressure Containing Parts for Temperatures up to 650°F
ASTM A 563M	(1993) Standard Specification for Carbon and Alloy Steel Nuts (Metric)
ASTM B 370	(1992) Standard Specifications for Copper Sheet and Strip for Building Construction
ASTM B 62	(1993) Standard Specification for Composition Bronze or Ounce Metal Castings
ASTM B 749	(1991) Standard Specification for Lead and Lead Alloy Strip, Sheet and Plate Products
ASTM B 88M	(1995) Standard Specification for Seamless Copper Water Tube (Metric)
ASTM C 920	(1994) Standard Specification for Elastomeric Joint Sealants
ASTM E 1	(1995) Standard Specification for ASTM Thermometers
ASTM F 104	(1995) Standard Classification System for Nonmetallic Gasket Materials

ASTM F 568 (1995) Standard Specification for Carbon and Alloy Steel Externally Threaded Metric Fasteners

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME A112.19.2M (1990) Vitreous China Plumbing Fixtures

ASME B16.1 (1989) Cast Iron Pipe Flanges and Flanged Fittings

ASME B16.22 (1989) Wrought Copper and Copper Alloy Solder Joint Pressure Fittings

ASME B16.3 (1992) Malleable-Iron Threaded Fittings, Classes 150 and 300

ASME B16.39 (1986) Malleable Iron Threaded Pipe Unions, Classes 150, 250, and 300

ASME B16.5 (1988; Errata) Pipe Flanges and Flanged Fittings

ASME B16.9 (1993) Factory-Made Wrought Steel Buttwelding Fittings

ASME B31.3 (1993) Chemical Plant and Petroleum Refinery Piping

ASME-17 (1995) Boiler and Pressure Vessel Code; Section IX, Welding and Brazing Qualifications

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C511 (1992) Reduced Pressure Principle Backflow-Prevention Assembly (first edition)

AMERICAN WELDING SOCIETY (AWS)

AWS-02 (1990) Welding Handbook; Eighth Ed; Vol Two - Welding Process

FEDERAL SPECIFICATIONS (FS)

FS HH-I-558 (Rev C) Insulation, Blocks, Boards, Blankets, Felts, Sleeving (Pipe and Tube Covering), and Pipe Fitting Covering, Thermal (Mineral Fiber, Industrial Type)

FS FF-S-325 (Int Amd 3) Shield, Expansion; Nail, Expansion; and Nail, Drive Screw (Devices, Anchoring, Masonry)

MANUFACTURER'S STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS
INDUSTRY (MSS)

MSS SP-58	(1993) Pipe Hangers and Supports - Materials, Design and Manufacture
MSS SP-67	(1995) Butterfly Valves
MSS SP-69	(1991) Pipe Hangers and Supports - Selection and Application
MSS SP-70	(1990) Cast Iron Gate Valves, Flanged and Threaded Ends
MSS SP-72	(1992) Ball Valves with Flanged or Butt-Welding Ends for General Service

1.2 GENERAL REQUIREMENTS

Section 15003, "General Mechanical Provisions," applies to work specified in this section.

1.3 SUBMITTALS

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

SD-01 Data

Equipment and Performance Data shall be submitted for the following items consisting of corrosion resistance, life expectancy, gage tolerances, and grade line analysis.

Pipe and Fittings
Piping Specialties
Valves
Miscellaneous Materials
Supporting Elements

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

SD-04 Drawings

Installation Drawings shall be submitted for Pipes, Valves, and Specialties in accordance with the paragraph entitled, "Pipe Installation," of this section. Drawings shall include the manufacturer's design and construction calculations, forces required to obtain rated axial, lateral, or angular movements, installation criteria, anchor and guide requirements for

equipment, and equipment room layout and design. Drawing shall specifically advise on procedures to be followed and provisions required to protect expansion joints during specified hydrostatic testing operations.

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-09 Reports

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

- Hydrostatic Tests
- Valve-Operating Tests
- System Operation Tests

SD-13 Certificates

Certificates of Compliance shall be submitted for pipes, valves and specialties showing conformance with test requirements as contained in the reference standards contained in this section.

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

2.1.1 Type BCS, Black Carbon Steel - Chilled Water

Pipe (DN6 through DN300) shall be Schedule 40 black carbon steel, conforming to ASTM A 53.

Pipe (DN6 through DN250) shall be Schedule 40 seamless or electric-resistance welded black carbon steel, conforming to ASTM A 53, Type E, Grade B (electric-resistance welded), Type S (seamless). Grade A should be used for permissible field bending, in both cases.

Fittings (DN50 and under) shall be 1034 kilopascal working steam pressure (wsp) banded black malleable iron screwed, conforming to ASTM A 197M and ASME B16.3.

Unions (DN50 and under) shall be 1724 kilopascal (250 psi) female, screwed, black malleable iron with brass-to-iron seat, and ground joint, conforming to ASME B16.39.

Fittings (DN65 and over) shall be Steel butt weld, conforming to ASTM A 234/A 234M and ASME B16.9 to match pipe wall thickness.

Flanges (DN65 and over) shall be 1034 kilopascal (150-pound) forged-steel conforming to ASME B16.5, welding neck to match pipe wall thickness.

2.1.2 Type CPR, Copper - Condensate and Domestic Water

2.1.2.1 Type CPR-A, Copper Above Ground

Tubing (DN50 and under) shall be seamless copper tubing, conforming to ASTM B 88M, Type L (hard-drawn for all horizontal and all exposed vertical lines, annealed for concealed vertical lines).

Fittings (DN50 and under) shall be 1034 kilopascal wsp wrought-copper solder joint fittings conforming to ASME B16.22.

Unions (DN50 and under) shall be 1034 kilopascal wsp wrought-copper solder joint, conforming to ASME B16.22.

2.2 Air Vents

Manual air vents shall be 10 millimeter (3/8-inch) globe valves.

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 8 millimeters. Orifice shall be 3 millimeters. Trim shall be corrosion-resistant steel conforming to ASTM A 480/A 480M. Vent shall be fitted with try-cock. Vent shall discharge air at any pressure to 1034 kilopascal. Outlet shall be copper tube routed.

2.3 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.

2.4 Flexible Metallic Pipe

Flexible pipe shall be the bellows-type with wire braid cover and shall be designed, constructed, and rated in accordance with the applicable requirements of ASME B31.3.

Working pressure minimum rating shall be 690 kilopascal at 149 degrees C.

Minimum burst pressure shall be four times working pressure at 149 degrees C. Bellows material shall be AISI Type 316L corrosion-resistant steel. Braid shall be AISI 300 series corrosion-resistant steel wire.

Flanged end connection rating and materials shall conform to specifications for system primary-pressure rating.

2.5 Thermometers

Thermometers shall conform to ASTM E 1. Thermometers shall be industrial pattern Type I, except red Organic-liquid-filled, Class 3 (well-threaded and seal-welded). Thermometers installed 1800 millimeter or higher above the floor shall have an adjustable angle body. Scale shall be not less than 180 millimeter long. Case face shall be manufactured from manufacturer's standard polished aluminum or AISI 328 series polished corrosion-resistant steel. Thermometer range shall be 0°C to 20°C. Thermometers shall be provided with nonferrous separable wells. Lagging

extension to accommodate insulation thickness shall be provided. Thermometers shall be dual scale displaying both English and Metric units.

2.6 PRESSURE GAGES

Pressure gages shall conform to ANSI B40.1 and to requirements specified herein. Pressure gages shall be Type I, Class 1. Pressure-gage size shall be 90 millimeters nominal diameter. Case shall be corrosion-resistant steel, conforming to any of the AISI 300 series of ASTM A 6/A 6M, 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. All gages shall be equipped with gage isolators. Provide dual scale (metric and English scale). Pressure gage range shall be as shown on the drawings.

2.7 STRAINERS

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. All 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. All strainers larger than DN65 shall be fitted with manufacturer's standard ball-type blowdown valve. Body material shall be cast iron conforming to Class 30 ASTM A 278.

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 to exceed 1.14 millimeters. 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.

2.8 VALVES

2.8.1 Ball and Butterfly Valves

Butterfly valves shall conform to MSS SP-67. Valves shall be lug type for mounting between specified flanges and shall be rated for 1034 kilopascal shutoff and nonshock working pressure. Bodies shall be cast ferrous metal conforming to ASTM A 126, 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. Electric actuators and end switches shall be provided where indicated on drawings.

2.8.2 Drain, Vent, and Gage Cocks

Drain, vent, and gage cocks shall be lever handle, ground key type, with washer and screw, constructed of polished ASTM B 62 bronze, and rated 862 kilopascal wsp. End connections shall be rated for specified service.

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 15 millimeter male, end threaded, and rated at not less than 862 kilopascal at 107 degrees C.

2.8.3 Gate Valves (GAV)

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.

Gate valves DN65 and larger, shall be Type I, (wedge disk, tapered seats, steam rated); Class I (862 kilopascal steam-working pressure at 178 degrees C saturation); and 1379 kilopascal, 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.

2.8.4 Check Valves

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. Valve shall be rated for 1379 kilopascal maximum, nonshock pressure at 66 degrees 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 A 278, Class 40 or equivalent strength ductile iron. Disks shall be manufacturer's standard bronze, aluminum bronze, or 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 tetrafluoroethylene.

2.9 BACKFLOW PREVENTION DEVICES

Backflow prevention devices shall be "Reduced Pressure" type and shall conform to AWWA C511.

Devices DN50 ips and smaller with moving components defined in AWWA C511, shall be constructed of nonferrous metals. Nonmetal components of such devices shall be rated for the applicable service temperature.

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.

External surfaces of devices used in conjunction with equipment with polished or chrome-plated surfaces shall be similarly finished.

External surfaces of devices may be rough castings where these devices are used outside of the building or in equipment rooms. Devices shall be protected from freezing and shall be installed, tested, and used in strict conformance with the manufacturer's instructions.

Unit shall include tightly closing shut-off valves on each end and be fitted with properly located test cocks.

2.10 MISCELLANEOUS MATERIALS

2.10.1 Bolting

Flange and general purpose bolting shall be hex-head and shall conform to

ASTM F 568, 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 A 563M. Square-head bolts and nuts are not acceptable. Threads shall be coarse-thread series.

2.10.2 Elastomer Calk

Polysulfide- or polyurethane-base elastomer calking material shall be two-component type, conforming to ASTM C 920.

2.10.3 Escutcheons

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

Escutcheons shall be one-piece type where mounted on chrome-plated pipe or tubing, and one-piece of split-pattern type elsewhere. All escutcheons shall have provisions consisting of setscrews for maintaining a fixed position against a surface.

2.10.4 Flashing

Sheet lead shall conform to ASTM B 749, Grade B (intended for use in laboratories and shops in general application).

Sheet copper shall conform to ASTM B 370 and shall be of not less than 4.88 kilogram per square meter weight.

2.10.5 Flange Gaskets

Compressed non-asbestos sheet, conforming to ASTM F 104, Type 7-P1161A, coated on both sides with graphite or similar lubricant, with nitrile composition, binder rated to 399 degrees C.

2.10.6 Pipe Thread Compounds

Tetrafluoroethylene tape not less than 0.05 to 0.08 millimeter 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.

2.11 SUPPORTING ELEMENTS

All 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. All 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.

Supporting elements shall conform to requirements of ASME B31.3, FS FF-S-325, MSS SP-58, and MSS SP-69 except as noted.

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.

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.

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.

Piping on roof shall be supported as shown on drawings.

2.11.1 Building Structure Attachments

2.11.1.1 Anchor Devices, Concrete and Masonry

Anchor devices shall conform to FS FF-S-325 for the following types:

Group I - shield, expansion (lead, bolt and stud anchors)

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

Group III - shield, expansion (self-drilling
tubular expansion shell bolt anchors)

Group VIII - anchors, expansion (non drilling)

Cast-in, floor mounted, equipment anchor devices shall provide adjustable positions.

Masonry anchor devices shall be built-in.

Powder-actuated anchoring devices shall not be used to support any mechanical systems components.

2.11.1.2 C-Clamps

C-clamps shall not be used.

2.11.2 Horizontal Pipe Attachments

2.11.2.1 Single Pipes

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.

Piping in sizes through DN200 inclusive shall be supported by Type 1

attachments.

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.

Where thermal movement of a point in a piping system DN100 and larger would cause a hanger rod to deflect more than 4 degrees from the vertical or where a horizontal point movement exceeds 13 millimeter, Type pipe rolls shall be used.

Type 40 shields shall be used on all 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.

Insulated piping without vapor barrier on roll supports shall be provided with Type 39a saddles.

2.11.3 Vertical Pipe Attachments

Vertical pipe attachments shall be Type 8.

Shop drawing data shall include complete fabrication and attachment details of any spring supports.

2.11.4 Hanger Rods and Fixtures

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.

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.

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-02.

Connections between steel piping and copper piping shall be electrically isolated from each other with dielectric couplings (or unions) rated for the service.

All pipe ends shall be reamed before joint connections are made.

Screwed joints shall be made up with specified joint compound 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 the requirements of the AWS-02, ASME B31.3, and ASME-17.

3.2 VALVES

Valves shall be provided in piping where indicated and as specified.

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 pipe.

Seismic anchorage of piping shall be in accordance with SMACNA-91.

Vertical risers shall be supported independently of connected horizontal piping, whenever practicable, with fixed or spring supports at the base and at intervals to accommodate system range of thermal conditions. Risers shall be guided for lateral stability. For risers subject to expansion, only one rigid support shall be provided at a point approximately one-third down from the top. Clamps shall be placed under fittings unless otherwise specified. Carbon-steel pipe shall be supported at each floor and at not more than 4572 millimeter intervals for pipe DN50 and smaller and at not more than 6096 millimeter intervals for pipe DN65 and larger.

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.

3.5 SLEEVES

Galvanized Steel Sleeves shall be provided where piping passes through roofs, masonry, concrete walls and floors.

Sleeves passing through steel decks shall be continuously welded to the deck.

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, (233 to 538 degrees C (451 to 1000 degrees F)). This packing shall be

provided wherever the piping passes through firewalls, equipment room walls, floors, and ceilings connected to occupied spaces, and other locations where sleeves or construction-surface penetrations occur between occupied spaces.

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 large enough to fit around the insulation. Escutcheons shall be chrome-plated in all occupied spaces and of size sufficient to effectively conceal openings in building construction. Escutcheons shall be firmly attached with setscrews.

3.7 DISINFECTION

Water piping, including all 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 a period of not less than 8 hours, after which the solution shall contain not less than 10 ppm of available chlorine or the piping shall be re-disinfected. After successful sterilization, the piping shall be thoroughly flushed before placing into service. Flushing shall be complete when the flush water contains less than 0.5 ppm of available chlorine. Water for disinfected will be furnished by the Government. Contractor shall be responsible for approved disposal of contaminated flush water.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 15 - MECHANICAL

SECTION 15072

VIBRATION ISOLATION FOR AIR CONDITIONING EQUIPMENT

03/03

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 GENERAL REQUIREMENTS
- 1.3 SUBMITTALS

PART 2 PRODUCTS

- 2.1 TYPE OF VIBRATION-ISOLATION PROVISIONS
 - 2.1.1 Materials
 - 2.1.2 Mountings
 - 2.1.3 Bases
- 2.2 VIBRATION-ISOLATION SYSTEMS APPLICATION
 - 2.2.1 Air-Moving Device Locations

PART 3 EXECUTION

- 3.1 INSTALLATION
- 3.2 TESTS AND REPORTS

-- End of Section Table of Contents --

SECTION 15072

VIBRATION ISOLATION FOR AIR CONDITIONING EQUIPMENT
03/03

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

- | | |
|------------|---|
| ANSI S2.40 | (1984; R 1990) Mechanical Vibration of Rotating and Reciprocating Machinery - Requirements for Measuring Vibration Severity |
| ANSI S3.29 | (1983; R 1990) Evaluation of Human Exposure to Vibration in Buildings, Guide to |

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

- | | |
|-----------|---|
| ASHRAE-02 | (1999) Handbook, HVAC Applications (IP Edition) |
| ASHRAE-05 | (1999) Handbook, HVAC Applications (SI Edition) |

NATIONAL ENVIRONMENTAL BALANCING BUREAU (NEBB)

- | | |
|---------------------------|---|
| NEBB Procedural Standards | (1994) Procedural Standards for Measuring Sound and Vibration |
| NEBB TABES | (1998) Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems |

1.2 GENERAL REQUIREMENTS

Section 15003, "General Mechanical Provisions," applies to work specified in this section to the extent applicable.

Section 15050, "Basic Mechanical Materials and Methods," applies to work specified in this section to the extent applicable.

All vibration-control apparatus shall be the product of a single manufacturing source, where possible. Human exposure levels should be considered using ANSI S3.29 and NEBB Procedural Standards.

Scheduled isolation mounting is in millimeter and is a minimum static deflection.

Spans referred to in Part 2, "Vibration-Isolation Systems Application," shall mean longest bay dimension.

Exact mounting sizes and number of isolators shall be determined by the isolator manufacturer based on equipment that will be installed. Equipment revolutions per minute (rpm) and spring deflections shall be checked to verify that resonance cannot occur.

Installation Drawings for vibration isolator systems shall include equipment and performance requirements.

Outline Drawings for vibration isolator systems shall indicate overall physical features, dimensions, ratings, service requirements, and weights of equipment.

Equipment and Performance Data for vibration isolator systems shall include equipment base design; inertia-block mass relative to support equipment weight; spring loads and free, operating, and solid heights of spring; spring diameters; nonmetallic isolator loading and deflection; disturbing frequency; natural frequency of mounts; deflection of working member; and anticipated amount of physical movement at the reference points.

1.3 SUBMITTALS

The following shall be submitted in accordance with Section 01330, "Submittal Procedures," in sufficient detail to show full compliance with the specification:

SD-02 Shop Drawings

Installation Drawings and Outline Drawings shall be submitted in accordance with paragraph entitled, "General Requirements," of this section.

SD-02 shop Drawings

Chiller vibration isolation system shop drawings shall be scaled, dimensioned drawings with a complete material list and design calculations stamped by a licensed professional mechanical or structural engineer.

SD-03 Product Data

Equipment and Performance Data shall be submitted in accordance with paragraph entitled, "General Requirements," of this section.

Manufacturer's catalog data shall be submitted for the following items:

- Mountings
- Bases
- Isolators
- Floor-Mounted Piping
- Vertical Piping

SD-06 Test Reports

Test reports shall be submitted for deflection tests in accordance with the paragraph entitled, "Type of Vibration-Isolation Provisions," of this section. Reports shall include the following information:

Type of Isolator
Type of Base
Allowable Deflection
Measured Deflection

PART 2 PRODUCTS

2.1 TYPE OF VIBRATION-ISOLATION PROVISIONS

Design for vibration isolation using ASHRAE-05, Chapter 42, as applicable to the following sections.

Test reports for deflection tests shall be submitted for each Type of Isolator and each Type of Base, and meet referenced standards contained within this section. Test reports shall also include Allowable Deflection and Measured Deflection also meeting referenced standards within this section.

2.1.1 Materials

Rubber shall be natural rubber. Elastomer shall be chloroprene. Shore A durometer measurement of both materials shall range between 40 and 60.

Inorganic materials such as precompressed, high-density, fibrous glass encased in a resilient moisture-impervious membrane may be used in lieu of specified natural rubber and elastomers. Where this substitution is made, specified deflections shall be modified by the manufacturing source to accommodate physical characteristics of inorganic materials and to provide equal or better vibration isolation.

Weather-exposed metal vibration-isolator parts shall be corrosion protected. Springs shall be chloroprene coated.

2.1.2 Mountings

Mountings shall be:

Type A: Composite pad, with 6.3 millimeter thick elastomer top and bottom layers, molded to contain a pattern with nonslip characteristics in all horizontal directions. Elastomer loading shall not exceed 275 kilopascal. Minimum overall thickness shall be 25 millimeter. Maximum deflections up to 6.3 millimeter are allowed.

Type B: Double rubber-in-shear with molded-in steel reinforcement in top and bottom. Maximum deflections up to 12.7 millimeter are allowed.

Type C: Free-standing laterally stable open-spring type for deflections over 12.7 millimeter, with built-in bearing and leveling provisions, 6.3 millimeter thick Type A base elastomer pads, and accessories. Outside diameter of each spring shall be equal to or greater than 0.9 times the operating height of the spring under rated load.

Type D: Partially housed type, containing one or more vertically restrained springs with at least 12.7 millimeter clearance maintained around springs, with adjustable limit stops, 6.3 millimeter thick Type A base elastomer pads, and accessories.

2.1.3 Bases

Bases shall be:

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 shall be sufficient to provide stiffness required to maintain equipment manufacturer's recommended alignment and duty efficiency of power-transmission components. Height of steel member shall not result in member deflection at midpoint of unsupported span of more than $1/1,440$ th of the span between isolators. Minimum height shall be 127 millimeter.

Type CIB: Concrete inertia blocks shall be common to the entire assembly, shall have welded-joint construction, mill-rolled structural-steel perimeters, welded-in No. 4 reinforcing bars 200 millimeter on center each way near the bottom of the block, outrigger-isolator mounting provisions, anchor bolts, and shall be filled with 20.68 Megapascal cured-strength concrete.

Configuration of inertia bases shall be rectangular to accommodate equipment supported.

Minimum thickness of inertia base, in addition to providing suitable mass, shall be sufficient to provide stiffness to maintain equipment manufacturer's recommended alignment and duty efficiency of power-transmission components. Minimum thickness shall be sufficient to result in base deflection at midpoint of unsupported span of not more than $1/1,440$ th of the span between isolators. Minimum thickness, the preceding requirements not withstanding, shall be 8 percent of the longest base dimension.

Pumps with flexible couplings shall have inertia bases not less than 200 millimeter thick.

Minimum mass of concrete inertia block shall be equal in weight to supported equipment.

2.2 VIBRATION-ISOLATION SYSTEMS APPLICATION

Vibration isolation design per ASHRAE-05, Chapter 42.

2.2.1 Air-Moving Device Locations

Vibration-isolation provisions apply to housed free-standing fans of any pressure rating, located in factory-fabricated central-station units.

PART 3 EXECUTION

3.1 INSTALLATION

Equipment shall be installed in accordance with manufacturer's recommendations.

Rails, structural steel bases, and concrete inertia blocks shall be raised not less than 25 millimeter above the floor and shall be level when equipment supported is under operating load.

Vibration-isolation installation and deflection testing after equipment start-up shall be directed by a competent representative of the manufacturer.

3.2 TESTS AND REPORTS

Vibration-isolation devices shall be deflection tested. Test reports shall be submitted in accordance with paragraph entitled, "Submittal Procedures," substantiating that all equipment has been isolated as specified and that minimum specified deflections have been met. All measurements shall be made in the presence of the Contracting Officer.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 15 - MECHANICAL

SECTION 15083

DUCT INSULATION

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SYSTEM DESCRIPTION
- 1.3 PERFORMANCE REQUIREMENTS
- 1.4 SUBMITTALS

PART 2 PRODUCTS

- 2.1 MATERIALS
 - 2.1.1 Adhesives
 - 2.1.1.1 Cloth
 - 2.1.1.2 Adhesive Vapor Barrier
 - 2.1.2 Coatings
 - 2.1.2.1 Outdoor Vapor-Barrier Finishing
 - 2.1.2.2 Indoor Vapor-Barrier Finishing
 - 2.1.2.3 Outdoor and Indoor Nonvapor-Barrier Finishing
 - 2.1.3 Insulation
 - 2.1.3.1 Insulation for Double Wall Ducts
 - 2.1.4 Jacketing
 - 2.1.4.1 Sheetmetal Jacketing
 - 2.1.4.2 Vapor Barrier Material

PART 3 EXECUTION

- 3.1 INSTALLATION OF INSULATION SYSTEMS
- 3.2 SYSTEM TYPES
 - 3.2.1 Mineral Fiber Insulation
 - 3.2.2 Semi-Rigid Mineral Fiber with Jacket -- Double Wall Ducts
 - 3.2.3 Type T-11, Flexible Mineral Fiber with Jacket -- Ducts Enclosed in the Housing at Roof Penetrations

-- End of Section Table of Contents --

SECTION 15083

DUCT INSULATION

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 1136	(1992) Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation
ASTM C 592	(1980) Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type)
ASTM C 916	(1985; R 1990) Standard Specification for Adhesives for Duct Thermal Insulation
ASTM E 84	(1995) Standard Test Method for Surface Burning Characteristics of Building Materials

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 220	(1992) Standard Types of Building Construction
----------	--

1.2 SYSTEM DESCRIPTION

Section 15003, "General Mechanical Provisions," and Section 15815, "Low Pressure Ductwork" apply to work specified in this section.

1.3 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. Flame-contributed classification (FCC) shall be as specified for the application. These maximum values shall be determined in accordance with ASTM E 84. 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.

1.4 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
- Thermal-Insulation Materials
- Jacketing Materials

SD-04 Drawings

Installation Drawings for Duct Insulation Systems shall be in accordance with the adhesive manufacturer's recommended instructions for application.

SD-14 Samples

Contractor shall submit the following samples:

- Adhesives
- Coatings
- Thermal-Insulation Materials
- Jacketing 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 shall be asbestos free and conform to the following.

2.1.1 Adhesives

2.1.1.1 Cloth

Adhesives for adhering, sizing, and finishing open-weave glass cloth shall be pigmented polyvinyl acetate emulsion and shall conform to the requirements of ASTM C 916, Class 1, Grade A.

2.1.1.2 Adhesive Vapor Barrier

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 the solvent-base synthetic-rubber type and shall conform to the requirements of ASTM C 916, Class 2, Grade A, for attaching fibrous-glass insulation to metal surfaces. Solvents shall be nonflammable.

2.1.2 Coatings

2.1.2.1 Outdoor Vapor-Barrier Finishing

Coatings for outdoor vapor-barrier and weather-barrier finishing of insulation shall comply with manufacturer's recommendation for material compatibility, service life, and environment.

2.1.2.2 Indoor Vapor-Barrier Finishing

Coatings for indoor vapor-barrier finishing of insulation surfaces shall be pigmented resin and solvent compound and shall conform to ASTM C 1136.

2.1.2.3 Outdoor and Indoor Nonvapor-Barrier Finishing

Coatings for outdoor and indoor nonvapor-barrier finishing of insulation surfaces shall be pigmented polymer emulsion recommended by the insulation-material manufacturer for the surface to be coated and shall be applied to the specified dry-film thickness.

2.1.3 Insulation

Insulation conductances shall be maximum values, as tested at any point, not an average. Insulation conductance found by test to exceed the stipulated maximum shall either be replaced or augmented by an additional thickness to bring it to the required maximum conductance.

Insulation materials requirements for exterior applications are acceptable for interior applications.

2.1.3.1 Insulation for Double Wall Ducts

Insulation shall be mineral fiber conforming to ASTM C 592, shall be suitable for surface temperatures up to 188 degrees C, and shall be not less than 24 kilogram per cubic meter density, unless otherwise specified. Thermal conductivity shall be not greater than 37.5 milliwatt per meter per degrees K at 66 degrees C (338.8 degrees K), unless otherwise specified. Double wall ducts shall be as manufactured by United McGill Corporation or approved equal.

2.1.4 Jacketing

2.1.4.1 Sheetmetal Jacketing

Outer walls of double wall ducts shall be used as jacketing.

2.1.4.2 Vapor Barrier Material

Vapor barrier material shall conform to ASTM C 1136, Type I, low vapor transmission, high puncture resistance for use on insulation for piping, ducts, and equipment, and as indicated.

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 100-percent coverage basis. Departure from these requirements shall be a basis for rejection.

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. Longitudinal seams of exposed insulation shall be directed away from normal view.

Surfaces shall be clean and free of all 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

3.2.1 Mineral Fiber Insulation

All ducts, except for the enclosed ducts in the housing at roof penetrations, shall be double wall with 25.4 mm thick mineral fiber insulation.

3.2.2 Semi-Rigid Mineral Fiber with Jacket -- Double Wall Ducts

Insulation shall be adhered to inner surface of the outer shell sheet metal surfaces with vapor-barrier adhesive.

Vapor-barrier jackets, jacket flaps, and bands shall be securely cemented in place with vapor-barrier adhesive. Jacketing bands for butt joints shall be not less than 100 millimeter wide.

Insulation shall be brought tightly against raised-flange standing seams and sealed with vapor-barrier coating. A 75 millimeter wide strip of the insulation of adequate thickness to give 13 millimeter covering over flange shall be provided. Strip shall be routed out to accommodate the still-exposed portion of the seam or flange and shall be cemented in place over the seam or flange by use of vapor-barrier coating material.

Duct insulation terminating at insulated and uninsulated sheet-metal and equipment surfaces, supports, damper fittings, access doors, walls, and similar penetration and construction points shall be sealed with outdoor vapor-barrier coating. Where lengths exceeding 600 millimeter are involved, insulation shall be flashed with glass-cloth tape and sheet-metal trimming. Glass-cloth tape shall provide not less than 75 millimeter overlap, shall be in two layers, and shall be embedded in not less than 1.6 millimeter dry-film thickness of outdoor vapor-barrier coating. Sheet metal trimming shall be installed after glass-cloth jacket is in place.

3.2.3 Type T-11, Flexible Mineral Fiber with Jacket -- Ducts Enclosed in the Housing at Roof Penetrations

Sheet metal ducts shall be covered with mineral-fiber duct insulation with factory-attached vapor-barrier jacket. Vapor seal shall be maintained. Jacket overlap shall be not less than 50 millimeter.

Insulation nominal thickness shall be 50 millimeter.

Insulation shall be adhered to sheet metal surfaces with vapor-barrier adhesive.

Insulation on all rectangular ducting with side- or bottom-surface dimensions over 750 millimeter shall, in addition to being adhered with adhesive, be impaled on pins secured to the duct surface and then locked by means of flush pin caps. Pins shall be clipped flush with face of cap. Pins shall be 300 millimeter on center placed not more than 50 millimeter from duct edges, and there shall be not less than two rows of pins per surface. Pins shall be sealed with outdoor vapor-barrier coating and vapor-barrier duct tape.

When insulation is in place, total thickness shall be reduced by not more than 13 millimeter, and no condensation shall appear on any surface.

Jackets, jacket flaps, and bands shall be securely cemented in place with vapor-barrier adhesive. Jacketing bands for butt joints shall be not less than 100 millimeter wide. In lieu of jacketing bands, pressure-sensitive vapor-barrier tape not less than 75 millimeter wide shall be used to seal horizontal and transverse seams.

Duct insulation shall be rigid-board 50 kilogram per cubic meter density where penetrations through sleeves or prepared openings occur.

Duct insulation terminating at insulated or uninsulated sheet metal and equipment surfaces, supports, damper fittings, walls, and similar penetration and construction points shall be sealed with outdoor vapor-barrier coating and, where lengths exceeding 600 millimeter are involved, flashed with glass-cloth tape and sheet metal trimming. Glass-cloth tape shall be in two layers with not less than 75 millimeter of overlap imbedded in not less than 1.6 millimeter dry-film thickness of outdoor vapor-barrier coating.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 15 - MECHANICAL

SECTION 15085

PIPING INSULATION

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SYSTEM DESCRIPTION
- 1.3 PERFORMANCE REQUIREMENTS
- 1.4 SUBMITTALS

PART 2 PRODUCTS

- 2.1 MATERIALS
 - 2.1.1 Adhesives
 - 2.1.1.1 Cloth Adhesives
 - 2.1.1.2 Vapor-Barrier Material Adhesives
 - 2.1.1.3 Cellular Elastomer Insulation Adhesive
 - 2.1.2 Coatings
 - 2.1.2.1 Outdoor Vapor-Barrier Finishing
 - 2.1.2.2 Outdoor Nonvapor-Barrier Finishing
 - 2.1.2.3 Cellular-Elastomer Insulation Coating
 - 2.1.2.4 Coating Color
 - 2.1.3 Insulating Cement
 - 2.1.3.1 General Purpose Insulating Cement
 - 2.1.4 Calking
 - 2.1.5 Corner Angles
 - 2.1.6 Insulation Materials
 - 2.1.6.1 Mineral Fiber
 - 2.1.6.2 Pipe Fittings
 - 2.1.6.3 Cellular Elastomer
 - 2.1.7 Jacketing
 - 2.1.7.1 Aluminum Jackets
- 2.2 PIPING SYSTEMS
 - 2.2.1 Chilled Water Piping
 - 2.2.2 Chilled-Water Pumps

PART 3 EXECUTION

- 3.1 INSTALLATION OF INSULATION SYSTEMS
- 3.2 SYSTEM TYPES
 - 3.2.1 Type T-1, Mineral Fiber with Vapor-Barrier Jacket
 - 3.2.2 Type T-2 Mineral Fiber with Glass Cloth Jacket
 - 3.2.3 Type T-6, Mineral Fiber with Aluminum Jacket
 - 3.2.4 Type T-9, Cellular Elastomer

-- End of Section Table of Contents --

SECTION 15085

PIPING INSULATION

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM B 209M	(1995) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric)
ASTM C 1136	(1992) Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation
ASTM C 195	(1990) Mineral Fiber Thermal Insulating Cement
ASTM C 534	(1988) Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form
ASTM C 592	(1980) Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type)
ASTM C 916	(1985; R 1990) Standard Specification for Adhesives for Duct Thermal Insulation
ASTM C 920	(1994) Standard Specification for Elastomeric Joint Sealants
ASTM C 921	(1989) Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation
ASTM E 84	(1995) Standard Test Method for Surface Burning Characteristics of Building Materials

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 220	(1992) Standard Types of Building Construction
----------	--

1.2 SYSTEM DESCRIPTION

Section 15003, "General Mechanical Provisions," applies to work specified in this section.

1.3 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 E 84. 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.

1.4 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

SD-04 Drawings

Installation Drawings for Pipe Insulation shall be in accordance with manufacturer's written instructions.

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 shall be asbestos free and conform to the following.

2.1.1 Adhesives

2.1.1.1 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 the requirements of ASTM C 916, Class 1, Grade A or B.

2.1.1.2 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 the requirements of ASTM C 916, Class 2, Grade A or B, for attaching fibrous-glass insulation to metal surfaces. Solvent shall be

nonflammable.

2.1.1.3 Cellular Elastomer Insulation Adhesive

Adhesive for cellular elastomer insulation shall be a solvent cutback chloroprene elastomer conforming to ASTM C 916, Type II or III, Class 1, and shall be of a type approved by the manufacturer of the cellular elastomer for the intended use.

2.1.2 Coatings

2.1.2.1 Outdoor Vapor-Barrier Finishing

Coatings for outdoor vapor-barrier finishing of insulation surfaces such as fittings and elbows shall be a nonasphaltic, hydrocarbon polymer, solvent-base mastic containing a blend of nonflammable solvents. Coatings shall conform to the requirements of ASTM C 1136 and ASTM C 921.

2.1.2.2 Outdoor 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.

2.1.2.3 Cellular-Elastomer Insulation Coating

Finish coating for cellular-elastomer insulation shall be a polyvinylchloride lacquer approved by the manufacturer of the cellular elastomer.

2.1.2.4 Coating Color

Coating color shall be white.

2.1.3 Insulating Cement

2.1.3.1 General Purpose Insulating Cement

General purpose insulating cement shall be mineral fiber and shall conform to ASTM C 195. Composite shall be rated for 982 degrees C service and shall have a thermal-conductivity maximum of .123 watt per meter per degree Kelvin temperature differential at 93 degrees C (367 degrees K) mean temperature for 25 millimeter thickness.

2.1.4 Calking

Calking used with specified insulation materials shall be an elastomeric joint sealant in accordance with ASTM C 920, Type S, Grade NS, Class 25, Use A.

2.1.5 Corner Angles

Corner angle piping insulation shall be nominal 0.41 millimeter aluminum 25 by 25 millimeter with factory applied kraft backing. Aluminum shall be in accordance with ASTM B 209M, Alloy 3003.

2.1.6 Insulation Materials

Insulation shall be suitable for outdoor use. 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.

2.1.6.1 Mineral Fiber

Mineral fiber shall conform to ASTM C 592, shall be suitable for surface temperatures up to 188 degrees C (461 degrees K), and shall be of not less than 64.1 kilograms per cubic meter density. Thermal conductivity shall be not greater than 0.037 watt per meter per degree Kelvin at 66 degrees C (339 degrees K) mean.

2.1.6.2 Pipe Fittings

Pipe fitting insulation shall be Form E, molded pipe fitting covering, Class 16, for use at temperatures up to and including 232 degrees C (505 degrees K).

2.1.6.3 Cellular Elastomer

Cellular elastomer shall conform to ASTM C 534, except that the water-vapor permeability shall not exceed 0.44 nanogram per meter per second per pascal mercury pressure difference for 25 millimeter thickness.

2.1.7 Jacketing

2.1.7.1 Aluminum Jackets

Aluminum Jacket shall be provided for outdoor pipe insulation. Aluminum sheet shall be in accordance with ASTM B 209M and shall be 0.41 millimeter thick with factory-applied vapor barrier on the insulation side. Aluminum shall be made from smooth, polished, Temper H14 or H16, Alloy 3003. Straps shall be AISI 300 series corrosion-resistant steel, 0.381 millimeter thick, 13 millimeter wide, for pipe under DN300 diameter and 20 millimeter wide for pipe over DN300 diameter.

Elbow jackets shall be 0.41 millimeter thick, deep-drawn, die-shaped, two-piece components for long-radius, butt-weld elbows manufactured from the same materials as specified for jackets, with factory-attached vapor-seals on underside of the aluminum. Preinsulated, voidless, jacketed components conforming to these specifications shall be used. Preinsulated fittings shall have a 50 millimeter overlay beyond route for weld bead.

Vapor barrier shall be 30-60-30 laminated-asphalt paper or 3 kilogram per square meter kraft paper with 0.5 kilogram per square meter polyethylene coating.

Pipe jackets shall have not less than 50-millimeter longitudinal and circumferential lap.

Sealant for longitudinal and butt joints of aluminum jacketing shall be an aluminum-pigmented, butyl, polymer sealant with high-butyl solids.

2.2 PIPING SYSTEMS

Insulation thickness and pipe sizes are in millimeter. Pipe sizes include pipe nominal pipe size (NPS) and tubing outside diameter.

2.2.1 Chilled Water Piping

Insulation shall be mineral fiber with vapor barrier jacket, Type T-1. Thickness shall be not less than that given in the following list. All pipes, valve bodies, fittings, unions, and flanges shall be insulated.

<u>PIPE SIZE</u> (MILLIMETRE)	<u>INSULATION THICKNESS</u> (MILLIMETRE)
Up to 32	25
32 to 75	40
75 and larger	50

2.2.2 Chilled-Water Pumps

Insulation shall be cellular elastomer, Type T-9. Thickness shall be 25 millimeter. Surfaces subject to condensation shall be covered, and a vapor-barrier coating shall be supplied.

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.

Insulation shall not impede access to duct covers/access panels on the duct.

3.2 SYSTEM TYPES

3.2.1 Type T-1, Mineral Fiber with Vapor-Barrier Jacket

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 40 millimeter. Jacketing bands for butt joints shall be 75 millimeter wide.

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 1.52 millimeter coating of 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.

In lieu 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, 0.381 millimeter thick by 15 millimeter wide.

Pipe insulation shall be set into an outdoor vapor-barrier coating for a minimum of 150 millimeter at maximum 3500-millimeter spacing and the ends of the insulation sealed to the jacketing with the same material to provide an effective vapor-barrier stop.

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.

Piping insulation at hangers shall consist of 208 kilogram per cubic meter 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.

White-bleached kraft paper side of the jacketing shall be on the side exposed to view.

Exposed-to-view insulation shall be finished with not less than a 0.152-millimeter dry-film thickness of nonvapor-barrier coating suitable for painting.

3.2.2 Type T-2 Mineral Fiber with Glass Cloth Jacket

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.

Pipe insulation shall be set into outdoor vapor-barrier coating for a minimum of 150 millimeters at maximum 3500 millimeter spacing. Ends of the insulation shall be sealed to the jacketing with the same material to provide effective vapor barrier stops.

Vapor barrier shall be continuous over all surfaces, including areas inside pipe sleeves, hangers, and other concealment.

Piping insulation shall be applied to both sides of pipe hangers. Junctions shall be insulated with a special mastic mixture, glass cloth mesh tape, and mastic as previously specified.

Jacket laps, flaps, and bands shall be securely cemented in place with aluminum jacket sealant. Jacketing bands for butt joints shall be 150 millimeters wide.

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 25 millimeters. Jacketing material shall be lapped a minimum of 50 millimeters, circumferentially sealed with mastic, and strapped to provide a waterproof covering throughout. Straps shall be located 200 millimeters 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.

Exposed longitudinal edges of aluminum jacketing shall be stiffened by bending a 25 millimeter hem on one edge.

Expansion joints shall provide for maximum and minimum dimensional fluctuations.

To prevent corrosion, the aluminum jacketing shall not come in direct contact with other types of metal.

At openings in jacket, an outdoor vapor-barrier coating shall be applied for 50 millimeters in all directions. Jacketing shall be applied while waterproofing is tacky.

Screws shall be used at each corner of each sheet, at fitting jackets, and as necessary for the service. Number 7, 10 millimeters long, binding-head aluminum sheet metal screws shall be placed through the mastic seal.

3.2.3 Type T-6, Mineral Fiber with Aluminum Jacket

Piping shall be covered with mineral-fiber pipe insulation with factory-attached or field-applied aluminum jacketing.

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 secured temporarily in place with light cord ties. A 1.52 millimeter coating of vapor-barrier mastic shall be applied, and while still tacky, wrapped with glass lagging tape.

3.2.4 Type T-9, Cellular Elastomer

Pump surfaces shall be solvent cleaned. Not less than 25 millimeter 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 13 millimeter thick cellular elastomer insulation attached and joined into a continuous sheet with an outdoor vapor-barrier coating recommended by the insulation 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 millimeter wet, or approximately 3.7 square meter per liter 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.

Insulation shall be finished with a 0.051 millimeter minimum dry-film application of a polyvinylchloride lacquer coating recommended by the manufacturer and applied in not less than two coats.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 15 - MECHANICAL

SECTION 15136

CHILLED WATER PUMPING PACKAGE

PART 1 GENERAL

- 1.1 SCOPE
- 1.2 REFERENCES
- 1.3 DESIGN REQUIREMENTS
 - 1.3.1 Pumps
 - 1.3.2 Expansion Tank
 - 1.3.3 Air Separators
- 1.4 SUBMITTALS
- 1.5 GENERAL REQUIREMENTS

PART 2 PRODUCTS

- 2.1 BASE-MOUNTED CENTRIFUGAL PUMPS
 - 2.1.1 Pump Schedule
 - 2.1.2 Pump Type
 - 2.1.3 Pump Selection
 - 2.1.4 Impellers
 - 2.1.5 Balancing
 - 2.1.6 Casing
 - 2.1.7 Wearing Rings
 - 2.1.8 Shaft
 - 2.1.9 Mechanical Seals
 - 2.1.10 Bearings and Lubrication
 - 2.1.11 Flexible Coupling
 - 2.1.12 Bedplate
 - 2.1.13 Pump Motors
 - 2.1.14 Vibration Isolator
- 2.2 EXPANSION TANK
- 2.3 AIR SEPARATOR
- 2.4 CHEMICAL FEEDER
- 2.5 PIPING AND ACCESSORIES
- 2.6 CONTROL PANEL
- 2.7 PIPING

PART 3 EXECUTION

- 3.1 PUMP PROTECTION
- 3.2 VIBROMETER
- 3.3 INSTALLATION
- 3.4 ALIGNMENT
- 3.5 PUMP ACCEPTANCE

-- End of Section Table of Contents --

SECTION 15136

CHILLED WATER PUMPING PACKAGE

PART 1 GENERAL

1.1 SCOPE

The packaged system shall include, as a minimum, centrifugal pumps, an expansion tank, air separator, chemical feeder, control panel, gauges, isolation valves and interconnecting piping and wiring. All components shall be mounted on a structural steel baseplate covered with 1/4" steel decking. The structural skid shall be sand blasted, cleaned and primed with inorganic zinc. The entire assembled unit shall be finished with a heavy coat of exterior-grade machine enamel. The package shall be UL listed. The entire skid shall be braced and supported to meet the California seismic requirements.

1.2 REFERENCES

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

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B16.1 (1989) Cast Iron Pipe Flanges and Flanged Fittings

ANTI-FRICTION BEARING MANUFACTURERS ASSOCIATION (AFBMA)

AFBMA 11 (1990) Load Ratings and Fatigue Life for Roller Bearings

AFBMA 9 (1990) Load Ratings and Fatigue Life for Ball Bearings

INTERNATIONAL STANDARDS ORGANIZATION (ISO)

ISO 2858 (1975) End Suction Centrifugal Pump (Rating 16 Bar) Designation Nominal Duty Point and Dimensions

ISO 5199 (1986) Technical Specifications for Centrifugal Pumps, Class II

ISO 7005-2 (1988) Metallic Flanges Part 2: Cast Iron Flanges

MANUFACTURER'S STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP 51 (1991; R 1995) Class 150 LW Corrosion Resistant Cast Flanges and Flanged Fittings

MSS SP-86 (1987; R 1992) Guidelines for Metric Data in Standards for Valves, Flanges, Fittings

and Actuators

1.3 DESIGN REQUIREMENTS

1.3.1 Pumps

Pumps shall be selected at a point within the maximum efficiency for a given impeller casing combination. Deviations within 3 percent of maximum efficiency are permissible, provided the lesser efficiency is not less than the scheduled efficiency.

Pumps having impeller diameters larger than 90 percent of the published maximum diameter of the casing or less than 15 percent larger than the published minimum diameter of the casing will be rejected.

Pumps selected shall have characteristics specifically suitable parallel operation without unstable operation:

Pumps shall be suitable for operation at indicated temperature without vapor binding and without cavitation under any system operating condition. The only acceptable means of rectification of cavitation shall be replacement of entire pump assembly.

Available Net Positive Suction Head (NPSH) shall exceed required NPSH by not less than 0.46 meter.

Pumps of the same duty condition, classification, and accessories, shall be identical and the product of one manufacturing source.

1.3.2 Expansion Tank

Expansion tank shall be designed for 862 kPa (125 psig) per ASME Section VIII.

1.3.3 Air Separators

Air separators shall be provided at pump suction and shall be designed for 862 kPa (125 psig) per ASME Section VIII.

1.4 SUBMITTALS

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

SD-01 Data

Equipment and Performance Data consisting of pump curves (liter per minute versus total head in millimeter at rated rpm) shall be provided for each Centrifugal Pump.

Curves shall also indicate KW, horse power, pump efficiency and NPSH required.

Provide overall dimension drawings including anchor bolt locations.

Provide catalog data for the expansion tank, air separator and chemical feeder.

SD-04 Drawings

Provide overall dimension drawings including anchor bolt locations, for the chilled water pumping package.

Provide a detailed drawing of the control panel.

Installation Drawings for Centrifugal Pumps shall be submitted in accordance with Part 3, "Execution," of this section.

SD-09 Reports

Test Reports for pumps shall be submitted on the following tests:

- Hydraulic Tests
- Efficiency Tests
- Vibration Tests
- Output Efficiency
- Deflection Tests
- Alignment Measurement Results

SD-19 Operation and Maintenance Manuals

A detailed operation and maintenance manual shall be submitted for the pumping package. The manual shall include wiring diagrams and parts list.

1.5 GENERAL REQUIREMENTS

Section 15003, "General Mechanical Provisions," applies to work specified in this section.

PART 2 PRODUCTS

2.1 BASE-MOUNTED CENTRIFUGAL PUMPS

Pumps provided shall conform to ISO 2858 and ISO 5199 standards for centrifugal pumps and to requirements specified herein.

2.1.1 Pump Schedule

Pump capacity design requirements, and characteristics not specified herein shall be as indicated on the pump schedules.

2.1.2 Pump Type

Pumps shall be, single-stage, base-mounted, end-suction centrifugal type. Pumps shall be capable of being serviced without disturbing piping connections.

2.1.3 Pump Selection

Pumps shall be selected at the point of maximum efficiency for a given impeller/casing combination. Deviations within 3 percent of maximum efficiency are permissible, provided that the efficiency is not less than the scheduled efficiency. Pumps having impeller diameters larger than 90 percent of the published maximum diameter of the casing or less than 15 percent larger than the published minimum diameter of the casing will be rejected.

2.1.4 Impellers

Impellers shall be enclosed type Cast-bronze

2.1.5 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.

2.1.6 Casing

Pump casing shall be bronze-fitted cast iron with a design working pressure of not less than 862 kilopascal at 93 degrees C. Casing piping connections sizes shall be flanged and shall conform to ASME B16.1 MSS SP 51, MSS SP-86 and ISO 7005-2. Casing shall have integrally cast pedestal supports, trap-equipped openings for air venting, priming, draining, and suction and discharge gages. Pump shall be convertible to packing service without machining of casing.

2.1.7 Wearing Rings

Wearing rings shall be provided in every pump case and on all impellers larger than 200 millimeter diameter.

2.1.8 Shaft

Shaft shall be solid, sleeved type with AISI 300 series shaft and AISI 400 series corrosion-resistant steel sleeves hardened to 425 Brinell.

Shaft vibration at sealing face shall conform to paragraph entitled, "Pump Acceptance" when pump is operating against shutoff head.

2.1.9 Mechanical Seals

Mechanical seals shall be internally flushed type per manufacturer's standard for the specified and indicated service.

2.1.10 Bearings and Lubrication

Bearings shall be heavy-duty ball or roller type and shall have an L-10 rated life of not less than 80,000 hours in accordance with AFBMA 9 or AFBMA 11.

Bearings shall be grease lubricated and shall be provided with grease supply and relief fittings located at bottom of bearing.

2.1.11 Flexible Coupling

Pump shaft shall be connected to the motor shaft through an elastomeric flexible member in shear and shall be a tire shape or a solid-mass serrated-edge disk shape retained by fixed flanges. Flexible coupling shall act as a dielectric connector and shall not transmit sound, vibration, or end thrust. A coupling guard shall be provided to protect against moving parts.

2.1.12 Bedplate

Pump and driver shall be mounted on a common bedplate which shall be installed on vibration isolation springs and seismic snubbers.

2.1.13 Pump Motors

Pump Motors shall be selected to match the pump requirements. Motors shall comply with the requirements of Section 16050 "Base Electrical Materials and Methods," and Section 16225, "Motors." Motors shall have totally enclosed enclosures.

2.1.14 Vibration Isolator

Each pump shall be mounted on a vibration isolation system per Specification Section 15072.

2.2 EXPANSION TANK

Expansion tank shall be pressurized bladder type. A flanged access opening shall be provided for bladder replacement. Tank shall have a charging valve and system connection.

2.3 AIR SEPARATOR

A centrifugal type air separator shall be provided at pump suction as indicated on the drawings.

2.4 CHEMICAL FEEDER

A chemical bypass feeder shall be provided across the pump. It shall be made of carbon steel and complete with isolation valves, drain and vent valves.

2.5 PIPING AND ACCESSORIES

The pumping package shall include interconnecting piping, stainless steel bellows type pump connectors, automatic vents, drains, valves, and instruments as shown on the drawings.

2.6 CONTROL PANEL

The main electrical control panel shall be UL approved and carry a NEMA 3R rating for outdoor services. The control panel shall contain a main circuit breaker disconnect switch, combination motor circuit protector switched, H-O-A selector switches, control circuit transformer with fuse protection, operation lights, and provisions for remote start and stop functions from the FMCS. The panel shall provide for the electrical requirements and control of all of the components within the skid assembly.

The panel shall include controls to monitor pump failure, light a door mounted pump failure lamp, close a pump failure dry contact for remote monitoring and start the back-up pump. A differential pressure switch shall be mounted on each pump. Provide remote contacts for the package on/off and summary alarm for HVAC system control and monitoring.

2.7 PIPING

Provide stainless steel bellows at pump inlet and outlet. Provide C isolation valves at the inlet and outlet of the pumps and the entire

package. Provide a circuit setter, a non-slam check valve on each pump outlet. Provide isolation valves for each piece of equipment.

PART 3 EXECUTION

3.1 PUMP PROTECTION

Before any pump is operated, piping systems shall be cleaned and flushed to remove all particles larger than 1,000 micrometer 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.

Mechanical-seal flushing water shall be provided with centrifugal separator or 10-micrometer filter element where loose rust may be present at startup.

3.2 VIBROMETER

A calibrated, certified vibrometer shall be provided for pump-vibration checking. Instrument shall be readable to 0.0025 millimeter deflection. Testing shall be performed by an experienced operator. Contractor shall provide a tabulation of readings and points read, together with instrument data. Vibrometer shall remain the property of the Contractor.

3.3 INSTALLATION

The chilled water pumping package shall be installed on the roof as shown on the drawings and connected to supply, return and make-up water piping.

3.4 ALIGNMENT

Pump and driver shall be aligned to manufacturer's maximum permissible tolerances, but in no case shall angularity exceed 0.5 degree nor shall parallel misalignment exceed 0.051 millimeter.

Pump shall be dowelled in place with AISI 18-8 corrosion-resistant steel spiral-wrapped pins before being subjected to pressure or piping reaction. After anchoring and final alignment, and no sooner than after 40 hours of continuous operation, the driver shall be similarly dowelled in place. Taper pins are not acceptable.

3.5 PUMP ACCEPTANCE

Prior to final acceptance, dial indicator gages shall be used to demonstrate that pump and motor are aligned as specified and that the pump casing is entirely free of any piping loads.

Prior to final acceptance, pump conformance to specifications shall be demonstrated by checking vibration with specified vibrometer while the pump is operating against shutoff head; i.e., with discharge valve closed.

Pump shall be operated and demonstrated to be nonoverloading at any operating point and that the flow capacity is as specified.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 15 - MECHANICAL

SECTION 15628

AIR-COOLED WATER CHILLERS

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS

PART 2 PRODUCTS

- 2.1 CENTRIFUGAL WATER-CHILLER PACKAGES
- 2.2 COMPRESSOR
- 2.3 CONDENSER
 - 2.3.1 Fans and Drives
 - 2.3.2 Condenser Coils
- 2.4 EVAPORATOR
- 2.5 CONTROL AND CONTROL PANELS
- 2.6 MOTORS
 - 2.6.1 Compressor Motors
 - 2.6.2 Condenser Fan Motor
 - 2.6.3 Miscellaneous Electrical
- 2.7 INSULATION
- 2.8 NOISE REDUCTION
- 2.9 SPECIAL TOOLS

PART 3 EXECUTION

- 3.1 SHIPMENT
- 3.2 MANUFACTURER'S REPRESENTATIVE
- 3.3 SHOP TESTING
- 3.4 FIELD TESTING

-- End of Section Table of Contents --

SECTION 15628

AIR-COOLED WATER CHILLERS

PART 1 GENERAL

1.1 REFERENCES

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

AIR CONDITIONING AND REFRIGERATION INSTITUTE (ARI)

ARI 550/590 (1998) Water-Chilling Packages using the Vapor Compression cycle

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

ASHRAE 90A (1980; 90A-a 1987) Energy Conservation in New Building Design

ASHRAE-07 (1992) Handbook, HVAC Systems and Equipment (SI Edition)

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME-16 (1995) Boiler and Pressure Vessel Code; Section VIII, Pressure Vessels Division 1 - Basic Coverage

INTERNATIONAL STANDARDS ORGANIZATION (ISO)

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

NATIONAL ELECTRICAL MANUFACTURER'S ASSOCIATION (NEMA)

NEMA 250 (1991) Enclosures for Electric Equipment (1000 Volts Maximum)

1.2 SUBMITTALS

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

SD-01 Data

Equipment Foundation Data shall be submitted for the Air-cooled Water Chillers including equipment weight and operating loads, location and projection of anchor bolts, and horizontal and vertical clearances for installation, operation, and maintenance. Data shall also include dimensions of foundations and relative elevations, and installation requirements such as noise abatement, vibration isolation, and utility services.

SD-01 Data

Equipment and Performance Data shall be submitted for the chillers indicating the guaranteed maximum power consumption at 75-, 50-, 25-, and 10- percent points of full compressor capacity at design condenser air inlet temperature.

SD-01 Data

Manufacturer's Catalog Data shall be submitted for the following items:

- Air-Cooled Water Chillers
- Compressors
- Condensers
- Coolers
- Motors
- Control and Control Panels
- Insulation
- Special Tools
- Spare Parts

SD-04 Drawings

Connection Diagrams shall be submitted indicating the relations and connections of the following items. Drawings shall indicate the physical layout of all controls, and internal tubing and wiring details.

- Air-Cooled Water Chillers
- Compressors
- Condensers
- Coolers
- Motors
- Control and Control Panels

SD-04 Drawings

Control Diagrams shall be submitted for the Chiller Units showing the physical and functional relationship of equipment. Electrical diagrams shall show the size, type, and capacity of the system.

SD-04 Drawings

Installation Drawings shall be submitted for the Chillers Showing overall physical features, dimensions, ratings, service requirements, and equipment weights.

SD-04 Drawings

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

SD-06 Instructions

Detailed installation and start up instructions shall be submitted for the chiller units.

SD-011 & 12 Factory and Field Test Reports

Test Reports for chiller units shall be submitted indicating the results of "Shop Testing" and Tests performed in accordance with the paragraph entitled, "Field Testing," of this section. Include results of vibration tests.

SD-13 Certificates

Certificates of Compliance shall be submitted for following items showing conformance with the referenced standards contained in this section.

- Air-Cooled Water Chillers
- Compressors
- Condensers
- Coolers
- Motors
- Control and Control Panels
- Insulation
- Special Tools
- Spare Parts

SD-19 Operation and Maintenance Manuals

The Contractor shall provide 6 copies of the Operations and Maintenance Manuals.

PART 2 PRODUCTS

2.1 CENTRIFUGAL WATER-CHILLER PACKAGES

Air-cooled water-chiller assemblies shall be packaged and self-contained, and shall include screw compressors, air-cooled condensers, coolers (refrigerant evaporator) accessories, control panels, and intercomponent piping and wiring ready for field-terminal connections.

The chillers shall meet the performance requirements indicated on the drawings.

The chillers shall utilize Refrigerant HFC-134a.

Units shall conform to the applicable requirements of ARI 550/590 and specified requirements. Energy efficiency rating shall exceed ASHRAE 90A requirements. Units shall comply with ASHRAE 15 safety code.

Chiller shall be suitable for 460 volts, 3 phase, 60 HZ power supply.

Chillers shall meet the seismic requirements of the California Building Code.

2.2 COMPRESSOR

Each chiller shall have two (2) compressors. Compressors shall be semi-hermetic, screw type. Motor windings shall be refrigerant cooled. Rotor shall be statically and dynamically balanced to ISO 1940/1-1986, G2.5 at the factory.

Lubrication system shall be of the forced-feed type, including a heater, hermetically sealed pump, oil filter, and strainer. Oil temperature shall be thermostatically controlled.

Compressor shall be provided with temperature-actuated capacity reduction to provide automatic capacity regulation from 100 percent to 20 percent of capacity. Capacity modulation shall be based on the water leaving the cooler. Unit controller shall be able to maintain leaving-water temperature at plus or minus 0.25 degrees C of the set point.

2.3 CONDENSER

Air-cooled condenser shall include fans, motors, drives, refrigerant condensing coils, controls, and totally enclosed weatherproof casing.

2.3.1 Fans and Drives

Condenser fans shall be direct driven, axial flow type with shrouds. Impeller blades shall have an airfoil cross section. Impellers shall be statically and dynamically balanced to ISO 1940/1-1986, G2.5 at the factory. Air shall be discharged vertically upwards. Fans shall be protected by galvanized steel wire safety guards. Fan motors shall be totally enclosed type.

2.3.2 Condenser Coils

Condensing coils shall be designed and sized specifically for air-cooled condenser service. Coil construction shall be seamless copper type, with aluminum extended surface, integral with or mechanically attached to the tube. All coil surfaces shall have an epoxy coating applied by an electrocoating process for corrosion protection. Coils shall be factory tested pneumatically under water at not less than 2758 kilopascals. A purging vent shall be provided at the highest point of the entering refrigerant header of each coil circuit. Coil subcooling shall be provided when a differential not greater than 7 degrees C below zero degrees C exists between condensing and ambient temperatures.

Condenser coil and receiver shall have an excess capacity of not less than 20 percent for storage of pumped-down refrigerant.

Condensing coil and remainder of refrigerant circuit shall be cleaned and factory charged with dry nitrogen or refrigerant.

Coils shall be protected from physical damage.

2.4 EVAPORATOR

Evaporator shall be shell-and-tube type, of welded steel construction, with removable steel heads with two independent refrigerant circuits.

Tubes shall be cleanable, seamless copper, expanded into tube sheets.

Design, test, and stamp refrigerant side for 1550 kilopascals working pressure, and water side for 1030 kilopascals working pressure, in accordance with ASME-16 and ASHRAE-07. Provide water drain connections.

Insulate with 19 millimeter thick flexible expanded polyvinyl chloride foam insulation with maximum K value of 0.037 watt per meter per degree Kelvin.

2.5 CONTROL AND CONTROL PANELS

Water-chilling unit shall be provided with one or more control panels containing safety and operating devices and intercomponent piping and wiring for field terminal connection and fully automatic operation.

Controls shall be coordinated with automatic temperature controls systems and electrical work specified and indicated. Control panel shall contain control equipment specified, and control equipment normally furnished and recommended by the manufacturer for optimum operation of the system. All gages shall have dual english/metric, scales. Control panel items shall be permanently identified, including at least the following:

- Refrigerant suction and discharge pressure gages
- Oil-pressure gages
- Refrigerant low-temperature or low-pressure cutout
- Refrigerant high-pressure cutout
- Time delay relays
- Motor high-temperature cutout
- Lubricating-oil high-temperature cutout if required by equipment
- Oil differential-pressure interlock
- Interlock relays and reset button
- Pilot lights indicating position of safety controls
- System start/stop provisions with condition-indicating lights
- Capacity Control System
- Cooler refrigerant thermometer with well
- Main circuit protective and interruptive device
- Transformers for any other source-voltage requirements
- Terminals for field-installed equipment
- Motor controllers
- Amperage readout per compressor
- NEMA 250, enclosures suitable for outdoor environment.

The following items shall be provided as part of the installation:

- Audible-alarm bell, 100 millimeter diameter
- Chilled-water and condenser supply-and-return thermometers with wells
- Indicating-type chilled-water thermostat with well

Chilled-water low-temperature cutout

2.6 MOTORS

2.6.1 Compressor Motors

Bearings shall be oil-lubricated, replaceable-sleeve, insertable type.

Hermetically sealed motors shall conform to requirements NEMA MG-1 and ARI 520 for motors specified here.

Motor shall have two manually resettable thermal-overload protective devices located within windings.

If water-chilled unit or any component could be damaged by reverse motor operation, and when proposed water-chiller unit contains a mechanically driven lubricating-oil pump, the manufacturer's responsibility shall include, providing reverse-phase rotation protection.

2.6.2 Condenser Fan Motor

Motors shall conform to NEMA MG-1 and be totally enclosed, 3 phase type, with permanently lubricated bearings.

2.6.3 Miscellaneous Electrical

The chiller units shall be suitable for Wye-Delta start. Chillers shall be provided with control transformers and non-fused disconnects. Chillers shall be suitable for remote start/stop from the existing Siemens Facility Monitoring and Control System (FMCS). Chillers shall transmit trouble alarms to the FMCS. Chiller panels shall have capability to provide 120V power and control to an electric actuated butterfly isolation valve on the chilled water supply line to each chiller.

2.7 INSULATION

Cooler shell and suction piping between evaporator and first stage of each compressor unit shall be insulated and vapor-sealed. Water boxes shall be insulated to provide for ease of access to heads for inspection and repair.

Vapor-seal material shall be manufacturer's standard color elastomeric unicellular foam in manufacturer's standard thickness to preclude condensation of ambient moisture on any surface under site-operating conditions. If unicellular material is black or is otherwise coated, only polyvinylchloride lacquer shall be used for coating. Any coating that cracks when unicellular material is compressed shall be removed and replaced with specified coating at no additional expense to the Government.

2.8 NOISE REDUCTION

Sound reduction enclosures shall be provided on the chiller unit to minimize noise levels. Sound pressure level at a distance of 5 meters shall not exceed 72 dBA.

2.9 SPECIAL TOOLS

One complete set of special tools, as recommended by the manufacturer, shall be provided for field maintenance of the system. Tools shall be contained in a locked toolbox. Two keys shall be provided to the

Contracting Officer.

PART 3 EXECUTION

3.1 SHIPMENT

Chillers shall be shipped with a complete charge of refrigerant and oil. The evaporator shall be charged with glycol, if recommended by the manufacturer. Chillers shall be packed and crated suitable for outdoor storage.

3.2 MANUFACTURER'S REPRESENTATIVE

Chillers shall be installed in accordance with manufacturer's instructions and drawings. Services of a competent factory-trained representative shall be provided, to supervise the installation, charging, testing, and startup of equipment; in addition, Government personnel shall receive 4 hours of instructions in proper operation and maintenance procedures.

3.3 SHOP TESTING

Each chiller unit shall be completely assembled, inspected and full load run tested at the factory.

3.4 FIELD TESTING

Prior to start up, the Contractor shall verify that refrigerant and oil charges are satisfactory, and replenish if required. Upon completion of the installation, and within 15 days after the date of initial operation, performance tests shall be conducted in the presence of the Contracting Officer. These tests shall be conducted until the performance of the system is proven, with 8 hours of successful operation as a minimum period.

Any equipment defects or performance deficiencies shall be corrected, and the tests repeated until performance is fully satisfactory. Water flows shall be determined from pressure-drop across chiller and condenser, and from pump curves. Calibrated test instruments shall be provided. Government will provide chilled water and the load.

Each unit shall be tested for leaks under pressure and shall be evacuated and dehydrated to 2 degrees C wet bulb, or an absolute pressure of not over 813 pascal.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 15 - MECHANICAL

SECTION 15720

AIR HANDLING UNITS

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 GENERAL REQUIREMENTS
- 1.3 SUBMITTALS

PART 2 PRODUCTS

- 2.1 AIR HANDLING UNIT (AHU)
- 2.2 UNIT CABINET
- 2.3 FANS
- 2.4 DRAIN PANS
- 2.5 INSULATION
- 2.6 FAN MOTORS
- 2.7 COIL
- 2.8 FILTERS
- 2.9 ECONOMIZER
- 2.10 CONTROL AND INSTRUMENTATION

PART 3 EXECUTION

- 3.1 AHU EQUIPMENT INSTALLATION
- 3.2 AHU TESTING

-- End of Section Table of Contents --

SECTION 15720

AIR HANDLING UNITS

PART 1 GENERAL

1.1 REFERENCES

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

AIR CONDITIONING AND REFRIGERATION INSTITUTE (ARI)

ARI 430 (1989) Central-Station Air-Handling Units

AIR MOVEMENT AND CONTROL ASSOCIATION (AMCA)

AMCA 211 (1994) Certified Ratings Program - Air Performance

AMCA 99 (1986; AMCA 99-0401) Standards Handbook

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 653/A 653M (1990) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM B 117 (1994) Standard Test Method of Salt Spray (Fog) Testing

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

ASHRAE 51 (1985) Laboratory Methods of Testing Fans for Rating

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 90A (1993) Standard for the Installation of Air Conditioning and Ventilating Systems

NATIONAL ELECTRICAL MANUFACTURER'S ASSOCIATION (NEMA)

NEMA MG 1 (1993) Motors and Generators

1.2 GENERAL REQUIREMENTS

Section 15003, "General Mechanical Provisions," applies to work specified in this section.

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 Air Handling Units in accordance with the specification. Data shall consist of use life, total static pressure and coil face area classifications, and performance ratings.

SD-01 Data

Manufacturer's Catalog Data shall be submitted for the following items:

- Unit Cabinet
- Fans
- Drain Pans
- Insulation
- Plenums
- Multizone AHU
- Blow-Through AHU
- Spare Parts
- Vibration Isolation

SD-19 Operation and Maintenance Manuals

Contractor shall submit Operation and Maintenance Manuals prior to testing the Air Handling Units. Data shall be updated and resubmitted for final approval no later than 30 days prior to contract completion.

PART 2 PRODUCTS

2.1 AIR HANDLING UNIT (AHU)

Air handling unit (AHU) shall be central-station type, factory fabricated, and assembled. AHU shall include components and auxiliaries in accordance with ARI 430. Units shall be designed for outdoor service. Windload shall be per UBC, 120 km/Hr, exposure C. AHUs shall meet the dimensional requirements shown on drawings.

Total static pressure and coil face area classification shall conform to AMCA 99.

AHU and components shall be performance tested and rated in accordance with AMCA 211 and ASHRAE 51. AHU ratings shall be in accordance with ARI 430.

Fans with enlarged outlets shall not be permitted.

Supply fan shall be double-width, double-inlet, air foil or backward inclined centrifugal type. Return fan shall be double-width, double-inlet, forward curved or backward inclined centrifugal type.

The Contractor shall ensure sufficient access to the fan is present to allow for cleaning and in-place balancing of the fan.

2.2 UNIT CABINET

AHU cabinet shall be double wall type with 50 mm thick insulation. Interior liner shall be minimum 0.9mm galvanized steel. Unit shall be

suitable for pressure class based on the fan static pressure. Unit shall have leaktight joints, closures, penetrations, and access provisions. Cabinet shall not expand or contract perceptibly during starting and stopping of fans and shall not pulsate during operation. Cabinet surfaces with deflections in excess of 0.004167 of unsupported span shall be reinforced prior to acceptance. Pulsating panels, which produce low frequency noise due to diaphragming of unstable panel walls, shall be stiffened to raise natural frequency to an easily attenuated level. Enclosure shall be fabricated from mill-galvanized or primed and painted carbon steel sheet of required thickness. Mill-galvanized sheet metal shall conform to ASTM A 653/A 653M and shall be coated with not less than 0.38 kilogram of zinc per square meter of two-sided surface. Mill-rolled structural steel shall be hot-dip galvanized or primed and painted. Cut edges, burns, and scratches in galvanized surfaces shall be corrosion protected. Primed and painted black carbon steel cabinet construction shall comply with this specification.

Access doors and panels shall be hinged and latched at a spacing sufficiently close to preclude leaks caused by distortion, and shall be effectively gasketed.

Black carbon steel cabinet construction shall be acceptable when the following conditions are met:

All interior and exterior surfaces, including lapped contacting surfaces, shall be coated with a corrosion-protective coating.

Coating shall be certified as passing a 500-hour exposure salt-spray fog test in accordance with ASTM B 117.

Immediately after completion of the test, the specimen shall show no signs of wrinkling, cracking or loss of adherence, and no signs of rust creepage beyond 3 millimeter on either side of the scratch mark.

After 11 months of service and prior to expiration of guarantee, cabinet shall pass inspection of interior and exterior surfaces for the same defects as the salt-spray fog test specimen.

Interior surfaces of cabinets constructed of intact mill-galvanized steel shall require no further protection.

Exterior surfaces of cabinets constructed of mill-galvanized steel shall be prepared by a phosphatizing treatment, and painted with two coats of manufacturer's enamel finish in a color to match the new roof screen.

2.3 FANS

Overall fan-section depth shall be equal to or greater than the manufacturer's free-standing fan.

Location of fan inlet shall provide not less than one-half fan-wheel diameter clearance from cabinet wall.

AHU fan motor and drive shall be installed inside fan cabinet. Motor shall be installed on an adjustable base. An access door of adequate size for servicing motor and drive shall be provided. An open mesh belt guard shall be provided inside the cabinet, or the access door shall be interlocked with the supply fan so that power to the fan will be interrupted when the access door is opened. The motor and fan shall be mounted on seismic

restrained, spring type vibration isolators, isolated from the outer casing.

Fan wheels shall be keyed to the shaft and shall be designed for continuous operation at the maximum rated fan speed and motor horsepower. Fan wheels and shafts shall be statically and dynamically balanced as an assembly.

Fan shafts shall be solid steel, turned, ground, polished, and coated with rust-preventative oil.

Fan bearings shall be self-aligning, pillow-block, regreasable ball or roller-type selected for a minimum average life of 200,000 hours.

Fans and motors shall be statically and dynamically balanced for ISO 1940/1.

Motor shall conform to NEMA MG-1. All fans shall be belt driven with adjustable sheaves.

2.4 DRAIN PANS

Pan material shall be 0.85 millimeter AISI Type 304 corrosion-resistant steel with silver-soldered joints. Minimum side of drain opening shall be 32 millimeter. Pan shall be piped to drain. Adequate supports shall be made from the same type material as pans or hot-dip galvanized angle iron with isolation at interface.

Integral cabinet drain pan shall extend under all areas where condensate must be collected and shall be watertight with welded or brazed joints, piped to drain, corrosion protected in condensate collection area, and insulated against sweating. Sheet metal shall be minimum 2.0 millimeter, except that 1.6 millimeter double-drain-pan construction shall be acceptable.

Cooling coil ends shall be enclosed by cabinet and shall be factory insulated against sweating or shall drain to drain pan.

2.5 INSULATION

Unit shall be double wall type with minimum 50mm insulation. Insulation shall be mineral wool with a minimum density of 64.1 kg/m³ and a maximum thermal conductivity of 0.037 watt per meter per degree kelvin at 66 degrees C mean. Insulation effectiveness shall preclude condensation on any exterior cabinet surface under conditions normal to the unit's installed location. Acoustic treatment shall attenuate fan noise in compliance with specified noise criteria. Material shall be applied to the cabinet with adhesive on 100-percent coverage basis. Adhesive and insulating material shall be in accordance with NFPA 90A.

2.6 FAN MOTORS

Fan motors shall be totally enclosed type and shall comply with Specifications Section 16225, "Motor".

2.7 COIL

Chilled Water Coil shall be in accordance with Specification Section 15762, "Air Coils".

2.8 FILTERS

Filters shall be extended media with a filter depth of 610mm. Filters shall have minimum dust spot efficiency of 65% per ASHRAE 52.1. Panel type

pre-filters shall be included. Filters shall have a UL 900 Class 2 listing. Initial filter resistance shall not exceed 90 Pascals at a face velocity of 2.5 m/s. Filters shall be designed to be replaced at a final pressure drop of 250 Pascals.

A dial type gage shall be provided to indicate filter pressure drop. The gage shall be graduated from 0 to 500 pa.

2.9 ECONOMIZER

Air handling units shall be suitable for an economizer cycle. Units shall be provided with appropriate dampers with actuators, plenums and controls. All controls and interlocks shall be internal to the unit.

2.10 CONTROL AND INSTRUMENTATION

All electrical components shall be housed in a weather-tight panel mounted on the air handling unit. Division 16 shall provide the disconnect switch and motor starter for each supply and return fan. The motor starter shall have the required auxiliary contacts for FMCS control and fan shut down.

PART 3 EXECUTION

3.1 AHU EQUIPMENT INSTALLATION

Equipment shall be installed in accordance with manufacturer's recommendations.

3.2 AHU TESTING

Testing shall be in accordance with specification Section 15990.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 15 - MECHANICAL

SECTION 15762

AIR COILS

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 GENERAL REQUIREMENTS
- 1.4 LABEL

PART 2 PRODUCTS

- 2.1 GENERAL
 - 2.1.1 Coil Pressure and Temperature Ratings
 - 2.1.2 Coil Casings
 - 2.1.3 Coil Headers
 - 2.1.4 Coil Tubing
 - 2.1.5 Coil Circuiting
 - 2.1.6 Coil Type

PART 3 EXECUTION

- 3.1 INSTALLATION
- 3.2 TESTS

-- End of Section Table of Contents --

SECTION 15762

AIR COILS

PART 1 GENERAL

1.1 REFERENCES

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

AIR CONDITIONING AND REFRIGERATION INSTITUTE (ARI)

ARI 410 (1991) Forced-Circulation Air-Cooling and Air-Heating Coils

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 653/A 653M (1990) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

1.2 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

Performance Data shall be submitted for chilled water coils.

SD-01 Data

Manufacturer's Catalog Data shall be submitted for the following coil types indicating, when applicable, coil pressure and temperature ratings, coil casings, headers, tubing, circuiting, and drainable coils.

Hot-Water Heating (Reheat Coils)

Chilled-Water Cooling

1.3 GENERAL REQUIREMENTS

Section 15003, "General Mechanical Provisions," applies to work specified in this section.

1.4 LABEL

Coils shall bear the ARI certification seal indicating compliance with ARI 410.

PART 2 PRODUCTS

2.1 GENERAL

2.1.1 Coil Pressure and Temperature Ratings

Coils shall be designed for the following fluid operating pressures and temperatures.

<u>Service</u>	<u>Pressure (kPa)</u>	<u>Temperature (Degrees C)</u>
Chilled water	1400	121

Coils shall be air-pressure tested under water at the following minimum pressures:

<u>Service</u>	<u>Pressure (kPa)</u>
Chilled water	1750

2.1.2 Coil Casings

Coil casing shall be mill-galvanized 1.6 millimeter, minimum, sheet metal with not less than 380 gram per square meter of two-sided metal surface conforming to ASTM A 653/A 653M. Casing shall be flanged on four sides for bolted assembly, except as otherwise specified.

Duct-mounted reheat coil casings not over 900 millimeter in length shall be fabricated from a minimum 1.0 millimeter galvanized steel conforming to above specified requirements; casings shall be flanged or suitable for drive-slip assembly.

Coil mounting within housing shall be either fixed or slide-out type, except as otherwise specified. Coils shall be slide-out type for ceiling-suspended package units, and for other package units whose capacity exceeds 7 cubic meter per second.

2.1.3 Coil Headers

Coil headers shall be brass or copper.

Coil headers shall be fitted with DN8 pipe size spring-loaded plug drains and vent petcocks. Automatic vents shall be provided where indicated.

2.1.4 Coil Tubing

Coils shall be constructed of copper tubing with copper fins. Helical coil fins shall be wound tight to the tubes and solder-coated. Plate fins shall have spacer collars in metallic contact with the adjacent fin, and fins shall be mechanically bonded to the tube. No bare tube surface shall be visible within the finned portion of the coil.

Cooling coils of helical wound copper design shall be solder-coated.

Coil tubes shall be parallel and shall 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 shall be unacceptable if tube centerline is displaced by more than 5 millimeter from centerline of tube connection at outlet header when coils are more than two rows deep and when installed in accordance with the manufacturer's instructions. Provisions for expansion and contraction shall be adequate to preclude sagging and distortion under thermal loads applied in indicated or specified service. Tubes shall be sloped to be free draining.

Coil face tube spacing shall not exceed 38 millimeter on center.

Tubes shall be straight, turns shall be made through headers or return U-bends, and connections and joints shall be brazed, except as otherwise specified.

Coil tube material shall be seamless deoxidized copper.

Tubes shall be DN15, minimum.

2.1.5 Coil Circuiting

Standard or full-circuited water coils shall have as many full-length tubes in each circuit as the number of tubes in the depth of the coil face; double-circuit water coils shall have twice as many as standard coils; and half-circuit water coils shall have half as many as standard coils and to the next larger whole number where odd numbers are involved.

Coils more than two rows deep shall be counterflow type, except that in the case of double- or half-circuit coils, reasonable deviation from counterflow arrangement will be permitted, provided the pressure drop and capacity requirements are met.

2.1.6 Coil Type

Coils shall be self-draining, cleanable, counterflow type. Tubes shall be straight-through type, rolled or brazed into steel tube sheets. Headers shall be enclosed with gasketed and bolted removable cover plates to provide access to tube internals from either one end or both ends of coil.

PART 3 EXECUTION

3.1 INSTALLATION

Coils shall be installed in accordance with the manufacturer's recommendations.

3.2 TESTS

For drainable types:

Coil pitch and leveling shall be field checked for drainability in the presence of the Contracting Officer.

Coils shall be pressure tested, dehydrated, vacuum tested, purged with inert gas, and sealed.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 15 - MECHANICAL

SECTION 15815

LOW PRESSURE DUCTWORK

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 PERFORMANCE REQUIREMENTS
- 1.4 DESIGN REQUIREMENTS

PART 2 PRODUCTS

- 2.1 GALVANIZED STEEL DUCTWORK MATERIALS
 - 2.1.1 Duct Hangers
 - 2.1.2 Mill-Rolled Reinforcing and Supporting Materials
- 2.2 FLEXIBLE CONNECTORS
- 2.3 MANUAL VOLUME DAMPERS
- 2.4 INSULATION

PART 3 EXECUTION

- 3.1 INSTALLATION
- 3.2 RECTANGULAR SHEET METAL DUCTS
 - 3.2.1 Longitudinal Duct Seams
 - 3.2.2 Joints and Gaskets
 - 3.2.3 Square Elbows
 - 3.2.4 Radius Elbows
- 3.3 OUTLETS, INLETS, AND DUCT BRANCHES
- 3.4 DUCT TRANSITIONS
- 3.5 BRANCH CONNECTIONS
- 3.6 ACCESS OPENINGS
- 3.7 DUCT SUPPORTS
- 3.8 DUCT PROBE ACCESS
- 3.9 OPENINGS IN ROOFS
- 3.10 DUCT SMOKE DETECTOR INSTALLATION AND TEST
- 3.11 DUCTWORK CLEANING PROVISIONS
- 3.12 DUCTWORK LEAKAGE TESTS

-- End of Section Table of Contents --

SECTION 15815

LOW PRESSURE DUCTWORK

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC S328 (1986) Specification for Structural Steel Buildings Load and Resistance Factor Design

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 123 (1989; Rev A) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A 36/A 36M (1994) Standard Specification for Structural Steel

ASTM A 653/A 653M (1994) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

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

ASHRAE-05 (1991) Handbook, HVAC Applications (SI Edition)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 90A (1993) Standard for the Installation of Air Conditioning and Ventilating Systems

SHEET METAL AND AIR CONDITIONING CONTRACTORS NATIONAL ASSOCIATION (SMACNA)

SMACNA-03 (1992) Fibrous Glass Duct Construction Standard

SMACNA-06 (1985; 1st Ed) HVAC Duct Construction Standards - Metal and Flexible

1.2 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:

Galvanized Steel Ductwork Materials
Flexible Ductwork Materials
Dampers
Flexible Connectors
Wall Collars

SD-04 Drawings

Installation Drawings shall be submitted for Low Pressure Ductwork Systems in accordance with the manufacturer's recommended instructions.

SD-04 Drawings

As-Built Drawings shall provide current factual information including deviations from, and amendments to the drawings and concealed or visible changes in the work, for Low Pressure Ductwork Systems.

SD-04 Drawings

Installation drawings for the roof duct penetrations at all roof locations. Drawings shall show the method of connecting the new double wall insulated duct to the existing ducts that stub-up through the roof, and assembly details for the sheetmetal duct enclosure. All installation drawings shall be scaled and suitable for fabrication.

SD-04 Drawings

Scaled, detailed drawings for all duct supports.

SD-07 Schedules

Material, Equipment, and Fixture Lists shall include the manufacturer's style or catalog numbers, specification and drawing reference numbers, warranty information, and fabrication site information.

SD-09 Reports

Test Reports shall be submitted for low pressure ductwork systems on the following tests in accordance with the paragraph entitled, "Ductwork Leakage Tests" and "Fire Damper Tests," of this section.

Operational Tests
Leakage Tests

SD-14 Samples

Manufacturer's Standard Color Chart shall indicate the manufacturer's standard color selections and finishes for Low Pressure Ductwork.

SD-18 Records

Records of Existing Conditions shall be submitted consisting of the results of Contractor's survey of work area conditions and features of existing structures and facilities within and adjacent to the jobsite. Commencement of work shall constitute acceptance of existing conditions.

1.3 PERFORMANCE REQUIREMENTS

Section 15003, "General Mechanical Provisions," applies to work specified in this section. Supports shall be designed in accordance with 1998 CBC Criteria.

1.4 DESIGN REQUIREMENTS

Low-pressure systems shall encompass ductwork and plenums where maximum air velocity is 10.1 meter per second and maximum static pressure is 500 pascal water gage (wg), positive or negative. All outdoor ducts shall be double wall construction, with insulation between the inner and outer sheet metal walls.

PART 2 PRODUCTS

2.1 GALVANIZED STEEL DUCTWORK MATERIALS

All duct work on the roof shall be double-wall type as manufactured by United McGill Corporation or approved equal.

All ductwork enclosed in the housing at roof penetrations shall be single wall type.

Galvanized steel ductwork sheet metal shall be carbon steel, of lock-forming quality, hot-dip galvanized, with regular spangle-type zinc coating, conforming to ASTM A 653/A 653M, Z275. Duct surfaces to be painted shall be treated by phosphatizing.

Sheet metal gages and reinforcement thickness shall conform to SMACNA-06.

2.1.1 Duct Hangers

Duct hangers in contact with galvanized duct surfaces shall be galvanized.

2.1.2 Mill-Rolled Reinforcing and Supporting Materials

Mill-rolled structural steel shall conform to ASTM A 36/A 36M and, whenever in contact with sheet metal ducting, shall be galvanized in accordance with ASTM A 123.

Equivalent strength, proprietary-design, rolled-steel structural support systems may be submitted for approval in lieu of mill-rolled structural steel.

2.2 FLEXIBLE CONNECTORS

Connectors shall be UL-listed, 610 kilograms per square meter, fire-retardant, airtight, woven fibrous-glass cloth impregnated with chloroprene. Clear width, not including clamping section, shall be 76 to 125mm.

2.3 MANUAL VOLUME DAMPERS

Volume damper construction shall conform to SMACNA-06.

Dampers shall be equipped with an indicating quadrant regulator with a locking feature externally located and easily accessible for adjustment. Where damper rod lengths exceed 760 millimeter, a regulator shall be provided at each end of damper shaft.

All damper shafts shall have two-end bearings.

Damper shaft shall be full length and shall extend beyond damper blade. A 10 millimeter square shaft shall be used for damper lengths up to 500 millimeter and a 15 millimeter square shaft shall be used for damper lengths 500 millimeter and larger. Where necessary to prevent damper vibration or slippage, adjustable support rods with locking provisions external to duct shall be provided at damper blade end.

Dampers in ducts having a width perpendicular to the axis of the damper that is greater than 300 millimeters shall be multiblade type having a substantial frame with blades fabricated of 1.6 millimeter metal. Blades shall not exceed 250 millimeter in width and 1220 millimeter in length and shall be welded to 15 millimeter diameter shafts. Dampers greater than 1220 millimeter in width shall be made in two or more sections with intermediate mullions, each section being mechanically interlocked with the adjoining section or sections. Blades shall have graphite-impregnated nylon bearings and shall be connected so that adjoining blades rotate in opposite directions.

2.4 INSULATION

Insulation for double wall ducts shall be 25.4 mm thick coated mineral fiber in accordance with specification Section 15083.

PART 3 EXECUTION

3.1 INSTALLATION

Sheet metal construction shall be provided in accordance with the SMACNA-06 and NFPA 90A.

Construction methods for any other items that are not covered herein shall be in accordance with ASHRAE-05.

Supplementary steel shall be designed and fabricated in accordance with AISC S328.

Fabrication shall be airtight and shall include necessary reinforcements, bracing, supports, framing, gasketing, sealing, and fastening to provide rigid construction and freedom from vibration, airflow-induced motion, noise, and excessive deflection at specified maximum system air pressure.

Offsets and transformations shall be provided as required to avoid interference with the building construction, piping, or equipment.

Sheet metal surfaces to be painted or surfaces to which adhesives will be applied shall be clean and free of oil, grease, and deleterious substances.

Where interiors of ducting may be viewed through air diffusion devices, the

viewed interior shall be sheet metal and shall be painted flat black.

Duct strength shall be adequate to prevent failure under pressure or vacuum created by fast closure of ductwork devices. Leaktight automatic relief devices shall be provided.

Plenum anchorage provisions, sheet metal joints, and other areas shall be made airtight and watertight by calking mating galvanized steel and concrete surfaces with a two-component elastomer.

3.2 RECTANGULAR SHEET METAL DUCTS

Angle iron frames shall be welded at corners and ends, whenever possible. Angle iron reinforcements shall be riveted or welded to ducts not more than 150 millimeter on center, with not less than two points of attachment. Spot welding, where used, shall be 75 millimeter on center.

Standard seam joints shall be sealed with an elastomer compound.

Crossbreaking shall be limited to 1220 millimeter and shall be provided on all ducts 200 millimeter wide and wider. Bead reinforcement shall be provided in lieu of crossbreaking where panel popping may occur. Where rigid insulation will be applied, crossbreaking is not required.

3.2.1 Longitudinal Duct Seams

For duct sizes through 300 millimeter, corner seams shall be button-punch snap lock. For duct sizes 330 millimeter and larger corner locks shall be used.

3.2.2 Joints and Gaskets

Companion angle flanges shall be bolted together with 8 millimeter diameter bolts and nuts spaced 150 millimeter on center. Flanged joints shall be gasketed with chloroprene full-face gaskets 3 millimeter thick, with Shore A 40 durometer hardness. Gaskets shall be one piece and dovetailed at joints.

3.2.3 Square Elbows

Double thickness turning vanes shall be provided in accordance with SMACNA-03.

3.2.4 Radius Elbows

Radius elbows shall conform to SMACNA-06. Radius elbows shall have an inside radius equal to the width of the duct. Where installation conditions preclude use of standard elbows, the inside radius may be reduced to a minimum of 0.25 times duct width and turning vanes shall be installed in accordance with the following schedule.

WIDTH OF ELBOWS MILLIMETRE	RADIUS OF TURNING VANES IN PERCENT OF DUCT WIDTH		
	VANE NO. 1	VANE NO. 2	VANE NO. 3
Up to 406	56	--	--
430 to 120	43	73	--

WIDTH OF ELBOWS MILLIMETRE	RADIUS OF TURNING VANES IN PERCENT OF DUCT WIDTH		
	VANE NO. 1	VANE NO. 2	VANE NO. 3
1245 and over	37	55	83

Where two elbows are placed together in the same plane in ducts 760 millimeter wide and larger, the guide vanes shall be continuous through both elbows rather than spaced in accordance with above schedule.

3.3 OUTLETS, INLETS, AND DUCT BRANCHES

Branches, inlets, and outlets shall be installed so that air turbulence will be reduced to a minimum and air volume properly apportioned. Adjustable splitter dampers shall be installed at all supply junctions to permit adjustment of the amount of air entering the branch. Wherever an air-diffusion device is shown as being installed on the side, top, or bottom of a duct, and whenever a branch takeoff is not of the splitter type, a commercially manufactured air extractor shall be provided to allow adjustment of the air quantity and to provide an even flow of air across the device or duct it services.

3.4 DUCT TRANSITIONS

Where the shape of a duct changes, the angle of the side of the transition piece shall not exceed 15 degrees from the straight run of duct connected thereto.

Where equipment is installed in ductwork, the angle of the side of the transition piece from the straight run of duct connected thereto shall not exceed 15 degrees on the upstream side of the equipment and 22-1/2 degrees on the downstream side of the equipment.

3.5 BRANCH CONNECTIONS

Radius tap-ins shall be constructed in accordance with SMACNA-06.

3.6 ACCESS OPENINGS

Access doors and panels shall be installed in ductwork upstream from coils adjacent to fire dampers, at controls or at any item requiring periodic inspection, adjustment, maintenance, or cleaning.

Minimum size of access opening shall be 305 by 460 millimeter, unless precluded by duct dimensions or otherwise indicated.

Access door construction shall be in accordance with SMACNA-06, except that sliding doors may be used only for special conditions upon prior approval. Insulated doors shall be double-panel type.

Access doors that leak shall be made airtight by adding or replacing hinges and latches or by construction of new doors adequately reinforced, hinged, and latched.

3.7 DUCT SUPPORTS

Provide duct support as shown on the drawings.

Maximum span between any two points shall be 3000mm or per UMC Table 6-E,

whichever is less with lesser spans for duct assemblies, interferences, and loads imposed or permitted.

3.8 DUCT PROBE ACCESS

Holes shall be provided with neat patches, threaded plugs, or threaded or twist-on caps where indicated, and where necessary, for air-balancing pitot tube access. Extended-neck fittings shall be provided with probe access area is insulated.

3.9 OPENINGS IN ROOFS

Openings indicated in roof are approximate. The Contractor shall field verify the sizes of existing openings before commencement of work.

3.10 DUCT SMOKE DETECTOR INSTALLATION AND TEST

Duct smoke detector shall be installed in accordance with manufacturer's instruction. The inlet sampling tube shall be the same width of the duct. Provide duct access opening up stream of the detector sensitivity check after installation. The detector shall be checked per manufacturer's instruction.

3.11 DUCTWORK CLEANING PROVISIONS

Open ducting shall be protected from construction dust and debris in a manner approved by the Contracting Officer. Dirty assembled ducting shall be cleaned by a method approved by the Contracting Officer. Compressed air used for cleaning ducting shall be water- and oil-free. Prior to acceptance of the work, dust and debris shall be removed from exterior surfaces.

3.12 DUCTWORK LEAKAGE TESTS

The Contractor shall conduct leakage tests on new duct in accordance with Section 15990, "Testing, Adjusting and Balancing". Test shall be performed prior to installing ductwork insulation and witnessed by the Government.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 15 - MECHANICAL

SECTION 15870

POWER ROOF VENTILATORS

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 GENERAL REQUIREMENTS
- 1.4 QUALITY ASSURANCE

PART 2 PRODUCTS

- 2.1 DESIGN AND FABRICATION REQUIREMENTS
- 2.2 HOUSING STYLE(S)
- 2.3 FAN TYPE(S)
 - 2.3.1 Type CB-PRV Centrifugal
- 2.4 MATERIALS
 - 2.4.1 Aluminum Alloy
- 2.5 FAN MOTOR
- 2.6 BASES
- 2.7 ROOF CURBS
- 2.8 SCREENS
- 2.9 SOUND BAFFLES

PART 3 EXECUTION

- 3.1 INSTALLATION
- 3.2 TESTS
- 3.3 LUBRICATION

-- End of Section Table of Contents --

SECTION 15870

POWER ROOF VENTILATORS

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM B 37 (1992) Standard Specification for Aluminum
for Use in Iron and Steel Manufacturer

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

ASHRAE-07 (1992) HVAC Systems and Equipment (SI
Edition)

UNDERWRITERS LABORATORIES (UL)

UL 705 (1984) UL Standard for Safety Power
Ventilators

1.2 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 Dimensions and Performance Data shall be submitted for
Power Roof Ventilators.

SD-01 Data

Manufacturer's Catalog Data shall be submitted for the following
items:

Housings
Fans
Motors
Drives
Bases
Roof Curbs
Dampers
Bird Screens
Sound Baffles
Spare Parts

SD-04 Drawings

Installation Drawings and Instructions shall be submitted for
Power and Gravity Roof Ventilators.

SD-04 Drawings

As-Built Drawings shall be submitted for Power and Gravity Roof Ventilators providing current factual information such as deviations from, and amendments to, the drawings and concealed and visible changes in the work.

SD-09 Reports

Test Reports shall be submitted for System Operational Tests in accordance with the paragraph entitled, "Tests," of this section.

1.3 GENERAL REQUIREMENTS

Section 15003, "General Mechanical Provisions," applies to work specified in this section.

1.4 QUALITY ASSURANCE

Power Roof Ventilators shall (also referred to as "Roof Exhaust Fans" on Plans), be rated and labeled in accordance with the applicable standards of the Air Movement Control Association, and shall be licensed to bear the AMCA seal for both air and sound.

PART 2 PRODUCTS

2.1 DESIGN AND FABRICATION REQUIREMENTS

All ventilators shall be furnished complete with bases, curbs, flashing flanges, noise baffles, and screens.

All Ventilators shall be designed for windloads in accordance with ASHRAE-07, Chapters 17 and 18, and UL 705, and in no case shall the installed design be for less than 120 kilometer per hour windload. Structural bracing shall be properly spaced to accommodate this loading and in accordance with the design requirements of the covering material. Ventilators shall be adequately reinforced and well braced with joints properly formed. Edges shall be wired or beaded where necessary to ensure rigidity. Galvanic action between different metals in direct contact shall be prevented by nonconductive separators.

Bolts, rivets, and other fastenings used in connection with protected metal shall be corrosion-resistant steel.

2.2 HOUSING STYLE(S)

Power roof ventilators shall be vertical discharge style as indicated. Gravity Roof Ventilators shall have square curbs, stationary type, with low profile dome shaped shrouds. Ventilators shall be made of aluminum with beaded and reinforced edges. Unit shall be complete with a bird screen. The ventilators shall be suitable for installation on existing roof openings and curbs.

2.3 FAN TYPE(S)

Fan shall be of the following type:

2.3.1 Type CB-PRV Centrifugal

Type CB-PRV ventilator shall be a centrifugal roof ventilator with V-belt drive and adjustable sheave, nonoverloading, backward-inclined wheel. Drive shall be vibration isolated with elastomer. Drive components shall be mounted in a compartment isolated from the airstream.

2.4 MATERIALS

Materials shall be manufacturer's standard materials.

2.4.1 Aluminum Alloy

Aluminum alloy shall be in accordance with ASTM B 37.

2.5 FAN MOTOR

Motors shall have local disconnects to provide means for fan and motor maintenance. All motors shall be provided with thermal overload protection. Motors located in airstreams shall be totally enclosed type.

2.6 BASES

Bases provided with the ventilators shall be factory formed, of the type indicated, shall be the same material as the hoods, and the thickness necessary to meet the design requirement for connection to the roof. Bases shall be suitable for raised curb mounting where indicated. Curb flanges of the base shall be formed as cap flashing extending at least 50 millimeter over roofing base. Where indicated or required, shafts of ventilators shall be extended a sufficient distance through the supporting construction to permit attachment of vent ducts.

2.7 ROOF CURBS

Factory-formed metal ventilator curbs shall be of type and design required for the ventilator and suitable for roof configuration and flashing.

Job-built curbs shall conform to the recommendations of the ventilator manufacturer, shall be sized correctly for the ventilator, and shall be suitable for type of supporting roof construction.

2.8 SCREENS

Bird screens shall be provided with frames of the same material as that used in the ventilators and shall be securely attached in a manner that will permit easy removal for access and cleaning.

2.9 SOUND BAFFLES

Sound baffles shall be permanent construction and impervious to moisture. Baffles shall be removable.

PART 3 EXECUTION

3.1 INSTALLATION

All ventilators shall be installed in accordance with manufacturer's installation instructions. Installation of ventilators shall be properly coordinated with other work. Anchors, attachments, and other items to be

built shall be coordinated for installation as the work progresses. Ventilators shall be rigidly installed in a weathertight and watertight manner and shall be free from vibration.

3.2 TESTS

After installation, each power roof ventilator shall be tested to demonstrate proper operation at indicated and specified performance requirements including running, balance, noise, and proper direction of fan rotation.

3.3 LUBRICATION

Movable parts of dampers and related operating hardware shall be lubricated in accordance with manufacturer's printed instructions and shall operate smoothly and quietly without binding.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 15 - MECHANICAL

SECTION 15900

TEMPERATURE CONTROLS

PART 1 GENERAL

1.1 SUMMARY

- 1.1.1 System Description
- 1.1.2 Basic Requirements for FMCS Installation
- 1.1.3 Related Work in Other Sections
- 1.1.4 Related Sections

1.2 REFERENCES

1.3 SUBMITTALS

1.4 OTHER GENERAL REQUIREMENTS

1.5 AS-BUILTS

1.6 GUARANTEE

PART 2 PRODUCTS

2.1 LOCAL DIRECT DIGITAL CONTROL

2.2 FIELD EQUIPMENT

- 2.2.1 Temperature Sensors
- 2.2.2 Static and Differential Pressure Sensor/Transmitter
- 2.2.3 Room Humidity Sensor / Transmitter
- 2.2.4 Current Sensors
- 2.2.5 Differential Pressure Switches
- 2.2.6 Current-Operated Switches
- 2.2.7 Water Flow Switches
- 2.2.8 Line Voltage Thermostats
- 2.2.9 Control Valves (Siemens Flowrite Series 599)
- 2.2.10 Electronic Valve Actuator
- 2.2.11 Electro-Pneumatic Air Valve
- 2.2.12 Room Air Thermostats
- 2.2.13 Volume Booster Relays
- 2.2.14 Pressure Gauges
- 2.2.15 Control Air Check Valve
- 2.2.16 Flow Meters

2.3 ELECTRICAL HARDWARE

- 2.3.1 Data Cable and Analog Signal Wires
- 2.3.2 Digital Signal Wire
- 2.3.3 Electrical Control Relays/Sockets
- 2.3.4 Electrical Control Accessories
- 2.3.5 Current Transformer Shorting Device

2.4 PNEUMATIC AIR PIPING

- 2.4.1 Copper Tubing
- 2.4.2 PLASTIC TUBING

PART 3 EXECUTION

3.1 ELECTRICAL WORK

3.2 FMCS CONTROL PROGRAMMING AND ALARM POINTS

3.3 COORDINATION INSTRUCTIONS

- 3.4 IDENTIFICATION AND TAGGING
- 3.5 CALIBRATION
- 3.6 START-UP RESPONSIBILITY
- 3.7 ACCEPTANCE TESTING
- 3.8 SEQUENCE OF OPERATION
- 3.9 FMCS HARDWARE AND SOFTWARE CONVENTIONS
- 3.10 ATTACHMENT INCLUDES
- 3.11 RELATED DOCUMENTS
- 3.12 GENERAL REQUIREMENTS FOR INSTALLATIONS
- 3.13 SYSTEM OVERVIEW
 - 3.13.1 SYSTEM FUNCTION
 - 3.13.2 SYSTEM COMPONENTS
 - 3.13.3 CURRENT SYSTEM LAYOUT
- 3.14 HARDWARE
- 3.15 SOFTWARE
- 3.16 GENERAL
- 3.17 CABINETS
- 3.18 SYSTEM NAMES
- 3.19 POINT DESCRIPTORS
- 3.20 POINTNAMES
- 3.21 COMMON SECTION
- 3.22 ALL PROGRAMMING
- 3.23 COMMENT LINES
- 3.24 SETPOINTS
- 3.25 DISABLE ALARMABILITY
- 3.26 GENERAL
- 3.27 GRAPHIC NAMING
- 3.28 COLOR USAGE
- 3.29 SYMBOL USAGE
- 3.29 GRAPHIC ORGANIZATION

-- End of Section Table of Contents --

SECTION 15900

TEMPERATURE CONTROLS

PART 1 GENERAL

1.1 SUMMARY

Provide all 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.

Provision, installation, and connection of all sensors, relays, switches, controllers, and field control devices, except for devices specifically noted to be installed in pipes or ducts under other sections.

Provision, installation, and connection of Siemens Apogee System 600 Protocol II Direct Digital Control (DDC) panels.

All required interfacing with the existing NASA Ames Facility Management Control System (FMCS).

Provision, installation, and connection of communication wiring between DDC panels and existing FMCS trunk line termination point.

Control wiring of all voltages between terminals at new control panels, field devices, and equipment.

Testing, checking, and adjusting of all new installations and software.

Start-up assistance for all HVAC systems.

Minimum eight (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 descriptors, requesting data, execution of commands, log requests, and making changes.

1.1.1 System Description

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 manipulations, 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.

Only Siemens Apogee System 600 Protocol II products will be accepted.

All sensing devices shall be electric/electronic unless specified otherwise.

1.1.2 Basic Requirements for FMCS Installation

In accordance with the established standards at Ames, each FMCS addition must include the following:

1 Outside air temperature sensor per building

Also, all I/O points associated with a new installation must be terminated at an existing (or new) control panel mounted within the building that the I/O points reside.

1.1.3 Related Work in Other Sections

Complete motor control centers, including magnetic starters, H-O-A switches, pilot lights, interlocking relays and internal wiring.

Power wiring, conduit and connections to electric motors and junction boxes at new DDC panels. Final power connection to DDC panels shall be provided under this Section.

Installation of motorized valves, sensor wells, and other devices to be installed in piping and ductwork.

Provision and installation of control dampers on air handlers and ductwork.

Cutting, patching, and painting.

1.1.4 Related Sections

1. Division 15 - Mechanical
2. Division 16 - Electrical
3. Attachment 1 - NASA-Ames FMCS Installation Requirements
4. Attachment 2 - NASA-Ames FMCS Point Database Standards
5. Attachment 3 - NASA-Ames FMCS Program Standards

1.2 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- | | |
|-------------|--|
| ASTM B 88 | (1989) Standard Specification for Seamless Copper Water Tube |
| ASTM D 1693 | (1970; R 1988) Standard Test Method for Environmental Stress-Cracking of Ethylene Plastics |

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

Contractor shall submit the following items within thirty (30) days of contract award: Catalog cuts, technical data, and descriptive literature on all 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. All hardware cuts shall be tagged with the device names and numbers used on the Drawings.

SD-01, Data

A complete point listing, including Logical Point names, final User names, Alarm Limits and Priorities, and interlocks, and complete PPCL file listings and sketches for Insight 11 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 all approved system control loop structures, all 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-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 all equipment, valves, dampers, and other devices (open-closed, on-off). Software submittal including Logical Point names, Preliminary User names, and flowcharts for PPCL files.

SD-05, Acceptance Testing

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 to coordinate schedules, equipment interfaces, signal compatibility, termination requirements, and power requirements to insure 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.

All electrical work required for the installation of the temperature control system shall be done in conformance with Division 16.

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. All conventions used with the FMCS will apply to the new DDC system including, but not limited to, the following: termination standards, fail safes, console 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 all work, and before final acceptance, provide updated and corrected submittal documentation to as-built conditions. Submit one electronic copy of all 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. One separate set of reproducible shall be furnished. Include record copies of all 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.

The Contractor shall provide four hour response to guarantee calls at all times 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

Local direct digital control shall be accomplished by Contractor furnished DDC panels. The panels will form a portion of the Ames FMCS network. All products to be furnished herein, and their installation requirements shall also follow the guidelines given in Attachment 1 at the end of this section.

Direct Digital Control (DDC) Panels:

All DDC panels shall be complete with any and all components, standard or optional, to meet functional requirements as described in this section and the drawings.

All panels and components shall be manufactured by Siemens and will be capable of operating on a Apogee System 600 Protocol II networks.

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.

Direct Digital Control (DDC) Software:

Contractor furnished resident DDC panel firmware shall be the latest revision available (Rev 2.4 Apogee or higher).

Contractor shall furnish program language (FFCL) 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.

Field Interface Panel (FIP):

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.

All switches, relays, transformers, I-P transducers and other interface devices required between sensors, actuators, Motor Control Centers and other system inputs and the DDC panels shall be housed in the FIP. No control devices except for sensors, actuators, E.P. switches, and VAV terminal controls shall be located and mounted outside the FIP.

2.2 FIELD EQUIPMENT

All 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.

All analog sensors which 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. All transmitters shall be selected to be compatible with the medium to be monitored. All heating hot water sensors shall be rated 1.034 megapascal at 121 degrees Celsius. All chilled water, condenser water, and control air sensors shall be rated 1.034 megapascal at 82 degrees Celsius. Air side devices shall be rated to operate system static pressures up to 2.5 kilopascal and 121 degrees Celsius.

2.2.1 Temperature Sensors

Duct Temperature Sensor - Siemens Models 535-490 or 533-380, Minco, or equal, with linear precision resistance elements, range -6°C to 49°C, 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.

Room Temperature Sensor - Siemens Model 536-200, Minco, or equal, with linear precision resistance elements, range 4°C to 32°C, accuracy +/- 0.3°C over span, platinum element rated 100 W +/- 0.1 percent at 0°C, and linearity within +/- 0.25 percent of span. For Siemens TEC applications

use Siemens space temp. sensor model 540-676CA.

Room Temperature Thermistor - Siemens 536-195, or equal, with -7°C to 49°C range, accuracy $\pm 0.25^{\circ}\text{C}$ at midrange, with metal base and cover.

Fluid Immersion Temperature Sensor - Siemens Models 536-767, Minco Bulletin RT-6, or equal, linear precision resistance elements, range -1°C to 121°C for heating hot water, chilled water and condenser water, accuracy $\pm 0.5^{\circ}\text{C}$ over span, with compatible stainless steel insertion well.

Outside Air Temperature Sensor - Siemens, 536-768 Minco, or equal, with protective mounting enclosure, 4 mA to 20 mA dc output, -50°C to 50°C range, accuracy $\pm 0.7^{\circ}\text{C}$ over span.

Transmitter for Temperature Sensors - Siemens, Minco, or equal, with 4 mA to 20 mA 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 0°C to 50°C , suitable for the specified sensing elements, with up to 230 m of 0.8 mm² (AWG 18) twisted shielded pair signal carrier allowable.

2.2.2 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 (combining non-linearity, non-repeatability, and hysteresis), 4 mA to 20 mA dc output, 15 V dc to 35 V dc input, operating temperature range of -40°C to 80°C , 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 3.5 kPa, with up to 230 m of 0.8 mm² (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 tap in duct. Use maximum 300 mm length of specified polyethylene tubing for connection at sensor. Furnish range 0 to 0.5 kPa for end-of-line supply duct static pressure.

R2.2.3 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, 4 mA to 20 mA dc output, 12 V dc to 35 V dc input, maximum 1 W consumption, maximum one minute response time, 4°C to 55°C operating temperature, with up to 230 m of 0.8 mm² (AWG 18) twisted shielded pair signal carrier allowable.

2.2.4 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, 4 mA to 20 mA dc output, accuracy ± 1 percent and repeatability/linearity ± 0.1 percent over the entire range, maximum 300 ms response time to 99 percent of final value, -10°C to 70°C operating temperature, flame-retardant case.

2.2.5 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 0 to 0.5 kPa for air filter switches and 0 to 1.25 kPa for supply fan high limit static pressure switches. Operating temperature range shall be -7°C to 50°C. Install using Dwyer No. A-301, or approved equal, static pressure sensing tips.

2.2.6 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 will also have an LED for indicating switch status.

2.2.7 Water Flow Switches

McDonnell Miller FS7-4S, or equal, paddle-type screw-in flow switches rated for 2.0 MPa at 150°C. 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 15 mm pipe tap for conduit entry.

2.2.8 Line Voltage Thermostats

Siemens, Honeywell, Johnson Controls, or equal, with setpoint adjustable from 10°C to 30°C, deadband adjustable from 1°C to 5°C, auto-off-hand switch, 0.75 kW rated switching capability at 120 V, SPDT snap switch, metal base and cover.

2.2.9 Control Valves (Siemens Flowrite Series 599)

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 860 kPa (gage) at 120°C. Valves shall shut tight against 170 kPa (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 (15 mm through 50 mm) 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.

2.2.10 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.

2.2.11 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 350 kPa (gage), maximum inlet pressure 138 kPa (gage), maximum differential pressure 7 kPa (gage), maximum air flow 165 cm³/s, Cv flow factor 0.06, voltage input 24 V ac to 480 V ac, and be UL and CSA approved.

2.2.12 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.

2.2.13 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 35 kPa (gage) in either direction. Volume booster output capacity shall be at least 450 cm³/s with air consumption less than 9.5 cm³/s.

2.2.14 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 115 mm diameter dial. Range 0 to 1.1 MPa (gage) unless otherwise noted in Drawings.

2.2.15 Control Air Check Valve

Siemens 380-024, or equal. Capacity to 8.2 cm³/s at 7 kPa (gage) pressure drop, 55 000 cm³/s at 55 kPa (gage) pressure drop.

2.2.16 Flow Meters

Water Flow Meters

Hoffer Turbine Flow Meter HO Series with HIT-2 Digital Flow Totalizer/Rate indicator, or equal, configured to provide 4 mA to 20 mA 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 configure for a minimum of 50 ms. Shall have a NEMA 4X enclosure and be capable of operating moist

environment at operating temperatures from -20°C to 70°C.
Accuracy to within 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

All material and execution shall conform to the requirements of Division 16.

2.3.1 Data Cable and Analog Signal Wires

Belden #8760, or equal, 0.8 mm² (AWG 18) tinned copper, polyethylene insulated, twisted pair, "Beldfoil" aluminum polyester shield, 0.5 mm² (AWG 20) stranded tinned copper drain wire, chrome PVC jacket.

2.3.2 Digital Signal Wire

Belden #8460, or equal, 0.8 mm² (AWG 18) tinned copper, PVC insulated twisted pair. Must pass VW-1 Vertical Wire Flame Test.

2.3.3 Electrical Control Relays/Socket

IDEC RH2B-ULC-AC24V (or 120V or 240V), or equal, DPDT relay with 20 millisecond maximum energize/de-energize time, 1.2 VA rating for AC circuits, 0.9 W rating for DC circuits, Ag-CdO contact material, 50 megohm maximum contact resistance, 100 megohm minimum insulation resistance, and -30 to 70 degrees Celsius operating temperature.

IDED SH2B-05, or equal, snap-mount/surface-mount socket with screw terminals, hold-down wire clamps, and 300V/10A rating.

2.3.4 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.

2.3.5 Current Transformer Shorting Device

General Electric type PK test plug, Kele U3889 switch assembly, Buchanan 3B106P 6-pole one piece terminal block with shorting bar or equal. 600V, 30A rated. UL listed.

2.4 PNEUMATIC AIR PIPING

Contractor shall provide all pneumatic control devices to meet the functional requirements of the specifications and as shown on the Drawings.

Pneumatic controls shall all be the product of a single manufacturer unless special selections are required to meet functional or performance requirements.

2.4.1 Copper Tubing

ASTM B 88, hard drawn deoxidized copper tubing, type "K" or "L", with wrought copper solder joint fittings conforming to ANSI B16.22.

2.4.2 PLASTIC TUBING

Virgin polyethylene tubing, FR rated, tested in accordance with ASTM D 1693 standards with minimum burst pressure of 4.137 megapascal and minimum working pressure of 690 kilopascal at 24 degrees Celsius. Color coded twin-tube FR tubing with a protective poly-vinyl covering shall be used for thermostat runs in concealed walls.

PART 3 EXECUTION

3.1 ELECTRICAL WORK

All 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. All terminations shall have either tinned wire ends or shall use crimped-on lugs.

All conductors shall be continuous, from the terminal at the module in the FMCS panel to the terminal at the field device/sensor, without splices.

All control and signal wiring shall be in conduits. (Please note that Class 1 circuits (rated greater than or equal to 100 VA) must be run in separate conduits than Class 2 circuits (rated less than 100 VA)).

All wiring and terminal blocks shall be identified by labels, tags, or other permanent means. Markings shall clearly indicate the function and source of all cable, wiring, and terminals. All 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 FMCS CONTROL PROGRAMMING AND ALARM POINTS

Provide all required hardware and programming to make operational, all 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 Logical point name, user name, console configurations, interlocks, limits, and other data necessary to make the point functional in the FMCS.

All 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.

3.3 COORDINATION INSTRUCTIONS

DDC panel location(s) must meet prior Government approval. Provide the quantity of panels most suitable to 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 shown 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 thermostates and temperature sensors shall be mounted where shown on the drawings or where directed, approximately 1500 millimeter above the floor.

All other relays, switches, interface hardware, and miscellaneous control devices are to 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 thermostat sensors, actuators, and fan coil controls. All sensors and actuators mounted in outside locations shall be enclosed in NEMA 3R weatherproof cabinets.

3.4 IDENTIFICATION AND TAGGING

All panels shall be provided with permanently attached labels which identify names and functions in accordance with project nomenclature. Each smart panel such as 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.

All field sensing devices, except room thermostats, shall be appropriately labeled in accordance with schedule tag numbers and the appropriate function the device serves (i.e. temperature sensor monitoring air handler 2's supply air temperature in a project shall be tagged as "AH2 SA TEMP").

All labels used for panels and sensing devices shall be two-color engraved plastic with double-sided adhesive tape on the back of the label.

3.5 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 Contracting Officer upon request. Upon request by the Government, provide personnel and instrumentation necessary for checking any of the calibration data. Recalibrate any device which fails to meet specified tolerances. At the end of the project, the Contractor shall provide six copies of bound and indexed calibration logs to the Government.

3.6 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 all control loop, setpoint, and other modifications with the Contracting Officer.

3.7 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.

Submit an acceptance testing plan with the software submittals sixty (60) days prior to scheduled start-up. The plan must include methods and provisions for validating the functionality of all control loops, special control sequences and routines, and the proper operation of all sensors and actuators. The Contracting Officer will approve and/or modify the submitted procedures and will witness tests conducted by the Contractor.

3.8 SEQUENCE OF OPERATION

Apply proportional (P), proportional plus integral (PI), or proportional plus integral plus derivative (PID) control loops to specified operating sequences which 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 all control loops operate smoothly, on setpoint, without hunting, or unnecessary cycling.

3.9 FMCS HARDWARE AND SOFTWARE CONVENTIONS

All work under this Section which 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
NASA AMES
FACILITY MANAGEMENT CONTROL SYSTEM
INSTALLATION REQUIREMENTS

3.10 ATTACHMENT INCLUDES

1. Overview of NASA-Ames Facility Management Control System (FMCS)
2. Requirements for Hardware Installations
3. Requirements for Software Installations (Programming)
4. Coordination/Execution

3.11 RELATED DOCUMENTS

- A. National Electric Code (NEC)
- B. National Fire Code (NFC)
- C. Siemens SCU/RCU Engineering Manuals
- D. Siemens Insight, Volume 1

3.12 GENERAL REQUIREMENTS FOR INSTALLATIONS

All new installations shall follow manufacturer's (Siemens) most current specifications for Apogee System 600 equipment. In addition, any and all applicable construction codes and standards shall be followed in the installation.

All installations will occur at the NASA-Ames Research Center. Software installations shall occur at the FMCS Host computer.

Persons performing the installations shall have the following qualifications pertaining to the work they will provide.

For Hardware: At least two years experience installing Direct Digital Control (DDC) equipment including two projects in which Siemens Apogee System 600 panels were installed.

For Software: At least one year experience installing Apogee System 600 software including three projects in which Insight Graphics, point database and PPCL files were installed on a networked Apogee System 3.

All personnel must be approved to work on the FMCS by the FMCS System Manager prior to installation.

Installations will be accomplished with the rest of the FMCS remaining on-line. Any work which may interfere with day-to-day operations by NASA-Ames personnel assigned to the FMCS must be scheduled with the FMCS System Manager before to starting work.

3.13 SYSTEM OVERVIEW

3.13.1 SYSTEM FUNCTION

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 Center wide.

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.

3.13.2 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 reunning Siemens Apogee software. All alarms under the FMCS are received by the Host and in turn by all the operator Consoles attached to the Host. The FMCS uses real time dynamic graphic displays for all monitoring, control, report generation, and alarm acknowledgement functions.

3.13.3 CURRENT SYSTEM LAYOUT

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 Host. All of the controller point and program databases are entered, deleted, modified, and/or through an operator workstations attached to the server.

Currently the FMCS has been configured of four networks utilizing Stand-Alone Control Units (SCUs), Modular Building Controller (MBC), and Remote Control Units (RCUs) which interface with the server. The panels all communicate via Apogee Protocol II. There are over 160 panels on the FMCS with a combined control/monitoring task of over 6000 physical points.

3.14 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). All the 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 must be a Siemens Apogee compatible product.

Telecommunications: No panels capable of being connected to a FMCS P2trunkline (BLN) shall be allowed to be installed Stand-Alone.

No panel to be connected to a FMCS trunkline shall be without proper surge protection.

All 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 to the start of work.

Power Requirements: All 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 the design power requirement of 3 amps (ac) at 120 VAC.

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 all FMCS panels. The ground wire must 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 which will run in the event of a FMCS panel failure.

All 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.

All wiring shall be labeled and a listing of wire assignments given to the FMCS System Manager at completion of installation.

All wiring shall be continuous with no splices.

3.15 SOFTWARE

All 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.

Point Database Files:

Cabinet addressing assignments for SCUs, RBCs and MBCs will be made by the FMCS System Manager.

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 they are assigned to. The point name 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.

Any alarmable or commandable point must 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. All subsystem graphics of air handlers, cooling plants, cooling towers, and heating plants will have the outside air temperature displayed.

All PPCL control programming must be fully commented, explaining what each group of related program lines are doing, especially if a predefined Equipment Sequence of Operation is being programmed. All SCU/MBC/RBC programs will be optimized to minimize unnecessary network communications between the server and other SCUs/MBCs/RBCs on the network. All 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 through the Apogee server is prohibited.

3.16 GENERAL

All installation work will be coordinated with the FMCS System Manager.

When hardware is ready to be tied into the FMCS network, the FMCS System Manager shall be contacted.

-- End of Attachment --

ATTACHMENT 2
NASA AMES
FACILITY MANAGEMENT CONTROL SYSTEM
POINT DATABASE STANDARDS

3.17 CABINETS

All cabinets shall have a virtual point to be used for node commanding.

3.18 SYSTEM NAMES

All System Names must be at least six characters, but no more than 10 characters.

For building numbers in the 200 series, the first two characters must correspond to the reserved code letters (prefix) for each building as shown in the following table:

<u>BLD#</u>	<u>PFX</u>	<u>BLD#</u>	<u>PFX</u>	<u>BLD#</u>	<u>PFX</u>
N200	AA	N222	CC	N243A	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		

The next four characters are used to define the point. (Nodes are defined with SF## - where ## represents the Node.)

For building numbers that are not in the 200 series, the first three characters (derived from the building number) of the logical point names must conform to the following derivation procedure:

- a. All building numbers shall be of the 3-digit format. For building numbers with alphabet suffixes, drop all the alphabet suffixes (i.e. 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 (i.e. Building 1 shall be represented as Building 001).
- b. The first digit of the 3-digit building number shall be dropped and replaced with a character as shown in the following table:

<u>First Digit</u>	<u>Replace With</u>	<u>First Digit</u>	<u>Replace With</u>
0	A	6	G
1	B	7	H
3	D	8	I
4	E	9	J
5	F		

(i.e. Building 547E is F47; Building 1 is A01, etc.)

- c. The last two digits of the building number shall remain the same.

The next three characters are used to define the point.

3.19 POINT DESCRIPTORS

All Point Descriptors must be 12 characters.

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 = Logical 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 L2SL points
	CTR	for LCTLR points
	PAC	for LPACI points
	VAO	for virtual AO points
	VDO	for virtual DO points

3.20 POINTNAMES

One Pointnames shall be provided for the following equipment:

Air Conditioning Units

BLDAC#LOC

Air Handling Units

BLDAHU#TFLOC

Chillers

BLDCHILLER#LOC

Chilled Water Pumps

BLDCHWP#LOC

Boilers

BLDTYPBOILER#LOC

Exhaust Fans

BLDEXHFAN#LOC

Fan Coil Units

BLDFCOILER#LOC

Condenser Water Pumps

BLDcwp#LOC

Where: A. Characters which are not underlined do not change for each Building.

- B. BLD Building Number (i.e. 200, 243, ...)
- C. # Unit Number (i.e. 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

All Siemens points shall have Pointnames in the format of:

bldcab ADDRESS BLD

Where: CAB Cabinet type (i.e. SCU, MBC, RCU, DPU, MPU, UC, ...)

ADDRESS Cabinet address (through cabinet number for smart panels and device number for dumb panels)

BLD Building Number

All other points (including virtual points) shall have Usernames 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, ...)

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

3.21 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

3.22 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-...	Electrical and Gas Metering
Lines 10000 -	EOF Statement

3.23 COMMENT LINES

Shall precede each section to describe the Sequence of Operations.

3.24 SETPOINTS

Shall be soft-coded (Virtual points) to ease control changes.

3.25 DISABLE ALARMABILITY

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 shall 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
NASA AMES
FACILITY MANAGEMENT CONTROL SYSTEM
GRAPHICS STANDARDS

3.26 GENERAL

Each building shall have one main graphic, Floor plan graphic(s), Sequence of Operations graphic(s), 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.

3.27 GRAPHIC NAMING

Graphic names are to be structured as in the following examples:

Main	xxx.Building	
Floor	xxxx.First.Floor.PlanSequence	xxxx.SequenceHWS
	xxxx.Hot.Water.SystemCWS	xxxx.Chilled.Water.SystemAHU#
	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.

3.28 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

3.29 SYMBOL USAGE

All graphics shall use the standards, symbols, and backgrounds created in the Apogee server.

3.29 GRAPHIC ORGANIZATION

Each graphic shall have a title (with large lettering) consistent with its

purpose displayed at the top center.

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 site directory and associated floor plan, if applicable. These are to be displayed from upper left to upper right, respectively.

Each graphic shall include any virtual setpoints associated with it. The OA temperature shall also be included.

The Main Graphic shall include the following information.

- An overhead view of the building.
- Representations of the control panels, their locations, and addresses.
- Any points not associated with one of the other graphics (Sump Pumps, Power Consumption)

The Floor Plan Graphic(s) 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. All room temperatures are to be displayed, if applicable. The Floor Plan Graphic(s) shall be updated each time a new system is added to a building, or the room layout has been modified.

The Sequence of Operations Graphic(s) 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 --

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 15 - MECHANICAL

SECTION 15990

TESTING, ADJUSTING AND BALANCING

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 GENERAL REQUIREMENTS

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

- 3.1 WATER SYSTEM TESTING
 - 3.1.1 Test Gages
 - 3.1.2 Test and Acceptance Criteria
- 3.2 AIR-HANDLING SYSTEMS TESTING
 - 3.2.1 Low Pressure Duct Systems
 - 3.2.2 Leak Tests
 - 3.2.2.1 Test Apparatus
 - 3.2.2.2 Test Procedures
 - 3.2.3 Test Report Criteria
- 3.3 AIR AND HYDRONIC SYSTEMS TESTING AND ADJUSTMENT
 - 3.3.1 Air-Handling Systems
 - 3.3.1.1 Balancing, Adjustment, and Acceptance Criteria
 - 3.3.1.2 Balancing and Adjustment, Apparatus and Procedures
 - 3.3.1.3 Test Reports
 - 3.3.2 Hydronic Systems
 - 3.3.2.1 System Balancing, Adjustment, and Acceptance Criteria
 - 3.3.2.2 Test Apparatus and Procedures
 - 3.3.2.3 Hydronic Systems Preparation
 - 3.3.2.4 Operational Test Report
 - 3.3.3 System and Temperature-Control Adjustment
 - 3.3.3.1 Adjustment and Acceptance Criteria
- 3.4 DRAINAGE AND VENTING SYSTEM TESTING

-- End of Section Table of Contents --

SECTION 15990

TESTING, ADJUSTING AND BALANCING

PART 1 GENERAL

1.1 REFERENCES

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

ASSOCIATED AIR BALANCE COUNCIL (AABC)

AABC MN-1 (1989; 5th Ed) 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 (1991) Handbook, HVAC Applications (SI Edition)

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

SMACNA-07 (1983; 1st Ed) HVAC Systems - Testing, Adjusting and Balancing

1.2 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 Contracting Officer 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.

SD-18 Records

Records of Existing Conditions shall be submitted consisting of the results of Contractor's survey of work area conditions and features of existing structures and facilities within and adjacent

to the jobsite. Commencement of work shall constitute acceptance of existing conditions.

1.3 GENERAL REQUIREMENTS

Section 15003, "General Mechanical Provisions," applies to work specified in this section.

The work includes:

- a. Testing and balancing all supply, return, exhaust, and OSA air systems.
- b. Testing all new piping system, including the replaced new valves and strainers.
- c. Balancing the entire hydronic system including the chilled water pumps, chiller and air handling units.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 WATER SYSTEM TESTING

Prior to acceptance of the work, systems shall be tested in the presence of the Contracting Officer.

Tests shall be performed prior to 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 Contracting Officer.

Tests shall be hydrostatic, unless otherwise specified. Water used for testing shall be potable.

Government will supply testing water, but the Contractor shall provide for approved disposal of contaminated water.

Contractor may conduct tests for his own purposes, but the acceptance test shall be conducted as specified herein.

If the test demonstrates that leakage rate exceeds specified limits, the source(s) 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.

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.

Precautions shall be taken to vent the expansive force of compressed air trapped during high-pressure hydrostatic testing to preclude injury and damage.

Contracting Officer 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.

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 prior to hydrostatic testing.

Leaking gasket joints shall be remade with new gaskets. Leaking copper joints shall be remade with new fittings and new tube ends.

Temperature of water used for testing shall not cause condensation on system surfaces.

Test media shall not be added to a system during a test for a period specified or to be determined by the Contracting Officer.

Duration of a test will be determined by the Contracting Officer and shall be for a minimum of 2 hours, with a maximum of 24 hours. Test may be terminated by direction of the Contracting Officer at any time during this period after it has been determined that the permissible leakage rate has not been exceeded.

Test records of piping systems tests shall be prepared and maintained. Records shall show test personnel responsibilities, dates, test gage identification numbers, ambient and test water temperatures, pressure ranges, rate of pressure drop, leakage rates, and other system characteristics.

3.1.1 Test Gages

Test gages shall have a 115 millimeter or larger dial, be accurate to plus or minus one-half of 1 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 prior to use, test gage number, and project number.

3.1.2 Test and Acceptance Criteria

Above ground water systems shall be tested at 1050 kilopascal and the applied test pressure shall be maintained without further addition of test media for not less than 2 hours. No leakage is allowed.

Duration of each leakage test shall be not less than 2 hours. During the test, the main shall be subjected to 1380 kilopascal pressure, based on the elevation of the lowest section under test and corrected to the elevation of the test gage.

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 prior to insulation of surfaces, painting, or concealment of work. Unless waived by the Contract Officer, systems containing repaired defects shall be retested to original criteria for acceptance.

All ducts are low pressure, designed for 500 Pascals (positive and negative).

Seal Class A: All seams, joints, fastener penetrations and connections sealed.

3.2.1 Low Pressure Duct Systems

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:

There are no visible mechanical defects.

There is no audible leakage at any point when area ambient noise is at normal-occupancy level.

No leakage is perceptible to the hand, when placed within 150 millimeter of a joint.

Measured total system leakage shall not exceed 1 percent of total system cubic meter per second (mps) when tested in accordance with "Leak Tests."

3.2.2 Leak Tests

Test apparatus and procedures shall be similar in all respects to those defined in SMACNA-07. 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.

3.2.2.1 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.

3.2.2.2 Test Procedures

Test for audible leaks as follows:

- a. 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.
- b. 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 6250 Pascal).
- c. Gradually open the inlet damper until the duct pressure reaches 500 Pascal 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.

- d. Survey joints for audible leaks. Mark each leak and repair after shutting down blower. Do not apply a retest until sealants have set.

After all audible leaks have been sealed, the remaining leakage should be measured with the test apparatus orifice section as follows:

- a. Start blower and open damper until duct pressure reaches 25 percent in excess of designed duct operating pressure.
- b. Read the pressure differential across the orifice on manometer No. 2. Leakage rate in cubic meter per second is read directly from the calibration curve. If leakage does not occur, the pressure differential will be zero.
- c. 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.
- d. If all audible leaks have been corrected, it is unlikely that the measured leakage will exceed one percent of capacity. If it does, the leaks shall be located by careful listening or feeling along the joint.
- e. 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.

3.2.3 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

The Contractor shall perform the baseline and final air measurements in the presence of the Contracting Officer, or the Contracting Officer's Technical Representative (COTR). The Contractor shall have the COTR sign the baseline and final air measurements before leaving the facility. Only air measurement/air balance submittals having the COTR signature will be accepted.

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. All work shall be done in accordance with ASHRAE-05, AABC MN-1 or SMACNA-07, where applicable, the requirements of the contract documents, and in the presence of the Contracting Officer.

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.

Hydronic systems structural and leakage testing shall be performed in accordance with requirements specified herein under "Water Systems Testing."

Air-handling systems structural and leakage testing shall be performed in accordance with requirements specified herein under "Air-Handling System Testing."

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.

Equipment shall not be operated until properly lubricated and brought into specified service condition.

Air- and hydronic-system final adjustments shall be permanently marked to be readily restorable if disturbed.

Systems acceptance is predicated upon successful completion of specified work, receipt by the Contracting Officer 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.

3.3.1 Air-Handling Systems

3.3.1.1 Balancing, Adjustment, and Acceptance Criteria

Final volume conditions for all systems shall be within the following limits:

Air-handler delivery:	Plus 5 percent, minus 0 percent of design cubic meter per second at design temperature
Primary air delivery:	Plus or minus 5 percent of design cubic meter per second at design temperature

3.3.1.2 Balancing and Adjustment, Apparatus and Procedures

Balancing and adjustment apparatus and procedures shall be in accordance with AABC MN-1.

Balancing and adjustment apparatus and procedures shall be in accordance with ASHRAE-05 and AABC MN-1.

Instrumentation shall be provided to record air movement data, motor kilowatt (kW) 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.

3.3.1.3 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:

Air-handling apparatus data

Exhaust-fan data

Air-diffusion devices data

Duct-traverse data for the following:

Main supply duct

Filter apparatus data, including visual condition, inlet pressure, and differential pressure for each filter installation

Coil data, including visual condition, inlet pressure, and differential pressure for each coil installation

3.3.2 Hydronic Systems

3.3.2.1 System Balancing, Adjustment, and Acceptance Criteria

Systems final flow conditions shall be within the following limits:

Pump delivery: Plus 10 percent, minus 0 percent of design liter per second at design temperature

3.3.2.2 Test Apparatus and Procedures

Test apparatus shall consist of devices required for hydronic systems flow measuring and balancing including:

Pressure gages and fittings

Dry bulb thermometers

Wet bulb thermometers

Pyrometers

Balancing-cock adjustment wrenches

Differential-pressure gages or manometers

Thermometer wells, where necessary for balancing, but where permanent installation of thermometers is not indicated or required

Complete air balance shall have been accomplished before water balance begins.

3.3.2.3 Hydronic Systems Preparation

Hydronic systems shall be prepared in the following manner:

Proper installation of valves and balancing devices shall be verified.

Valves shall be opened to full-open position, including coil-stop valves, bypass valves, and return-line balancing cocks.

Strainer screens shall be removed and cleaned.

Water in each system shall be examined to determine that it has been treated.

Air vents shall be checked at high points to verify proper installation and operation.

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.

The existing Water-circulating pumps shall be set to proper liter per second delivery.

Water flow through convertors shall be adjusted.

Water temperature shall be checked at inlet side of cooling and heating coils. Note rise or drop of temperature from source.

Next, each coil shall be balanced.

Upon completion of flow reading and adjustment of coils, all settings shall be marked and all data recorded.

After adjustments to coils have been made, settings at pumps, chiller, and convertors shall be rechecked and readjusted if required.

Pressure drop through coils shall be measured at set flow rate on call for full cooling and on full heating.

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.

Same procedure on chiller to adjust chiller bypass valves shall be followed.

Instrumentation shall be provided to record apparatus motor kW 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.

3.3.2.4 Operational Test Report

Operational test report shall provide data on systems tested, test apparatus data, and orifice or Venturi data, and shall include:

For each heating and cooling element:

Inlet water temperature

Leaving water temperature

Inlet air temperature

Leaving air temperature

Pressure drop across each element

Calculated and measured flow rates through coils elements

For each chilled and hot water pump at

Balanced-condition suction and discharge pressures:

Flow rate

Mechanical specifications of unit

Rated and actual kW input and power factor

For each apparatus such as chiller, cooling tower, and converter:

Inlet water temperature

Leaving water temperature

Pressure drop across units

Calculated and measured waterflow

Mechanical specifications of units

Rated and actual kW input and power factor for motors

Heating- and cooling-element data

Pump data

3.3.3 System and Temperature-Control Adjustment

3.3.3.1 Adjustment and Acceptance Criteria

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 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 a 30 kPa water pressure. In testing successive sections, at least the upper 3050 millimeter of the next preceding section shall be tested so that each joint or pipe in the system, except the uppermost 3050 millimeter, has been submitted to a test with not less than a 30 kPa 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.

-- End of Section --



SECTION TABLE OF CONTENTS

DIVISION 16 - ELECTRICAL

SECTION 16003

GENERAL ELECTRICAL PROVISIONS

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS (Not Applicable)
- 1.3 INTERPRETATION OF DRAWINGS AND SPECIFICATIONS
- 1.4 CODES AND STANDARDS
- 1.5 COORDINATION
- 1.6 APPROVAL REQUIREMENTS
- 1.7 PREVENTION OF CORROSION

PART 2 PRODUCTS

- 2.1 IDENTIFICATION PLATES
- 2.2 WARNING SIGNS
- 2.3 ANCHOR BOLTS
- 2.4 SEISMIC ANCHORAGE
- 2.5 PAINTING

PART 3 EXECUTION

- 3.1 INSTALLATION
- 3.2 PAINTING APPLICATION
- 3.3 IDENTIFICATION PLATE INSTALLATION
- 3.4 EQUIPMENT PADS
- 3.5 CUTTING AND PATCHING
- 3.6 DAMAGE TO WORK
- 3.7 CLEANING
- 3.8 FIELD TESTING AND TEST EQUIPMENT

-- End of Section Table of Contents --

SECTION 16003

GENERAL ELECTRICAL PROVISIONS

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 123 (1989; Rev A) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

FEDERAL SPECIFICATIONS (FS)

FS W-J-800 (Rev E; Am 1) Junction Box: Extension, Junction Box; Cover, Junction Box (Steel, Cadmium, or Zinc-Coated)

FEDERAL STANDARDS (FED-STD)

FED-STD 595 (Rev B) Colors Used in Government Procurement

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2 (1993) National Electrical Safety Code

MILITARY SPECIFICATIONS (MS)

MS MIL-T-704 (Rev J) Treatment and Painting of Material

NATIONAL ELECTRICAL MANUFACTURER'S ASSOCIATION (NEMA)

NEMA Z 535 (1991) Safety Color Code

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (1999) National Electrical Code

UNDERWRITERS LABORATORIES (UL)

UL-05 (1995) Electrical Construction Materials Directory

1.2 SUBMITTALS (Not Applicable)

1.3 INTERPRETATION OF DRAWINGS AND SPECIFICATIONS

It is the intent of these specifications and the contract drawings to provide a complete and workable facility.

Design drawings are diagrammatic and do not show all offsets, bends,

elbows, or other specific elements that may be required for proper installation of the work. Such work shall be verified at the site. Additional bends and offsets, and conduit as required by vertical and horizontal equipment locations or other job conditions, shall be provided to complete the work at no additional cost to the Government.

Except where shown in dimensional detail, the locations of switches, receptacles, lights, motors, outlets, and other equipment shown on plans are approximate. Such items shall be placed to eliminate interference with ducts, piping, and equipment. Exact locations shall be determined in the field. Door swings shall be verified to ensure that light switches are properly located.

Equipment sizes indicated are minimum. Before installing any wire or conduit, the Contractor shall obtain the exact equipment requirements and shall install wire, conduit, disconnect switches, motor starters, heaters, circuit breakers, and other items of the correct size for the equipment actually installed. Wire and conduit sizes shown on the drawings shall be taken as a minimum and shall not be reduced without written approval.

1.4 CODES AND STANDARDS

Equipment design, fabrication, testing, performance, and installation shall, unless shown or specified otherwise, comply with the applicable requirements of NFPA 70 and IEEE C2 to the extent indicated by the references.

1.5 COORDINATION

Installation of the electrical work shall be coordinated with the work of other trades.

1.6 APPROVAL REQUIREMENTS

Where materials and equipment are specified to conform to the standards of the Underwriters Laboratories (UL), Inc., the label of, or listing with re-examination, in UL-05 will be acceptable as sufficient evidence that the items conform to the requirements.

Where materials or equipment are specified to be constructed or tested in accordance with the standards of NEMA, ANSI, ASTM, or other recognized standards, a manufacturer's certificate of compliance indicating complete compliance of each item with the applicable NEMA, ANSI, ASTM, or other commercial standards specified will be acceptable as proof of compliance.

1.7 PREVENTION OF CORROSION

Metallic materials shall be protected against corrosion. Equipment enclosures shall be given a rust-inhibiting treatment and the standard finish by the manufacturer. Aluminum shall not be used in contact with earth. Dissimilar metals in intimate contact shall be protected by approved fittings, barrier material, 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 or nonferrous materials shall be hot-dip galvanized in accordance with ASTM A 123 for exterior locations and cadmium-plated in conformance with FS W-J-800 for interior locations.

PART 2 PRODUCTS

2.1 IDENTIFICATION PLATES

Identification plates shall be 3-layer black-white-black, engraved to show white letters on a black background. Letters shall be uppercase. Identification plates 40 millimeter high and smaller shall be 2 millimeter thick with engraved lettering 3 millimeter high. Identification plates larger than 40 millimeter high shall be 3 millimeter thick with engraved lettering not less than 5 millimeter high. Identification plates having edges of 40 millimeter high and larger shall be beveled.

2.2 WARNING SIGNS

Each item of electrical equipment operating at 480 volts and above shall be provided with conspicuously located warning signs conforming to the requirements of Occupational Safety and Health Agency (OSHA) standards.

Any equipment with externally powered wiring shall be marked with a laminated plastic nameplate having 5 millimeter high white letters on a red background as follows:

DANGER - EXTERNAL VOLTAGE SOURCE

Safety color coding for identification of warning signs shall conform to NEMA Z 535.

2.3 ANCHOR BOLTS

Anchor bolts shall be provided for equipment placed on concrete equipment pads or slabs.

2.4 SEISMIC ANCHORAGE

Electrical equipment, except communications, emergency, and standby equipment, shall be anchored to withstand a lateral force as specified in 1998 CBC, Zone 4 Criteria.

Communications, emergency, and standby equipment shall be anchored to withstand a lateral force of 0.6 times the weight of the equipment.

The following standard anchoring should be adequate for equipment not classified as communications, emergency, or standby:

Panels - floor-mounted with four M14 diameter anchor bolts

2.5 PAINTING

Enclosures of the following listed items shall be cleaned, primed, and factory-painted inside and outside in accordance with MS MIL-T-704.

ITEM	FINISH COLOR
Circuit Breakers	No. 61 gray (FED-STD 595)
Transformers	No. 61 gray (FED-STD 595)
Safety Switches	Manufacturer's standard
Panelboards	Manufacturer's standard

ITEM

FINISH COLOR

Motors
Control Components

Manufacturer's standard
Manufacturer's standard

PART 3 EXECUTION

3.1 INSTALLATION

Installation shall be accomplished by workers skilled in this type of work. Installation shall be made so that there is no degradation of the designed fire ratings of walls, partitions, ceilings, and floors. Except as otherwise indicated, emergency switches and alarms shall be installed in conspicuous locations.

3.2 PAINTING APPLICATION

Exposed conduit, supports, fittings, cabinets, pull boxes, and racks, if not factory painted, shall be thoroughly cleaned and painted as specified in Section 09915, "Painting," unless otherwise noted. Work shall be left in a neat and clean condition at final completion of the contract.

Emergency equipment, such as fire-alarm boxes, shall be cleaned, primed, and painted red. Color shall conform to FED-STD 595, Color 11105.

3.3 IDENTIFICATION PLATE INSTALLATION

Identification plates shall be fastened by means of corrosion-resistant steel or nonferrous metal screws. Hand lettering, marking, or embossed self-adhesive tapes are not acceptable.

3.4 EQUIPMENT PADS

Equipment pads shall be constructed with a minimum 100 millimeter margin around the equipment and supports.

3.5 CUTTING AND PATCHING

Contractor shall install his work in such a manner and at such time as will require a minimum of cutting and patching on the building structure.

Holes in or through existing masonry walls and floors in exposed locations shall be drilled and smoothed by sanding. Use of a jackhammer will be permitted only where specifically approved.

3.6 DAMAGE TO WORK

Required repairs and replacement of damaged work shall be done as directed by and subject to the approval of the Contracting Officer, and at no additional cost to the Government.

3.7 CLEANING

Exposed surfaces of wireways, conduit systems, and equipment that have become covered with dirt, plaster, or other material during handling and construction shall be thoroughly cleaned before such surfaces are prepared for final finish or painting or are enclosed within the building structure.

Before final acceptance, electrical equipment, including lighting fixtures

and glass, shall be clean and free from dirt, grease, and fingermarks.

3.8 FIELD TESTING AND TEST EQUIPMENT

All Field testing specified in Divisions 16 electrical specification shall be made with test equipment specially designed and calibrated for the purpose. Test equipment used shall be calibrated and certified by an approved testing laboratory. Date of last calibration and certification shall not be more than 90 days old at the time of field testing.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 16 - ELECTRICAL

SECTION 16050

BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 PREVENTION OF CORROSION

PART 2 PRODUCTS

- 2.1 MATERIALS
 - 2.1.1 General
 - 2.1.2 Rigid Steel Conduit
 - 2.1.3 Electrical Metallic Tubing (EMT)
 - 2.1.4 Flexible Metallic Conduit
- 2.2 WIRE AND CABLE
- 2.3 SPLICES AND CONNECTORS
- 2.4 SWITCHES
 - 2.4.1 Safety Switches
- 2.5 RECEPTACLES
- 2.6 OUTLETS, OUTLET BOXES, AND PULL BOXES
- 2.7 CIRCUIT BREAKERS

PART 3 EXECUTION

- 3.1 CONDUITS, RACEWAYS AND FITTINGS
 - 3.1.1 Rigid Steel Conduit
 - 3.1.2 Electrical Metallic Tubing (EMT)
 - 3.1.3 Flexible Metallic Conduit
- 3.2 WIRING
- 3.3 SAFETY SWITCHES
- 3.4 WIRING DEVICES
 - 3.4.1 Receptacles
 - 3.4.2 Device Plates
- 3.5 BOXES AND FITTINGS
- 3.6 IDENTIFICATION PLATES AND WARNINGS
- 3.7 PAINTING
- 3.8 FIELD TESTING

-- End of Section Table of Contents --

SECTION 16050

BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

- ANSI A117.1 (1986) Buildings and Facilities -
Providing Accessibility and Usability for
Physically Handicapped People
- ANSI Z53.1 (1979) Safety Color Code for Marking
Physical Hazards

ELECTRONIC INDUSTRIES ASSOCIATION (EIA)

- EIA 480 (1981) Toggle Switches

NATIONAL ELECTRICAL MANUFACTURER'S ASSOCIATION (NEMA)

- NEMA 250 (1991) Enclosures for Electric Equipment
(1000 Volts Maximum)
- NEMA FB 1 (1988) Fittings, Cast Metal Boxes, and
Conduit Bodies for Conduit and Cable
Assemblies
- NEMA KS 1 (1990) Enclosed and Miscellaneous
Distribution Equipment Switches (600
Volts Maximum)
- NEMA OS 1 (1989) Sheet-Steel Outlet Boxes, Device
Boxes, Covers, and Box Supports
- NEMA OS 2 (1986) Nonmetallic Outlet Boxes, Device
Boxes, Covers and Box Supports
- NEMA PB 1 (1990) Panelboards
- NEMA RN 1 (1989) Polyvinyl-Chloride (PVC)
Externally Coated Galvanized Rigid Steel
Conduit and Intermediate Metal Conduit
- NEMA TC 13 (1986) Electrical Nonmetallic Tubing (ENT)
- NEMA VE 1 (1991) Metallic Cable Tray Systems
- NEMA WD 1 (1983; Rev 1989) General Requirements for
Wiring Devices
- NEMA WD 6 (1988) Wiring Devices - Dimensional

Requirements

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (1999) National Electrical Code

UNDERWRITERS LABORATORIES (UL)

UL 1 UL Standard for Safety - Flexible Metal Conduit

UL 1242 (1983; 1st Ed, June 26, 1991) UL Standard for Safety - Intermediate Metal Conduit

UL 489 (1991; 8th Ed; May 1, 1992; Bulletin Feb 11, 1992; Bulletin Mar 16, 1992) UL Standard for Safety Molded-Case Circuit Breakers and Circuit-Breaker Enclosures

UL 506 (1989; 10th Ed) UL Standard for Specialty Transformers

UL 6 (1993) UL Standard for Safety - Rigid Metal Conduit

UL 797 (1983; 5th Ed; July 8, 1991) UL Standard for Safety - Electrical Metallic Tubing

UL 870 (1991; 6th Ed) UL Standard for Safety Wireways, Auxiliary Gutters, and Associated Fittings

1.2 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:

Conduit, Raceway and Fittings
 Wire and Cable
 Splices and Connectors
 Switches
 Receptacles
 Outlets, Outlet Boxes, and Pull Boxes
 Circuit Breakers
 Spare Parts

1.3 PREVENTION OF CORROSION

Metallic materials shall be protected against corrosion. Equipment enclosures shall have the standard finish by the manufacturer. Aluminum shall not be used in contact with earth and, where connected to dissimilar metal, shall be protected by approved fittings and treatment. Ferrous metals such as but not limited to, anchors, bolts, braces, boxes, bodies, clamps, fittings, guards, nuts, pins, rods, shims, thimbles, washers, and

miscellaneous parts not of corrosion-resistant steel shall be hot-dip galvanized except where other equivalent protective treatment is specifically approved in writing.

For outdoor installations, provide corrosion resistant high performance coatings.

PART 2 PRODUCTS

2.1 MATERIALS

Materials and equipment to be provided shall be the standard cataloged products of manufacturers regularly engaged in the manufacture of the products.

2.1.1 General

Rigid steel conduit shall be used in conduit systems, except where otherwise shown on the contract drawings, and where flexible conduit is required. Rigid steel conduits shall be used in all outside locations.

All conduit shall be 20 millimeter diameter minimum, except where specifically shown smaller on the contract drawings, and except for switch leg runs.

Rigid aluminum conduit is permitted in lieu of rigid steel conduit in sizes 50 millimeter and larger in indoor locations.

Conduit and raceway runs concealed in or behind walls, above ceilings, or exposed on walls and ceilings 1524 millimeter or more above finished floors, and not subject to mechanical damage, may be electrical metallic tubing (EMT).

Conduit, connectors, and fittings shall be UL approved for the installation of electrical conductors.

2.1.2 Rigid Steel Conduit

Rigid steel conduit shall be in accordance with UL 6 and shall be galvanized by the hot-dip process. Where underground and in corrosive areas, rigid steel conduit shall be polyvinylchloride (PVC) coated in accordance with NEMA RN 1 or shall be painted with bitumastic.

Fittings for rigid steel conduit shall be threaded.

Gaskets shall be solid. Conduit fittings with blank covers shall have gaskets, except in clean, dry areas or at the lowest point of a conduit run where drainage is required.

Covers shall have captive screws and shall be accessible after the work has been completed.

2.1.3 Electrical Metallic Tubing (EMT)

EMT shall be in accordance with UL 797 and shall be zinc coated steel. Couplings and connectors shall be zinc-coated, raintight, gland compression type fittings with insulation throat. Crimp, spring, or setscrew type fittings shall not be acceptable.

2.1.4 Flexible Metallic Conduit

Flexible metallic conduit shall be in accordance with UL 1 and shall be galvanized steel.

Fittings for flexible metallic conduit shall be specifically designed for such conduit.

Liquidtight flexible metallic conduit shall be provided with a protective jacket of PVC extruded over a flexible interlocked galvanized steel core to protect wiring against moisture, oil, chemicals, and corrosive frames.

Fittings for liquidtight flexible metallic conduit shall be specifically designed for such conduit.

2.2 WIRE AND CABLE

Conductors installed in conduit shall be copper 600-volt type THHN. All conductors AWG No. 8 and larger, shall be stranded. All conductors smaller than AWG No. 8 shall be solid.

Conductors installed in plenums shall be marked plenum rated.

2.3 SPLICES AND CONNECTORS

Splices in AWG No. 8 and smaller shall be made with approved indentor crimp-type connectors and compression tools.

Splices in AWG No. 6 and larger shall be made with indentor crimp-type connectors and compression tool. Joints shall be wrapped with an insulating tape that has an insulation and temperature rating equivalent to that of the conductor.

2.4 SWITCHES

2.4.1 Safety Switches

Safety switches shall be in accordance with NEMA KS 1, and shall be the heavy-duty type with enclosure, voltage, current rating, number of poles, and fusing as indicated. Switch construction shall be such that, with the switch handle in the "ON" position, the cover or door cannot be opened. Cover release device shall be coinproof and shall be so constructed that an external tool must be used to open the cover. Provisions shall be made to lock the handle in the "OFF" position, but the switch shall not be capable of being locked in the "ON" position.

Switches shall be of the quick-make, quick-break type. Terminal lugs shall be approved for use with copper conductors.

Safety color coding for identification of safety switches shall conform to ANSI Z53.1.

2.5 RECEPTACLES

Receptacles shall be commercial grade, 20A, 125 VAC, 2-pole, 3-wire duplex conforming to NEMA WD 6, NEMA 5-20R. Special receptacles shall be as indicated in the drawings.

2.6 OUTLETS, OUTLET BOXES, AND PULL BOXES

Outlet boxes for use with conduit systems shall be in accordance with NEMA FB 1 and NEMA OS 1 and shall be not less than 100 x 100 x 40 millimeter deep. Pull and junction boxes shall be furnished with screw-fastened covers.

2.7 CIRCUIT BREAKERS

Circuit-breaker interrupting rating shall be not less than those indicated and in no event less than 10,000 amperes root-mean-square (rms) symmetrical at 208 volts, respectively. Multipole circuit breakers shall be the common-trip type with a single handle. Molded case circuit breakers shall be bolt-on type conforming to UL 489.

PART 3 EXECUTION

3.1 CONDUITS, RACEWAYS AND FITTINGS

Conduit runs between outlet and outlet, between fitting and fitting, or between outlet and fitting shall contain not more than the equivalent of three 90-degree bends, including those bends located immediately at the outlet or fitting.

Crushed or deformed conduit shall not be installed. Trapped conduit runs shall be avoided where possible. Care shall be taken to prevent the lodgment of foreign material in the conduit, boxes, fittings, and equipment during the course of construction. Clogged conduit shall be cleared of obstructions or shall be replaced.

3.1.1 Rigid Steel Conduit

Field-made bends and offsets shall be made with approved hickey or conduit bending machine. Conduit elbows larger than 65 millimeter shall be long radius.

Conduit stubbed-up through concrete floors for connections to free-standing equipment with the exception of motor-control centers, cubicles, and other such items of equipment, shall be provided with a flush coupling when the floor slab is of sufficient thickness. Otherwise, a floor box shall be provided and set flush with the finished floor. Conduits installed for future use shall be terminated with a coupling and plug set flush with the floor.

3.1.2 Electrical Metallic Tubing (EMT)

EMT shall be grounded in accordance with NFPA 70, using pressure grounding connectors especially designed for EMT.

3.1.3 Flexible Metallic Conduit

Flexible metallic conduit shall be used to connect recessed fixtures from outlet boxes in ceilings, transformers, and other approved assemblies.

Bonding wires shall be used in flexible conduit as specified in NFPA 70, for all circuits. Flexible conduit shall not be considered a ground conductor.

Electrical connections to vibration-isolated equipment shall be made with

flexible metallic conduit.

Liquidtight flexible metallic conduit shall be used in wet and oily locations and to complete the connection to motor-driven equipment.

3.2 WIRING

Feeder and branch circuit conductors shall be color coded as follows:

<u>CONDUCTOR</u>	<u>480Y/277V COLOR AC</u>	<u>208Y/120V COLOR AC</u>
Phase A	Brown	Black
Phase B	Orange	Red
Phase C	Yellow	Blue
Neutral	White	White
Equipment Grounds	Green	Green

Conductors up to and including AWG No. 2 shall be manufactured with colored insulating materials. Conductors larger than No. 2 shall be identified with color plastic tape in outlet, pull, or junction boxes and at terminations.

Splices shall be in accordance with the NFPA 70. Conductor identification shall be provided within each enclosure where a tap, splice, or termination is made and at the equipment terminal of each conductor. Terminal and conductor identification shall match as indicated.

Where several feeders pass through a common pullbox, the feeders shall be tagged to clearly indicate the electrical characteristics, circuit number, and panel designation.

3.3 SAFETY SWITCHES

Switches shall be securely fastened to the supporting structure or wall, utilizing a minimum of four 6 millimeter bolts. Sheet metal screws and small machine screws shall not be used for mounting. Switches shall not be mounted in an inaccessible location or where the passageway to the switch may become obstructed. Mounting height shall be 1500 millimeter above floor level, when possible.

3.4 WIRING DEVICES

3.4.1 Receptacles

Receptacles shall be so installed that when device plates are applied, the plates will be aligned vertically to within 2 millimeter.

Ground terminal of each flush-mounted receptacle shall be bonded to the outlet box with an approved green bonding jumper when used with dry wall type construction.

3.4.2 Device Plates

Device plates for switches that are not within sight of the loads controlled shall be suitably engraved with a description of the loads.

Device plates and receptacle cover plates for receptacles other than 125-volt, single-phase, duplex, convenience outlets shall be suitably marked, showing the circuit number, voltage, frequency, phasing, and amperage available at the receptacle. Required marking shall consist of a self-adhesive label having 6 millimeter embossed letters.

Device plates for convenience outlets shall be similarly marked indicating the supply panel and circuit number.

3.5 BOXES AND FITTINGS

Pullboxes shall be furnished and installed where necessary in the conduit system to facilitate conductor installation. Conduit runs longer than 30480 millimeter or with more than three right-angle bends shall have a pullbox installed at a convenient intermediate location.

Boxes and enclosures shall be securely mounted to the building structure with supporting facilities independent of the conduit entering or leaving the boxes.

3.6 IDENTIFICATION PLATES AND WARNINGS

Identification plates shall be furnished for lighting and power panelboards, motor control centers, all line voltage heating and ventilating control panels, fire detector and sprinkler alarms, door bells, pilot lights, disconnect switches, manual starting switches, and magnetic starters. Process control devices and pilot lights shall have identification plates.

Identification plates shall be furnished for all line voltage enclosed circuit breakers, identifying the equipment served, voltage, phase(s) and power source. Circuits 480 volts and above shall have conspicuously located warning signs in accordance with OSHA requirements.

3.7 PAINTING

Exposed conduit, supports, fittings, cabinets, pull boxes, and racks shall be thoroughly cleaned and painted to match the walls/floors/ceilings.

Outdoor installations shall be painted with corrosion resistant high performance coatings.

3.8 FIELD TESTING

After the installation is completed, wire and cable shall be given a continuity and insulation resistance test. Insulation resistance test shall be with a (1000)-volt insulation test set. Readings shall be recorded after a minimum of 3 minutes and until the reading is constant for 1 minute. Resistance between phase conductors and ground shall be no less than 25 megohms.

Phase-rotation tests shall be conducted on three-phase circuits using a phase-rotation indicating instrument. Phase rotation of electrical connections to connected equipment shall be A, B, C left to right, or top

to bottom facing the equipment.

Final acceptance will depend upon the satisfactory performance of the equipment under test. No conductor or circuit shall be energized until the installation has been approved by the COTR. Final test data shall be provided to the Contracting Officer. Data shall have a cover letter/sheet clearly marked with the system name, date, and the words "Final Test Data".

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 16 - ELECTRICAL

SECTION 16145

STANDARD WIRING SYSTEMS

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 GENERAL REQUIREMENTS
- 1.3 SUBMITTALS

PART 2 PRODUCTS

- 2.1 CONDUITS, RACEWAYS, AND FITTINGS
 - 2.1.1 Rigid Steel Conduit
 - 2.1.2 Flexible Metallic Conduit
 - 2.1.3 Wireways and Auxiliary Gutters
- 2.2 WIRE AND CABLE
 - 2.2.1 Splices and Connectors
- 2.3 BOXES AND FITTINGS
 - 2.3.1 Sheet Metal Boxes and Outlets
 - 2.3.2 Pull and Junction Boxes

PART 3 EXECUTION

- 3.1 INSTALLATION
 - 3.1.1 Installation of Rigid Metal Conduit
 - 3.1.2 Installation of Flexible Metallic Conduit
- 3.2 INSTALLATION OF WIRING
- 3.3 BOXES AND FITTINGS
- 3.4 IDENTIFICATION PLATES
- 3.5 FIELD TESTING

-- End of Section Table of Contents --

SECTION 16145

STANDARD WIRING SYSTEMS

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

- ANSI C80.1 (1990) Rigid Steel Conduit - Zinc Coated
ANSI C80.3 (1991) Electrical Metallic Tubing - Zinc-Coated

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- ASTM A 123 (1989; Rev A) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM B 173 (1990) Standard Specification for Rope-Lay-Stranded Copper Conductors Having Concentric-Stranded Members, for Electrical Conductors
ASTM B 3 (1995) Standard Specification for Soft or Annealed Copper Wire
ASTM D 2301 (1988; R 1993) Standard Specification for Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

- IEEE Std 383 (1974; R 1992) Standard for Type Test Class 1E Electric Cables, Field Splices, and Connections for Nuclear Power Generating Stations

NATIONAL ELECTRICAL MANUFACTURER'S ASSOCIATION (NEMA)

- NEMA 250 (1991) Enclosures for Electric Equipment (1000 Volts Maximum)
NEMA FB 1 (1993) Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies
NEMA KS 1 (1990) Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum)
NEMA RN 1 (1989) Polyvinyl-Chloride (PVC)

- Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit
- NEMA TC 3 (1990) PVC Fittings for Use With Rigid PVC Conduit and Tubing
- NEMA WC 5 (1992) Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy
- NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)
- NFPA 70 (1999) National Electrical Code
- UNDERWRITERS LABORATORIES (UL)
- UL 1 (1993) UL Standard for Safety - Flexible Metal Conduit
- UL 1581 (1991; 2nd Ed; Dec 17, 1991) UL Standard for Safety - Reference Standard for Electrical Wires, Cables, and Flexible Cords
- UL 486C (1991; 2nd Ed; Oct 10, 1991) UL Standard for Safety Splicing Wire Connectors
- UL 50 (1992; 10th Ed) UL Standard for Safety - Enclosures for Electrical Equipment
- UL 514B (1989; 2nd Ed; Aug 9, 1990; Errata 1991; Bulletin Sept 16, 1991; Bulletin Jan 20, 1992) UL Standard for Safety Fittings for Conduit and Outlet Boxes
- UL 6 (1993; 10th Ed) UL Standard for Safety - Rigid Metal Conduit
- UL 651 (1989; 5th Ed; Dec 4, 1989) UL Standard for Safety Schedule 40 and 80 Rigid PVC Conduit
- UL 83 (1991; 10th Ed) UL Standard for Safety Thermoplastic-Insulated Wires and Cables
- UL 854 (1991; 8th Ed; Bulletin Jan 13, 1992; Bulletin Jan 27, 1992) UL Standard for Safety Service-Entrance Cables
- UL 870 (1995; 7th Ed) UL Standard for Safety Wireways, Auxiliary Gutters, and Associated Fittings

1.2 GENERAL REQUIREMENTS

Section 16003, "General Electrical Provisions," applies to work specified in this section.

1.3 SUBMITTALS

The following shall be submitted in accordance with Section 01330, "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:

Conduit, Raceways and Fittings
Wire and Cable
Boxes and Fittings

SD-04 Drawings

Fabrications Drawings shall be submitted for the Standard Wiring Systems consisting of fabrication and assembly drawings for all parts of the work in sufficient detail to enable the Government to check conformity with the requirements of the contract documents.

SD-07 Schedules

Material, Equipment, and Fixture Lists shall be submitted for the following items showing manufacturer's style or catalog numbers, specification and drawing reference numbers, warranty information, and fabrication site.

Conduit, Raceways and Fittings
Wire and Cable
Boxes and Fittings

SD-09 Reports

Test Reports shall be submitted for Standard Wiring Systems in accordance with the paragraph entitled, "Field Testing," of this section.

SD-13 Certificates

Certificates of Compliance shall be submitted for the following items showing conformance with the referenced standards contained in this section.

Conduit, Raceways and Fittings
Wire and Cable
Boxes and Fittings

SD-18 Records

Test Readings, including the method of testing and the environmental conditions of the test, shall be recorded and submitted to the Contracting Officer.

PART 2 PRODUCTS

2.1 CONDUITS, RACEWAYS, AND FITTINGS

Conduit shall be 20 millimeter diameter minimum, except where specifically shown smaller on the contract drawings.

Conduit, connectors, and fittings shall be approved for the installation of electrical conductors.

2.1.1 Rigid Steel Conduit

Rigid steel conduit, including couplings, elbows, bends, and nipples, shall conform to the requirements of UL 6 and ANSI C80.1 Steel fittings shall be galvanized by the hot-dip process. Where indicated, and in corrosive areas, rigid steel conduit shall be polyvinylchloride (PVC) coated and conform to NEMA RN 1, Type 20.

Fittings for rigid steel conduit shall be threaded and shall conform to NEMA FB 1.

Gaskets shall be solid for fittings sized 40 millimeter and less. Conduit fittings with blank covers shall have gaskets except in clean, dry areas or at the lowest point of a conduit run where drainage is required.

Covers shall have captive screws and shall be accessible after the work has been completed.

2.1.2 Flexible Metallic Conduit

Flexible metallic conduit shall meet the requirements of UL 1.

Liquidtight flexible metallic conduit shall be provided with a protective jacket of PVC extruded over a flexible interlocked galvanized steel core to protect wiring against moisture, oil, chemicals, and corrosive fumes.

Fittings for flexible metallic conduit shall meet the requirements of UL 514B, Type I box connector, electrical, Type III coupling, electrical conduit, flexible steel, or Type IV adapter, electrical conduit.

Fittings for liquidtight flexible metallic conduit shall meet the requirements of UL 514B, Type I box connector, electrical, Class 3 liquidtight flexible metallic conduit connectors.

2.1.3 Wireways and Auxiliary Gutters

Wireways and auxiliary gutters for use in exposed, dry locations shall be a prefabricated channel-shaped sheet metal trough with hinged or removable covers, associated fittings, and supports for housing, and protecting electrical wires and cables in accordance with UL 870.

Straight sections of trough, elbows, tees, crosses, closing plates, connectors, and hanging brackets shall be constructed from sheet steel of commercial quality not less than 1.6 millimeter. Sheet metal component parts shall be cleaned, phosphatized, and coated with a corrosion-resistant gray paint.

Straight sections of wireways and auxiliary gutters shall be solid or have knockouts as indicated in both sides and bottom, 75 millimeter on center.

Straight sections shall be not more than 1500 millimeter long, with covers held closed with screws.

2.2 WIRE AND CABLE

Insulated current-carrying wire and grounding conductors shall be copper and shall conform to NFPA 70 and UL 1581. Wire bundles with cable ties shall be secured to the enclosure with sheet-metal screws. Self-sticking adhesive attachments are not acceptable.

2.2.1 Splices and Connectors

Splices in building wire 3.15 millimeter (No. 8) and smaller and multiple conductor cables shall be made with insulated Scotchlock, or equal, connectors or with indentor crimp-type connectors and compression tools to ensure a satisfactory mechanical and electrical joint.

Splices in building wire 4.1 millimeter diameter (No. 6) and larger and single-conductor cables shall be made with indentor crimp-type connectors and compression tools or with bolted clamp-type connectors to ensure a satisfactory mechanical and electrical joint.

Joints shall be wrapped with an insulating tape that has an insulation and temperature rating equivalent to that of the conductor. Splices in rubber-insulated neoprene-jacketed wire and cables shall be watertight.

Vinyl-plastic electrical insulating tape shall meet the requirements of ASTM D 2301. Where pressure-sensitive tape is used, the surface shall be cleaned free of dust, sand, or other foreign material and a primer recommended by the tape manufacturer shall be applied prior to taping.

Where indicated and for building wire 3.15 millimeter (No. 8) and larger, terminations shall utilize screw-set pressure terminal lugs.

Where indicated, building wire 2.5 millimeter diameter (No. 10) and smaller shall be terminated in pre-insulated crimp ring lugs on terminal blocks.

Solid wiring shall be terminated with terminal blocks specifically designed for solid wire. Crimp type shall not be used on solid wire for termination.

Stranded wire shall use crimp type lugs for termination on terminal blocks.

2.3 BOXES AND FITTINGS

Boxes shall have sufficient volume to accommodate the number of conductors entering the box in accordance with the requirements of NFPA 70 and UL 514A. Boxes that are exposed to the weather or that are in normally wet locations shall be cast-metal with threaded hubs rated NEMA 3R Minimum. Surface-mounted boxes on interior walls shall be cast-metal. Boxes in other areas shall be cadmium-plated or zinc-coated sheet metal.

2.3.1 Sheet Metal Boxes and Outlets

Junction boxes flush-mounted in walls or ceilings shall be square -shaped boxes as appropriate, with extension rings and covers.

Boxes shall be formed from carbon-steel sheets of commercial quality, not less than 1.9 millimeter. Boxes shall be one-piece construction, zinc- or cadmium-plated in accordance with UL 514A. Boxes and box extension rings shall be provided with knockouts.

Surface-mounted boxes shall be outside flange type with a matching solid flat cover. Flush-mounted boxes in walls and floors shall be the outside flange type with a matching recessed solid walkway cover. Box bodies and covers shall be galvanized by the hot-dip process in accordance with ASTM A 123, Class A.

2.3.2 Pull and Junction Boxes

Pull and junction boxes shall be fabricated from carbon steel and shall conform to UL 50. Box dimensions and conduit connections shall conform to NFPA 70.

Boxes shall be welded construction with flat removable covers fastened to the box with machine screws. Seams and joints at corners or back edges of the box shall be closed and reinforced with flanges formed of the same material from which the box is constructed or by other means such as continuous welding which provides a construction equivalent to integral flange construction.

Boxes intended for outdoor use shall be hot-dipped galvanized with threaded hubs and neoprene-gasketed covers rated NEMA 3R minimum.

Boxes intended for use in dry locations shall be sheet steel galvanized after fabrication conforming to UL 514A.

PART 3 EXECUTION

3.1 INSTALLATION

Power, Control & Instrumentation and all related components shall be installed in accordance with NFPA 70.

Any run of rigid conduit between outlet and outlet, between fitting and fitting, or between outlet and fitting shall contain not more than the equivalent of three 90-degree bends, including those bends located immediately at the outlet or fitting. Field bends shall be made in accordance with the manufacturer's recommendations, which normally require use of a one-size-larger bender than would be required for uncoated conduit. Installed conduit and fittings shall be free of dirt and trash and shall not be deformed or crushed. Empty conduit shall have a pullwire installed.

Conduit shall be installed with a minimum of 75 millimeter of free air space separation from mechanical piping.

Conduit in finished areas shall be installed concealed. Conduit passing through masonry or concrete walls shall be installed in sleeves.

Conduit shall be securely clamped and supported at least every 3000 millimeter vertically and 2400 millimeter horizontally. Galvanized pipe straps shall be fastened to structure with bolts, screws, and anchors. Wooden masonry plugs shall not be used.

Conduit and boxes shall not be supported from T-bar ceiling wires.

Conduit connections to boxes and fittings shall be supported not more than 900 millimeter from the connection point. Conduit bends shall be supported not more than 900 millimeter from each change in direction. Conduit shall be installed in neat symmetrical lines parallel to the centerlines of the building construction and the building outline. Multiple runs shall be parallel and grouped whenever possible on common supports.

Conduit and raceway runs in or under concrete, in damp, corrosive, or outdoor locations, in hazardous areas, where subject to mechanical damage, or intended for conductors rated over 600 volts, shall be rigid steel conduit. Conduit joints in corrosive areas shall be painted with corrosion-inhibiting compounds.

Ends of conduit extending from the interior to the exterior of the building and portions of interior conduit exposed to widely varying temperatures shall be sealed to prevent the passage of air within the conduit. Conduit shall be sloped to drain and shall be provided with drainage fittings at the lower end of the run. Curved portion of conduit bends shall not be visible above the finished floor. Underground service entrance and feeder conduit entering or leaving the building above the ground floor shall be terminated in a pull box.

Expansion fittings with flexible ground strap shall be provided in conduit runs crossing building expansion joints.

Bushings shall be provided on the open ends of conduit containing conductors. Insulated bushings shall be provided for conduits containing conductors 5.2 millimeter diameter (No. 4) or larger with an insulating ring an integral part of the bushing.

Flexible metallic conduit shall be used to connect metallic transformers. Sections of flexible steel conduit shall be not more than 1800 millimeter long and shall be installed only in exposed or accessible locations. Interior surfaces of conduit shall be free from burrs and sharp edges which might cause abrasion of wire and cable coverings. Ends of flexible steel conduit shall be provided with grounding bushings and approved fittings.

Bonding wires shall be used in flexible conduit for all circuits. Flexible conduit shall not be considered a ground conductor.

Liquidtight flexible metallic conduits shall be used in wet and oily locations.

Wire or cable shall not be installed in conduit until the conduit system is completed; the inner surfaces of conduit shall be clean and dry.

A polypropylene pull rope with a tensile strength not less than 580 newton shall be installed in new empty conduit.

3.1.1 Installation of Rigid Metal Conduit

Ends of conduit shall be cut square, reamed and threaded, and joints shall be brought butt-to-butt in the couplings. Joints shall be mechanically tight. Conduit shall be protected against damage and the entrance of water or foreign material during construction.

Ninety-degree bends of conduit with a diameter larger than 25 millimeter shall be made with factory-made elbows. Conduit elbows larger than 65 millimeter shall be long radius. Field-made bends and offsets shall be made with an approved hickey or conduit-bending machine. Changes in directions of runs shall be made with symmetrical bends or cast-metal fittings.

At connections to sheet metal enclosures and boxes, a sufficient number of threads shall project through to permit the bushing to be drawn tight against the end of the conduit, after which the locknut shall be pulled up sufficiently tight to draw the bushing into firm electrical contact with the box. Conduit shall be fastened 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 the box, and where indicated.

Conduit joints shall be made with tapered threads set firmly. Each length of conduit cut in the field shall be reamed before installation. Where conduit is threaded in the field, each threaded end shall consist of at least five full threads. Corrosion-inhibitive compound shall be used on conduit threads in exterior areas.

Conduit stubbed-up through concrete floors for connections to free-standing equipment except motor-control centers, cubicles, and other such items of equipment shall be provided with a flush coupling if the floor slab is of sufficient thickness; if not, a floor box shall be provided and set flush with the finished floor. Conduits installed for future use shall be terminated with a coupling and plug set flush with the floor.

3.1.2 Installation of Flexible Metallic Conduit

Flexible metallic conduit shall be installed only in exposed, accessible locations in accordance with NFPA 70. A grounding green conductor shall be installed in all runs. Connections to vibrating equipment shall be made with flexible metallic conduit.

3.2 INSTALLATION OF WIRING

Raceways shall be completely installed, with interiors protected from the weather, before proceeding with the installation of wires and cables. Conductors of special-service systems and emergency light and power systems shall not occupy the same enclosure with light and power conductors or the same enclosure with each other. Conductors shall be continuous with splices and connections made in outlet, junction, or pull boxes only. All control wiring shall be continuous between components and/or terminal boards.

Phase conductors and the neutral conductor of each branch or feeder circuit shall be contained in a single enclosure or paralleled in separate enclosures to avoid overheating the raceway by electromagnetic induction. Conductors and conduit in parallel shall be the same length and size, shall have conductors of the same type of insulation, shall be terminated at both ends in a manner to ensure equal division of the total current among conductors, and shall have a separate neutral conductor in each conduit.

Conductors installed in heavy-wall rigid steel conduit and EMT shall have allowable current-carrying capacity and ampere ratings in accordance with

NFPA 70. Larger-sized conductors shall be used to compensate for derating factors when more than three current-carrying conductors are installed in raceways and when conductors are installed in wet locations.

Conductors 600 volts and below shall be color coded or taped in accordance with the following:

<u>CONDUCTOR</u>	<u>120/208 COLOR</u>	<u>480/277 COLOR</u>	<u>15KV COLOR</u>
Phase A	Black	Brown	Red
Phase B	Red	Orange	Yellow
Phase C	Blue	Yellow	Blue
Neutral	White	White	
Equipment Grounds	Green	Green	Green

Conductors up to and including 6.5 millimeter diameter (No. 2) shall be manufactured with colored insulating materials. Conductors larger than 6.5 millimeter diameter (No. 2) shall have ends identified with colored plastic tape in outlet, pull, or junction boxes. Control circuit conductors shall be identified at each connection point.

Connectors and splices shall conform to UL 486C and shall be made in approved enclosures utilizing solderless pressure connectors and adequate insulation with vinyl-plastic electrical insulating tape. Conductors and materials used in a splice, tap, or connection shall be thoroughly cleaned prior to makeup to ensure good electrical and mechanical connections. Conductor identification shall be provided within each enclosure where a tap, splice, or termination is made and at the equipment terminal of each conductor. Terminal and conductor identification shall match that shown on approved shop drawings. Hand lettering or marking is not acceptable. Control-circuit terminals of equipment shall be properly identified by color-coded insulated conductors, number-coded plastic self-sticking printed markers, or permanently attached metal-foil markers. Cable fittings shall conform to UL 514B; insulating tape shall conform to ASTM D 2301.

Where several feeders pass through a common pullbox, the feeders shall be tagged to clearly indicate the electrical characteristics, circuit number, and panel designation.

Grounding shall be provided in accordance with NFPA 70. Noncurrent-carrying parts of electrical equipment shall be bonded and grounded together.

3.3 BOXES AND FITTINGS

Pullboxes shall be furnished and installed where necessary in the conduit system to facilitate conductor installation. Conduit runs longer than 30 meter or with more than three right-angle bends shall have a pullbox installed at a convenient intermediate location.

Boxes and enclosures shall be securely mounted to the building structure with supporting facilities independent of the conduit entering or leaving the boxes.

Bonding jumpers shall be used around concentric or eccentric knockouts.

3.4 IDENTIFICATION PLATES

An identification plate marked DANGER: 480 VOLTS shall be provided on the outside of 480-volt enclosures. Identification plate shall use white lettering on a red laminated plastic.

Any equipment with externally powered wiring shall be marked with a laminated plaster nameplate having 5 millimeter high white letters on a red background as follows:

DANGER - EXTERNAL VOLTAGE SOURCE

3.5 FIELD TESTING

After completion of the installation and splicing, and prior to energizing the conductors, wire and cable shall be given continuity and insulation tests as herein specified before the conductors are energized.

Necessary test equipment, labor, and personnel shall be provided by the Contractor to perform the tests, as herein specified. Continuity tests shall be conducted using a DC device with bell or buzzer.

Wire and cable in each voltage classification shall be completely isolated from all extraneous electrical connections at cable terminations and joints. Substation and switchboard feeder breakers, above 600 Volts, circuit breakers in panel boards, and other disconnecting devices shall be used to isolate the circuits under test.

Insulation tests on circuits rated 480-volts and less shall be conducted using a 500- or 1,000-volt insulation-resistance test set. Readings shall be taken every minute until three equal and consecutive readings are obtained. Resistance between phase conductors and between phase conductors and ground shall be not less than 25 megohms.

Insulation tests on circuits rated 240 volts or less, with conductor sizes 2 AWG and larger, shall be conducted using a 500- or 1,000-volt insulation-resistance test set. Readings shall be taken after 1 minute and until the reading is constant for 15 seconds. Resistance between phase conductors and between phase conductors and ground shall be not less than 25 megohms.

Phase-rotation tests shall be conducted on all three-phase circuits using a phase-rotation indicating instrument. Phase rotation of electrical connections to connected equipment shall be clockwise, facing the source.

Final acceptance will depend upon the successful performance of wire and cable under test. No conductor shall be energized until the installation is approved.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 16 -- ELECTRICAL

SECTION 16225

MOTORS

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 GENERAL REQUIREMENTS
- 1.3 SUBMITTALS

PART 2 PRODUCTS

- 2.1 EQUIPMENT
- 2.2 MOTOR TYPES
- 2.3 SIZES OF MOTORS
 - 2.3.1 Motors
 - 2.3.2 Electrically Driven Equipment
- 2.4 VOLTAGE RATINGS
- 2.5 TEMPERATURE RATING AND INSULATION
- 2.6 MOTOR ENCLOSURES
- 2.7 SERVICE FACTOR
- 2.8 FACTORY TESTS

PART 3 EXECUTION

- 3.1 INSTALLATION
- 3.2 SITE TESTING

-- End of Section Table of Contents --

SECTION 16225

MOTORS

PART 1 GENERAL

1.1 REFERENCES

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

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE Std 112 (1991) Standard Test Procedure for Polyphase Induction Motors and Generators

NATIONAL ELECTRICAL MANUFACTURER'S ASSOCIATION (NEMA)

NEMA MG 1 (1993) Motors and Generators

ANTI-FRICTION BEARING MANUFACTURERS ASSOCIATION (AFBMA)

AFBMA 11 (1990) Load Ratings and Fatigue Life for Roller Bearings

AFBMA 9 (1990) Load Ratings and Fatigue Life for Ball Bearings

INTERNATIONAL STANDARDS ORGANIZATION (ISO)

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

1.2 GENERAL REQUIREMENTS

Section 16003, "General Electrical Provisions," applies to work specified in this section.

1.3 SUBMITTALS

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

SD-01 Data

Equipment and Performance Data shall be submitted for Motors consisting of use life, system functional flows, safety features, and mechanical automated details. Curves indicating tested and certified equipment response and performance characteristics shall also be submitted.

SD-04 Drawings

Outline Drawings for Motors shall indicate overall physical features, dimensions, ratings, service requirements, and weights of equipment.

PART 2 PRODUCTS

2.1 EQUIPMENT

Design, fabrication, testing, and performance of motors shall be in accordance with NEMA MG 1.

Testing and performance of polyphase induction motors shall be in accordance with IEEE Std 112, Method B.

Efficiency labeling shall be in accordance with NEMA MG 1. Allowable balance limits shall be in accordance with ISO 1940/1, Table 1.

2.2 MOTOR TYPES

Induction motors with a power rating 3.7 to 7.5 (up to 185) kilowatt shall be the energy-efficient type. Motor shall be marked with a NEMA INDEX letter shown or a letter that indicates a higher efficiency.

Motors shall be of the following types:

250 watt rating and smaller, single phase - capacitor start

375 watt and larger, three-phase - induction squirrel-cage type, NEMA Design B, having normal starting torque and low starting current

Motors shall be designed for across-the-line starting and shall be designed with torque characteristics to carry the specified rated starting load.

Motors shall have factory-sealed ball bearings with an L10 life of not less than 80,000 hours in accordance with AFBMA 9 and AFBMA 11.

2.3 SIZES OF MOTORS

2.3.1 Motors

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

2.3.2 Electrically Driven Equipment

When electrically driven equipment differs from that indicated, adjustments shall be made to the motor size, wiring and conduit systems, disconnect devices, and circuit protection to accommodate the equipment actually installed, at no additional cost to the Government. Control and protective devices shall be in accordance with Section 16286, "Overcurrent Protective Devices."

2.4 VOLTAGE RATINGS

Motors shall have the following minimum voltage ratings for the specified service voltages as indicated on the drawings:

MOTOR TYPE	MOTOR SIZE		SERVICE	MOTOR VOLTAGE RATING
		WATTAGE RATING		
Single-phase	250 and smaller		120/208-volt, 3-phase, 4-wire	115-volt, 60-hertz
3-phase	375 and larger		480-volt, 3-phase, 3-wire	230/460-volt, 3-phase, 60-hertz

2.5 TEMPERATURE RATING AND INSULATION

Motors shall be designed for continuous operation at the rated full load in an ambient temperature of 40 degrees C.

Insulation level shall be at least Class B.

2.6 MOTOR ENCLOSURES

Motors installed in indoor, clean, dry, nonhazardous locations shall have open-type drip-proof enclosures. Enclosures shall have a hinged access cover at each vibration collection point. Cover must be large enough to enable the placement of a magnet/accelerometer data collection instrument.

Motors installed in indoor, wet, nonhazardous locations shall have open splash-proof enclosures. Enclosures shall have a hinged access cover at each vibration collection point. Cover must be large enough to enable the placement of a magnet/accelerometer data collection instrument.

Motors installed in indoor, nonhazardous locations where it is necessary to protect the motor from dirt and moisture in the surrounding atmosphere shall be the totally enclosed type. Enclosures shall have a hinged access cover at each vibration collection point. Cover must be large enough to enable the placement of a magnet/accelerometer data collection instrument.

Motors installed in outdoor, non-hazardous locations shall have waterproof enclosures.

Motors with weatherproof/waterproof enclosures shall have permanent accelerometers installed in the horizontal, vertical, and axial directions. The enclosures 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.

2.7 SERVICE FACTOR

Service factor of general purpose and other open ac motors shall be in accordance with NEMA MG 1.

Totally enclosed ac motors shall have a service factor of 1.15.

2.8 FACTORY TESTS

Motors shall be factory-tested in accordance with the requirements of NEMA MG 1. Polyphase induction motors shall be factory-tested in accordance with IEEE Std 112, Method B. Tests shall consist of measurements of

voltage, frequency, speed, and current under no-load conditions; voltage, frequency, and current under locked-rotor conditions; and efficiency, noise, power factor, and thermal protection. Routine tests on all motors shall include high-potential tests.

PART 3 EXECUTION

3.1 INSTALLATION

Motors shall be installed, aligned, and connected in accordance with these specifications and the equipment manufacturer's instructions.

Alignment of motors shall be rechecked and adjusted as required after the motor has been in operation for not less than 48 hours.

3.2 SITE TESTING

Motors on motor-driven equipment shall be given continuity and insulation tests after the installation is completed and before the equipment is energized. Motors shall be inspected for damage, moisture, alignment, proper lubrication, oil leaks, phase identification, and cleanliness before conduit tests. Motors shall be completely isolated from the source of supply before conducting the tests.

Test equipment, labor, and personnel shall be provided to perform the tests required. Continuity tests shall be conducted when indicated.

Insulation tests:

Insulation tests on 480-volt motors shall be conducted using a 1000-volt insulation-resistance test set. Readings shall be recorded every minute until three equal and consecutive readings are obtained. The resistance between phase conductors and ground shall be not less than 25 megohms.

Test data shall be recorded and shall include the location and identification of motors and megohm readings versus time.

After the installation has been thoroughly tested and found to be in satisfactory condition, with thermal overload relays in motor controllers properly rated and in place, written authorization shall be obtained from the Contracting Officer prior to energizing the equipment at the system voltage for final operational tests.

Duration of final operational tests to prove satisfactory performance will be determined by the Contracting Officer.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 16 - ELECTRICAL

SECTION 16286

OVERCURRENT PROTECTIVE DEVICES

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 GENERAL REQUIREMENTS

PART 2 PRODUCTS

- 2.1 MOTOR CONTROL
 - 2.1.1 Manual Motor Controllers
 - 2.1.2 Magnetic Motor Controllers
 - 2.1.2.1 Full-Voltage Controllers
 - 2.1.3 Combination Motor Controllers
 - 2.1.3.1 Nonreversing Combination Motor Controllers
- 2.2 ENCLOSURES
 - 2.2.1 Equipment Enclosures
 - 2.2.2 Remote-Control Station Enclosures
- 2.3 CIRCUIT BREAKERS
 - 2.3.1 Molded-Case Circuit Breakers
- 2.4 FUSES
- 2.5 CONTROL DEVICES
 - 2.5.1 Magnetic Contactors
 - 2.5.2 Control-Circuit Transformers
 - 2.5.3 Magnetic Control Relays
 - 2.5.4 Pushbuttons and Switches
 - 2.5.4.1 Pushbuttons
 - 2.5.4.2 Selector Switches
- 2.6 FACTORY TESTING
- 2.7 INDICATING LIGHTS
 - 2.7.1 General-Purpose Type

PART 3 EXECUTION

- 3.1 INSTALLATION
- 3.2 FIELD TESTING

-- End of Section Table of Contents --

SECTION 16286

OVERCURRENT PROTECTIVE DEVICES

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

- ANSI C37.121 (1989) Unit Substation Requirements
- ANSI C37.16 (1988) Switchgear - Low-Voltage Power Circuit Breakers and AC Power Circuit Protectors - Preferred Ratings, Related Requirements, and Application Recommendations
- ANSI C37.17 (1979; R 1988) Trip Devices for AC and General-Purpose DC Low-Voltage Power Circuit Breakers
- ANSI C39.1 (1981; R 1992) Electrical Analog Indicating Instruments
- ANSI C78.23 (1989) Electric Lamps - Incandescent Lamps-Miscellaneous Types

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- ASTM A 167 (1994; Rev A) Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
- ASTM A 48 (1994; Rev A) Standard Specification for Gray Iron Castings
- ASTM D 877 (1987; R 1995) Standard Test Method for Dielectric Breakdown Voltage of Insulating Liquids Using Disk Electrodes

ELECTRONIC INDUSTRIES ASSOCIATION (EIA)

- EIA 443 (1985) Solid State Relays, EIA/NARM, Standard for

INSTITUTE FOR INTERCONNECTING AND PACKAGING ELECTRONIC CIRCUITS (IPC)

- IPC D330 7.1.3.5 (1973) Switches

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

- IEEE C12.1 (1988; 8th Ed) Code for Electricity Metering
- IEEE C37.13 (1990) Low-Voltage AC Power Circuit Breakers Used in Enclosures
- IEEE C37.90 (1994) Standard for Relays and Relay Systems Associated With Electric Power Apparatus
- IEEE C57.13 (1993) Standard Requirements for Instrument Transformers
- IEEE C63.2 (1987) Standard for Instrumentation - Electromagnetic Noise and Field Strength, 10 kHz to 40 GHz - Specifications
- IEEE C63.4 (1992) Methods of Measurement of Radio - Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz

JOINT INDUSTRIAL COUNCIL (JIC)

- JIC-01 (1967) Electrical Standards for Mass Production Equipment

NATIONAL ELECTRICAL MANUFACTURER'S ASSOCIATION (NEMA)

- NEMA 107 (1987; R 1993) Methods of Measurement of Radio Influence Voltage (RIV) of High-Voltage Apparatus
- NEMA 250 (1991) Enclosures for Electric Equipment (1000 Volts Maximum)
- NEMA AB 1 (1993) Molded Case Circuit Breakers and Molded Case Switches
- NEMA AB 3 (1993) Molded Case Circuit Breakers and Their Application
- NEMA FU 1 (1986) Low Voltage Cartridge Fuses
- NEMA ICS 1 (1993) Industrial Control and Systems General Standards
- NEMA ICS 2 (1993) Industrial Control and Systems Controllers, Contactors, and Overload Relays Rated Not More Than 2000 Volts AC or 750 Volts DC
- NEMA ICS 3 (1993) Industrial Control and Systems Factory Built Assemblies
- NEMA ICS 6 (1993) Industrial Control and Systems Enclosures

NEMA SG 2	(1993) High-Voltage Fuses
NEMA SG 5	(1990) Power Switchgear Assemblies
NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)	
NFPA 70	(1999) National Electrical Code
UNDERWRITERS LABORATORIES (UL)	
UL 20	(1986; 10th Ed; July 12, 1993, Errata - 1988) UL Standard for Safety General-Use Snap Switches
UL 489	(1991; 8th Ed; May 1, 1992; Bulletin Feb 11, 1992; Bulletin Mar 16, 1992) UL Standard for Safety Molded-Case Circuit Breakers and Circuit-Breaker Enclosures
UL 50	(1992; 10th Ed) UL Standard for Safety - Enclosures for Electrical Equipment
UL 508	(1992) UL Standard for Industrial Control Equipment

1.2 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:

- Motor Controls
- Enclosures
- Circuit Breakers
- Fuses

SD-04 Drawings

Connection Diagrams shall be submitted showing the relations and connections of the following items by showing the general physical layout of all controls, the interconnection of one system (or portion of system) with another, and internal tubing, wiring, and other devices.

Protective Devices

SD-04 Drawings

Installation Drawings shall be submitted for the following items in accordance with the paragraph entitled, "Installation," of this section.

- Control Devices
- Protective Devices

SD-09 Reports

Test Reports shall be submitted for the following tests on control and protective devices in accordance with the paragraph entitled, "Field Testing, of this section.

Operation Tests

SD-18 Records

No change in continuous-current rating, interrupting rating, and clearing or melting time of fuses shall be made unless written permission has first been secured from the Contracting Officer.

1.3 GENERAL REQUIREMENTS

Section 16003, "General Electrical Provisions," applies to work specified in this section.

PART 2 PRODUCTS

2.1 MOTOR CONTROL

Motor controllers shall conform to NEMA ICS 1, NEMA ICS 2, and UL 508. Controllers shall have thermal overload protection in each phase.

2.1.1 Manual Motor Controllers

Manual motor controllers for the control and protection of single-phase 60-hertz ac small wattage rating squirrel-cage induction motors shall be full-voltage, manually operated devices.

Controllers shall be single-throw, single- or double-pole, three-position devices rated not more than 750 watt rated at 277-volts single phase. Controller shall include a supporting base or body of electrical insulating material with enclosed switching mechanism, yoke, thermal overload relay, and terminal connectors. Controllers shall clearly indicate operating condition: on, off, or tripped.

Manual motor controllers shall be the toggle- or key-operated type as indicated and shall be arranged so that they may be locked with a padlock in the "OFF" position.

Recessed manual motor controllers for single-speed, small wattage rating squirrel-cage induction motors shall include a single controller and indicating light in a 100 millimeter square wall outlet box for flush-wiring devices with matching corrosion-resistant steel flush cover plate. Surface-mounted manual motor controllers for single-speed, small wattage rating squirrel cage induction motors shall include a single controller and indicating light in a NEMA 250, Type 1 or Type 3R as indicated on the drawings, general-purpose enclosure.

2.1.2 Magnetic Motor Controllers

2.1.2.1 Full-Voltage Controllers

Magnetic motor controllers for the control and protection of single- and three-phase, 60-hertz, squirrel-cage induction motors shall be

full-voltage, full magnetic devices in accordance with NEMA ICS 1, NEMA ICS 2, and UL 508.

Operating coil assembly shall operate satisfactorily between 85 and 110 percent of rated coil voltage. Motor control circuits shall be 120 volts, 60 hertz.

Controller shall be provided with two normally open and two normally closed auxiliary contacts rated per NEMA ICS 1 and NEMA ICS 2 in addition to the sealing-in contact for control circuits.

Solderless pressure wire terminal connectors shall be provided for line-and load-connections to controllers.

Overcurrent protection shall include three manually resettable thermal overload devices, one in each pole of the controller. Thermal overload relays shall be bimetallic nonadjustable type with continuous current ratings and service-limit current ratings and shall have a plus or minus 15 percent adjustment to compensate for ambient operating conditions.

An externally operable manual-reset button shall be provided to re-establish control power to the holding coil of the electromagnet. After the controller has tripped from overload, resetting the motor-overload device shall not restart the motor.

Enclosure shall be in accordance with NEMA 250, Type 1 or 3R as indicated on drawings.

2.1.3 Combination Motor Controllers

Following requirements are in addition to the requirements specified for magnetic motor controller:

Combination motor controllers for the control and protection of single-and three-phase 60-hertz alternating-current squirrel-cage induction motors with branch-circuit disconnecting and protective devices shall be in accordance with NEMA ICS 1, NEMA ICS 2, and JIC-01.

Combination motor controllers shall include magnetic motor controllers and molded-case circuit breakers or MCP in metal enclosures in accordance with NEMA 250 or motor-control center draw-out assemblies with control-power transformers, selector switches, pushbuttons, and indicating lights as follows:

Magnetic motor controllers and enclosures shall be full-voltage, full-magnetic devices as specified in this section under paragraph entitled, "Remote-Control Station Enclosures."

Molded-case circuit breakers shall be thermal-magnetic breakers as specified in paragraph entitled, "Manual Motor Controllers." Manufacturer's standard MCP may be used in lieu of molded-case circuit breakers.

Control-power transformers 120-volt ac maximum selector switches, pushbuttons, and pilot lights shall be as required.

Combination motor controllers shall be identified with identification plates affixed to front cover of the controller.

2.1.3.1 Nonreversing Combination Motor Controllers

Following requirements are in addition to the requirements for magnetic motor controllers:

Nonreversing combination motor controllers for the control and protection of single-speed squirrel-cage induction motors shall include a magnetic controller with molded-case circuit breaker or MCP with selector switch or start/stop pushbutton and indicating light in the cover of the enclosure.

Rating of single and three-phase single-speed full-voltage magnetic controllers for nonplugging and nonjogging duty shall be in accordance with NEMA ICS 1 and NEMA ICS 2.

Wiring and connections for full-voltage single-speed magnetic controllers shall be in accordance with NEMA ICS 1 and NEMA ICS 2.

2.2 ENCLOSURES

2.2.1 Equipment Enclosures

Enclosures for equipment shall be in accordance with NEMA 250.

Equipment installed inside, clean, dry locations shall be contained in NEMA Type 1, general-purpose sheet-steel enclosures.

Equipment installed in wet locations shall be contained in NEMA Type 4 watertight, corrosion-resistant sheet-steel enclosures, constructed to prevent entrance of water when tested in accordance with NEMA ICS 6 for Type 4 enclosures.

Equipment installed in industrial locations shall be contained in NEMA Type 12 industrial use, sheet-steel enclosures constructed to prevent the entrance of dust, lint, fibers, flyings, oil, and coolant seepage.

Sheet-steel enclosures shall be fabricated from uncoated carbon-steel sheets of commercial quality, with box dimensions and thickness of sheet steel in accordance with UL 50.

Steel enclosures shall be fabricated from corrosion-resistant, chromium-nickel steel sheet conforming to ASTM A 167 Type 300 series with ASM No. 4 general-purpose polished finish. Box dimensions and thickness of sheet steel shall be in accordance with UL 50.

Ferrous-metal surfaces of electrical enclosures shall be cleaned, phosphatized, and painted with the manufacturer's standard finish.

2.2.2 Remote-Control Station Enclosures

Remote-control station enclosures for pushbuttons, selector switches, and indicating lights shall be in accordance with the appropriate articles of NEMA ICS 6 and NEMA 250.

Remote-control stations installed in indoor, clean, dry locations shall be contained in NEMA Type 1 general-purpose, sheet-steel enclosures. Recessed remote-control stations shall be contained in standard wall outlet boxes with matching corrosion-resistant steel flush cover plate.

Remote-control stations installed in wet locations shall be contained in NEMA Type 4 watertight, corrosion-resistant sheet-steel enclosures constructed to prevent entrance of water when tested in accordance with NEMA ICS 6 and NEMA 250 for Type 4 enclosures.

Remote-control stations installed in industrial locations shall be contained in NEMA Type 12 industrial-use, sheet-steel enclosures constructed to prevent the entrance of dust, lint, fibers, flyings, oil, and coolant seepage.

Sheet-steel enclosures shall be fabricated from uncoated carbon-steel sheets of commercial quality with box dimensions and thickness of sheet steel in accordance with UL 50.

Steel enclosures shall be fabricated from corrosion-resistant, chromium-nickel steel sheet conforming to ASTM A 167, Type 300 series with ASM No. 4 general-purpose polished finish. Box dimensions and thickness of sheet steel shall be in accordance with UL 50.

Ferrous-metal surfaces of remote-control-station enclosures shall be cleaned, phosphatized, and painted with the manufacturer's standard finish.

Remote-control stations shall be installed with the centerline 1700 millimeter above the finished floor.

2.3 CIRCUIT BREAKERS

Circuit breakers shall conform to UL 489, NEMA AB 1, and NEMA AB 3.

2.3.1 Molded-Case Circuit Breakers

Circuit breakers shall be molded case, manually operated, trip-free, with inverse-time thermal-overload protection and instantaneous magnetic short-circuit protection as required. Circuit breakers shall be completely enclosed in a molded case, with the calibrated sensing element factory-sealed to prevent tampering.

Thermal-magnetic tripping elements shall be located in each pole of the circuit breaker and shall provide inverse-time-delay thermal overload protection and instantaneous magnetic short-circuit protection. Instantaneous magnetic tripping element shall be adjustable and accessible from the front of the breaker on frame sizes larger than 100 amperes.

Breaker size shall be as required for the continuous current rating of the circuit. Breaker class shall be as required.

Interrupting capacity of the panel and lighting branch circuit breakers shall be sufficient to successfully interrupt the maximum short-circuit current imposed on the circuit at the breaker terminals. Circuit breaker interrupting capacities shall be a minimum of 10,000 amperes and shall conform to NEMA AB 3.

Multipole circuit breakers shall be of the common-trip type having a single operating handle and shall have a two-position on/off indication. Circuit breakers shall have temperature compensation for operation in an ambient temperature of 40 degrees C. Circuit breakers shall have root mean square (rms) symmetrical interrupting ratings sufficient to protect the circuit being supplied. Interrupting ratings may have selective type tripping (time delay, magnetic, thermal, or ground fault).

Breaker body shall be of phenolic composition. Breakers shall be capable of having such accessories as handle-extension, handle-locking, and padlocking devices attached where required.

Circuit breakers used for motor-circuit disconnects shall meet the applicable requirements of NFPA 70 and shall be of the motor-circuit protector type.

Circuit breakers used for service disconnection shall be the enclosed circuit-breaker type with external handle for manual operation. Enclosures shall be sheet metal with a hinged cover suitable for surface mounting.

2.4 FUSES

A complete set of fuses for all switches shall be provided. Fuses shall have a voltage rating not less than the circuit voltage.

Fuses rated 30 amperes, 125 volts or less shall be the nonrenewable cartridge type. Fuses rated above 30 amperes 600 volts or less shall be the renewable cartridge type with time-delay dual elements, except where otherwise indicated. Fuses shall conform to NEMA FU 1.

Fuses shall be labeled showing UL class, interrupting rating, and time-delay characteristics, when applicable.

Fuse holders field-mounted in a cabinet or box shall be porcelain. Field installation of fuse holders made of such materials as ebony asbestos, Bakelite, or pressed fiber shall not be used.

2.5 CONTROL DEVICES

2.5.1 Magnetic Contactors

Magnetic contactors for the control of low-voltage, 60-hertz, tungsten-lamp loads, fluorescent-lamp loads, resistance-heating loads, and the primary windings of low-voltage transformers shall be in accordance with NEMA ICS 1 and NEMA ICS 2 as required.

Core-and-coil assembly shall operate satisfactorily with coil voltage between 85 and 110 percent of its voltage rating.

Contactors shall be designed with a normally open holding circuit auxiliary contact for control circuits. Rating of the auxiliary contact shall be in accordance with NEMA ICS 1 and NEMA ICS 2.

Solderless pressure wire terminal connectors shall be furnished or made available for line-and-load connections to contactors in accordance with NEMA ICS 1 and NEMA ICS 2.

Rating of magnetic contactors shall be in accordance with NEMA ICS 1 and NEMA ICS 2.

2.5.2 Control-Circuit Transformers

Control-circuit transformers shall be provided within the enclosure of magnetic contactors and motor controllers when the line voltage is in excess of 120 volts. Transformer shall be encapsulated dry type,

single-phase, 60-hertz, with a 120-volt (or 24-volt) isolated secondary winding.

Rated primary voltage of the transformer shall be not less than the rated voltage of the controller. Rated secondary current of the transformer shall be not less than continuous-duty current of the control circuit.

Voltage regulation of the transformer shall be such that, with rated primary voltage and frequency, the secondary voltage shall not be less than 95 percent nor more than 105 percent of rated secondary voltage.

Source of supply for control-circuit transformers shall be the load side of the main disconnecting device. Secondary winding of the transformer and control-circuit wiring shall be protected against overloads and short circuits with fuses selected in accordance with JIC-01. Secondary winding of the control-circuit transformer shall be grounded in accordance with JIC-01.

2.5.3 Magnetic Control Relays

Magnetic control relays for energizing and de-energizing the coils of magnetic contactors or other magnetically operated devices in response to variations in the conditions of electric control devices shall be in accordance with NEMA ICS 1, and NEMA ICS 2.

Core-and-coil assembly shall operate satisfactorily with coil voltages between 85 and 110 percent of their voltage rating.

Relays shall be designed to accommodate normally open and normally closed contacts.

Magnetic control relays shall be 120-volt, 60-hertz, Class AIB devices with a continuous contact rating of 10 amperes and with current-making and -breaking ability in accordance with NEMA ICS 1 and NEMA ICS 2, two normally open and two normally closed.

2.5.4 Pushbuttons and Switches

2.5.4.1 Pushbuttons

Pushbuttons for low-voltage ac full-voltage magnetic controllers shall be heavy-duty oiltight NEMA 250, Type 12, momentary-contact devices rated 600 volts, with pilot light, and with the number of buttons and the marking of identification plates as shown. Color code for pushbuttons shall be in accordance with JIC-01.

Pushbuttons shall be designed with normally open, circuit-closing contacts; normally closed circuit-opening contacts; and two-circuit normally open and normally closed circuit-closing and -opening contacts. Pushbutton-contact ratings shall be in accordance with NEMA ICS 1 and NEMA ICS 2 with contact designation A600.

Pushbuttons in remote control stations shall be identified with identification plates affixed to front cover in a prominent location. Identification plate shall carry the identification of the system being controlled.

2.5.4.2 Selector Switches

Selector switches for low-voltage control circuits shall be heavy-duty oiltight maintained-contact devices with the number of positions and the marking of identification plates in accordance with NEMA ICS 1 and NEMA ICS 2.

Selector switches in remote control stations shall be identified with engraved identification plates affixed to front cover in a prominent location. Identification plate shall carry the identification of the system being controlled.

2.6 FACTORY TESTING

Factory tests on control and protective devices shall be performed in accordance with the manufacturer's recommendations.

Short-circuit tests shall be in accordance with Section 2 of NEMA ICS 1.

2.7 INDICATING LIGHTS

2.7.1 General-Purpose Type

Indicating lights shall be oiltight instrument devices with threaded base and collar for flush-mounting, translucent convex lens, candelabra screw-base lampholder, and 120-volt, 6-watt, Type S-6 incandescent lamp in accordance with ANSI C78.23. Color code for indicating lights shall be in accordance with JIC-01.

Indicating lights shall be provided in remote-control stations when pushbuttons and selector switches are out of sight of the controller.

PART 3 EXECUTION

3.1 INSTALLATION

Control and protective devices not factory installed in equipment shall be installed in accordance with the manufacturer's recommendations and shall be field adjusted and tested for operation. Installations shall conform to NFPA 70, NEMA ICS 1, NEMA ICS 2, and NEMA ICS 3 requirements for installation of control and protective devices.

3.2 FIELD TESTING

Control and protective devices not factory installed in equipment shall be demonstrated to operate as indicated.

Reduced-voltage starting devices shall be field adjusted to obtain optimum operating conditions. Test meters and instrument transformers shall conform to IEEE C12.1 and IEEE C57.13.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 16 - ELECTRICAL

SECTION 16446

PANELBOARDS

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 GENERAL REQUIREMENTS
- 1.3 SUBMITTALS

PART 2 PRODUCTS

- 2.1 PANELBOARDS
- 2.2 CIRCUIT BREAKERS
- 2.3 DIRECTORY CARD AND HOLDER
- 2.4 FACTORY TESTING

PART 3 EXECUTION

- 3.1 INSTALLATION
- 3.2 SITE TESTING

-- End of Section Table of Contents --

SECTION 16446

PANELBOARDS

PART 1 GENERAL

1.1 REFERENCES

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

ELECTRONIC INDUSTRIES ASSOCIATION (EIA)

EIA 416 (1974; R 1981) Fittings, Radio Interface

EIA 46 (1987) Test Procedure for Resistance to Soldering (Vapor Phase Technique) for Surface Mount Devices

FEDERAL STANDARDS (FED-STD)

FED-STD 595 (Rev B) Colors Used in Government Procurement

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE Std 474 (1973; R 1982) Fixed and Variable Attenuators, dc to 40 GHz Including Trial-Use Sections on Insertion-Loss Repeatability and Characteristic Insertion Loss of a Noninsertable Two-Port

MILITARY HANDBOOKS (MIL-HDBK)

MIL-HDBK 232 (Rev A) Red/Black Engineering Installation Guidelines

NATIONAL ELECTRICAL MANUFACTURER'S ASSOCIATION (NEMA)

NEMA 250 (1991) Enclosures for Electric Equipment (1000 Volts Maximum)

NEMA AB 1 (1993) Molded Case Circuit Breakers and Molded Case Switches

NEMA PB 1 (1990) Panelboards

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (1993) National Electrical Code

UNDERWRITERS LABORATORIES (UL)

UL 67 (1993; 11th Ed) Panelboards

1.2 GENERAL REQUIREMENTS

Section 16003, "General Electrical Provisions," applies to work specified in this section.

1.3 SUBMITTALS

The following shall be submitted in accordance with Section 01330, "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:

Panelboards - 120/208 volt, 3-phase and 277/480 volt, 3-phase
Directory Card and Holder

SD-04 Drawings

Detail Drawings shall be submitted for the Panelboards consisting of fabrication and assembly drawings for all parts of the work in sufficient detail to enable the Government to check conformity with the requirements of the contract documents. Drawings shall include details of bus layout.

SD-04 Drawings

Outline Drawings for Panelboards shall indicate overall physical features, dimensions, ratings, service requirements, and weights of equipment.

SD-06 Instructions

Manufacturer's Instructions shall be submitted for Panelboards including special provisions required to install equipment components and system packages. Special notices shall detail impedances, hazards and safety precautions.

SD-09 Reports

Test Reports shall be submitted for the following tests in accordance with the paragraph entitled, "Site Testing," of this section. Panelboards shall not be energized until the recorded test data have been submitted to and approved by the Contracting Officer.

Continuity Tests
Insulation Tests

SD-14 Samples

Keys shall then be properly tagged and delivered to the Contracting Officer.

PART 2 PRODUCTS

2.1 PANELBOARDS

Power-distribution panelboards and lighting and appliance branch-circuit panelboards shall be totally enclosed in a steel cabinet, dead-front circuit breaker type with copper buses, surface-mounted, as indicated. Panelboards shall conform to NEMA PB 1 and NEMA AB 1. Branch circuit panels shall have buses fabricated for bolt-on type circuit breakers.

An outer door or cover, hinged on one side, shall be provided on surface-mounted panelboards to provide gutter space access. A center door shall be provided for circuit breaker/switch access only.

Voltage and current rating, number of phases, and number of wires shall be as indicated. Four-wire distribution panelboards and lighting and appliance branch-circuit panelboards shall be provided with an isolated full-capacity neutral bus. Panelboards shall be rated for 120/208-volt, three-phase, and 277/480 volt, three-phase, 60-hertz current.

Three-phase, 4-wire and single-phase, 3-wire distribution lighting and branch circuit panelboards shall be provided with an isolated full-capacity bus providing spaces for single-pole circuit breakers/switches and spaces indicated as spare.

Panelboards shall be provided with a separate grounding bus bonded to the enclosure. Grounding bus shall be a solid bus bar of rectangular cross section equipped with binding screws for the connection of equipment grounding conductors.

Each panelboard, as a complete unit, shall have a short-circuit current rating equal to or greater than the integrated equipment rating shown on the panelboard schedule or as indicated.

Panelboards and main lugs or main breaker shall have current ratings as shown on the panelboard schedule.

Bus bar connections to the branch circuit breakers shall be the "distributed phase" or "phase sequence" type. Three-phase, four-wire busing shall be such that when any three adjacent single-pole breakers are individually connected to each of the three different phases, two- or three-pole breakers can be installed at any location. Current-carrying parts of the bus assembly shall be plated. Mains ratings shall be as shown.

Mechanical lugs furnished with panelboards shall be cast copper or copper alloys of sizes suitable for the conductors indicated to be connected thereto.

Panelboard box shall be galvanized code-gage sheet steel without knockouts. Entire panelboard front shall be hinged on one side with a piano hinge for the full height and shall also have captive screws opposite the hinged side. Where panelboards are installed flush with the walls, the installation details shall be such that the hinged front can be opened without damage to the adjacent wall surfaces. Color of the finished coat of trim and front shall match the adjacent walls except that when the box is installed in electrical closets or equipment rooms, the gray finish as specified will be acceptable.

Panelboard enclosures shall be NEMA, Type 1 for indoor use and NEMA 3R for outdoor use. Enclosures shall be provided with hinged fronts and corrosion-resistant steel pin-tumbler cylinder locks. Locks shall be keyed alike, and two keys shall be provided for each enclosure.

Panelboards shall be finished with baked enamel. Finish color shall be No. 61 gray conforming to FED-STD 595.

2.2 CIRCUIT BREAKERS

Circuit breakers shall be the molded-case type as specified in Section 16286, "Overcurrent Protective Devices." Frame and trip ratings shall be as indicated.

Interrupting rating of circuit breakers shall be as indicated. If not shown, the interrupting rating for circuit breakers in 120/208-volt panelboards shall be not less than 14,000 amperes rms symmetrical, and that for breakers in 277/480-volt panelboards shall be not less than 22,000 amperes rms symmetrical.

Circuit breakers shall be bolt-on type. Plug-in type shall not be acceptable.

Shunt trips shall be provided where indicated.

In branch circuit panelboards, branch circuit breakers feeding convenience outlets shall have sensitive instantaneous trip settings of not more than 10 times the trip rating of the breaker to prevent repeated arcing shorts resulting from frayed appliance cords. Single-pole 15- and 20-ampere circuit breakers shall be UL listed as "Switching Breakers" at 120 volts ac. UL Class A (5-milliampere sensitivity) ground fault circuit protection shall be provided on 120-volt ac branch circuit as indicated. This protection shall be an integral part of the branch circuit breaker that also provides overload and short-circuit protection for branch circuit wiring. Tripping of a branch circuit breaker containing ground fault circuit interruption shall not disturb the feeder circuit to the panelboard. A single-pole circuit breaker with integral ground fault circuit interruption shall require no more panelboard branch circuit space than a conventional slide pole circuit breaker.

Connections to the bus shall be bolt-on type.

When multiple wires per phase are specified, the circuit breakers shall be furnished with connectors made to accommodate multiple wires.

Circuit breaker spaces called out on the drawings shall be complete with mounting hardware to permit ready installation of the circuit breakers.

2.3 DIRECTORY CARD AND HOLDER

A directory card shall be mounted on the inside of hinged fronts and doors 0.76 millimeter thick minimum plastic in a metal frame, with spaces for circuit numbers, outlets controlled, and room numbers. Where hinged fronts or doors are not required, the directory card shall be provided 0.76 millimeter thick minimum plastic in a metal frame mounted on the left-hand side of the front trim. Directory card shall identify each branch circuit with its respective and numbered circuit breaker.

2.4 FACTORY TESTING

Complete panelboards shall be tested in accordance with UL 67.

PART 3 EXECUTION

3.1 INSTALLATION

Panelboards shall be installed as indicated and in accordance with the manufacturer's instructions. Panels shall be fully aligned and mounted so that the height of the top operating handle will not exceed 1800 millimeter above the finished floor.

Directory-card information shall be typewritten in capital letters to indicate outlets controlled and final room numbers served by each circuit and shall be mounted in holders behind protective covering.

3.2 SITE TESTING

Each panelboard enclosure key shall be shown to operate the enclosure locks in the presence of the Contracting Officer.

Panelboards shall be given continuity and insulation tests after the installation has been completed and before the panelboard is energized.

Test equipment, labor, and personnel shall be provided by the Contractor as required to perform the tests as specified. Continuity tests shall be conducted using a dc device with buzzer.

Insulation tests on 480-volt panelboards shall be conducted using a 1,000-volt insulation-resistance test set. Readings shall be recorded every minute until three equal and consecutive readings have been obtained. Resistance between phase conductors and between phase conductors and ground shall be not less than 50 megohms.

Insulation tests on panelboards rated 300 volts or less shall be conducted using a 500-volt minimum insulation-resistance test set. Readings shall be recorded after 1 minute and until the reading is constant for 15 seconds. Resistance between phase conductors and between phase conductors and ground shall be not less than 25 megohms.

Test data shall be recorded and shall include the location and identification of panelboards and megohm readings versus time.

-- End of Section --

GENERAL DECISION: CA20030029 CA29

Date: June 13, 2003

General Decision Number: CA20030029

Superseded General Decision No. CA020029

State: California

Construction Type:

BUILDING
DREDGING
HEAVY
HIGHWAY

County(ies):

ALAMEDA	MARIPOSA	SAN MATEO
CALAVERAS	MERCED	SANTA CLARA
CONTRA COSTA	MONTEREY	SANTA CRUZ
FRESNO	SAN BENITO	STANISLAUS
KINGS	SAN FRANCISCO	TUOLUMNE
MADERA	SAN JOAQUIN	

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

COUNTY(ies):

ALAMEDA	MARIPOSA	SAN MATEO
CALAVERAS	MERCED	SANTA CLARA
CONTRA COSTA	MONTEREY	SANTA CRUZ
FRESNO	SAN BENITO	STANISLAUS
KINGS	SAN FRANCISCO	TUOLUMNE
MADERA	SAN JOAQUIN	

ASBE0016A 01/01/2003

	Rates	Fringes
ASBESTOS WORKER / INSULATOR Includes the application of all insulating materials, Protective Coverings, Coatings, and Finishes to all types of mechanical systems	37.58	9.96

ASBE0016E 05/01/2002

	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	22.90	3.25
AREA 2	13.90	2.25

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

BOIL0549B 10/01/2002

	Rates	Fringes
--	-------	---------

BOILERMAKER 32.46 13.55

BRCA0003B 08/01/2002

	Rates	Fringes
MARBLE FINISHER	25.17	6.42

BRCA0003D 08/01/2002

	Rates	Fringes
MARBLE MASON	35.44	11.96

BRCA0003G 07/01/2002

	Rates	Fringes
SAN FRANCISCO AND SAN MATEO COUNTIES: BRICKLAYER	32.85	10.95
ALAMEDA, CONTRA COSTA, SAN BENITO AND SANTA CLARA COUNTIES BRICKLAYER	31.57	10.13
CALAVERAS, SAN JOAQUIN, STANISLAUS AND TOULUMNE COUNTIES BRICKLAYER	27.30	8.70
MONTEREY AND SAN CRUZ COUNTIES BRICKLAYER	29.98	10.50
FRESNO, KINGS, MADERA, MARIPOSA AND MERCED COUNTIES BRICKLAYER	25.50	9.50

FOOTNOTES: Operating a saw or grinder: \$0.50 per hour additional.
Gunitite nozzle person: \$1.00 per hour additional.

BRCA0003P 07/01/2001

	Rates	Fringes
TERRAZZO WORKER	33.80	10.15
TERRAZZO FINISHER	18.06	6.57

BRCA0003T 04/01/2002

	Rates	Fringes
ALAMEDA, CONTRA COSTA, MONTEREY, SAN BENITO, SAN FRANCISCO, SAN MATEO, SANTA CLARA AND SANTA CRUZ COUNTIES: TILE LAYER	33.53	7.80
TILE FINISHER	18.06	6.57
CALAVERAS, SAN JOAQUIN, STANISLAUS AND TUOLUMNE COUNTIES TILE LAYER	29.58	7.75
TILER FINISHER	18.06	6.52
FRESNO, KINGS, MADERA, MARIPOSA AND MERCED COUNTIES TILE LAYER	26.27	5.65
TILE FINISHER	18.55	4.77

CARP0003A 08/01/2002

	Rates	Fringes
ALAMEDA, CONTRA COSTA, SAN FRANCISCO, SAN MATEO AND SANTA CLARA COUNTIES DRYWALL INSTALLER/LATHER	29.75	12.415
DRYWALL STOCKER/SCRAPPER	14.88	6.795

MONTEREY, SAN BENITO AND SANTA CRUZ COUNTIES

Total Project value
\$25 Million and over

DRYWALL INSTALLER/LATHER	29.75	12.415
DRYWALL STOCKER/SCRAPPER	14.88	6.795

Total Project Value
under \$25 Million

DRYWALL INSTALLER/LATHER	24.62	12.415
DRYWALL STOCKER/SCRAPPER	12.31	6.795

REMAINDER OF COUNTIES:

Total Project value \$25 million and over

DRYWALL INSTALLER/LATHER	29.75	12.415
DRYWALL STOCKER/SCRAPPER	14.88	6.975

Total Project value under \$25 million

DRYWALL INSTALLER/LATHER	23.77	12.415
DRYWALL STOCKER/SCRAPER	11.89	7.795

CARP0034A 07/01/2002

	Rates	Fringes
DIVERS:		
Diver standby	32.34	14.475
Diver wet pay	43.59	14.475
Tender	32.34	14.475
Saturation diver	46.50	14.475

DEPTH PAY (Surface Diving):

50 to 100 ft	\$1.32/ft
100 to 150 ft	\$66.00 + \$1.85/ft
150 to 200 ft	\$158.00 + \$2.65/ft
200 ft and over	\$291.00 + \$3.00/ft

CARP0034C 07/01/2002

	Rates	Fringes
PILEDRIIVER	29.40	14.475

CARP0035A 01/01/2003

ALAMEDA, CONTRA COSTA, SAN FRANCISCO, SAN MATEO, AND SANTA CLARA COUNTIES:

	Rates	Fringes
CARPENTERS:		
Carpenter	29.75	11.975
Hardwood Floorlayer; Shingler; Power Saw Operator; Steel Scaffold & Steel Shoring		
Erector; Saw Filer	29.90	11.975
Bridge Builder	29.75	11.975
Millwright	29.85	13.315

CALAVERAS, FRESNO, KINGS, MADERA, MARIPOSA, MERCED, SAN JOAQUIN, STANISLAUS, AND TUOLUMNE COUNTIES:

PROJECTS \$25,000,000 & OVER:

	Rates	Fringes
CARPENTERS:		
Carpenter	29.75	11.975
Hardwood Floorlayer; Shingler; Power Saw Operator; Steel Scaffold & Steel Shoring		
Erector; Saw Filer	29.90	11.975
Bridge Builder	29.75	11.975
Millwright	29.85	13.315

PROJECTS UNDER \$25,000,000:

	Rates	Fringes
CARPENTERS:		
Carpenter	23.27	11.975
Hardwood Floorlayer; Shingler; Power Saw operator; Steel Scaffold & Steel Shoring		
Erector; Saw Filer	23.42	11.975
Bridge Builder	28.59	11.975

Millwright 25.27 13.315

MONTEREY, SAN BENITO, AND SANTA CRUZ COUNTIES:

PROJECTS \$25,000,000 & OVER:

CARPENTERS:

Carpenter	29.75	11.975
Hardwood Floorlayer; Shingler; Power Saw Operator; Steel Scaffold & Steel Shoring Erector; Saw Filer	29.90	11.975
Bridge Builder	29.75	11.975
Millwright	29.85	13.315

PROJECTS UNDER \$25,000,000:

CARPENTERS:

Carpenter	24.62	11.975
Hardwood Floorlayer; Sshingler Power Saw Operator; Steel Scaffold & Steel Shoring Erector; Saw Filer	24.77	11.975
Bridge Builder	28.87	11.975
Millwright	26.62	13.315

CARP0035H 07/01/2002

	Rates	Fringes
ALAMEDA, CONTRA COSTA, SAN FRANCISCO, SAN MATEO, SANTA CLARA COUNTIES		

MODULAR FURNITURE INSTALLER	18.18	5.455
-----------------------------	-------	-------

MONTEREY, SAN BENITO AND SANTA CRUZ COUNTIES

MODULAR FURNITURE INSTALLER	16.00	5.455
-----------------------------	-------	-------

CALAVERAS, FRESNO, KINGS, MADERA, MARIPOSA, MERCED, SAN JOAQUIN,
STANISLAUS, TUOLUMNE COUNTIES

MODULAR FURNITURE INSTALLER	15.23	5.455
-----------------------------	-------	-------

ELEC0006A 12/01/2000

	Rates	Fringes
ALAMEDA, CONTRA COSTA, MONTEREY, SAN BENITO, SAN FRANCISCO, SAN MATEO, SANTA CLARA, AND SANTA CRUZ COUNTIES:		

COMMUNICATIONS AND SYSTEMS WORK:

Communications and Systems Installer	23.32	.3%+4.10
Communications and Systems Technician	26.55	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.

ELEC0006H 06/01/2002

	Rates	Fringes
SAN FRANCISCO COUNTY:		
ELECTRICIAN	45.55	13.885

ELEC0006K 12/01/1999

	Rates	Fringes
CALAVERAS, MARIPOSA, MERCED, SAN JOAQUIN, STANISLAUS AND TUOLUMNE COUNTIES:		
COMMUNICATIONS AND SYSTEMS WORK:		
Communications and Systems Installer	18.72	3%+4.10
Communications and Systems 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.

ELEC0100C 06/01/2002

	Rates	Fringes
FRESNO, KINGS, AND MADERA COUNTIES:		
ELECTRICIAN	27.10	3%+8.81

ELEC0100F 01/07/2002

	Rates	Fringes
FRESNO, KINGS, MADERA AND TULARE COUNTIES:		
COMMUNICATIONS AND SYSTEMS INSTALLER	21.47	3%+5.40

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 music
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.

 ELEC0234A 01/27/2003

	Rates	Fringes
MONTEREY, SAN BENITO AND SANTA CRUZ COUNTIES:		
ELECTRICIANS	32.01	3%+14.14

 ELEC0302A 06/01/2002

	Rates	Fringes
CONTRA COSTA COUNTY:		
ELECTRICIANS	37.51	3%+9.90

CABLE SPLICER 41.26 3%+9.90

ELEC0332A 12/01/2002

	Rates	Fringes
SANTA CLARA COUNTY:		
ELECTRICIAN	42.57	3%+12.52
CABLE SPLICER	48.96	3%+12.52

FOOTNOTES: Work under compressed air or where gas masks are required, or work 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.

ELEC0595A 12/01/2002

	Rates	Fringes
ALAMEDA COUNTY:		
Electricians	37.00	3.45%+15.40
Cable Splicers	46.83	3.45%+15.40

ELEC0595B 12/01/2002

	Rates	Fringes
CALAVERAS AND SAN JOAQUIN COUNTIES:		
TUNNEL WORK:		
Electrician	28.32	3%+14.73
Cable splicer	31.84	3%+14.73
ALL OTHER WORK:		
Electrician	28.19	3%+14.73
Cable splicer	31.71	3%+14.73

ELEC0617A 06/01/2002

	Rates	Fringes
SAN MATEO COUNTY:		
ELECTRICIAN	42.37	3%+11.66

ELEC0684A 07/01/2002

	Rates	Fringes
MARIPOSA, MERCED, STANISLAUS AND TUOLUMNE COUNTIES:		
ELECTRICIAN	29.17	7%+9.55
Cable splicer	32.09	7%+9.55

ELEC1245A 06/01/2002

	Rates	Fringes
LINE CONSTRUCTION		
Lineman; Cable splicer	33.16	4.5%+7.08
Equipment specialist (operates crawler tractors, commercial motor vehicles, backhoes, trenchers, cranes (50 tons and below), and overhead and underground distribution line equipment)	28.19	4.5%+6.80
Groundman	21.56	4.5%+6.80
Powderman	31.51	4.5%+6.84

ELEV0008A 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.

 ENGI0003G 06/16/2002

	Rates	Fringes
POWER EQUIPMENT OPERATORS:		
AREA 1:		
GROUP 1	34.47	13.51
GROUP 2	32.94	13.51
GROUP 3	31.46	13.51
GROUP 4	30.08	13.51
GROUP 5	28.81	13.51
GROUP 6	27.49	13.51
GROUP 7	26.35	13.51
GROUP 8	25.21	13.51
GROUP 8-A	23.00	13.51
AREA 2:		
GROUP 1	36.47	13.51
GROUP 2	34.94	13.51
GROUP 3	33.46	13.51
GROUP 4	32.08	13.51
GROUP 5	30.81	13.51
GROUP 6	29.49	13.51
GROUP 7	28.35	13.51
GROUP 8	27.21	13.51
GROUP 8-A	25.00	13.51
POWER EQUIPMENT OPERATORS - ALL CRANES AND ATTACHMENTS:		
AREA 1:		
GROUP 1	35.35	13.51
Truck crane oiler	28.38	13.51
Oiler	26.09	13.51
GROUP 2	33.59	13.51
Truck crane oiler	28.12	13.51
Oiler	25.88	13.51
GROUP 3	31.85	13.51
Truck crane oiler	27.88	13.51
Hydraulic	27.49	13.51
Oiler	25.60	13.51
AREA 2:		
GROUP 1	37.35	13.51
Truck crane oiler	30.38	13.51
Oiler	28.09	13.51
GROUP 2	35.59	13.51
Truck crane oiler	30.12	13.51
Oiler	27.88	13.51
GROUP 3	33.85	13.51
Truck crane oiler	29.88	13.51
Hydraulic	28.12	13.51
Oiler	27.60	13.51
POWER EQUIPMENT OPERATORS - PILEDRIVERS:		
GROUP 1	35.69	13.51
Truck crane oiler	28.77	13.51
Oiler	26.43	13.51
GROUP 2	33.87	13.51
Truck crane oiler	28.46	13.51
Oiler	26.16	13.51
GROUP 3	32.19	13.51
Truck crane oiler	28.17	13.51
Oiler	25.94	13.51
GROUP 4	30.42	13.51
GROUP 5	27.78	13.51
GROUP 6	25.55	13.51

POWER EQUIPMENT OPERATORS - STEEL ERECTION:

GROUP 1	36.32	13.51
Truck crane oiler	29.00	13.51
Oiler	26.77	13.51
GROUP 2	34.55	13.51
Truck crane oiler	28.78	13.51
Oiler	26.50	13.51
GROUP 3	33.07	13.51
Truck crane oiler	28.51	13.51
Hydraulic	28.12	13.51
Oiler	26.28	13.51
GROUP 4	31.05	13.51
GROUP 5	29.75	13.51

POWER EQUIPMENT OPERATORS TUNNEL AND UNDERGROUND WORK:

UNDERGROUND:

AREA 1:

GROUP 1-A	32.94	13.51
GROUP 1	30.47	13.51
GROUP 2	29.21	13.51
GROUP 3	27.88	13.51
GROUP 4	26.74	13.51
GROUP 5	25.60	13.51

AREA 2:

GROUP 1-A	34.94	13.51
GROUP 1	32.47	13.51
GROUP 2	31.21	13.51
GROUP 3	29.88	13.51
GROUP 4	28.74	13.51
GROUP 5	27.60	13.51

SHAFTS, STOPEs AND RAISES:

AREA 1:

GROUP 1-A	33.04	13.51
GROUP 1	30.57	13.51
GROUP 2	29.31	13.51
GROUP 3	27.98	13.51
GROUP 4	26.74	13.51
GROUP 5	25.70	13.51

AREA 2:

GROUP 1-A	35.04	13.51
GROUP 1	32.57	13.51
GROUP 2	31.31	13.51
GROUP 3	29.98	13.51
GROUP 4	28.84	13.51
GROUP 5	27.70	13.51

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 construction 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 machine (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 fire tender; 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

POWER EQUIPMENT OPERATOR CLASSIFICATIONS

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;

POWER EQUIPMENT OPERATORS - 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

POWER EQUIPMENT OPERATORS - 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

POWER EQUIPMENT OPERATORS: 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

AREA DESCRIPTIONS

POWER EQUIPMENT OPERATORS, CRANES AND ATTACHMENTS, TUNNEL AND UNDERGROUND

These areas do not apply to Piledrivers and Steel Erectors.

AREA 1: ALAMEDA, CONTRA COSTA, KINGS, MERCED, SAN BENITO, SAN FRANCISCO, SAN JOAQUIN, SAN MATEO, SANTA CLARA, SANTA CRUZ AND STANISLAUS COUNTIES

AREA 2 - The remaining counties are split between Area 1 and Area 2 as noted below:

CALAVERAS COUNTY:

Area 1: Except Eastern part
Area 2: Eastern part

FRESNO COUNTY

Area 1: Except Eastern part
Area 2: Eastern part

MADERA COUNTY

Area 1: Except Eastern part
Area 2: Eastern part

MARIPOSA COUNTY

Area 1: Except Eastern part
Area 2: Eastern part

MONTEREY COUNTY

Area 1: Except Southwestern part
Area 2: Southwestern part

ENGI0003M 07/01/2001

	Rates	Fringes
POWER EQUIPMENT OPERATORS:		
DREDGING: CLAMSHELL & DIPPER DREDGING;		
HYDRAULIC SUCTION DREDGING:		
AREA 1:		
Leverman	34.39	12.37
Dredge Dozer; Heavy duty repairman	29.43	12.37
Booster Pump Operator; Deck Engineer; Deck mate; Dredge Tender; Winch Operator	28.31	12.37
Bargeman; Deckhand; Fireman;		

Leveehand; Oiler	25.01	12.37
AREA 2:		
Leverman	36.39	12.37
Dredge Dozer; Heavy duty Repairman	29.93	12.37
Booster Pump Operator; Deck Engineer; Deck mate; Dredge tender; Winch operator	30.31	12.37
Bargeman; Deckhand; Fireman; Leveehand; Oiler	27.01	12.37

AREA DESCRIPTIONS

AREA 1: ALAMEDA, CONTRA COSTA, KINGS, MERCED, SAN BENITO, SAN FRANCISCO, SAN JOAQUIN, SAN MATEO, SANTA CLARA, SANTA CRUZ AND STANISLAUS COUNTIES

THE REMAINING COUNTIES ARE SPLIT BETWEEN AREA 1 AND AREA 2 AS NOTED BELOW:

CALAVERAS COUNTY:

Area 1: Except Eastern part
Area 2: Eastern part

FRESNO COUNTY:

Area 1: Except Eastern part
Area 2: Eastern part

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

TUOLUMNE COUNTY:

Area 1: Except Eastern part
Area 2: Eastern part

IRON0001U 07/01/2002

	Rates	Fringes
ALAMEDA, CALAVERAS, CONTRA COSTA, FRESNO, KINGS, MADERA, MARIPOSA, MERCED, SAN BENITO, SAN FRANCISCO, SAN JOAQUIN, SAN MATEO, SANTA CLARA, SANTA CRUZ, STANISLAUS AND TUOLUMNE COUNTIES:		

IRONWORKERS:

Fence erector	25.97	15.29
Ornamental, reinforcing and structural	26.86	15.29

FOOTNOTE: A. CITY OF SAN FRANCISCO defined as the city limits of San Francisco (as described by the San Francisco County Recorder's Office as of July 1, 1998), the Golden Gate Bridge in its entirety, and the west side of the San Francisco Bay Bridge up to and including Treasure Island): Zone fee: \$10.00 per day.

B. ALAMEDA, SAN MATEO AND SANTA CLARA COUNTIES ONLY:

Zone Fee: \$8.00 per day.

IRON0001V 07/01/2002

	Rates	Fringes
MONTEREY COUNTY:		
IRONWORKERS:		
Fence erector	25.97	15.29
Ornamental, reinforcing and		

structural

26.86

15.29

FOOTNOTE: Work at the Army Defense Language Institute, and the Naval Post Graduate School additional \$2.00 per hour.

LABO0036A 07/01/2002

	Rates	Fringes
SAN FRANCISCO AND SAN MATEO COUNTIES:		
BRICK TENDER	23.82	9.61

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.

LABO0036B 07/01/2002

	Rates	Fringes
SAN FRANCISCO AND SAN MATEO COUNTIES:		
PLASTERER TENDER	23.82	9.69

FOOTNOTES: Work on a suspended scaffold: \$5.00 per day additional. Work operating a plaster mixer pump gun: \$1.00 per hour additional.

LABO0067B 12/01/2002

	Rates	Fringes
ALAMEDA, CALAVERAS, CONTRA COSTA, FRESNO, KINGS, MADERA, MARIPOSA, MERCED, MONTEREY, SAN BENITO, SAN MATEO, SANTA CLARA, SAN FRANCISCO, SAN JOAQUIN, SANTA CRUZ, STANISLAUS, AND TUOLUMNE COUNTIES:		
ASBESTOS REMOVAL LABORER	10.75	2.31

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.

LABO0067H 06/24/2002

	Rates	Fringes
ALAMEDA, CONTRA COSTA, SAN FRANCISCO, SAN MATEO AND SANTA CLARA COUNTIES:		

LABORERS:

Construction specialist group	23.34	9.08
Group 1	22.64	9.08
Group 1-a	22.86	9.08
GROUP 1-b: see note below		
GROUP 1-c	22.69	9.08
GROUP 1-d: see note below		
GROUP 1-e	23.19	9.08
GROUP 1-f	23.22	9.08
GROUP 1-g (Contra Costa County)	22.84	8.08
GROUP 2	22.49	9.08
GROUP 3	22.39	9.08
GROUP 4	16.08	9.08

See groups 1-b and 1-d under laborer classifications.

GUNITE LABORERS:

GROUP 1	23.60	9.08
GROUP 2	23.10	9.08
GROUP 3	22.51	9.08
GROUP 4	22.39	9.08

WRECKING WORK:

GROUP 1	22.64	9.08
GROUP 2	22.49	9.08
GROUP 3	16.08	9.08

GARDENERS, HORTICULTURAL AND LANDSCAPE LABORERS:

New construction	22.39	9.08
Establishment warranty period	16.08	9.08

CALAVERAS, FRESNO, KINGS, MADERA, MARIPOSA, MERCED,
MONTEREY, SAN BENITO, SANTA CRUZ, SAN JOAQUIN, STANISLAUS
AND TUOLUMNE COUNTIES:

LABORERS:

Construction specialist group	22.34	9.08
Group 1	21.64	9.08
Group 1-a	21.86	9.08
GROUP 1-b: see note below		
GROUP 1-c	21.69	9.08
GROUP 1-d: see note below		
GROUP 1-e	22.19	9.08
GROUP 1-f	22.22	9.08
GROUP 2	21.49	9.08
GROUP 3	21.39	9.08
GROUP 4	15.08	9.08

See groups 1-b and 1-d under laborer classifications.

GUNITE LABORERS:

GROUP 1	22.60	9.08
GROUP 2	22.10	9.08
GROUP 3	21.51	9.08
GROUP 4	21.39	9.08

WRECKING WORK:

GROUP 1	21.64	9.08
GROUP 2	21.49	9.08
GROUP 3	15.08	9.08

GARDENERS, HORTICULTURAL AND LANDSCAPE LABORERS:

New construction	21.39	9.08
Establishment warranty period	15.08	9.08

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; 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 bucket; 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 shall 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: All 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)

LABO0067N 06/30/2002

	Rates	Fringes
TUNNEL AND SHAFT LABORERS:		
GROUP 1	27.00	9.08
GROUP 2	26.77	9.08
GROUP 3	26.52	9.08
GROUP 4	26.25	9.08
GROUP 5	26.07	9.08
GROUP 6	25.53	9.08

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

LABO0073C 07/01/2002

Rates Fringes
CALAVERAS, MARIPOSA, MERCED, SAN JOAQUIN, STANISLAUS AND
TUOLUMNE COUNTIES:

BRICK TENDER 23.84 6.51

LABO0073E 07/01/2002

Rates Fringes
CALAVERAS, FRESNO, KINGS, MADERA, MARIPOSA, MERCED, SAN JOAQUIN,
STANISLAUS AND TUOLUMNE COUNTIES:

PLASTERER TENDER 21.58 9.27

LABO0166A 07/01/2002

Rates Fringes
ALAMEDA AND CONTRA COSTA COUNTIES:

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.

LABO0166B 07/01/2002

Rates Fringes
ALAMEDA AND CONTRA COSTA COUNTIES:

PLASTERER TENDERS:

Plasterer tender 27.29 11.41
Gun operator 28.04 11.41

LABO0185A 07/01/2002

Rates Fringes
MONTEREY AND SAN BENITO COUNTIES:

BRICK TENDER 23.84 6.51

LABO0270A 07/01/2002

Rates Fringes
SANTA CLARA COUNTY:
BRICK TENDER 25.45 6.45

FOOTNOTE: \$2.00 per hour for refractory work where
heat-protective clothing is required.

SANTA CRUZ COUNTY:

BRICK TENDER 24.45 6.45

LABO0270E 07/01/2000

Rates Fringes
SANTA CLARA AND SANTA CRUZ COUNTIES:

All wood framed buildings
four (4) stories or less
and excludes steel structures,
structures with metal studs

PLASTER TENDER 22.68 6.85

All wood framed buildings
five (5) stories or more
includes all steel structures
and all structures with metal
studs

PLASTER TENDER 24.60 6.75

LABO0294A 07/01/2002

	Rates	Fringes
FRESNO, KINGS AND MADERA COUNTIES:		
BRICK TENDER	24.14	6.51

LABO0297A 08/01/2002

	Rates	Fringes
MONTEREY AND SAN BENITO COUNTIES:		
PLASTERER TENDER	22.75	5.75

FOOTNOTE: Mixer person: \$4.00 per day additional.

PAIN0016A 11/01/2002

	Rates	Fringes
ALAMEDA AND CONTRA COSTA:		

PAINTERS:

Work on industrial buildings
(used for the manufacture and
processing of goods for sale or
service); Also, steel construction
(bridges), stacks, towers, tanks and
similar structures):

Brush and Roller	28.43	11.84
Working over 50 feet	30.43	11.84
100 to 180 feet	32.43	11.84
over 180 feet	34.43	11.84
Spray and Sandblast	28.93	11.84
Working over 50 feet	30.93	11.84
100 to 180 feet	32.93	11.84
over 180 feet	34.93	11.84
Application of Exotic materials	29.18	11.84
Working over 50 feet	31.18	11.84
100 to 180 feet	33.18	11.84
over 180 feet	35.18	11.84
All Other Work:		
Brush and Roller	28.28	11.84
Working over 50 feet	30.18	11.84
100 to 180 feet	32.18	11.84
over 180 feet	34.18	11.84
Application of Exotic materials	28.93	11.84
Working over 50 feet	30.93	11.84
100 to 180 feet	32.93	11.84
over 180 feet	34.93	11.84

PAIN0016C 02/01/2003

	Rates	Fringes
CALAVERAS, MARIPOSA, MERCED, MONTEREY, SAN BENITO SAN JOAQUIN, SANTA CRUZ, STANISLAUS AND TUOLUMNE COUNTIES:		
DRYWALL FINISHER/TAPER	28.94	11.17

ALAMEDA, CONTRA COSTA, SAN FRANCISCO, SAN MATEO AND SANTA CLARA
COUNTIES:

DRYWALL FINISHER/TAPER	32.84	12.77
------------------------	-------	-------

PAIN0016H 01/01/2003

	Rates	Fringes
FRESNO, KINGS AND MADERA COUNTIES:		

PAINTERS:

Brush and Roller	19.59	8.42
Drywall Taper	20.84	8.42

Spray and sandblasters 20.84 8.42

FOOTNOTES: Paperhangers, and work over 30 feet (does not include work from a lift): \$0.50 per hour additional.

PAIN0016K 11/01/2002

Rates Fringes
FRESNO, KINGS, MADERA AND COUNTIES:

SOFT FLOOR LAYER 18.83 6.69

PAIN0016N 11/01/2002

Rates Fringes
MONTEREY, SAN BENITO, SAN MATEO, SANTA CLARA AND SANTA CRUZ COUNTIES:

PAINTER: 27.73 11.84

PAIN0016Q 11/01/2002

Rates Fringes
CALAVERAS AND SAN JOAQUIN COUNTIES:

PAINTERS:

Brush 21.89 7.94
Sandblaster; Waterblaster;
Steam cleaning 22.89 7.94
Work with coal tar and exotic
materials 23.64 7.94

PAIN0016S 11/01/2002

Rates Fringes
MARIPOSA, MERCED, STANISLAUS, AND TOULUMNE COUNTIES:

PAINTER:

Brush 20.25 9.75
Paperhanger; Spray & Sandblast 21.25 9.75
Hazardous coating, application
and removal 22.00 9.75

PAIN0016Y 01/01/2003

Rates Fringes
SAN FRANCISCO COUNTY:

PAINTER 31.51 12.10

PAIN0169A 07/01/2002

Rates Fringes
FRESNO, KINGS, MADERA, MARIPOSA AND MERCED COUNTIES:

GLAZIER 25.52 8.77

PAIN0169E 07/01/2002

Rates Fringes
ALAMEDA AND CONTRA COSTA COUNTIES:

GLAZIER 32.33 10.14

PAIN0169I 07/01/2002

Rates Fringes
ALAMEDA AND CONTRA COSTA:

SHOWER DOOR INSTALLER 24.83 5.01+α

PAID HOLIDAYS: New Year's Day, President's Day, Memorial Day, Fourth of July, Labor Day, Thanksgiving Day, Day after

Thanksgiving, and Christmas Day.

PAIN0718B 07/01/2002

	Rates	Fringes
SAN FRANCISCO AND SAN MATEO COUNTIES:		
GLAZIER	30.90	11.57

PAIN0767A 07/01/2002

	Rates	Fringes
CALAVERAS, SAN JOAQUIN, STANISLAUS AND TUOLUMNE COUNTIES:		
GLAZIER	28.43	9.01

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 required to wear a bod harness shall receive \$1.50 per hour above the basic hourly rate at any elevation.

PAIN1176A 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

Service Person (maintenance and repair of equipment)	13.33	5.87
Parking Lot, Game Court and Playground Installer	19.51	6.91

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

PAIN1237C 06/01/2001

	Rates	Fringes
CALAVERAS; SAN JOAQUIN COUNTIES; STANISLAUS AND TUOLUMNE COUNTIES:		

SOFT FLOOR LAYER	25.00	7.17
------------------	-------	------

PAIN1600G 01/01/2003

	Rates	Fringes
ALAMEDA, CONTRA COSTA, MARIPOSA, MERCED, MONTEREY, SAN BENITO, SAN FRANCISCO, SAN MATEO, SANTA CLARA AND SANTA CRUZ COUNTIES		

SOFT FLOOR LAYER	33.85	10.43
------------------	-------	-------

PAIN1621A 07/01/2002

Rates Fringes
MONTEREY, SAN BENITO, SANTA CLARA AND SANTA CRUZ COUNTIES:

GLAZIER 32.36 10.11

PLAS0001D 07/01/2001

Rates Fringes
CEMENT MASON 27.18 7.58

PLAS0066B 07/01/2001

Rates Fringes
ALAMEDA, CONTRA COSTA, SAN MATEO AND SAN FRANCISCO COUNTIES:

PLASTERER 28.76 11.40

PLAS0300A 01/01/2003

Rates Fringes
FRESNO, KINGS AND MADERA COUNTIES:
PLASTERER 24.03 8.95

SAN BENITO, SANTA CLARA AND SANTA
CRUZ COUNTIES:
PLASTERER 27.75 8.65

CALAVERAS AND SAN JOAQUIN COUNTIES:
PLASTERER 25.62 8.65

MONTEREY COUNTY:
PLASTERER 24.34 8.15

MARIPOSA, MERCED, STANISLAUS AND
TUOLUMNE COUNTIES:
PLASTERER 25.63 8.65

PLUM0036A 01/01/2003

Rates Fringes
CALAVERAS, MARIPOSA, MERCED, SAN JOAQUIN, STANISLAUS AND TUOLUMNE
COUNTIES:
PLUMBER & STEAMFITTER 29.29 11.79

FRENNO, KINGS AND MADERA COUNTIES:
PLUMBER & STEAMFITTER 28.79 11.79

PLUM0036E 01/01/2003

Rates Fringes
FRESNO AND MERCED COUNTIES:
BUILDING CONSTRUCTION ONLY
PIPE TRADESMAN 12.00 4.85

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

PLUM0036U 01/01/2003
 Rates Fringes
 MONTEREY AND SANTA CRUZ COUNTIES:
 PLUMBER & STEAMFITTER 31.89 11.79

PLUM0038A 07/01/2002
 Rates Fringes
 SAN FRANCISCO COUNTY:
 Work on wooden frame structures
 5 stories or less excluding
 high-rise buildings and
 commercial work such as
 hospitals, prisons, hotels
 and schools:
 PLUMBERS 30.75 17.35
 All other work:
 PLUMBERS 41.00 20.50

PLUM0038E 07/01/2002
 Rates Fringes
 SAN FRANCISCO COUNTY
 LANDSCAPE/IRRIGATION FITTER 25.40 10.38

PLUM0159A 07/01/2002
 Rates Fringes
 CONTRA COSTA COUNTY:
 Construction of motels
 under 4 stories
 PLUMBERS & STEAMFITTERS 27.41 9.64
 All other work
 PLUMBERS & STEAMFITTERS 35.21 14.34

PLUM0342A 07/01/2002
 Rates Fringes
 ALAMEDA COUNTY
 PLUMBERS, PIPEFITTERS
 AND STEAMFITTER 35.51 15.05

PLUM0355D 07/01/2002
 Rates Fringes
 ALAMEDA, CALAVERAS, CONTRA COSTA, FRESNO, KINGS, MADERA,
 MARIPOSA, MERCED, MONTEREY, SAN BENITO, SAN JOAQUIN, SAN MATEO,
 SANTA CLARA, SANTA CRUZ, STANISLAUS, AND TUOLUMNE COUNTIES:
 UNDERGROUND UTILITY WORKER 23.75 5.05

PLUM0355G 07/01/2002
 Rates Fringes
 ALPINE, AMADOR, BUTTE, COLUSA, EL DORADO, GLENN, LASSEN, MODOC,
 NAPA, NEVADA, PLACER, PLUMAS, SACRAMENTO, SHASTA, SIERRA,
 SISKIYOU, SOLANO, SUTTER, TEHAMA, TRINITY, YOLO, AND YUBA

COUNTIES

LANDSCAPE FITTER 23.75 5.05

PLUM0393A 07/01/2002

Rates Fringes
 SAN BENITO AND SANTA CLARA COUNTIES:

Work on motels and hotels which do not exceed 4 stories in height, excluding garages and parking areas:

PLUMBER AND PIPEFITTER 25.87 4.88

All other work:

PLUMBER AND PIPEFITTER 45.51 11.67

PLUM0467A 07/01/2002

Rates Fringes
 SAN MATEO COUNTY:

PLUMBER, PIPEFITTER, & STEAMFITTER

REFRIGERATION & AIR CONDITIONING 40.65 12.12

ALL OTHER WORK 39.40 11.81

ROOF0027C 01/01/2003

Rates Fringes
 FRESNO, KINGS, AND MADERA COUNTIES:

ROOFER 22.10 7.05

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.

ROOF0040B 08/01/2001

Rates Fringes
 SAN FRANCISCO & SAN MATEO COUNTIES:

ROOFER 22.87 11.27

ROOF0081A 08/01/2000

Rates Fringes
 ALAMEDA AND CONTRA COSTA COUNTIES:

ROOFER 22.80 9.85

ROOF0081E 08/01/2001

Rates Fringes
 CALAVERAS, MARIPOSA, MERCED, SAN JOAQUIN, STANISLAUS AND TUOLUMNE COUNTIES:

ROOFER 19.8 6.15

ROOF0095B 08/01/2002

Rates Fringes
 MONTEREY, SAN BENITO, SANTA CLARA, AND SANTA CRUZ COUNTIES:

ROOFERS 27.57 8.45

KETTLE PERSON (2 kettles) 27.57 8.45

BITUMASTIC ENAMELERS, COAL TAR, PITCH AND MASTIC WORKERS 29.57 8.45

SFCA0483A 08/01/2001

Rates Fringes
ALAMEDA, CONTRA COSTA, SAN FRANCISCO, SAN MATEO AND SANTA CLARA
COUNTIES:

SPRINKLER FITTER (FIRE) 36.59 11.20

SFCA0669K 04/01/2003

Rates Fringes
CALAVERAS, FRESNO, KINGS, MADERA, MARIPOSA, MERCED, MONTEREY, SAN
BENITO, SAN JOAQUIN, SANTA CRUZ, STANISLAUS AND TUOLUMNE
COUNTIES:

SPRINKLER FITTER (FIRE) 30.65 6.10

SHEE0104A 07/01/2002

Rates Fringes
ALAMEDA AND CONTRA COSTA COUNTIES:

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

SHEET METAL WORKER 31.71 14.95

ALL OTHER WORK:

SHEET METAL WORKER 37.40 15.12

MONTEREY AND SAN BENITO COUNTIES:

SHEET METAL WORKER 31.41 12.59

SAN MATEO COUNTY:

Work 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 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

SHEET METAL WORKER 35.10 12.61

ALL OTHER WORK

SHEET METAL WORKER 38.55 13.77

SAN FRANCISCO COUNTY:

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

SHEET METAL WORKER	37.09	13.52
ALL OTHER WORK:		
SHEET METAL WORKER	37.86	14.65

SANTA CRUZ COUNTY:		
SHEET METAL WORKER	32.95	11.05

SANTA CLARA COUNTY:
 Work 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 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

SHEETMETAL WORKER	36.54	11.91
ALL OTHER WORK:		
SHEETMETAL WORKER	38.75	13.75

SHEE01040 07/01/2002

ALAMEDA, CONTRA COSTA, MONTEREY, SAN BENITO, SAN FRANCISCO, SAN
 MATEO, SANTA CLARA AND SANTA CRUZ COUNTIES:

	Rates	Fringes
Metal decking and siding only:		
SHEETMETAL WORKER	28.17	15.12

SHEE0162A 01/01/2003

CALAVERAS AND SAN JOAQUIN COUNTIES:

	Rates	Fringes
SHEET METAL WORKER	27.37	10.63

SHEE0162C 07/01/2002

MARIPOSA, MERCED, STANISLAUS AND TUOLUMNE COUNTIES:

	Rates	Fringes
SHEET METAL WORKER (excluding metal deck and siding)	28.18	11.93

SHEE0162D 06/01/2002

FRESNO, KINGS, AND MADERA COUNTIES:

	Rates	Fringes
SHEET METAL WORKER	28.52	12.46

SHEE0162M 07/01/1999

CALAVERAS, FRESNO, KINGS, MADERA, MARIPOSA, MERCED, SAN JOAQUIN,
 STANISLAUS AND TUOLUMNE COUNTIES:

	Rates	Fringes
Metal decking and siding only:		
SHEET METAL WORKER	29.42	9.52

TEAM0094A 07/01/2002

	Rates	Fringes
TRUCK DRIVERS:		
GROUP 1	23.02	13.10
GROUP 2	23.32	13.10
GROUP 3	23.62	13.10
GROUP 4	23.97	13.10
GROUP 5	24.32	13.10

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); Lowbed 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

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.
=====

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 (29 CFR 5.5(a)(1)(ii)).

In the listing above, the "SU" designation means that rates listed under that 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, D. C. 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, D. C. 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, D. C. 20210

4.) All decisions by the Administrative Review Board are final.
END OF GENERAL DECISION

STANDARD FORM 24

BID BOND

BID BOND <i>(See instruction on reverse)</i>	DATE BOND EXECUTED <i>(Must not be later than bid opening date)</i>	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 <i>(Legal name and business address)</i>	TYPE OF ORGANIZATION <i>("X" one)</i> <input type="checkbox"/> INDIVIDUAL <input type="checkbox"/> PARTNERSHIP <input type="checkbox"/> JOINT VENTURE <input type="checkbox"/> 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 <i>(Construction, Supplies, or Services)</i>	

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. _____ <i>(Seal)</i>	2. _____ <i>(Seal)</i>	3. _____ <i>(Seal)</i>
NAME(S) & TITLE(S) <i>(Typed)</i>	1. _____	2. _____	3. _____

INDIVIDUAL SURETY(IES)			
SIGNATURE(S)	1. _____ <i>(Seal)</i>	2. _____ <i>(Seal)</i>	
NAME(S) <i>(Typed)</i>	1. _____	2. _____	

CORPORATE SURETY(IES)				
SURETY A	NAME & ADDRESS		STATE OF INC.	LIABILITY LIMIT (\$)
	SIGNATURE(S)	1. _____	2. _____	<i>Corporate Seal</i>
	NAME(S) & TITLE(S) <i>(Typed)</i>	1. _____	2. _____	

SURETY B	NAME & ADDRESS		STATE OF INC.	LIABILITY LIMIT (\$)	Corporate Seal
	SIGNATURE(S)	1.	2.		
	NAME(S) & TITLE(S) <i>(Typed)</i>	1.	2.		
SURETY C	NAME & ADDRESS		STATE OF INC.	LIABILITY LIMIT (\$)	Corporate Seal
	SIGNATURE(S)	1.	2.		
	NAME(S) & TITLE(S) <i>(Typed)</i>	1.	2.		
SURETY D	NAME & ADDRESS		STATE OF INC.	LIABILITY LIMIT (\$)	Corporate Seal
	SIGNATURE(S)	1.	2.		
	NAME(S) & TITLE(S) <i>(Typed)</i>	1.	2.		
SURETY E	NAME & ADDRESS		STATE OF INC.	LIABILITY LIMIT (\$)	Corporate Seal
	SIGNATURE(S)	1.	2.		
	NAME(S) & TITLE(S) <i>(Typed)</i>	1.	2.		
SURETY F	NAME & ADDRESS		STATE OF INC.	LIABILITY LIMIT (\$)	Corporate Seal
	SIGNATURE(S)	1.	2.		
	NAME(S) & TITLE(S) <i>(Typed)</i>	1.	2.		
SURETY G	NAME & ADDRESS		STATE OF INC.	LIABILITY LIMIT (\$)	Corporate Seal
	SIGNATURE(S)	1.	2.		
	NAME(S) & TITLE(S) <i>(Typed)</i>	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 designated "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 <i>(See Instructions on Reverse)</i>	<i>Form Approved</i> 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 NASA Ames Research Center		b. ADDRESS (Street, City, State, and Zip Code) M/S: Moffett Field, CA 94035-1000	
2. TYPE CODE REQUESTED (X one)		3. EXCEPTION CODES	
a. TYPE A		a. CAO	
b. TYPE F		b. ADP	
4. INITIATOR			
a. TYPED NAME (Last, First, Middle Initial)		b. OFFICE SYMBOL	c. SIGNATURE
			d. TELEPHONE NO. 650-604-

SECTION B - TO BE COMPLETED BY FIRM TO BE CODED

1. FIRM		b. ADDRESS (Street, City, State and Zip Code)	
a. NAME (Include Branch of, Division of, etc.)			
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)	
a. MANUFACTURER		a. APPROVED BY SMALL BUSINESS ADMINISTRATION (SBA) FOR SECTION 8(a) PROGRAM	
b. DEALER/DISTRIBUTOR		b. OTHER DISADVANTAGED SMALL BUSINESS FIRM	
c. CONSTRUCTION FIRM		c. NOT DISADVANTAGED SMALL BUSINESS FIRM	
d. SERVICE COMPANY			
e. SALES OFFICE		6. NUMBER OF EMPLOYEES	
f. OTHER (specify)		7. WOMAN OWNED BUSINESS (X one)	
		a. YES	
		b. NO	
		8. STANDARD INDUSTRIAL CLASSIFICATION (SIC) CODE(S)	
		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

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	SECTION B - (Continued)
Item 1: Self-explanatory.	Item 4: 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 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 3: If applicable, enter the exception DoD Activity Address Code for the Servicing Contract Administration Office (CAO) or ADP point.	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.
Item 4: Self-explanatory.	
SECTION B- TO BE COMPLETED BY THE FIRM TO WHICH THE CODE WILL BE ASSIGNED	Items 9 and 10: Self-explanatory.
Items 1 a and 1 b: Self-explanatory.	<p>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:</p> <p style="text-align: center;">Commander Defense Logistics Services Center ATTN: DLSC-FBA Federal Center 74 Washington N. Battle Creek, MI 49017-3084</p>
Item 1 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.	