STANDARD FORM 30, JULY 1966
GENERAL SERVICES ADMINISTRATION
FED. PROC. REG. (41 CFR) 1-16.101

AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT

PAGE 1 OF 3

1. AMENDMENT/MODIFICATION NO.	2. EFFECTIVE DATE	3. REQUISITION/PURCHASE REQUEST NO.	4. PROJECT NO. (If applicable)
NO. 1	4 Oct 1983		Spec. No. 05-82-2541

5. ISSUED BY	CODE	6. ADMINISTERED BY (If other than block 5)	CODE
Officer in Charge of Construction Jacksonville, North Carolina Area Building 1005, Marine Corps Base Camp Lejeune, North Carolina 28542	406		

7. CONTRACTOR NAME AND ADDRESS (Street, city, county, state, and ZIP Code) — CODE

Make folder
New wells 612 → 626
607 & 628
Now
Contract 2541

9. THIS BLOCK APPLIES ONLY TO AMENDMENTS OF SOLICITATIONS

[X] The above numbered solicitation is amended as set forth in block 12.

Offerors must acknowledge receipt of this amendment prior to the hour a

(a) By signing and returning _____ copies of this amendment; (b) By ackn which includes a reference to the solicitation and amendment numbers. DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If, by or letter, provided such telegram or letter makes reference to the solicitat

10. ACCOUNTING AND APPROPRIATION DATA (If required)

11. THIS BLOCK APPLIES ONLY TO MODIFICATIONS OF CONTRACTS/ORDERS

(a) [ ] This Change Order is issued pursuant to _____
The Changes set forth in block 12 are made to the above numbered contract/order.

(b) [ ] The above numbered contract/order is modified to reflect the administrative changes (such as changes in paying office, appropriation data, etc.) set forth in block 12.

(c) [ ] This Supplemental Agreement is entered into pursuant to authority of _____
It modifies the above numbered contract as set forth in block 12.

12. DESCRIPTION OF AMENDMENT/MODIFICATION

NEW WATER WELLS 612 AND 626
at the
MARINE CORPS BASE, CAMP LEJEUNE, NORTH CAROLINA

Throughout plans and specifications change:

(1) Title from "NEW WATER WELLS 612 AND 626" to read:
"REPLACE WATER WELLS 612 AND 626"

(2) New well near existing well 612 shall be changed to read:
"New well 607"

(3) New well near existing well 626 shall be changed to read:
"New well 628"

Except as provided herein, all terms and conditions of the document referenced in block 8, as heretofore changed, remain unchanged and in full force and effect.

13. [ ] CONTRACTOR/OFFEROR IS NOT REQUIRED TO SIGN THIS DOCUMENT [ ] CONTRACTOR/OFFEROR IS REQUIRED TO SIGN THIS DOCUMENT AND RETURN _____ COPIES TO ISSUING OFFICE

14. NAME OF CONTRACTOR/OFFEROR	17. UNITED STATES OF AMERICA
BY _____ (Signature of person authorized to sign)	BY M. L. ENNETT (Signature of Contracting Officer) By direction
15. NAME AND TITLE OF SIGNER (Type or print) / 16. DATE SIGNED	18. NAME OF CONTRACTING OFFICER (Type or print): R. E. CARLSON, CDR, CEC, USN for COMNAVFACENGCOM / 19. DATE SIGNED: 4 Oct 1983

☆ U.S. GOVERNMENT PRINTING OFFICE : 1982 O - 361-526 (7447)

SECTION 02485, TURF: Delete this section. Insert SECTION 02823, RE-ESTABLISHING VEGETATION". Section 02823 is enclosed.

SECTION 02734, ROTARY-DRILLED WATER WELL:

1.1 APPLICABLE PUBLICATIONS: At the end of the publications listing, insert:

"1.1.4 N. C. Department of Natural Resources and Community Development Publication (NC Code):

"N. C. Title 15, Chapter 2, Subchapter 2C N. C. Administrative Code - Well Construction Standards - 1978".

1.3 DELIVERY.....After this paragraph, insert:

"1.4 GENERAL: All work shall conform to N. C. Code, Title 15, Chapter 2, Subchapter 2C."

3.2 ABANDONING EXISTING WELL: Change the sentence to read: "Abandon and seal existing wells in accordance wih N. C. Code Title 15, Chapter 2, Subchapter 2C."

At the end of this section, insert the enclosed sheet "DD Form 710, Physical and Chemical Analysis of Water".

SECTION 09910. FIELD PAINTING OF BUILDINGS

1.1.1 Federal Specifications: Delete the entire listing for TT-P-98.

1.1.5 Military Standard: Delete this subparagraph and the MIL-STD-101B listing in its entirety from "1.1.5" through "Compressed-Gas Cylinders"

3.3.4.3

b. Piping and Conduit Identification....Delete this subparagraph in its entirety.

SECTION 16301. UNDERGROUND ELECTRICAL WORK

3.1.5.3 Paving repairs...Delete this subparagraph in its entirety.

SECTION 16510. LIGHTING, INTERIOR

1.1.3 National Electrical Manufacturers Association. Delete the NEMA listing from "1.1.3" through "Controls and Systems".

SECTION 16852. ELECTRIC SPACE HEATING EQUIPMENT

3.1.1 Electric Unit Heaters....: Line 2: Delete "4 feet, 6 inches above the floor".

STANDARD FORM 30, JULY 1966
GENERAL SERVICES ADMINISTRATION
FED. PROC. REG. (41 CFR) 1-16.101

AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT

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NO. 1	4 Oct 1983		Spec. No. 05-82-2541

5. ISSUED BY CODE 406

Officer in Charge of Construction
Jacksonville, North Carolina Area
Building 1005, Marine Corps Base
Camp Lejeune, North Carolina 28542

6. ADMINISTERED BY (If other than block 5) CODE

7. CONTRACTOR NAME AND ADDRESS (Street, city, county, state, and ZIP Code) CODE FACILITY CODE

8. [XX] AMENDMENT OF SOLICITATION NO. N62470-82-B-2541, DATED NOT YET ISSUED (See block 9)

[ ] MODIFICATION OF CONTRACT/ORDER NO. _____ DATED _____ (See block 11)

9. THIS BLOCK APPLIES ONLY TO AMENDMENTS OF SOLICITATIONS

[X] The above numbered solicitation is amended as set forth in block 12. The hour and date specified for receipt of Offers [ ] is extended, [X] is not extended.

Offerors must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation, or as amended, by one of the following methods:

(a) By signing and returning _____ copies of this amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGEMENT TO BE RECEIVED AT THE ISSUING OFFICE PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If, by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter, provided such telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

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at the
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14. NAME OF CONTRACTOR/OFFEROR	17. UNITED STATES OF AMERICA
BY _____ (Signature of person authorized to sign)	BY M. L. ENNETT By direction (Signature of Contracting Officer)
15. NAME AND TITLE OF SIGNER (Type or print) / 16. DATE SIGNED	18. NAME OF CONTRACTING OFFICER (Type or print): R. E. CARLSON, CDR, CEC, USN for COMNAVFACENGCOM / 19. DATE SIGNED: 4 Oct 1983

* U.S. GOVERNMENT PRINTING OFFICE : 1982 O - 361-526 (7447)

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SECTION 16852. ELECTRIC SPACE HEATING EQUIPMENT

3.1.1 Electric Unit Heaters....: Line 2: Delete "4 feet, 6 inches above the floor".

SECTION 02823
RE-ESTABLISHING VEGETATION

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS: The work includes seedbed preparation, liming, fertilizing and seeding of all areas where natural soil conditions have been disturbed by this contract, including damage by Contractor vehicles. Areas to be restored will receive grass only.

PART 2 - PRODUCTS

2.1 TOPSOIL shall be obtained from off Base. Fill shall be free from roots, wood, or other scrap material, and other vegetable matter and refuse. Fill shall be friable sandy loam with pH 6.0 to 7.0, soluble salts less than 550 ppm, high organic matter content, which is capable of producing satisfactory agricultural crops.

2.2 LIME shall be ground dolomitic agricultural limestone containing ten percent Magnesium Oxide.

2.3 FERTILIZER shall be standard commercial product of 10-10-10 analysis.

2.4 SEED shall be 55 percent fescue, 25 percent annual ryegrass, and 20 percent Bermuda (unhulled), uniformly mixed with 1/8-pound centipede grass seed, and shall be certified seed or equivalent based on North Carolina Seed Improvement Association requirements for certification.

PART 3 - EXECUTION

3.1 SEEDBED PREPARATION: The areas to be vegetated shall be prepared by thoroughly loosening the soil to a depth of four inches. After loosening the soil, all surface irregularities where surface water could collect and pond shall be smoothed out. Topsoil removed shall be reinstalled and leveled.

3.2 LIMING: Limestone shall be uniformly applied at the rate of 40 pounds per 1,000 square feet to all areas to be vegetated. Limestone shall be applied after seedbed preparation, but before seeding, lime shall be thoroughly incorporated into the entire depth of prepared seedbed.

3.3 FERTILIZING: Fertilizer shall be uniformly applied at the rate of 35 pounds per 1,000 square feet. The fertilizer shall be incorporated into the upper three or four inches of prepared seedbed.

3.4 SEEDING: Seed shall be sown by hand or an approved seeder and distributed uniformly at the rate of one-half pound per 100 square feet. The seeder shall keep the small centipede grass seeds well distributed throughout the seeding operations. The seed shall be planted no deeper than 1/4-inch. After seeding, the seeded areas shall be compacted lightly with a hand roller. All seeding and compacting shall be done when weather conditions are favorable and not when seedbed is wet.

END OF SECTION

DEPARTMENT OF THE NAVY

ATLANTIC DIVISION, NAVAL FACILITIES ENGINEERING COMMAND

NAVAL STATION, NORFOLK, VIRGINIA

NOTICE:

N62470-82-B-2541

Bids to be opened at 2:00 p.m.

FEB 7 1984

at the office of the
Officer in Charge of Contruction
Jacksonville, North Carolina Area
Building 1005, Marine Corps Base
Camp Lejeune, North Carolina

NAVFAC
SPECIFICATION
No. 05-82-2541

Appropriation: OMMC

NEW WATER WELLS 612 AND 626

AT THE

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

(Station Project LE 311M)

Review & Return to M5C35

DESIGN BY:

Atlantic Division
Naval Facilities Engineering Command
Norfolk, Virginia 23511

SPECIFICATION PREPARED BY:

Architect: C.M. Tennefoss, R.A.
Mechanical: C.A. Throckmorton, E.I.T.
Civil-Structural: H.F. White, P.E.
Date: 9 August 1983

SPECIFICATION APPROVED BY:

Specification Branch Head: C.R. Rose, P.E. CRR
Design Director: K.E. Godfrey, P.E. KEG
For EFD for Commander, NAVFAC: K E Godfrey
Date: 16 August 1983

CONTENTS

SECTION 00101
BIDDING INFORMATION

1. CONTENTS: This Invitation for Bids, IFB NO.N62470-82-B-2541, consists of the following documents:

(a) Bid Instruction Documents
(i) Invitation for Bids (Standard Form 20, January 1961 Ed.)
(ii) Bidding Information
(iii) Instructions to Bidders, dated March 1979
(b) Bid Submittal Documents
(i) Bid Form (Standard Form 21, December 1965 Ed.)
(ii) Representations and Certifications, Standard Form 19-B, June 1976 Ed. (REV 1980 AUG), including Appendix "A", dated August 1980
(iii) Bid Guaranty (Standard Form 24, June 1964 Ed.) (See Instructions to Bidders)
(c) Contract Documents
(i) Construction Contract (Standard Form 23, Jan 1961 Ed.)
(ii) Performance Bond (Standard Form 25, June 1967 Ed.)
(iii) Payment Bond (Standard Form 25A, June 1964 Ed.)
(iv) Labor Standards Provisions, dated November 1979)
(v) General Provisions dated March 1981 (Rev 12/81)
a. Clause 43. ACCIDENT PREVENTION (1977 Jun): Change the date of the Corps of Engineers Manual, EM 385-1-1, from "1 June 1977" to "1 April 1981"
b. Clause 63. VALUE ENGINEERING INCENTIVE (1977 AUG): Delete this clause and substitute the following therefor:

"63. VALUE ENGINEERING INCENTIVE--CONSTRUCTION (1980 DEC):
(a) Applicability. This clause applies to any Contractor developed, prepared, and submitted Value Engineering Change Proposal (VECP).
(b) Definitions.
(1) "Contractor's development and implementation costs" means those costs incurred on a VECP Government acceptance and those costs the Contractor incurs specifically to make the changes required by Government acceptance of a VECP.
(2) "Government costs" means those agency costs that result directly from developing and implementing the VECP and any net increases in the cost of testing, operations, maintenance, and logistic support. They do not include the normal administrative costs of processing the VECP.
(3) "Instant contract savings" means the estimated reduction in Contractor cost of performance resulting from acceptance of the VECP, minus allowable Contractor's development and implementation costs (including subcontractors' development and implementation costs). (See paragraph (g).)
(4) "Value Engineerng Change Proposal (VECP) means a proposal that:
(i) requires a change to this, the instant contract, to implement; and
(ii) results in reducing the contract price or estimated cost without impairing essential functions or characteristics, provided that it does not involve a change in deliverable end-item quantities only.

(c) VECP preparation. As a minimum, the Contractor shall include the information described in (1) through (6) in each VECP. If the proposed change affects contractually required configuration management procedures, the instructions in the procedures relating to format, identification, and priority assignment shall govern VECP preparation. The VECP shall include the following:

(1) A description of the difference between the existing contract requirement and that proposed, the comparative advantages and disadvantages of each, a justification when an item's function or characteristics are being altered, and the effect of the change on the end item's performance.

(2) A list of the contract requirements that must be changed if the VECP is accepted, including any suggested specification revisions.

(3) A separate, detailed cost estimate for both the affected portions of the existing contract requirement and the VECP. The cost reduction associated with the VECP shall take into account the Contractor's allowable development and implementation costs, including any amount attributable to subcontracts under paragraph (g). The Contractor shall also include a description and estimate of costs the Government may incur in implementing the VECP, such as test and evaluation and operating and supports costs.

(4) A projection of any effects the proposed change would have on collateral costs to the agency.

(5) A statement of the time by which a contract modifiction accepting the VECP must be issued in order to achieve the maximum cost reduction, noting any effect on the contract completion time or delivery schedule.

(6) Identification of any previous submissions of the VECP, including the dates submitted, the agencies and contract numbers involved, and previous Government actions, if known.

(d) Submissions.

(1) The Contractor shall submit VECPs to the Resident Engineer at the worksite, with a copy to the Contracting Officer. The Contracting Officer shall notify the Contractor of the status of the VECP within 45 calendar days after the contracting office receives it. If additional time is required because of extenuating circumstances, the Contractor shall be notified within the 45-day period and provided the reason for the delay and the expected date of the Contracting Officer's decision. VECPs shall be processed expeditiously; however, the Government shall not be liable for any delay in acting upon a VECP.

(2) If the VECP is not accepted, the Contracting Officer shall provide the Contractor written notification fully explaining the reasons for rejection. The Contractor may withdraw, in whole or in part, any VECP not accepted by the Government within the period specified in the VECP. The Contracting Officer may require that the Contractor provide written notification before undertaking significant expenditures for VECP effort.

(e) Acceptance. Any VECP may be accepted in whole or in part by the Contracting Officer's award of a modification to this contract citing this clause. The Contracting Officer may accept the VECP, even though an agreement on price reduction has not been reached, by issuing the Contractor a notice to proceed with the change. Until a notice to proceed is issued or a contract modification applies a VECP to this contract, the Contractor shall perform in accordance with the existing contract. The Contracting Officer's decision to accept all or part of any VECP shall be final and not subject to the Disputes clause.

(f) Sharing.

(1) Rates. The Contractor's share of savings is determined by subtracting Government costs from instant contract savings and multiplying the result by 55 percent for fixed-price contracts and 25 percent for cost-reimbursement contracts.

(2) Payment. Payment of any share due the Contractor for use of a VECP on this contract shall be authorized by a modification to this contract to:

(i) accept the VECP;

(ii) reduce the contract price or estimated cost by the amount of instant contract savings; and

(iii) provide the Contractor's share of savings by adding the amount calculated in (f)(1) to the Contract price or fee.

(g) Subcontracts. The Contractor shall include appropriate VE clauses in any subcontract of $50,000 or more and may include them in subcontracts of lesser value. To compute any adjustment in the contract price under paragraoh (f), the Contractor's VECP development and implementation costs shall include any subcontractor's development and implementation costs that clearly result from the VECP, but shall exclude any VE incentive payments to subcontractors. The Contractor may choose any arrangement for subcontractor VE incentive payments, provided that these payments are not made from the Government's share of the savings resulting from the VECP.

(h) Data. The Contractor may restrict the Govenment's right to use any part of a VECP or the supporting data by marking the following legend on the affected parts:

"These data, furnished under the Value Engineering Incentive--Construction clause of Contract _____, shall not be disclosed outside the Government or duplicated, used, or disclosed, in whole or in part, for any purpose other than to evaluate a VECP submitted under the clause. This restriction does not limit the Government's right to use information contained in these data if it has been obtained or is otherwise available from the Contractor or from another source without limitations."

If a VECP is accepted, the Contractor hereby grants the Government unlimited rights in the VECP and supporting data, except that, with respect to data qualifying and submitted as limited rights technical data, the Government shall have the rights specified in the contract modification implementing the VECP and shall appropriately mark the data."

c. Clause 97. AFFIRMATIVE ACTION COMPLIANCE REQUIREMENTS FOR CONSTRUCTION (1978 SEP): Change the date of this clause to "(1982 FEB)".

(vi) NAVFAC Specification No. 05-82-2541

(vii) Drawings identified in Section 01011 of the specifications

(viii) Wage Determination Decision NC81-1148, Water and Sewer Construction

2. BIDS:

2.1 Instructions to Bidders: Instructions to Bidders and Invitation for Bids, Standard Form 20, January 1961 edition, shall be observed in the preparation of bids. Bidders shall affix their names and return addresses in the upper left corner of bid envelope. Envelopes containing bids must be sealed.

2.2 Bid Guaranty: For bids of $25,000 or greater, a bid guaranty will be required as stipulated in the Instructons to Bidders.

2.3 Items of Bids: Bids shall be submitted in duplicate on Standard Form 21, Bid Form, and shall be accompanied by Standard Form 19B, Representations and Certifications, with Appendix "A" and by Bid Guaranty, all in accordance with the Bid Instruction Documents listed in paragraph 1(a) hereinbefore upon the following item:

BASE BID: Price for the entire work, complete in accordance with the drawings and specifications.

2.4 TELEGRAPHIC MODIFICATIONS OF BIDS in accordance with the instructions to bidders may be made. Two signed copies of the telegram in a sealed envelope marked "Copies of telegraphic modification of bid for NEW WATER WELLS 612 and 626, Specification No. 05-82-2541", should be forwarded immediately to the office to which written bids were submitted.

2.5 TELEGRAPHIC MODIFICATIONS OR WITHDRAWAL OF BIDS will be considered as specified herein. TELEPHONIC RECEIPT OF TELEGRAPHIC MODIFICATIONS OR WITHDRAWAL OF BIDS WILL NOT QUALIFY THE TELEGRAM AS TIMELY. The telegram must be received at the place specified for receipt of bids prior to the exact time set for receipt of bids.

2.6 HAND DELIVERED BIDS: All hand delivered bids must be deposited with personnel in the Contract Branch, Room No. 26, Building 1005, Marine Corps Base, Camp Lejeune, North Carolina 28542, prior to the time and date set for bid opening. Any bids submitted by hand after the time set for receipt will not be accepted.

3. PRE-BID SITE VISITATION: To inspect the site of the work prior to bid opening, prior appointment must be made with the Officer in Charge of Construction, Jacksonville, North Carolina Area, telephone 919-451-2581. Bidders are urged and expected to inspect the site where the services are to be performed and to satisfy themselves as to all general and local conditions that may affect the cost of performance of the contract to the extent such information is reasonably obtainable. In no event will a failure to inspect the site constitute grounds for withdrawal of a bid after opening or for a claim after award of the contract.

4. CONTROLLED MATERIALS DATA: The Contracting Officer will issue a DO-C2 priority rating for procurement of critical materials. See General Provision entitled "PRIORITIES, ALLOCATIONS AND ALLOTMENTS".

5. INQUIRIES:

5.1 Plans and Specifications: Questions regarding the plans and specifications occurring prior to bid opening shall be presented to the Public Works Design Division, Building 1005, Marine Corps Base, Camp Lejeune, North Carolina 28542, telephone 919-451-5507. Questions requiring interpretation of drawings and specifications must be submitted at least ten days before bid opening. Interpretations or modifications to specifications made as a result of questions will be made by amendment only, and unless so done, all bidders should base their bids on the plans and specifications as issued.

5.2 Bidding Procedures: All questions concerning the bidding procedures shall be presented to OICC-ROICC Contract Branch, Room 26, Building 1005, Marine Corps Base, Camp Lejeune, North Carolina, telephone 919-451-2581.

6. AVAILABILITY OF SPECIFICATIONS, STANDARDS AND DESCRIPTIONS (1977 JUN): Specifications, standards and descriptions cited in this solicitation are available as indicated below:

a. Unclassified Federal, Military and Other Specifications and Standards (Excluding Commercial), and Data Item Descriptions: Submit request on DD Form 1425 (Specifications and Standards Requisition) to:

Commanding Officer
U. S. Naval Publications and Forms Center
5801 Tabor Avenue, Philadelphia, Pennsylvania 19120

The Acquisition Management Systems and Data Requirements Control List: DOD Directive 5000.19L, Volume II, may be ordered on the DD Form 1425. The Department of Defense Index of Specifications and Standards (DODISS) may be purchased from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. When requesting a specification or standard, the request shall indicate the title, number, date and any applicable amendment thereto by number and date. When requesting a data item description, the request shall cite the solicitation. When DD Form 1425 is not available, the request may be submitted in letter form, giving the same information as listed above, and the solicitation or contract number involved. Such request may also be made to the activity by TELEX No. 834295, Western Union No. 710-670-1685, or telephone 215-697-3321 in case of urgency.

b. Commercial Specifications, Standards and Descriptions: These specifications, standards and descriptions are not available from Government sources. They may be obtained from the publishers.

c. Availability for Examination of Specifications, Standards, Plans, Drawings, and other Pertinent Documents: The specifications, standards, plans, drawings, and other pertinent documents cited in this solicitation may be examined at the following location:

Public Works Division
Specifications and Estimates Section
Building 1005, Marine Corps Base
Camp Lejeune, North Carolina

7. RECOVERED MATERIAL: The Contractor certifies by signing this bid/proposal/quotation that recovered materials as defined in DAR 1-2500.4 will be used as required by the applicable publications.

8. REFERENCE TO AMENDMENTS: Each bidder shall refer in his bid to all amendments to this specification; failure to do so may consititute an informality in the bid.

9. CERTIFICATE OF CURRENT COST OR PRICING DATA: (This paragraph applies to negotiated contracts of $500,000 or more, except where the price is based on adequate competition, and to change orders of $500,000 or more, to any contract.) The Contractor shall submit to the Contracting Officer a certificate in the form set forth below as soon as practicable after agreement is reached on the contract price:

This is to certify that, to the best of my knowledge and belief, cost or pricing data defined in DAR 3-807.1(a)(1) submitted, either actually or by specific identification in writing (see DAR 3-807.3(a)) to the Contracting Officer or his representative in support of _____* are accurate, complete, and current as of _____**
day month year

This certification includes the cost or pricing data supporting any advance agreement(s) and forward pricing rate agreements between the offeror and the Government which are part of the proposal.

Firm_____
Name_____
Title_____

_____***
Date of Execution

*Describe the proposal, quotation, request for price adjustment or other submission involved, giving appropriate identifying number (e.g. RFP No. _____).

**The effective date shall be the date when price negotiations were concluded and the contract price was agreed to. The responsibility of the Contractor is not limited by the personal knowledge of the Contractor's negotiator if the Contractor had information reasonably available at the time of agreement, showing that the negotiated price is not based on accurate, complete and current data.

***This date should be as close as practicable to the date when the price negotiations were concluded and the contract price was agreed to.

END OF SECTION

SECTION 01011
GENERAL PARAGRAPHS

1. GENERAL INTENTION: It is the declared and acknowledged intention and meaning to provide and secure new water wells 612 and 626, complete and ready for use. This is a fixed-price contract awarded on a lump sum basis.

2. GENERAL DESCRIPTION: The work includes providing two wells, associated pumps, piping, pump houses, and incidental related work.

3. LOCATION: The work shall be located at the Marine Corps Base, Camp Lejeune, approximately as shown. The exact location will be indicated by the Contracting Officer. "Contracting Officer" and "Officer in Charge of Construction (OICC)" are used interchangeably in this specification and have the same meaning.

4. COMMENCEMENT, PROSECUTION AND COMPLETION OF WORK: The Contractor will be required to commence work under the contract 15 calendar days after the date of receipt of Notice of Award, to prosecute said work diligently, and to complete the entire work ready for use within 210 calendar days. The time stated for completion shall include final cleanup of the premises. The contract completion date will be computed starting 15 calendar days after the date of Notice of Award. This 15-day period is to allow for mailing of the notice of Award and the Contractor's submission of required bonds. [No roofing or exterior painting will be permitted between 15 December and 15 March].

5. LIQUIDATED DAMAGES: In case of failure on the part of the Contractor to complete the work within the time fixed in the contract or any extensions thereof, the Contractor shall pay to the Government as liquidated damages pursuant to General Provisions clauses entitled "Termination for Default - Damages for Delay - Time Extensions', and "Damages for Delay - Defense Materials System and Priorities" the sum of $35.00 for each day of delay.

6. DRAWINGS ACCOMPANYING SPECIFICATIONS: The following drawings accompany this specification and are a part thereof. Drawings are the property of the Government and shall not be used for any purpose other than that contemplated by the specification.

EFD DWG. NO.	NAVFAC DWG. NO.	TITLE
197808	4097808	Location Plan
197809	4097809	Site Plans and Demolition Plan
197810	4097810	Wells and Details
197811	4097811	Floor Plans and Details
197812	4097812	Plans, Legends, Diagram and Schedules

7. NORTH CAROLINA SALES AND USE TAX IS REQUIRED. See section entitled "Additional General Paragraphs".

8. SCHEDULING THE WORK:

8.1 General Scheduling Requirements: Notwithstanding the requirements of clause entitled "Progress Charts and Requirements for Overtime Work" of the General Provisions, immediately after award the Contractor shall meet with the Contracting Officer and present a schedule of work, prepared in accordance with said clause, for review by the Contracting Officer. The schedule will be reviewed at this meeting and will be retained by the Contracting Officer for final review and approval.

8.2 Work Outside Regular Hours: If the Contractor desires to carry on work outside regular hours or on Saturdays, Sundays, or holidays, he shall submit application to the Contracting Officer, but shall allow ample time to enable the Government to make satisfactory arrangements for inspecting the work in progress. At night he shall light the different parts of the work in an approved manner. All utility cutovers shall be made after normal working hours or on weekends. Anticipated costs shall be included in the bid. Regular working hours are 7:45 A.M. to 4:15 P.M., Monday through Friday, excluding holidays.

9. SAFETY PROGRAM: The Contractor shall implement a safety program conforming to the requirements of Federal, State and local laws, rules and regulations. The program shall include, but is not limited to, the following:

a. "Occupational Safety and Health Standards" which can be examined at the office of the Contracting Officer or be ordered from the Superintendent of Documents, U. S. Government Printing Office, Washington, DC 20402.

b. Department of the Army, Corps of Engineers "General Safety Requirements" which may be examined at the office where bids are being received or may be purchased from the Superintendent of Documents, U. S. Government Printing Office.

c. General Provisions clause entitled "Accident Prevention".

d. NFPA 241-1975, Safeguarding Building Construction and Demolition Operations, which may be examined in the Design Branch, Public Works Division, Building 1005, Marine Corps Base, Camp Lejeune, or may be purchased from the National Fire Protection Association, 470 Atlantic Avenue, Boston, MA 02210

10. FACTORY INSPECTION of material and equipment for which tests at the place of manufacture are required in refrenced publications will be waived if notarized copies of factory reports are furnished that show compliance with the specification requirements. Factory inspection will be required only where specified herein or in the technical sections of this specification. Factory inspection will not be required for lumber if it is grade marked and trademarked by the association under whose rules it is graded, or if it is accompanied by certificates of inspection issued by the association under whose rules it is graded or by another inspection agency that is satisfactory to the Contracting Officer. The Government reserves the right to charge to the Contractor any additional cost of Government inspection and tests when materials and equipment are not ready at the time inspection and tests are required by the Contractor.

11. TRAILER OR STORAGE BUILDINGS will be permitted on the job site, where space is available, subject to the approval of the Contracting Officer. The trailers or buildings shall be suitably painted and kept in a good state of repair. Failure of the Contractor to maintain his trailers or storage buildings in good condition will be considered sufficient reason to require their removal from the job site.

12. WRITTEN GUARANTIES AND GUARANTOR'S LOCAL REPRESENTATIVE: Prior to completion of the contract, the Contractor shall obtain and furnish to the Contracting Officer's designated representative, written guarantees for all equipment and/or appliances furnished under the contract. The Contractor shallfurnish with each guarantee the name, address and telephone number of the guarantor's representative nearest to the location where the equipment and/or appliances are installed, who, upon request of the using service's representative, will honor the guarantee during the guaranty period and will provide the services prescribed by the terms of the guarantee. At the time of installation, the Contractor shall tag each item of warranted equipment with a durable oil and water resistant tag approved by the Contracting Officer. Leave the date of acceptance and inspector's signature blank until the project is accepted for beneficial occupancy. The tag shall show the following information:

EQUIPMENT WARRANTY TAG

Type of Equipment: _____
Accepted Date: _____
Warranted Until: _____
Under Contract No. N62470-_____
Inspector's Signature: _____
STATION PERSONNEL TO PERFORM ONLY OPERATIONAL MAINTENANCE

13. MATERIALS AND EQUIPMENT TO BE SALVAGED: Transformers to be removed shall be carefully removed and handled in such a manner as to avoid damage, and shall be delivered to storage on the Base at a location within three miles of each well designated by the Contracting Officer.

14. FORWARDING OF SAMPLES AND SUBMITTALS: Notwithstanding the requirements of clause entitled "Shop Drawings" of the General Provisions, the quantity of submittals required shall be as specified hereinafter.

14.1 Samples Required of the Contractor: As soon as practicable, and before installation, submit to the Contracting Officer for approval, samples of materials and equipment as may be requested, including all samples required in the technical sections of this specification.

END OF SECTION

Cat. #
82-2321-

Aug-85

603, 610, 613
Replace Aux. Motor

11. TRAILER OR STORAGE BUILDINGS will be permitted on the job site, where space is available, subject to the approval of the Contracting Officer. The trailers or buildings shall be suitably painted and kept in a good state of repair. Failure of the Contractor to maintain his trailers or storage buildings in good condition will be considered sufficient reason to require their removal from the job site.

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END OF SECTION

SECTION 01012
ADDITIONAL GENERAL PARAGRAPHS

1. UTILITIES:

1.1 GOVERNMENT-FURNISHED UTILITIES: The Government will furnish water and electricity from the nearest available outlet free of charge for pursuance of work under this contract. If the nearest available outlet cannot be utilized by the Contractor because of improper voltage, insufficient current, improper pressure, incompatibale connectors, etc., it shall be the responsibility of the Contractor to provide temporary utilities as required.

1.2 ENERGY AND UTILITIES CONSERVATION: The Contractor shall carefully conserve utilities furnished without charge. The Contractor, at his own expense and in a manner satisfactory to the Contracting Officer, shall install and maintain all necessary temporary connections and distribution lines and remove the same prior to final acceptance of the construction. (DAR 7-603.30)

1.3 OPERATION OF STATION UTILITIES: The Contractor shall not operate nor disturb the setting of any control devices in the Base utilities system, including water, sewer, electrical and steam services. The Government will operate the control devices as required for normal conduct of the work. The Contractor shall notify the Contracting Officer, giving reasonable advance notice, when such operation is required.

1.4 LOCATION OF UNDERGROUND UTILITIES: Where existing piping, utilities, and underground obstructions of any type are indicated in locations to be traversed by new piping, ducts, and other work provided hereunder, and are not indicated or specified to be removed, the elevations of the existing utilities and obstructions shall be determined before the new work is laid closer than the nearest manhole or other structure at which an adjustment in grade could be made. For any additional work required by reason of conflict between the new and existing work, an adjustment in contract price will be made in accordance with General Provisions clause entitled "Differing Site Conditions (1968 FEB)." The Base Telephone Officer, telephone 451-2531, will show the Contractor approximate locations of all buried telephone and fire alarm cables after receiving ten days notice. The locations of underground utilities shown is only approximate and the information is incomplete.

2. CHANGED CONDITIONS: Wherever changed conditions as defined in General Provisions clause entitled "Differing Site Conditions (1968 FEB)" are encountered, and wherever conditions exposed during the course of the work necessitate a change from quantities indicated or specified as either estimated quantities or as a basis for bids, whether or not provisions for a change in price for such variation is specified, the Contracting Officer must be notified in writing and written directions to do so must be obtained before quantities stated in the contract documents are exceeded.

3. SUBCONTRACTORS AND PERSONNEL: Promptly after the award of the contract, the Contractor shall submit to the Contracting Officer, in triplicate, a list of his subcontractors and the work each is to perform. On this form shall appear the names of the key personnel of the Contractor and subcontractors, together with their home addresses and telephone numbers, for use in event of emergency. From time to time as changes occur and additional information becomes available, the Contractor shall amplify, correct, and change the information contained in previous lists.

4. PRINTS FURNISHED TO CONTRACTOR: Six copies of the project specifications, and six sets of the drawings accompanying the specifications, will be furnished the Contractor. Additional sets of the specifications and drawings can be obtained, if required, by application to the Contracting Officer, provided that the need therefor is justified to the satisfaction of the Contracting Officer.

5. SCHEDULE OF PRICES: The original and seven copies of the Schedule of Prices shall be submitted to the Contracting Officer for approval. Payments will not be made until the Schedule of Prices has been submitted and approved.

6. CONTRACTOR'S INVOICE AND CONTRACT PERFORMANCE STATEMENT: Requests for payment in accordance with the terms of the contract shall consist of:

a. Contractor's Invoice on Form NAVFAC 7300/30(10/81), which shall show, in summary form, the basis for arriving at the amount of the invoice
b. Contractor's Monthly Estimate for Voucher (5ND GEN 5265/1)
c. Affidavit to Accompany Invoice (5ND LANTDIV 4-4235/4)(Rev 5/81)

Forms will be furnished by the Contracting Officer. Monthly invoices and supporting forms for work performed through the 15th of the month shall be submitted to the Contracting Officer by the 20th of the month in the following quantities:

a. Contractor's Invoice - Original and five copies
b. Contractor's Monthly Estimate for Voucher - Original and two copies
c. Affidavit - Original

7. OPTIONAL REQUIREMENTS: Where a choice of materials or methods is permitted herein, the Contractor will be given the right to exercise the option unless stated specifically otherwise.

8. QUARANTINE FOR IMPORTED FIRE ANT (CLNC 2/82): All of Onslow, Jones and Carteret Counties and portions of Duplin and Craven Counties, have been declared a generally infested area by the United States Department of Agriculture for the imported fire ant. Compliance with the quarantine regulations established by this authority as set forth in USDA Quarantine No. 81 dated 9 October 1970, and USDA Publication 301.81-2A of 23 July 1976, is required for operations hereunder.

8.1 The quarantine applies to materials originating from Camp Lejeune and the Marine Corps Air Station (Helicopter), New River, which are to be transported outside the Onslow County or adjacent suppression areas.

8.2 Certification is required for the following articles, and they shall not be moved from the reservation to any point outside the Onslow County and adjacent designated areas unless accompanied by a valid inspection certificate issued by an officer of the Plant Protection and Quarantine Program, USDA:

(1) Bulk soil
(2) Used mechanized soil-moving equipment
(3) Any other products, articles, or means of conveyance if it is determined by an inspector that they present a hazard of spread of the imported fire ant and the person in possession thereof has been so notified.

8.3 Authorization for movement of equipment outside the imported fire ant regulated area shall be obtained from USDA, APHIS, PPQ, Rural Route 6, Box 53, Wilmington, NC 28504; telephone (919) 343-4667. Requests for inspection shall be made at least two days in advance of the date of movement to permit arrangements for the services of authorized inspectors. The equipment shall be prpared and assembled so that it may be readily inspected. All soil on or attached to equipment, supplies and materials, shall be removed by washing with water and/or such other means as necessary to accomplish complete removal. Resulting spoil shall be wasted as directed.

9. EMERGENCY MEDICAL CARE: Only emergency medical care is available at Camp Lejeune Government facilities for Contractor employees who suffer on-the-job injury or disease. Emergency care will be rendered at the prevailing rates established in BUMEDINST 6320.4 series. Reimbursement shall be made by the Contractor to the Naval Regional Medical Center Collection Agent upon receipt of a monthly statement.

10. PROPRIETARY NAMES: Names indicated for colors, textures and patterns of materials are for the purpose of color, texture and pattern selection only. Other manufacturers' materials are acceptable provided they closely approximate colors, textures and patterns indicated and provided they conform to all other requirements.

11. NORTH CAROLINA STATE AND LOCAL SALES AND USE TAX (1977 JAN):

(a) As used throughout this clause, the term "materials" means building materials, supplies, fixtures and equipment which become a part of or are annexed to any building or structure erected, altered, or repaired under this contract.

(b) If this is a fixed-price contract as defined in the Defense Acquisition Regulation, the contract price includes the North carolina state and local sales and use taxes to be paid with respect to materials, notwithstanding any other provision of this contract. If this is a cost-reimbursement type contract as defined in such regulation, any North Carolina state and local sales and use taxes paid by the Contractor with respect to materials shall constitute an allowable cost under this contract.

(c) At the time specified in paragraph (d) below:

(i) The Contractor shall furnish the Contracting Officer certified statements setting forth the cost of the materials purchased from each vendor and the amount of North Carolina state and local sales and use taxes paid thereon. In the event the Contractor makes several purchases from the same vendor, such certified statement shall indicate the invoice numbers, the inclusive dates of the invoices, the total amount of the invoices and the North Carolina state and local sales and use taxes paid thereon by the Contractor. Any local sales or use taxes included in the Contractor's statements must be shown separately from the state sales and use tax. The Contractor shall furnish such additional information as the Commissioner of Revenue of the State of North Carolina may require to substantiate a refund claim for sales or use taxes.

(ii) The Contractor shall obtain and furnish to the Contracting Officer similar certified statements by his subcontractors.

(d) If this contract is completed before the next October 1, the certified statements to be furnished pursuant to paragraph (c) above shall be submitted within 60 days after completion. If this contract is not completed before the next October 1, such certified statements shall be submitted on or before the 30th day of November of each year and shall cover taxes paid during the twelve-month period which ended the preceding September 30.

(e) The certified statements to be furnished pursuant to paragraph (c) above shall be in the following form:

I hereby certify that during the period _____to_____, (name of Contractor or subcontractor) paid North Carolina state and local sales and use taxes aggregating $_____(state) and $_____(local) with respect to building materials, supplies, fixtures and equipment which have become a part of or annexed to a building or structure erected, altered or repaired by (name of Contractor) for the United States of America, and that the vendors from whom the property was purchased, the dates and numbers of the invoices covering the purchases, the total amount of the invoices of each vendor, the North Carolina state and local sales and use taxes paid thereon, shown separately, and the cost of property withdrawn from warehouse stock and North Carolina state and local sales or use taxes paid thereon are as set forth in the attachements hereto.

12. AS-BUILT DRAWINGS: During the progress of the work, one full-size print of each of the drawings accompanying this specification shall be neatly and clearly marked in red to show all variations between the construction actually provided and that indicated or specified in the contract documents. The as-builti drawings shall be kept up-to-date at the work site at all times during the contract, and shall be available for inspection by the Contracting Officer upon request. The Contractor shall also mark the drawings to indicate the exact location of any underground utility lines discovered in the course of the work. Where a choice of materials and/or methods is permitted herein, and where variations in the scope or character of the work indicated or specified are permitted either by award on bidding items specified for that purpose or by subsequent change to the contract, the as-built drawings shall define the construction actually provided. The representation of such variations shall conform to standard drafting practice and shall include such supplementary notes, legends, and details as may be necessary for legibility and clear portrayal of the as-built construction; the marked prints shall be subject to approval of the Contracting Officer before acceptance. Upon completion of the work, the completed as-built drawings shall be presented to the Contracting Officer.

END OF SECTION

SECTION 01401
QUALITY CONTROL

1. APPLICABLE PUBLICATION: The following publication is a part of this specification to the extent referenced. The publication is referred to by basic designation only in the text.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM):

ASTM E329-77 Standard Recommended Practices for Agencies for Concrete, Steel, and Bituminous Materials as Used in Construction

2. QUALITY CONTROL of this contract will be administered under the General Provisions Clause entitled "Contractor Inspection System".

3. DEFINITIONS:

3.1 Factory Tests: Tests made on various products and component parts prior to shipment to the job site, including but not limited to such items as transformers, boilers, air conditioning equipment, electrical equipment, and precast concrete.

3.2 Field Tests: Tests or analyses made at, or in the vicinity of, the job site in connection with the actual construction.

3.3 Product: The term "product" includes the plural thereof and mean a type or a category of manufactured goods, construction, installations and natural and processed materials or those associated services whose characterization, classification or functional performance determination is specified by standards.

3.4 Person: The term "person" means associations, companies, corporations, educational institutions, firms, government agencies at the Federal, State and Local level, partnerships, and societies, as well as divisions thereof, and individuals.

3.5 Testing Laboratory: The term "testing laboratory" means any "person", as defined above, whose functions include testing, analyzing, or inspecting "products", as defined above, and/or evaluating the designs or specifications of such "products", according to the requirements of applicable standards.

3.6 Certified Test Reports: Reports of tests signed by a qualified professional attesting that the test results reported are accurate and that items tested either meet or fail to meet the stated minimum requirements. These test reports include those performed by Factory Mutual, Underwriters' Laboratories, Inc., and others.

3.7 Certified Inspection Reports: Reports signed by approved inspectors attesting that the items inspected meet the specification requirements other than any exceptions included in the report.

3.8 Manufacturer's Certificate of Conformance or Compliance: A certificate signed by an authorized manufacturer's official attesting that the material or equipment delivered meets the specification requirements.

4. SUBMITTALS shall be prepared in accordance with this specification and the General Provisions and submitted to the Contracting Officer for approval. Each submittal shall be accompanied with a cover letter signed by the Contractor. Each item proposed to be incorporated into the contract shall be clearly marked and identified in the submittals, and shall be cross-referenced to the contract drawings and specifications so as to identify clearly the use for which it is intended. Each sheet of submittal shall be stamped with the Contractor's certification stamp. Data submitted in a bound volume or on one sheet printed on two sides, may be stamped on the front of the first sheet only. The Contractor's certification stamp shall be worded as follows:

"It is hereby certified that the (equipment)(materials) shown and marked in this submittal is that propsed to be incorporated into Contract Number_____, is in compliance with the contract drawings and specifications, can be installed in the allocated spaces, and is submitted for Government approval. Certified by _____ Date_____"

The person signing the certification shall be one designated in writing by the Contractor as having that authority. The signature shall be in original ink. Stamped signatures are not acceptable.

4.1 Submittal Status Logs: The Contractor shall maintain at the job site an up-to-date submittal status log showing the status of all submittals required by the contract. A sample format of an acceptable log is attached at the end of this section. While the use of this sample format is not required, any other format must contain the same information as shown on the sample.

4.2 Samples, Shop Drawings, Manufacturer's Data, Certifications and Data Required of the Contractor: Specification MIL-D-1000 shall be used as a guide and its use is encouraged, for all drawings and data submitted by the Contractor. Conformance to the provisions of Specification MIL-D-1000 is not mandatory for maps, sketches, presentation drawings, perspectives, renderings, and all other drawings not requiring Naval Facilities Engineering Command drawing numbers. Before starting the fabrication or installation of any of this work, the Contractor shall submit to the Contracting Officer for and receive approval of, in accordance with the General Provisions, such drawings as may be required, including all items specified in the applicable paragraphs of the technical sections of this specification. Seven copies of all submittals to be approved by the Contracting Officer shall be forwarded

4.3 Identification: All catalog cuts, shop drawings, samples and other data submitted for approval shall specifically identify the specification paragraph or contract drawing by number where each item submitted is required to be provided. All submittals shall be clearly marked in ink to indicate the specific item(s) submitted for approval. Samples shall be clearly labeled with strong tags, firmly affixed, or indelible markings to identify the contract number, contracctor, manufacturer, and item name.

4.4 Certified Test Reports: Before delivery of materials and equipment, four certified copies of the reports of all tsts listed in the technical sections and referenced publications shall be submitted and approved. The testing shall have been performed in a laboratory meeting the requirements

specified herein. The tests shall have been performed within three years of submittal of the reports for approval. Test reports shall be accompanied by certificates from the manufacturer certifying that the material and equipment proposed to be supplied is of the same type, quality, manufacture, and make as that tested.

4.5 Manufacturer's Certificates of Conformance or Compliance: Manufacturer's certification furnished by the Contractor on items of materials and equipment incorporated into the work will be accepted only when this method will assure full compliance with the provisions of the contrct, as determined by the Contracting Officer. Preprinted certifications will not be accaeptablle. All certifications shall be in the original. The original of all manufacturer's certifications shall name the appropriate item of equipment or material, specification, standard, or other document specified as controlling the quality of that item and shall have attached thereto certified copies of test reports upon which the certifications are based. All certificates shall be signed by the manufacturer's official authorized to sign certificates of conformance or compliance.

4.6 Laboratory Reports shall cite the contract requirements, the test or analysis procedures used, the actual tst results, and include a statement that the item tested or analyzed conforms or fails to conform to the specification requirements. Each report shall be conspicuously stamped on the cover sheet in large red letters "CONFORMS" or "DOES NOT CONFORM" to the specification requirements as the case may be. All test reports shall be signed by the representative of the testing laboratory authorized to sign certified test reports. The Contractor shall arrange for immediate and direct delivery of the signed original of all reports, certifications, and other documentation to the Contracting Officer.

4.7 Tabulation of Tests: In addition to the General Provisions requirements for CQC test reports, prior to final payment the Contractor shall obtain from each laboratory a tabulation of all tests it has performed in connection with the construction contract, including conforming or nonconforming, and repeated test results. The tabulations shall be certified as complete, and signed by the authorized representative of the laboratory, and shall be delivered to the Contracting Officer.

5. QUALITY CONTROL REQUIREMENTS: In accordance with the General Provisions Clause entitled "Contractor Inspection System", the Contractor shall inspect and test all work under the contract and maintain records of the inspections and tests. Approvals, except those required for field installations,, field applications, and field tests, shall be obtained before delivery of materials and equipment to the project site. Surveillance of the inspection system will be performed by the Contracting Officer.

5.1 Factory Tests: Unless otherwise specified, the Contractor will arrange for factory tests when they are required under the contract.

5.2 Factory Inspection: Unless otherwise specified, the Contractor will arrange for factory inspection when required under the contract.

5.3 Field Inspections and Tests by the Contractor: The Contracctor shall furnish all equipment, instruments, qualified personnel, and facilities necessary to inspect all work and perform all tests required by the contract. All inspections and tests performed and test results received each day shall be included in the Daily Report to Inspector.

5.4 Approval of Testing Laboratories: All laboratory work under this contract shall be performed by a laboratory approved by the Government, whether the laboratory is employed by the Contractor or is owned and operated by the Contractor. The basis of approval includes the following:

a. Testing laboratores performing work in connection with concrete, steel, and bituminous materials shall comply with ASTM E329, except that the Contracting Officer will perform the function of paragraphs 3.4 and 3.5 therein in the absence of other Government approval.

b. Testing laboratories performing work not in connection with concrete, steel, or bituminous materials shall comply with sections 3 and 4 of ASTM E329, except that the Contracting Officer will perform the functions of paragraphs 3.4 and 3.5 therein in the absence of other Government approval.

5.5 Repeated Tests and Inspections: The Contractor shall repeat tests and inspections after each correction made to nonconforming materials and workmanship until tests and inspections indicate the materials, equipment, and workmanship conform to the contract requirements. The retesting and reinspections shall be performed at no additional cost to the Government.

5.6 Daily Report to Inspector: The Daily Report to Inspector Form NAVFAC 4330/34 shall be submitted to the Contracting Officer by 10:00 A.M. on the working day following the day the work was performed.

SUBMITTAL STATUS LOG

"SEE INSTRUCTIONS ON REVERSE BEFORE FILLING IN"

PAGE______ OF______

CONTRACT NUMBER	SHORT TITLE	LOCATION	CONTRACTOR

SUBMIT'L/ TRANSMIT'L NO.	DESCRIPTION OF ITEMS	SPECIFICATION SECTION REQUIRING SUBMITTAL	SUBMITTAL REQUIRES: SHOP DWGS.	CATALOG DATA	SAMPLE	CERTIFI-CATION	TEST DATA	CONTRACTOR APPV'D	GOV'T APPROVED	CONTRACTOR ACTION: INSERT ACTION CODE	DATE OF ACTION	DATE FORWARDED FROM ROICC	ROICC ACTION: INSERT ACTION CODE	DATE OF ACTION	DATE: RECEIVED FROM ROICC	MAT'L/EQUIP RECEIVED ON SITE	APPROVED BY CONTRACTOR	REMARKS
(a)	(b)	(c)	(d)					(e)		(f)		(g)	(h)		(i)	(j)	(k)	

INSTRUCTIONS

1. This form may be used by the Contractor for listing all material submittals that require action by either the Contractor or the Government.

2. Columns (a) through (e) should be completed by the Contractor and must include all submissions that are required by the specifications.

3. As submittals are received and processed, the remaining columns are to be complted by the Contracctor.

4. In those instances where the Contractor has approved the submittal under his contraact responsibility, there may be a dual Action Code under column (f); e.g., "A/E", indicating approved as submitted and forwarded to the OICC for record purposes.

5. In column (f) for those items requiring OICC action (Action Code "D"), the reason for forwarding to the OICC should be entered in the "Remarks" column; e.g., gov't approval required; waiver requested because of variance, substitution, etc..

6. Where no Government action is required, (for Contractor review/approval items), there need be no entry in columns (h) and (i).

7. Column (j) is completed when material or equipment is deliverd to the project. Column (k) is completed only afteer verifiation that the delivered item is that represented by the approval submittal.

ACTION CODE: To be used when completing columns (f) and (h)

A. Approved as submitted

B. Approved as noted

C. Disapproved

D. Forwarded to OICC for action

E. Forwarded to OICCC for record purposes

END OF SECTION

SECTION 01560

ENVIRONMENTAL PROTECTION

PART 1 - GENERAL

1.1 APPLICABLE PUBLICATIONS: The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

ENVIRONMENTAL PROTECTION AGENCY (EPA):

40 CFR 61(Subpart B)	National Emission Standards for Asbestos (1979)
40 CFR 761	Polychlorinated Biphenyls (1979)

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

29 CFR 1910.1001	General Industry Safety and Health Standards (1979)

FEDERAL REGULATION (FR):

Executive Order 11988	Flood Plain Management (42 FR 28951)

NAVAL ENVIRONMENTAL PROTECTION SUPPORT SERVICE (NEPSS):

PS-015	Disposal of Lead-Acid Battery Electrolyte, April 18, 1980

1.2 DEFINITIONS OF CONTAMINANTS:

1.2.1 Sediment: Soil and other debris that has been eroded and transported by runoff water.

1.2.2 Solid Waste: Rubbish, debris, garbage, and other discarded solid materials resulting from industrial, commercial, and agricultural operations, and from community activities.

1.2.2.1 Rubbish: A variety of combustible and noncombustible wastes such as paper, boxes, glass, crockery, metal, lumber, cans, and bones.

1.2.2.2 Debris: Includes combustible and noncombustible wastes, such as ashes, waste materials that result from construction or maintenance and repair work, leaves, and tree trimmings.

1.2.3 Chemical Wastes: Includes salts, acids, alkalies, herbicides, pesticides, and organic chemicals.

1.2.4 Sanitary Wastes:

1.2.4.1 Sewage: Wastes characterized as domestic sanitary sewage.

1.2.4.2 Garbage: Refuse and scraps resulting from preparation, cooking, dispensing, and consumption of food.

1.2.5 Asbestos and Asbestos Materials: Asbestos means actinolite, amosite, anthophyllite, chrysotile, crocidolite, and tremolite. Asbestos material means asbestos or any material containing asbestos such as asbestos waste, scrap, debris bags, containers, equipment, and asbestos-contaminated clothing consigned for disposal. Friable asbestos material means any material that contains more than one percent asbestos by weight and that can be crumbled, pulverized, or reduced to powder, when dry, by hand pressure.

1.2.6 Oily Waste: Includes petroleum products and bituminous materials.

1.3 SUBMITTALS:

1.3.1 Environmental Protection Plan: Submit four copies of the proposed Enviornmental Protection Plan not later than 14 days after the meeting with the Contracting Officer to discuss the development of an Environmental Protection Plan.

1.3.2 Notices Pertinent to Asbestos Removal:

1.3.2.1 Notice to EPA: Submit three copies of the notice of intention to demolish asbestos insulated or fireproofed materials and equipment provided to the Administrator of EPA, and the State's Environmental Protection Agency as required in paragraph titled "Written Notice."

1.3.2.2 Preconstruction Survey Report: Submit three copies of the preconstruction survey report.

1.3.3 Solid Waste Disposal Permit: Submit one copy of State and local permit or license which reflects such agency's aproval of the disposal plan as being in compliance with their solid waste disposal regulations.

1.4 ENVIRONMENTAL PROTECTION REQUIREMENTS: Provide and maintain during the life of the contract, environment protection as defined herein. Provide environmental protective measures as required to control pollution that develops during normal construction practice. Provide also environmental protective measures required to correct conditions that develop during the construction of permanent or temporary environmental features associated with the project. Comply with all federal, state, and local regulations pertaining to water, air, and noise pollution. Develop proposals for an environmental protection plan for the project and, prior to the commencement of the work, meet with the Contracting Officer and discuss the proposed environmental protection plan. The meeting shall develop mutual understanding relative to details of environmental protection, including measures for protecting natural resources, required reports, and measures to be taken should the Contractor fail to provide adequate protection in an adequate and timely manner. Perform a preconstruction survey of the project site and take photographs as necessary to enhance the survey.

PART 2 - EXECUTION

2.1 PROTECTION OF NATURAL RESOURCES: The natural resources within the project boundaries and outside the limits of permanent work performed under this contract shall be preserved in their existing condition or restored to an equivalent or improved condition upon completion of the work. Confine construction activities to areas defined by the work schedule, drawings, and specification.

2.1.1 Land Resources: Except in areas indicated to be cleared, do not remove, cut, deface, injure, or destroy trees or shrubs without special permission from the Contracting Officer. Do not fasten or attach ropes, cables, or guys to any existing nearby trees for anchorages unless specifically authorized. Where such special emergency use is authorized, the Contractor shall be responsible for any resultant damage.

2.1.1.1 Protection: Protect existing trees which are to remain and which may be injured, bruised, defaced, or otherwise damaged by construction operations. Remove displaced rocks from uncleared areas. Protect monuments, markers, and works of art.

2.1.1.2 Repair or Restoration: Repair or restore to their original condition all trees or other landscape features scarred or damaged by the equipment or operations. Obtain approval of the repair or restoration from the Contracting Officer prior to its initiation. Include topsoil or nutriment during the seeding operation as necessary to provide a suitable stand of grass.

2.1.2 Water Resources: Perform all work in such a manner that any adverse environmental impact on water resources is reduced to a level acceptable to the Contracting Officer.

2.1.2.1 Stream Crossings: Limit equipment fording across stream to control turbidity.

2.1.2.2 Oily Substances: Take special measures to prevent oily or other hazardous substances from entering the ground, drainage areas, or local bodies of water. Surround all temporary fuel oil, petroleum, or liquid chemical storage tanks with a temporary earth berm of sufficient size and strength to contain the contents of the tanks in the event of content leakage or spillage.

2.1.3 Fish and Wildlife Resources: During the performance of the work take such steps as required to prevent interference or disturbance to fish and wildlife. Do not alter water flows or otherwise significantly disturb native habitat adjacent to the project area which are critical to fish and wildlife except as may be indicated or specified.

2.1.4 Historical and Archeological Resources: Carefully preserve and report immediately to the Contracting Officer all items having any apparent historical or archeological interest which are discovered in the course of any construction activities.

2.2 EROSION AND SEDIMENT CONTROL MEASURES:

2.2.1 Burn-off: Burn-off of ground cover is not permitted.

2.2.2 Borrow Pit Areas: Manage and control borrow pit areas to prevent sediment from entering nearby streams or lakes. Restore areas, including those outside borrow pit, disturbed by borrow and haul operations. Restoration includes grading, replacement of topsoil, and establishment of permanent vegetative cover. Uniformly grade side slopes of borrow pit to a slope of 30 degrees or less with the horizontal. Uniformly grade bottom of borrow pits to provide a flat bottom and drain by outfall ditches or other suitable means. Borrow locations will be as directed by the Contracting Officer.

2.2.3 Protection of Erodible Soils: All earthwork brought to final grade shall be immediately finished as indicated or specified. Protect immediately side slopes and back slopes upon completion of rough grading. Plan and conduct all earthwork in such a manner as to minimize the duration of exposure of unprotected. soils.

2.2.4 Temporary Protection of Erodible Soils: Utilize the following methods to prevent erosion and control sedimentation.

2.2.4.1 Mechanical Retardation and Control of Runoff: Mechanically retard and control the rate of runoff from the construction site. This includes construction of diversion ditches, benches, and berms, to retard and divert runoff to protected drainage courses.

2.2.4.2 Sediment Basins: Trap sediment in temporary or permanent sediment basins. Select basin size to accommodate the runoff of a local 50 year storm. Pump dry and remove accumulated sediment after each storm. Use a paved weir or vertical overflow pipe for overflow. Remove collected sediment from the site. Institute effluent quality monitoring programs as required by state and local environmental agencies.

2.2.4.3 Vegetation and Mulch: Provide temporary protection on all side and back slopes as soon as rough grading is completed or sufficient soil is exposed to require protection to prevent erosion. Such protection shall be accelerated growth of permanent vegetation, temporary vegetation, mulching, or netting. Stabilize slopes by hydroseeding, anchoring mulch in place, covering with anchored netting, sodding, or such combination of these and other methods necessary for effective erosion control.

2.3 CONTROL AND DISPOSAL OF SOLID, CHEMICAL, AND SANITARY WASTES: Pick up solid wastes and place in containers which are emptied on a regular schedule. The preparation, cooking, and disposing of food are strictly prohibited on the project site. Conduct handling and disposal of wastes to prevent contamination of the site and other areas. On completion, leave areas clean and natural looking. Obliterate signs of temporary construction and activities incidental to construction of the permanent work in place. The Base Sanitary Landfill will not accept liquid wastes or empty drums. If transporting any material off Government property, the Contractor shall provide the Contracting Officer a copy of state and/or local permit which reflects the responsible agency's approval of the disposal area and proposed waste disposal methods.

2.3.1 Disposal of Garbage, Rubbish and Debris: Remove garbage, rubbish and debris from Government property and dispose of it in compliance with federal, state and local requirements.

2.3.2 Sewage, Odor, and Pest Control: Dispose of sewage through connection to station sanitary sewage system. Where such systems are not available, use chemical toilets or comparably effective units and periodically empty wastes into municipal or station sanitary sewage system. Include provisions for pest control and elimination of odors.

2.3.3 Chemical Waste: Store chemical waste in corrosion resistant containers labeled to identify type of waste and date filled. Remove containers from the project site, and dispose of chemical waste in accordance with federal, state, and local regulations. For oil and hazardous material spills which may be large enough to violate federal, state, and local regulations, notify the Contracting Officer immediately.

2.3.3.1 Petroleum Products: Conduct fueling and lubricating of equipment and motor vehicles in a manner that affords the maximum protection against spills and evaporation. Dispose of lubricants to be discarded and excess oil in accordance with approved procedures meeting federal, state and local regulations.

2.3.3.2 Polychlorinated Biphenyls (PCB) Control: Comply with 40 CFR 761 for removal and disposal of PCB containing articles.

2.3.3.3 Lead-Acid Battery Electrolyte: Electrolyte solution from lead-acid batteries shall be disposed of in such a manner as to ensure compliance with applicable federal, state, and local regulations. The electrolyte shall not be dumped onto the ground, into storm drains or into the sanitary sewer without neutralization. One of the following alternatives shall be used for disposal of waste electrolytes.

a. An industrial waste treatment plant, if available and approved for neutralizing and disposing of battery-acid electrolyte.

b. Transport the electrolyte to a state-approved hazardous waste disposal site. Method of transportation and equipment must comply with applicable federal and state regulations.

2.3.4 Asbestos: Comply with 29 CFR 1910.1001, 40 CFR 61, and the requirements specified herein for the disposal of material containing asbestos and demolition of materials and equipment insulated or fireproofed with friable asbestos material. Use of the Base Sanitary Landfill will be mandatory for all removal involving friable asbestos fiber.

2.3.4.1 Written Notice: Provide written notice of intention to demolish to the Administrator of EPA and the State's environmental protection agency at least 20 days prior to commencement of such demolition. Prepare reports in accordance with Section 61.22 of 40 CFR 61 and forward to EPA. The notice shall contain the following information:

a. Name of Prime Contractor
b. Address of Prime Contractor
c. Address or location and description of buildings, structures, or facilities to be demolished or renovated, including size, age, prior use, and approximate amount of friable asbestos materials to be removed
d. Schedule indicating planned start and completion of demolition or renovation
e. Method of removal to be employed
f. Procedures to be employed to meet the requirements of Sections 61.22(d) and 61.22(j) of 40 CFR 61, and Volume 1 of 29 CFR 1910.1001.
g. The address or location of the waste disposal site for the friable asbestos wasted which will be the Camp Lejeune Base Sanitary Landfill.

2.3.4.2 Use the following procedures and those required by Section 61.22 of 40 CFR 61 to prevent emissions of particulate asbestos material to outside air:

a. Unless otherwise specified, wet all friable asbestos materials before removal from any building, structure, facility, or installation. Pipe, structural members, equipment, or other items insulated or fireproofed with friable asbestos materials may be removed as units or in sections without stripping. If pipes or structural members are cut or disjointed, wet all exposed friable asbestos materials. Wet all friable asbestos debris adequately to ensure that it remains wet during all stages of demolition and removal operations.

b. Do not drop or throw to ground any pipe, structural member, equipment, or item covered with friable asbestos insulation or fireproofing material. Carefully lower all asbestos and asbestos covered materials to ground level.

2.3.5 Rubble such as masonry, stone, concrete without reinforcing steel, and brick may be deposited as directed on the Base. Upon completion, the work and disposal area shall be left clean and natural looking. All signs of temporary construction and activities incidental to construction of the required permanent work in place shall be obliterated.

2.3.6 Optional use of Base Landfill shall require compliance with Landfill rules. Such rules do not allow accepting recyclable metals nor reusable wood or lumber over six feet in length.

2.4 DUST CONTROL: Keep dust down at all times, including non-working hours, weekends, and holidays. Sprinkle or treat, with dust suppressors, the soil at the site, haul roads, and other areas disturbed by operations. No dry power brooming is permitted. Instead, use vacuuming, wet mopping, wet sweeping, or wet power brooming. Air blowing is permitted only for cleaning nonparticulate debris, such as steel reinforcing bars. No sandblasting is permitted unless dust threrefrom is confined. Only wet cutting of concrete blocks, concrete, and asphalt is permitted. No unnecessary shaking of bags is permitted where bagged cement, concrete mortar, and plaster is used.

2.5 NOISE: When available, make the maximum use of "low-noise-emission products" as certified by EPA. No blasting or use of explosives is permitted without written permission of the Contracting Officer and then only during the designated times. Confine pile driving operations to the period between 8 a.m. and 4 p.m., Monday through Friday, unless specified otherwise.

END OF SECTION

SECTION 02050

DEMOLITION AND REMOVAL

PART 1 - GENERAL

1.1 SUBMITTALS: Submit proposed demolition and removal procedures to the Contracting Officer for approval before work is started. Procedures shall provide for coordination with other work in progress, a disconnection schedule of utility services, a detailed description of methods and equipment to be used for each operation, and sequence of operations.

1.2 REQUIREMENTS: The work includes demolition or removal of all construction indicated or specified. All materials resulting from demolition work, except as indicated or specified otherwise, shall become the property of the Contractor and shall be removed from the limits of Government property. Remove rubbish and debris from the station daily, unless otherwise directed; do not allow accumulations inside or outside the buildings. Store materials which cannot be removed daily in areas specified by the Contracting Officer.

1.3 PROTECTION:

1.3.1 Buildings: Protect existing work that is to remain in place, that is to be reused, or that is to remain the property of the Government by temporary covers, shoring, bracing, and supports. Repair items damaged during performance of the work or replace with new. Do not overload structural elements. Provide new supports or reinforcement for existing construction weakened by demolition or removal work.

1.3.2 Weather Protection: Protect building interior and all materials and equipment from the weather at all times. Where removal of existing roofing is necessary to accomplish work, have materials and workmen ready to provide adequate and approved temporary covering of exposed areas. Temporary coverings shall be attended, as necessary, to insure effectiveness and to prevent displacement.

1.3.3 Trees: Protect trees within the project site which might be damaged during demolition, and which are indicated to be left in place, by a 6-foot high fence. Restore trees scarred or damaged by Contractor equipment or operations to their original condition or replace as determined by the Contracting Officer. The Contracting Officer shall approve restoration prior to its initiation.

1.3.4 Personnel: Where pedestrian and driver safety is endangered in the area of removal work, use traffic barricades with flashing lights. Notify the Contracting Officer prior to beginning any such work.

1.4 EXPLOSIVES: Use of explosives will not be permitted.

PART 2 - EXECUTION

2.1 EXISTING FACILITIES TO BE REMOVED:

2.1.1 Structures: Remove indicated existing structures in their entirey.

2.1.2 Utilities:

2.1.2.1 Utilities and Related Equipment: Remove all existing utilities indicated to be removed and terminate in a manner conforming to the nationally recognized code covering the specific utility and at a time satisfactory to the Contracting Officer. Remove meters and related equipment and deliver to a location on the station in accordance with instructions of the Contracting Officer or his representative without additional cost to the Government. If utility lines are encountered that are not shown on the drawings contact the Contracting Officer for further instructions. Disposal shall be covered by "Differing Site Conditions" in accordance with General Provisions.

2.1.3 Paving and Slabs: Remove concrete and asphaltic concrete paving and slabs including aggregate base in its entirety.

2.1.4 Concrete: Where concrete work is to be removed, saw concrete along straight lines to a depth of not less than 2 inches. Make each cut in walls perpendicular to the face and in alignment with the cut in the opposite face. The remainder of the concrete shall be broken out, provided that the broken area is concealed in the finished work, and the remaining concrete is sound. At locations where the broken face cannot be concealed, it shall be ground smooth or the saw cut shall be made entirely through the concrete.

2.2 DISPOSITION OF MATERIAL:

2.2.1 Title to Materials: Title to all materials and equipment to be removed, except as specified otherwise, is vested in the Contractor upon receipt of notice to proceed. The Government will not be responsible for the condition or loss of, or damage to, such property after notice to proceed. Materials and equipment shall not be viewed by prospective purchasers or sold on the site.

2.3 CLEANUP:

2.3.1 Debris and Rubbish: Remove and transport debris and rubbish in a manner that will prevent spillage on streets or adjacent areas. Clean up spillage from streets and adjacent areas. Other applicable requirements are included under Section 01560, Environmental Protection.

2.3.2 Regulations: Comply with federal, state, and local hauling and disposal regulations.

*** END OF SECTION ***

SECTION 02200

EARTHWORK

PART 1 - GENERAL

1.1 APPLICABLE PUBLICATIONS: The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

1.1.1 American Society for Testing and Materials (ASTM) Publications:

D 423-66 (R 1972)	Liquid Limit of Soils
D 424-59 (R 1971)	Plastic Limit and Plasticity Index of Soils
D 698-78	Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 5.5-lb. (2.49kg) Rammer and 12-in. (305-mm) Drop
D 1140-54 (R 1971)	Amount of Material in Soils Finer than the No. 200 (75 micrometer) Sieve
D 1556-64 (R 1974)	Density of Soil in Place by the Sand Cone Method
D 2419-74 (R 1979)	Test for Sand Equivalent Value of Soils and Fine Aggregrates
D 2487-69 (R 1975)	Classification of Soils for Engineering Purposes
D 2922-78	Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
D 3017-78	Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

1.1.2 American Water Works Association (AWWA) Publications:

C600-82	Installation of Gray and Ductile Cast-Iron Water Mains and Appurtenances

1.2 DELIVERY AND STORAGE: Deliver and store materials in a manner to prevent contamination or segregation.

1.3 CRITERIA FOR BIDDING: Base bids on the following criteria:

a. That the surface elevations are as indicated.

b. That no pipes or other artifical obstructions, except those indicated, will be encountered.

c. That hard materials will not be encountered.

d. That the ground water elevation is 5 feet below existing grade.

Hard material is defined as solid rock, firmly cemented unstratified masses, or conglomerate deposits possessing the characteristics of solid rock which can not ordinarily be removed without systematic drilling and blasting, and any boulder, masonry, or concrete except pavement, exceeding 1/2-cubic yard in volume.

1.4 PROTECTION:

1.4.1 Shoring and Sheeting: Provide shoring and sheeting as required.

1.4.1.1 In addition to Section XXIII A and B of the Army Corps Engineer Manual EM-385-1-1 meet the following requirements:

a. Prevent undermining of pavements and slabs

b. Banks may be sloped where space permits and as directed

1.4.2 Dewatering: Include in dewatering the collection and disposal of all forms of surface and subsurface water that may be encountered in the course of construction.

1.4.3 Drainage of Construction Sites: It shall be the Contractor's responsibility to adequately and completely drain construction sites as required to keep subgrades and subsoils sufficiently dry to permit all construction operations to successfully progress during all periods in which work is in progress. In addition to permanent drainage features required, the Contractor shall provide all necessary additional temporary ditches, swales, and other drainage features and equipment required to maintain the soils dry during construction. Where the Contractor's operations or failure to comply with the above requirements results in the development of unsuitable working platforms for equipment operation and unsuitable soil support for subsequent construction features, the Contractor shall, at his expense, remove the unsuitable material to whatever depth is required to restore suitable working platforms and soil support and replace it with suitable material from sources outside the station."

1.4.4 Protection of Underground Utilities: Contact the PWO 48 hours prior to construction for the location of all existing underground utilities.

1.4.5 Movement of construction machinery and equipment over any pipes during any stage of construction shall be at the Contractor's risk. Repair or remove and provide new pipe for existing or newly-installed pipe that has been displaced or damaged.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS: In general, shall be free of debris, roots, wood, scrap material, vegetation, refuse, soft unsound particles, frozen, deleterious, or objectionable materials.

2.1.1 Granular Fill: For capillary water barrier shall conform to the general requirements for soil materials above and shall be a clean, coarse grained crushed stone, uncrushed gravel, or crushed gravel conforming to the following gradation: 90 to 100 percent passing the 3/4-inch sieve and zero to five percent passing the No. 4 sieve, and with a sand equivalent of not less than 50 when tested in accordance with ASTM D 2419.

2.1.2 Backfill and Fill: For structures and under spread footings, paving, or concrete slabs on grade which are not pile supported shall conform to the general requirements for soil materials above and shall be classified as GW, GP, GM, SW, SP, SM, GC or SC by ASTM D 2487 and conform to the following: liquid limit shall not exceed 35 percent when tested in accordance with ASTM D 423, plasticity index shall not be greater than 12 percent when tested in accordance with ASTM D 424, and no more than 25 percent by weight shall be finer than No. 200 sieve when tested in accordance with ASTM D 1140.

2.1.3 General Site Fill: And embankment material shall conform to the general requirements for soil materials above and shall be an unclassified soil material from the site or borrow, submitted for approval by the Contractor as possessing the characteristics required for compaction to the specified values of soil density herein specified for the location of intended use. Maximum particle size shall be 6 inches.

2.1.4 Topsoil: Shall be material free of subsoil, stumps, rocks larger than one inch diameter, brush, weeds, toxic substances, and other material or substance detrimental to plant growth. Topsoil shall be a natural, friable soil representative of productive soils in the vicinity.

2.1.5 Borrow: Shall be materials conforming to the requirements for general site fill, fill, backfill. Take borrow materials from the source indicated on Government property.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION:

3.1.1 Clearing and Grubbing: Remove all trees, logs, shrubs, and brush within the indicated clearing limits except as indicated otherwise. Properly protect from damage trees and shrubs which are not to be cut. Cut all merchantable timber into logs and store on the site where directed. Remove stumps entirely. Grub out roots and matted roots to at least 18 inches below the existing surface. Dispose of brush, refuse, stumps, roots, and unmerchantable timber off Government property.

3.1.2 Topsoil: Strip existing topsoil to a depth of 4 inches, stockpile separately from other excavated materials, and reuse for finished surface grading. Topsoil shall be free of stones, wood matter, cuttings, excessive quantities of vegetation, and debris of every kind. Locate piles of topsoil so that the material can be used readily for finished surface grading; protect topsoil and maintain until needed. The top 4-inch thickness of all newly graded earth surfaced areas shall consist of topsoil. If there is insufficient topsoil available to form the 4-inch thickness, utilize that available as directed. The Contractor will not be required to haul in additional topsoil if all requirements specified are complied with. Placing of topsoil is specified in Section 02485, "Turf."

3.1.3 Unsuitable Material: Remove vegetation, sod, muck, and rubbish under embankments which are less than 4 feet in thickness and under pavements or concrete slabs.

3.2 EXCAVATION: Shall be to the contours and dimensions indicated. Keep excavations free from water while construction is in progress. Notify the Contracting Officer immediately in writing in the event that it becomes necessary to remove hard, soft, weak, or wet material to a depth greater than indicated and an adjustment in contract price will be considered in accordance with "Differing Site Conditions" paragraph of the General Provisions. Refill excavations cut below the depths indicated, unless otherwise specified, with fill and compact to 95 percent of ASTM D 698 maximum density. Excavate and refill soil disturbed or weakened by the Contractor's operations and soils permitted to soften from exposure to weather with fill and compact to 95 percent of ASTM D 698 maximum density. All additional work of this nature will be at the Contractor's expense.

3.2.1 Excavations for Structures and Spread Footings: If cut below depths indicated shall be filled with concrete when the foundations or footings are placed.

3.2.2 Excavation of Pipe Trenches: Excavation shall be to grade (as set forth in AWWA C600), unless otherwise directed in the event of poor soil or excavation in rock. Width of trench shall be as shown on the Standard Pipe Trench Width details accompanying this section. Compaction of soil in the backfilling operation shall be as specified herein.

3.2.2.1 Bedding Requirements: Provide in accordance with applicable pipe sections.

3.3 FILLING AND BACKFILLING:

3.3.1 Backfill for Structures: Place under spread footings and concrete slabs not pile supported in lifts of 6 inches thick and compact each lift as specified herein before the overlaying lift is placed. Backfill adjacent to structural elements shall be placed, as far as practicable, as the adjacent structural elements have been completed and accepted. Backfill against concrete only when directed by the Contracting Officer.

3.3.2 General Site Fill and Embankments: Place in lifts of 8 inches thick and compact as specified herein, before the overlaying lift is placed. In all areas not accessible to rollers or compactors, compact the fill with mechanical hand tampers. If the mixture is excessively moistened by rain, aerate it by means of blade graders or harrows until the moisture content of the mixture is satisfactory. Finish the surface of the layer by blading or rolling with a smooth roller, or a combination thereof; surface shall be smooth.

3.3.3 Backfill for Trenches: Backfilling of trenches shall progress as rapidly as the construction, testing, and acceptance of the work permits. Except as specified otherwise elsewhere in this specification, in backfilling pipe trenches, fill shall be compacted in 6-inch layers to a depth of 1 foot over the top of the pipe; the remainder of the trench shall be backfilled and compacted as specified under compaction. For trenches excavated in roads and streets, the backfill shall be placed and compacted in 6-inch layers to the top of the trench.

3.3.4 Fill for Capillary Water Barrier: Place granular fill on compacted subgrade in lifts of 4 inches and compact with a minimum of two passes of a hand-operated plate type vibratory compactor.

3.4 COMPACTION OF SUBGRADES:

3.4.1 Subgrade of Soils in Cut: For structures, concrete floor slabs and paved areas but not for primary roads or airfield pavements, shall have a density of 95 percent of ASTM D 698 maximum density to a depth of 12 inches; if the existing subgrade natural density is less than 95 percent of ASTM D 698 maximum density, compact to that value.

3.4.2 Structure, Spread Footing, and Concrete Floor Slab: Compact subgrades to 95 percent of ASTM D 698 maximum density.

3.4.3 Adjacent Area: Compact subgrade adjacent to but not supporting any structural elements or areas within 5 feet of structures to 90 percent of ASTM D 698 maximum density.

3.4.4 Paved Area: Compact subgrade to 95 percent of ASTM D 698 maximum density in the upper 12 inches of the subgrade.

3.4.5 General Site: Compact area and embankment subgrades under vegetation to 85 percent of ASTM D 698 maximum density.

3.5 FINISH OPERATIONS:

3.5.1 Grading: Shall be to finished grades indicated within one tenth of a foot. Grade areas to drain water away from structures and to provide suitable surfaces for mowing machines. Grade as directed existing grades which are to remain but are disturbed by the Contractor's operations.

3.5.2 Spreading Topsoil: Areas indicated to receive topsoil for the finished surface shall be free of materials that would interfere with planting and maintenance operations. Do not place topsoil when the subgrade is frozen, extremely wet or dry, or in other conditions detrimental to seeding, planting, or grading. Comply with the requirements of Section 02485, "Turf."

3.5.3 Borrow Areas: Grade to drain properly. Maintain and restore borrow pits as specified in Section 01560, "Environmental Protection."

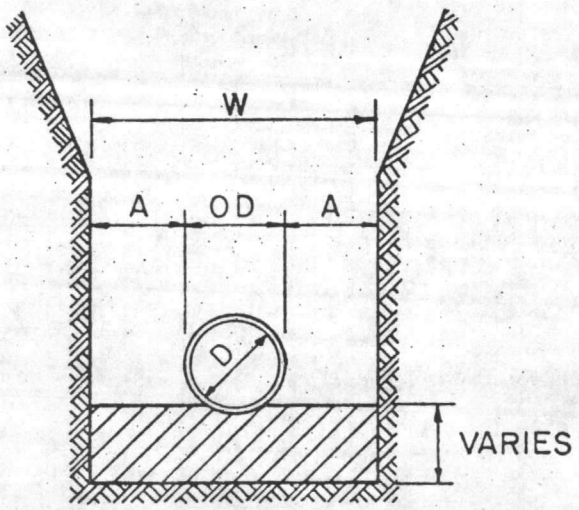
3.5.4 Disposition of Surplus Material: Waste by disposition at the Government borrow pit within a 5 mile haul distance. Surplus or other soil material not required or suitable for filling, backfilling, or embankment. Comply with the requirements of Section 01560, "Environmental Protection."

3.5.5 Protection of Surfaces: Protect newly graded areas from traffic, erosion, and settlements that may occur and as required in Section 01560, "Environmental Protection." Repair or re-establish damaged grades, elevations, or slopes.

3.6 FIELD TESTING:

3.6.1 Tests: Test fill and backfill materials for moisture density relations in accordance with ASTM D 698. Perform one of each of the required tests for each material used when directed. Provide additional tests as specified above for each source change. Perform density tests in randomly selected locations and in accordance with ASTM D 1556, ASTM D 2922 and ASTM D 3017 as follows: one test per 2000 square feet in each layer of lift.

*** END OF SECTION ***



PIPE DIA "D"	MAXIMUM "A"
6" TO 15"	8"
18" TO 21"	10"
24" TO 30"	12"
33" TO 42"	15"
48" & LARGER	18"

MAXIMUM TRENCH WIDTH "W" TAKEN AT TOP OF PIPE

NOTE: PROVIDE BEDDING IN ACCORDANCE WITH THE SPECIFICATIONS.

STANDARD PIPE TRENCH WIDTH

SECTION 02485

TURF

PART 1 - GENERAL

1.1 APPLICABLE PUBLICATIONS: The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

1.1.1 Federal Specification (Fed. Spec.):

O-F-241D Fertilizers; Mixed, Commercial

1.1.2 American Society for Testing and Materials (ASTM) Publication:

D 977-80 Emulsified Asphalt

1.1.3 U.S. Department of Agriculture (USDA) Publication:

Federal Seed Act of January 17, 1967,
Reprinted September, 1975:
53 Stat. Rules and Regulations

1.2 EXTENT OF WORK: Provide seedbed preparation, topsoiling, liming, fertilizing, seeding, and mulching of all newly graded finish earth surfaces, unless indicated otherwise, and at all areas inside or outside the limits of construction that are disturbed by the Contractor's operation.

1.3 SUBMITTALS:

1.3.1 Manufacturers' Certificates of Conformance:

a. Seed

b. Fertilizer

c. Topsoil

d. Lime

1.3.2 Manufacturer's Literature: Including physical characteristics, application and installation instructions, and recommendations:

a. Hydraulic Mulch Material

1.3.3 Delivery Schedule: Submit at least 10 days before delivery.

1.4 DELIVERY:

1.4.1 Fertilizer and Lime: Deliver materials to the site in the original, unopened containers bearing the manufacturer's chemical analysis, name, trade name, trademark, and indication of conformance to state and federal laws. In lieu of containers, furnish fertilizer and lime in bulk with a certificate indicating the above information accompanying each delivery.

1.4.2 Seed: Deliver seed to the site in original sealed packages bearing the producer's guaranteed analysis for percentages of mixtures, purity, germination, weedseed content, and inert material. Label in conformance with USDA Federal Seed Act 53 Stat. Rules and Regulations and applicable state seed laws. Wet, moldy, or otherwise damaged seed will be rejected.

1.5 STORAGE AND HANDLING: Store lime, fertilizer, and seed in dry locations away from contaminants. Protect seed from drying out. When handling materials, do not drop or dump from vehicles.

1.6 ENVIRONMENTAL PROTECTION: All work and Contractor operations shall comply with the requirements of Section 01560, "Environmental Protection."

PART 2 - PRODUCTS

2.1 SEED: State-certified seed of the latest season's crop. Mix seed on site only in the presence of the Contracting Officer. Proportion seed mixtures by weight as follows.

	Variety	Percent (by weight)
Spring:	Fescue Ky 31	80
	Common Bermuda (hulled)	20
Fall:	Fescue Ky 31	83
	Common Bermuda (unhulled)	17

2.2 TOPSOIL: Use existing on-site topsoil, stripped and stockpiled on the site, provided the topsoil is free of subsoil, stumps, rocks larger than one inch diameter, brush, weeds, toxic substances, and other material or substance detrimental to plant growth. Topsoil shall be a natural, friable soil representative of productive soils in the vicinity.

2.3 LIME: Commercial agricultural limestone containing not less than 94 percent of total carbonates, 52 percent calcium, and 42 percent magnesium; gradation as follows: minimum 75 percent passing 100-mesh sieve and 100 percent passing 20-mesh sieve.]

2.4 FERTILIZER: Commercial grade, free flowing, uniform in composition and conforming to Fed. Spec. O-F-241, Type I, Class 2, and bearing the manufacturer's guaranteed statement of analysis. Granular fertilizer shall contain a minimum percentage by weight of 10 percent nitrogen of which 50 percent shall be organic, 10 percent available phosphoric acid, and 10 percent potash.

2.5 MULCH: Free from noxious weeds, mold, or other deleterious material.

2.5.1 Straw: Stalks from oats, wheat, rye, barley, or rice. Furnish in air-dry condition and of proper consistency for placing with commercial mulch-blowing equipment.

2.5.2 Hay: Air-dry condition and of proper consistency for placing with commercial mulch-blowing equipment. Use only marsh hay for lawn areas.

2.5.3 Wood Cellulose Fiber: Processed to contain no growth or germination-inhibiting factors and dyed an appropriate color to facilitate visual metering of materials application. Composition on air-dry weight basis: 9-15 percent moisture, pH range from 3.5 to 5.0. Use with hydraulic application of grass seed and fertilizer.

2.6 ASPHALT ADHESIVE: Emulsified asphalt conforming to ASTM D 977, Grade RS-1. Use with straw or hay mulch.

2.7 WATER: Suitable quality for irrigation.

PART 3 - EXECUTION

3.1 PREPARATION:

3.1.1 Subgrade: After areas required to be seeded have been brought to the required subgrade, thoroughly till to minimum depth of 6 inches by scarifying, disking, harrowing, or other approved methods. Remove debris and stones larger than one inch remaining on the surface after tillage.

3.1.2 Topsoiling: Immediately prior to placing topsoil, scarify subgrade to a 2-inch depth for bonding of topsoil with subsoil. Spread topsoil evenly to a minimum depth of 4 inches. Do not spread topsoil when frozen or excessively wet or dry. Correct irregularities in finished surfaces to eliminate depressions. Protect finished topsoil areas from damage by vehicular or pedestrian traffic.

3.1.3 Fertilizer and Lime: Apply fertilizer at the rate of 1000 pounds per acre. Apply dolomitic lime at the rate of 3000 pounds per acre. Incorporate fertilizer and lime into the soil to a depth of at least 6 inches; this may be done as part of the subgrade tillage operation specified herein.

3.2 SEEDING:

3.2.1 Seeding Seasons and Conditions: Sow seed between 1 March and 15 May for spring planting or 1 September and 30 October for fall planting]. Immediately before seeding, restore soil to the proper grade. Do not seed when the ground is muddy, frozen, snow covered, or in any unsatisfactory condition for seeding. If special conditions exist that may warrant a variance in the above seeding dates or conditions, submit a written request to the Contracting Officer stating the special conditions and proposed variance.

3.2.2 Seeding Method: Sow seed with approved sowing equipment using one or a combination of the following methods at the rate of 240 pounds per acre. Sow one-half the seed in one direction, and sow remainder at right angles to the first sowing. Cover seed by means of spike-tooth harrow, cultipacker, or other approved device.

a. Drill Seeding: Use cultipacker seeders or grass seed drills 240. Drill seed uniformly to maximum depth of 1/4 inch in clayey soils and 1/2 inch in sandy soils.

b. Hydroseeding: Mix seed, fertilizer, and wood cellulose fiber in required amount of water to produce a homogeneous slurry. Add wood cellulose fiber after seed, water, and fertilizer have been thoroughly mixed and apply at the rate of 200 pounds per acre dry weight. Immediately following the application of the slurry mix, make separate application of wood cellulose mulch at the rate of 800 pounds, dry weight, per acre. When hydraulically sprayed on the ground, material shall form a blotterlike cover impregnated uniformly with grass seed. Cover shall allow rainfall or applied water to percolate to underlying soil.

3.2.3 Rolling: Immediately after seeding, firm entire area, except for slopes in excess of 3 to 1, with a roller not exceeding 90 pounds for each foot of roller width. If seeding is performed with cultipacker-type seeder or by hydroseeding, rolling may be eliminated.

3.2.4 Mulch: Spread straw or hay mulch evenly at the rate of 1.5 tons per acre. Anchor by crimping mulch with serrated disc or by spraying asphalt emulsion on the mulched surface at the rate of 5 gallons per 1000 square feet. Take precautionary measures to prevent asphalt materials from marking or defacing structures, pavements, utilities, or plantings.

3.3 PROTECTION OF SEEDED AREAS: Immediately after seeding, protect the area against traffic or other use by erecting barricades, as required, and placing approved signs at appropriate intervals until final acceptance.

3.4 RESTORATION: Restore to original condition existing turf areas which have been damaged during turfing operations. Keep at least one paved pedestrian access route and one paved vehicular access route to each building clean at all times. Clean other paving when work in adjacent areas is complete.

3.5 TURF:

3.5.1 Duration: Turf establishment period will be in effect until the turf is mowed three times.

3.5.2 Maintenance: During turf establishment period, mow the seeded area to an average height of 2 inches whenever the average height of grass becomes 4 inches. Remove excess clippings, eradicate weeds, water, fertilize, overseed, and perform other operations necessary to promote turf growth.

3.6 FINAL ACCEPTANCE:

3.6.1 Final Inspection and Acceptance: At the end of the turf establishment period, final inspection will be made upon written request at least 10 days prior to the anticipated date. Final acceptance will be based upon a satisfactory stand of turf, defined as 95 percent ground cover of the established species.

3.6.2 Replanting: In areas which do not have a satisfactory stand of turf, replant within specified planting dates.

*** END OF SECTION ***

SECTION 02684

GRAVEL PAVING

1. APPLICABLE PUBLICATIONS: The following publications of the issues listed below, but referred to elsewhere by basic designation only, form a part of this specification to the extent indicated by the references thereto (where a number is suffixed to the specification number, it denotes the effective amendment to the specification):

1.1 American Association of State Highway and Transportation Officials (AASHTO):

T96-721	Resistance to abrasion of small size ocarse aggregate by use of the Los Angeles Machine

1.2 North Carolina Department of Transportation and Highway Safety (NCDOT):

Standard Specification for Roads and Structures, dated July 1, 1982

2. SUBMITTALS:

2.1 Certificates of Conformance: Submit the following for approval:

a. Gravel paving course

3. MATERIALS:

3.1 Gravel Paving Course: Materials shall be in accordance with the NCDOT "Standard Specifications for Roads and Structures, Section 905 Standard Size No. 57 or 67. When tested in accordance with AASHTO T96, Test Grading A, aggregate shall show a loss not greater than 55 percent.

4. REQUIREMENTS: The work includes construction of gravel paving surface course. Preparation of the subgrade shall be as specified under the section of this specification entitled "Earthwork". Except as specified herein or indicated on the drawings, all work and materials shall be in accordance with the NCDOT "Standard Specifications for Roads and Structures". The provisions therein for method of measurement and payment do not apply.

5. CONSTRUCTION:

5.1 Gravel Paving Course: Spreading of the gravel material shall begin at the point nearest the source of supply. Hauling shall be done and traffic permitted over the gravel to assist in compaction. Any ruts formed by the traffic shall be carefully filled and re-rolled. After the

gravel course is in place, machining and rolling shall continue until the surface is smooth, hard, well bonded, and true to the designed cross section. Compaction of 100 percent of maximum density, as determined by the method specified in the section entitled "Earthwork", shall be obtained in the gravel course. The gravel shall be machined as often as necessary to maintain it smooth and true to grade and cross section.

6. TESTS: All tests to determine conformance to the specified requirements shall be performed by the Contractor. The following minimum number of tests shall be performed to insure compliance with the thickness and compaction requirements for gravel paving course:

a. Thickness of gravel paving course - one test for each 500 square yards or fraction thereof.

b. Density of gravel paving course - one laboratory test for the project and one field test for each 1000 square yards or fraction thereof of each lift.

*** END OF SECTION ***

SECTION 02713

EXTERIOR WATER DISTRIBUTION SYSTEM

PART 1 - GENERAL

1.1 APPLICABLE PUBLICATIONS: The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

1.1.1 American Society for Testing and Materials (ASTM) Publications:

D 698-78	Moisture Density Relations of Soils and Soil-Aggregate Mixtures Using 5.5-lb Rammer and 12-inch Drop
D 2321-74 (R80)	Underground Installation of Flexible Thermoplastic Sewer Pipe
D 2487-69 (R75)	Classification of Soils for Engineering Purposes
D 3139-77	Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
F 477-76 (R81)	Elastomeric Seals (Gaskets) for Joining Plastic Pipe

1.1.2 American Water Works Association (AWWA) Publications:

C104-80	Cement-Mortar Lining for Cast-Iron and Ductile-Iron Pipe and Fittings for Water
C110-82	Gray-Iron and Ductile-Iron Fittings 3 In. through 48 In. for Water and Other Liquids
C111-80	Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings
C115-75	Flanged Cast-Iron and Ductile-Iron Pipe with Threaded Flanges
C151-81	Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, For Water and Other Liquids

C500-80 Gate Valves, 3 Through 48 In. NPS, for Water and Sewage Systems

C600-82 Installation of Ductile-Iron Water Mains and Their Appurtenances

C601-81 Disinfecting Water Mains

C900-81 Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. Through 12 In., for Water

1.1.3 Underwriters Laboratories Inc. (UL) Publications:

262-80 Gate Valves for Fire-Protection Service

1.1.4 Uni-Bell Plastic Pipe Association (UNI) Publication:

B-3-79 Installation of Polyvinyl Chloride (PVC) Pressure Pipe Complying with AWWA Standard C-900

1.2 DESCRIPTION OF WORK: The work includes removing existing and providing new and modifying existing water piping systems and related work. Provide each system complete and ready for operation. Water piping systems including equipment, materials, installation, and workmanship shall be as specified herein. Exterior water piping systems shall include all piping buried more than 5 feet outside of building walls. Piping less than 5 feet outside of the building walls is specified under Section entitled "Water Well Pumps".

1.3 SUBMITTALS:

1.3.1 Manufacturer's Data:

a. Pipe, fittings, joints, couplings, and gaskets
b. Valves

1.3.2 Manufacturer's Certificates of Conformance:

a. Pipe and fittings, including shop-applied linings and coatings
b. Pipe joint materials
c. Valves

1.4 DELIVERY, STORAGE, AND HANDLING OF MATERIALS:

1.4.1 Delivery and Storage: Inspect materials delivered to site for damage. Unload and store with minimum handling. Store materials in enclosures or under protective covering. Store rubber gaskets and plastic piping not to be installed immediately under cover, out of direct sunlight. Do not store materials directly on the ground. Keep interior of pipes and fittings free of dirt and debris.

1.4.2 Handling: Handle pipe, fittings, valves, hydrants, and other accessories in such manner as to ensure delivery to the trench in sound, undamaged condition. Avoid injury to coatings and linings on pipe and fittings; make satisfactory repairs if coatings or linings are damaged. Carry pipe to the trench; do not drag it.

1.5 EXCAVATION, TRENCHING, AND BACKFILLING: Provide in accordance with Section entitled "Earthwork," except as specified herein.

PART 2 - PRODUCTS

2.1 MATERIALS FOR WATER DISTRIBUTION PIPING: (Piping 4-inch diameter and larger)

2.1.1 Ductile-Iron Pipe and Fittings: AWWA C151, minimum thickness Class 52; AWWA C115 for flanged pipe. Fittings shall be AWWA C110 with a pressure rating not less than that of the pipe. Provide AWWA C104 standard thickness cement-mortar lining for pipe and fittings. Provide AWWA C111 mechanical joints or push-on joints for buried piping. Provide AWWA C111 rubber gaskets for each flange in water piping [and cloth-inserted rubber gaskets for each flange in salt water piping].

2.1.2 Polyvinyl Chloride (PVC) Pipe and Fittings: AWWA C900 plain end or gasket bell end, minimum pressure Class 150 (DR18) with cast-iron pipe equivalent OD. Fittings shall be AWWA C110 gray-iron or ductile-iron, with a pressure rating not less than that of the pipe, and shall have AWWA C104 standard thickness cement-mortar lining. ASTM D 3139 push-on joints or ASTM D 3139 and AWWA C111 compression type mechanical joints for buried piping. ASTM F 477 gaskets for push-on joints for pipe, and AWWA C111 gaskets for push-on joints and mechanical joints for joint connections between pipe and metal fittings, valves, and accessories.

2.1.3 Insulating Joints: Joints between pipe of dissimilar metals shall have a rubber gasket or other approved type of insulating joint or dielectric coupling which will effectively prevent metal-to-metal contact between adjacent sections of piping.

2.1.4 Accessories: Provide flanges, connecting pieces, transition glands, transition sleeves, and other adapters as required.

2.2 VALVES, HYDRANTS, AND OTHER WATER PIPING ACCESSORIES:

2.2.1 Gate Valves on Buried Piping: Valves shall have nonrising stems and shall be double-disc parallel or inclined seat type. Valves shall open by counterclockwise rotation of the valve stem. Valves shall have O-ring stem seals, except when gearing is specified, use conventional packing. Stuffing boxes shall be bolted and constructed to permit easy removal of parts for repair.

2.2.1.1 Valves 3-Inch Size and Larger: AWWA C500 or UL 262, except as specified herein. Valves shall have AWWA C111 mechanical joint or push-on joint ends and gaskets, except as follows: Valves conforming to UL 262 shall be designed for a hydraulic working pressure of 175 psig for valve sizes 12-inch and smaller and 150 psig for sizes larger than 12-inch. For the following conditions, valves shall conform to UL 262 only: (a) for use at working pressures exceeding 175 psig for valve sizes 12-inch and smaller and 150 psig for 14-inch valve size; (b) for use with indicator posts.

2.2.2 Valve Boxes: Except where indicator posts are provided, each gate valve on buried piping shall be provided with an adjustable cast-iron valve box of a size suitable for the valve. Provide each cast-iron box with a heavy coat of bituminous paint. Outside of paved areas, boxes may be of plastic; such plastic valve boxes shall be constructed of ABS (Acrylonitrile-Butadiene-Styrene) plastic or of inorganic fiber reinforced black polyolefin plastic. The head shall be round and the lid shall have the word "WATER" cast on it. The least diameter of the box shaft shall be 5.25 inches.

2.3 TRACER WIRE FOR NONMETALLIC PIPING: Shall be bare copper or aluminum wire not less than 0.10 inch in diameter and provided in sufficient length to be continuous over each separate run of nonmetallic piping. Attach wire to top of pipe to prevent displacement during construction operations.

2.4 BURIED UTILITY WARNING AND IDENTIFICATION TAPE: Provide detectable aluminum foil plastic-backed tape or detectable magnetic plastic tape manufactured specifically for warning and identification of buried piping. Tape shall be detectable by an electronic detection instrument. Provide tape in rolls, 3 inches minimum width, color coded for the utility involved, with warning and identification imprinted in bold black letters continuously over entire tape length. Warning and identification shall be CAUTION BURIED WATER LINE BELOW or similar. Use permanent code and letter coloring unaffected by moisture and other substances contained in trench backfill material. Bury tape with the printed side up at a depth of 6 inches below the top surface of earth or the top surface of the subgrade under pavements.

2.5 IDENTIFICATION TAGS AND PLATES: Provide valves with tags or plates numbered and stamped for their usage. Plates and tags shall be of brass or nonferrous material and shall be mounted or attached to the valve.

PART 3 - EXECUTION

3.1 INSTALLATION: These requirements shall apply to all piping except as specified otherwise.

3.1.1 Location of Water Piping:

3.1.1.1 Water Piping Installation Parallel With Sewer Piping:

3.1.1.1.1 Normal Conditions: Water piping shall be laid at least 10 feet horizontally from a sewer or sewer manhole whenever possible. The distance shall be measured edge-to-edge.

3.1.1.1.2 Unusual Conditions: When local conditions prevent a horizontal separation of 10 feet, the water piping may be laid closer to a sewer or sewer manhole provided that:

a. The bottom (invert) of the water piping shall be at least 18 inches above the top (crown) of the sewer piping.

b. Where this vertical separation cannot be obtained, the sewer piping shall be constructed of AWWA-approved water pipe, pressure tested in place without leakage prior to backfilling.

c. The sewer manhole shall be of watertight construction and tested in place.

3.1.1.2 Installation of Water Piping Crossing Sewer Piping:

3.1.1.2.1 Normal Conditions: Water piping crossing above sewer piping shall be laid to provide a separation of at least 18 inches between the bottom of the water piping and the top of the sewer piping.

3.1.1.2.2 Unusual Conditions: When local conditions prevent a vertical separation described above, the following construction shall be used:

a. Sewer piping passing over or under water piping shall be constructed of AWWA-approved water piping, pressure tested in place without leakage prior to backfilling.

b. Water piping passing under sewer piping shall, in addition, be protected by providing:

(1) A vertical separation of at least 18 inches between the bottom of the sewer piping and the top of the water piping.

(2) Adequate structural support for the sewer piping to prevent excessive deflection of the joints and the settling on and breaking of the water piping.

(3) That the length (minimum 18 feet) of the water piping be centered at the point of the crossing so that joints shall be equidistant and as far as possible from the sewer piping.

3.1.1.3 Sewer Piping or Sewer Manholes: No water piping shall pass through or come in contact with any part of a sewer manhole.

3.1.2 Connections to Existing Water Supply Systems: Use tapping or drilling machine valve and mechanical joint type sleeves for the connection to be made under pressure for well No. 626. Bolt sleeves around mains; bolt valve conforming to AWWA C500 to the branch. Open valve, attach drilling machine, make tap, close valve, and remove drilling machine, all without interruption of service. Notify the Contracting Officer in writing at least 15 days prior to the date the connections are required; receive approval before any service is interrupted. Furnish all materials required to make connections into the existing water supply systems and perform all excavating, backfilling, and other incidental labor as required. Furnish the labor and the tapping or drilling machine for making the actual connections to the existing systems. The connection for well No. 612 shall not be made under pressure.

3.1.3 Pipe Laying and Jointing: Inspect pipe, fittings, valves, and accessories before and after installation; those found defective shall be replaced with new materials. Remove fins and burrs from pipe and fittings. Before placing in position, clean pipe, fittings, valves, and accessories, and maintain in a clean condition. Provide facilities for lowering sections of pipe into trenches. Do not drop or dump pipe, fittings, valves, or any other water piping material into trenches. Cut pipe accurately to measurements established at the site and work into place without springing or forcing. Replace pipe or fitting that does not allow sufficient space for proper installation of jointing material with new pipe or fittings of proper dimensions. Blocking or wedging between bells and spigots will not be permitted. Lay bell-and-spigot pipe with the bell end pointing in the direction of laying. Grade the piping in straight lines; avoid the formation of any dips or low points. Support pipe at its proper elevation and grade; ensure firm and uniform support. Wood support blocking will not be permitted. Lay pipe so that the full length of each section of pipe and each fitting will rest solidly on the pipe bedding; excavate recesses to accommodate bells, joints, and couplings. Provide anchors and supports where indicated and where necessary for fastening work into place. Make proper provision for expansion and contraction of piping. Keep trenches free of water until joints have been completely assembled. At the end of each day's work, close open ends of pipe temporarily with wood blocks or bulkheads. Depth of cover over top of pipe shall be not less than 3 feet.

3.1.4 Installation of Tracer Wire: Attach wire to top of pipe to prevent displacement during construction operations.

3.2 SPECIAL REQUIREMENTS FOR INSTALLATION OF WATER DISTRIBUTION PIPING: Install pipe and fittings in accordance with the general requirements for installation of piping, except as otherwise specified herein.

3.2.1 Ductile-Iron Pipe and Fittings: AWWA C600 for pipe installation, joint assembly, valve and fitting installation, and thrust restraint, except as otherwise specified hereunder. Provide AWWA C600 joint assembly for push-on joints. Provide AWWA C600 joint assembly for mechanical joints and with the recommendations of Appendix A to AWWA C111. Make flanged joints up tight; avoid undue strain on flanges, fittings, valves, and other accessories. Use full-sized bolts for the bolt holes; use of undersized bolts to make up for misalignment of bolt holes or for any other purpose will not be permitted. Do not allow adjoining flange faces to be out of parallel to such degree that the flanged joint cannot be made watertight without overstraining the flange. When any flanged pipe or fitting has dimensions that do not allow the making of a proper flanged joint as specified in this paragraph, replace it with one of proper dimensions. Assemble insulating joints as specified for flanged joints, except that bolts with insulating sleeves shall be full size for the bolt holes. Assure that there is no metal-to-metal contact between dissimilar metals after joint has been assembled.

3.2.2 Polyvinyl Chloride (PVC) Pipe and Fittings: UNI-B-3 for laying of pipe, joining PVC pipe to fittings and accessories, and setting of hydrants, valves, and fittings, except as specified hereunder. Make push-on joints with elastomeric gaskets using either elastomeric gasket bell-end pipe or elastomeric gasket couplings. Use push-on joint having factory-made bevel on pipe ends for pipe-to-pipe joint connections only; for push-on joint connections to metal fittings, valves, and other accessories, cut spigot end of pipe off square and rebevel pipe end to a bevel approximately the same as that on ductile-iron pipe used for the same type of joint. Use an approved lubricant recommended by the pipe manufacturer for push-on joints. Assemble push-on joints for pipe-to-pipe joint connections in accordance with the requirements of UNI-B-3 for laying the pipe. Assemble push-on joints for connection to fittings, valves, and other accessories in accordance with the requirements of UNI-B-3 for joining PVC pipe to fittings and accessories and with the applicable requirements of AWWA C600 for joint assembly. Assemble compression-type joints and mechanical joints with the gaskets, glands, bolts, nuts, and internal stiffeners in accordance with the requirements of UNI-B-3 and AWWA C600, and Appendix A to AWWA C111. Cut off spigot end of pipe for compression-type joint and mechanical-joint connections and do not rebevel.

3.2.3 Bedding Requirements: AWWA C600, Type 4, except as specified herein: Backfill to top of pipe shall be compacted to 95 percent of ASTM D 698 maximum density. Polyvinyl chloride (PVC) piping shall have bedding to springline of pipe. Materials shall be Class I, II, or III in accordance with ASTM D 2321 as follows:

a. Class I -- Angular, 6 to 40 mm (0.25 to 1.5 inches), graded stone, including a number of fill materials that have regional significance such as coral, slag, cinders, crushed stone, and crushed shells.

b. Class II -- Coarse sands and gravels with maximum particle size of 40 mm (1.5 inches), including variously graded sands and gravels containing small percentages of fines, generally granular and noncohesive, either wet or dry. Soil Types GW, GP, SW, and SP are included in this class as specified in ASTM D 2487.

c. Class III -- Fine sand and clayey gravels, including fine sands, sand-clay mixtures, and gravel-clay mixtures. Soil Types GM, GC, SM, and SC are included in this class as specified in ASTM D 2487.

3.2.4 Pipe Anchorage: Provide anchorage of buried piping by using concrete thrust blocks (reaction backing) having a minimum compressive strength of 2000 psi. All 22.5 degrees and sharper bends, tees, and dead ends of piping shall be securely blocked in the direction of flow with cast-in-place concrete bearing solidly against the piping and affording a minimum of 3 square feet of bearing area against a vertical trench face for 3- and 4-inch piping, and in accordance with Sketch NFGS-02713-1 for piping 6-inch diameter and larger.

3.2.5 Valves for Water Mains:

3.2.5.1 Valves: AWWA C600.

3.3 DISINFECTION: Disinfect the new potable water piping and existing potable water piping affected by Contractor's operations in accordance with AWWA C601. Fill the piping systems with solution containing minimum of 50 parts per million of available chlorine, and allow solution to stand for a minimum of 24 hours. Flush the solution from the systems with clean water until maximum residual chlorine content is not greater than 0.2 parts per million.

3.4 FIELD TESTS AND INSPECTIONS: Perform all field tests, and provide all labor, equipment, and incidentals required for testing, except that water and electric power needed for field tests will be furnished as set forth in Division 1. The Contractor shall produce evidence, when required, that any item of work has been constructed in accordance with contract requirements. Allow concrete to cure a minimum of 5 days before testing any section of piping where concrete thrust blocks have been provided.

3.4.1 Testing Procedure: Test water mains and water service piping in accordance with the following applicable standards, as modified herein:

3.4.1.1 Water Distribution Piping:

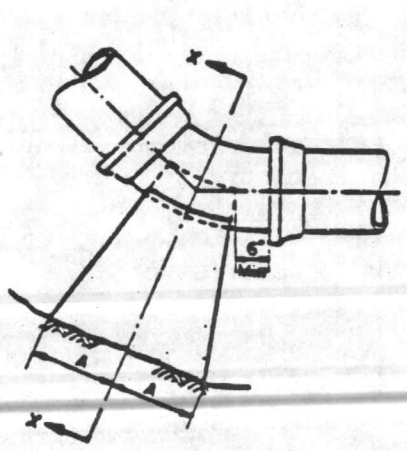
a. Ductile-Iron: AWWA C600 for pressure and leakage tests, except no leakage will be allowed for flanged joints.

b. PVC: UNI-B-3 for pressure and leakage tests.

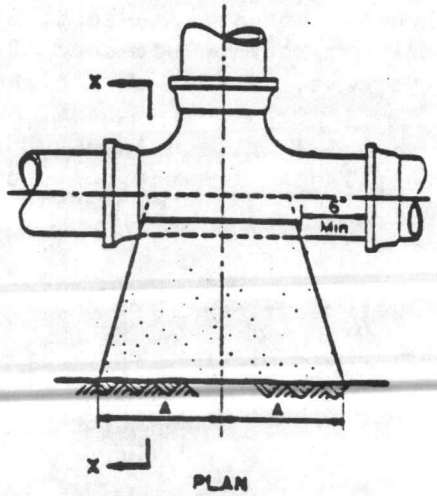
3.4.1.2 Special Testing Requirements: For pressure test, use a hydrostatic pressure 50 psi greater than the maximum working pressure of the system, but not less than 200 psi. Hold this pressure for not less than 2 hours. Prior to the pressure test, fill that portion of the piping being tested with water for a soaking period of not less than 24 hours. For leakage test, use a hydrostatic pressure not less than the maximum working pressure of the system. Leakage test may be performed at the same time and at the same test pressure as the pressure test.

3.4.1.3 All equipment shall be tested in operation to demonstrate compliance with the contract requirements.

*** END OF SECTION ***



PLAN
BENDS



PLAN
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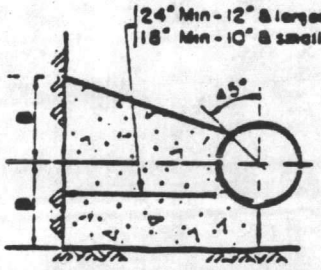
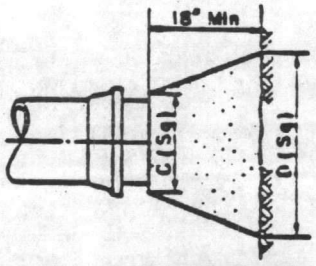


SECTION X-X
BENDS & TEES



PLAN & ELEVATION
PLUGS

SIZE	1/4 BENDS		1/8 BENDS		1/16 BENDS		TEES		PLUGS	
	A	B	A	B	A	B	A	B	C	D
6"	16"	10"	9"	10"	6"	8"	10"	12"	10"	21"
8"	22"	13"	12"	13"	8"	10"	13"	16"	12"	29"
10"	26"	17"	14"	17"	10"	13"	16"	20"	14"	36"
12"	29"	21"	16"	21"	11"	16"	18"	24"	16"	41"
14"	35"	24"	19"	24"	12"	20"	22"	27"	18"	48"
16"	38"	27"	21"	27"	12"	24"	24"	30"	20"	54"

NOTE: Based on 100 p.s.i. static pressure plus A.W.W.A. water hammer
All bearing surfaces to be carried to undisturbed ground

STANDARD THRUST BLOCKS FOR WATER MAINS

Sketch NFGS-02713-1

05-82-2541
02713-10

SECTION 02734

ROTARY-DRILLED WATER WELL

PART 1 - GENERAL

1.1 APPLICABLE PUBLICATIONS: The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

1.1.1 Federal Specification (Fed. Spec.):

GG-G-76E & Am 1	Gages, Pressure and Vacuum, Dial Indicating (for Air, Steam, Oil, Water, Ammonia, Chloro-Fluoro Hydrocarbon Gases, and Compressed Gases)

1.1.2 American Society for Testing and Materials (ASTM) Publications:

A 120-81	Pipe, Steel, Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless, for Ordinary Uses
B 88-81	Seamless Copper Water Tube
C 150-81	Portland Cement

1.1.3 American Water Works Association (AWWA) Publications:

A100-66	Deep Wells
C601-81	Disinfecting Water Mains

1.2 SUBMITTALS:

1.2.1 Shop Drawings: Submit shop drawings or catalog cuts showing all well components and details of well casings, well screens, air lines, and gages. The shop drawings or catalog cuts shall be accompanied by a cross section showing the relative size, location, and spacing of the well components such as the hole size, outer casing, inner casing, well screen, gravel fill, air line and gage, and grout.

1.2.2 Manufacturer's Certificates of Conformance:

a. Casings
b. Screens
c. Gravel
d. Cement

e. Air piping
f. Air gage
g. Drilling clay

1.2.3 Samples: One 5-pound sample of gravel.

1.3 DELIVERY, STORAGE, AND PROTECTION: Deliver materials in an undamaged condition. Store materials off the ground to provide protection against oxidation caused by ground contact. Replace defective or damaged materials with new materials.

PART 2 - PRODUCTS

2.1 MATERIALS: Materials shall conform to the respective specifications and other requirements as specified herein.

2.1.1 Casings: ASTM A 120; outer casing, 18 inch nominal diameter, 0.375 inch wall thickness, black steel pipe; inner casing, 8 inch nominal diameter, 0.322 inch wall thickness, zinc-coated steel pipe. Casings shall have screwed or welded joints.

2.1.2 Well Screens: Type 316 stainless steel, 8-inch inside diameter, continuous slot type. Screens shall have adequate strength to resist all external forces to which they will be subjected, both during and after installation. Length shall be as required to provide the quantity of water specified. Water velocity through openings shall not exceed 0.1 feet per second. Determine the well screen openings from an analysis of the sand in the water-bearing strata. Fit a back-pressure valve to the bottom of the screen to permit washing without the inflow of sand into the screen. Joints shall be of the same material as the screen, and shall be either threaded rings or butt-type welding rings.

2.1.3 Gravel: Clean, round, hard, water-worn quartz or granite with less than 5 percent felspar, no fossils, carbonate, or organics, and of proper size and gradation to allow free flow of water in the well and prevent the infiltration of sand. Gravel size will be selected by the Government, based upon the analysis of the sand in the water-bearing strata. Thoroughly sterilize gravel with hypochlorite before using.

2.1.4 Grout: Cement grout, Type I portland cement conforming to ASTM C 150, and water. The mixed grout shall contain no more than 6 gallons of water per cubic foot of cement.

2.1.5 Air Line: ASTM B 88, Type K, copper tube, 0.5 inch diameter.

2.1.6 Air Gage: Fed. Spec. GG-G-76, Class 1, Style X, 4 1/2-inch, brass case, bronze tube, calibrated in feet of water.

2.1.7 Drilling Clay: Bentonite type, readily thinned with commercial mud thinners or biodegradable polymer mud which will break down naturally. The specific gravity and the character of the mud-laden fluid shall be such that the production of the aquifers will not be impaired.

2.1.8 Auxiliary Equipment: Provide the necessary discharge piping to dispose of pumped water during developing and testing of well at a sufficient distance from each well to prevent flooding of the site and flow back into the well, as approved by the Contracting Officer.

2.2 TEST WELL: Drill a test well at the well site before construction of the permanent well is started. Test well shall be of sufficient size to obtain the necessary information required for the construction of the permanent well, but shall be not less than 4 inches. The location, size of well, and method of drilling must be approved before work is started. Test well shall be not less than 200 feet deep. Keep an accurate log and record of all material drilled through and the depths at which changes in formation occur. Do not construct permanent well until all data submitted for test well has been analyzed and approved by the Contracting Officer. Should the data obtained from any test well indicate unfavorable conditions, exploration shall be continued at other locations approved by the Contracting Officer until a suitable well site is located. In the event additional test wells are required and approved, the contract price and time for completion will be adjusted in accordance with the contract. A test well may be incorporated into the finished construction provided it meets the requirements for a finished well. Test well not used in finished construction shall be sealed as recommended in AWWA A100.

2.2.1 Material Samples: Take samples of the type of material found in each soil stratum and preserve in approved containers furnished by the Contractor. In addition, take samples at 5-foot intervals below the static water level to ensure that changes in sand size are noted. Label samples to show depth below ground surface and thickness of the stratum from which the samples were obtained. Describe all water-bearing strata in detail as to whether material is loose or compact, its color, and if gravel, whether it is water worn or angular. The presence of clay must be noted.

2.2.2 Water Quality Determination: Collect, and have analyzed by a Government-approved testing laboratory, water samples from all water-bearing strata encountered to accurately show the quality of water from each stratum. Include bacteriological and physical-chemical analysis, and further include all field and routine analysis data set forth in Parts I and III of DD Form 710, Physical and Chemical Analysis of Water, which accompanies this specification. In addition, analyze the water for any additional suspected minerals or contaminants which would make it unfit for human consumption, such as nitrate, fluoride, and mercury.

2.2.3 Electric Log: Furnish a complete electric log indicating resistivity and potential of all formations.

2.2.4 Recommendation and Data Submittal: Make recommendations for the permanent wells and submit all data obtained at each well site. Include with the recommendations the appropriate depth, details of construction, length and location of screens, screen openings, gravel size, and an estimation of the quantity of water that can be obtained from each water-bearing stratum and from each completed well. Submit electric log, drillers log, time penetration log (time to drill through each formation), and sieve analysis to substantiate recommendations.

PART 3 - EXECUTION

3.1 CONSTRUCTION: Except as modified herein, provide rotary-drilled water well in accordance with AWWA A100. The depth of well and number of screens provided shall be adequate to produce a guaranteed capacity of 250 gallons per minute of clear potable water, with a maximum drawdown of 50 feet. Secure all flow from a single aquifer; do not allow mixing of water from different aquifers.

3.1.1 Drilling: Drill a hole 24 inches in diameter to a minimum depth of 200 feet and to additional depths as required to produce the flow capacity required. When conventional rotary drilling is used, accomplish all drilling using drilling clay. Maintain the pH value of the drilling clay at 7.6 or more at all times, except that for polymer muds, maintain the pH at from 5 to 7.

3.1.2 Outer Casing: Install the outer casing concentrically in the drilled hole and extend the casing down to a minimum depth of 50 feet. Fill the void between the outer casing and the drilling hole with cement grout to seal the outer casing to the wall of the drilled hole. Grout outer casing from the bottom upward to effectively seal the void.

3.1.3 Inner Casing, Well Screens, and Gravel: Install the inner casing and well screens concentrically in the outer casing and drilled hole and completely envelope the inner casing and well screens with gravel. Provide sufficient screens at the water-bearing layer to be developed to secure all available flow. Pump gravel into place under pressure, through a temporary pipeline extending to the bottom of the screen. Raise the pipeline as the gravel fills the hole, so that the lower end of the pipe is always 2 to 6 feet below the gravel level. The gravel shall entirely fill the space around the screens and inner casing, and equipment and methods for placing the gravel shall be approved as adequate to accomplish the result before placement is begun. Control speed of gravel placement to prevent bridging and allow for settlement of the gravel. When the placement of gravel is completed, thin the drilling clay and pump the well free of all sand, mud, drillings, and other foreign matter. Extend the gravel from the bottom of the well to the bottom of the pump base.

3.1.3.1 Provide the air line at the same time as the inner casing and locate it so as not to interfere with the pumping units provided.

3.1.3.2 Repairs to Zinc Coating: Zinc coating on inner casing which is damaged during fabrication and assembly shall be repaired with a galvanizing repair paint.

3.1.4 Underreaming and Gravel Envelope: After the casing has been set and the cement has hardened, the Contractor may proceed to underream the sand strata to a diameter not less than the diameter indicated. Extend the underream continuously through the entire depth of the water-bearing strata. Following completion of the underream, completely fill the entire annular space between the screen and the outside wall of the underreamed hole with gravel. Extend the gravel pack a minimum of 20 feet up into the space between the upper casing and the lap pipe. Place the gravel by means of a gravel pipe lowered into the underreamed space.

3.1.5 Development of Well: Furnish all necessary pumps, compressors, plungers, bailing, or other needed equipment and fully develop the well as necessary to give the maximum yield of water per foot of drawdown and to limit the amount of sand which may be drawn into the well during the life of the well.

3.1.6 Tests: Upon completion of the permanent well, provide a temporary pump in the well for measuring the flow and drawdown. The temporary pump shall have a capacity of not less than 250 gallons per minute. After determining the static water level in the well, begin pumping at a rate of approximately 100 gallons per minute and check the drawdown at 15-minute intervals until it stabilizes. Continue pumping at that rate for 2 hours and check the water level at 30-minute intervals. The pumping rate shall then be increased in uniform increments not exceeding 50 gallons per minute and the described procedure repeated at each increment of increased rate until the capacity of the well is determined. The capacity of the well shall be the flow obtained at a drawdown level 10 feet above the top of the uppermost screen. After the safe maximum yield of the well has been determined, conduct a continuous 24-hour pumping test at that rate and check the drawdown at hourly intervals. Provide the necessary pipe and ditches to drain the water from the well site. Submit water disposal methods to the Contracting Officer for approval. Furnish a complete written log of the test, showing static water level, pumping rate, and drawdown at the specified intervals. At the end of the 24-hour test, water samples shall be taken and tested by an approved testing laboratory for complete chemical and bacteriological analysis. Furnish additional samples as required by Contracting Officer.

3.1.7 Disinfection: Disinfect well, equipment, and material therein in accordance with AWWA A100. Disinfect piping in accordance with AWWA C601.

3.1.8 Sanitary Seal: Provide a sanitary seal for the well to prevent contamination until the pump foundation and pump are installed on the well.

3.2 ABANDONING EXISTING WELLS: Abandon and seal existing wells as indicated on the drawings.

3.3 DISPOSAL OF SOIL: Dispose of soil removed from the drilled holes by deposition on Government property, as directed by the Contracting Officer, within a haul distance of 5 miles.

*** END OF SECTION ***

SECTION 03302

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 APPLICABLE PUBLICATIONS: The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

1.1.1 U. S. Department of Commerce Product Standard (PS) Publication:

1-74	Construction and Industrial Plywood

1.1.2 American Concrete Institute (ACI) Publications:

211.1-81	Recommended Practice for Selecting Proportions for Normal and Heavyweight Concrete
301-81	Specifications for Structural Concrete for Buildings
315-80	Manual of Standard Practice for Detailing Reinforced Concrete Structures
318-77 & 1980 Suppl.	Building Code Requirements for Reinforced Concrete
347-78	Recommended Practice for Concrete Formwork

1.1.3 American Society for Testing and Materials (ASTM) Publications:

A 185-79	Welded Steel Wire Fabric for Concrete Reinforcement
A 615-82	Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
C 31-69 (R 1980)	Making and Curing Concrete Test Specimens in the Field
C 33-82	Concrete Aggregates
C 39-81	Compressive Strength of Cylindrical Concrete Specimens

C 881-78	Epoxy Resin-Base Bonding Systems for Concrete
D 1190-74	Concrete Joint Sealer, Hot Poured Elastic Type
D 1751-73 (R 1978)	Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
D 1752-67 (R 1978)	Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
D 1850-74 (R 1979)	Concrete Joint Sealer, Cold-Application Type
C 94-81	Ready-Mixed Concrete
C 143-78	Slump of Portland Cement Concrete
C 150-81	Portland Cement
C 171-69 (R 1980)	Sheet Materials for Curing Concrete
C 172-71 (R 1977)	Sampling Fresh Concrete

1.2 SUBMITTALS:

1.2.1 Contractor Mix Design: Submit a mix design for each type of concrete, including a complete list of materials including admixtures and the applicable reference specifications, and copies of test reports showing that the mix has been successfully used to produce concrete with the properties specified.

1.2.2 Certification: Submit one copy of the delivery ticket for each load of ready-mixed concrete, showing all information required by ASTM C 94.

1.2.3 Certification: Submit one copy of the delivery ticket for each load of ready-mixed concrete, showing all information required by ASTM C 94.

1.2.4 Catalog Data: Submit manufacturers' recommendations for the items listed below. Clearly mark data to indicate which type, size, or item is proposed. Data shall be sufficient to show conformance to specified requirements.

a. Joint Filler

b. Joint Sealer

1.3 DELIVERY: Do not deliver concrete until forms, reinforcement, and embedded items are in place and ready for concrete to be placed.

1.4 STORAGE: Store reinforcement in a manner that will avoid excessive rusting or coating with grease, oil, dirt, and other objectionable materials. Store in separate piles or racks so as to avoid confusion or loss of identification after bundles are broken.

PART 2 - PRODUCTS

2.1 CONCRETE:

2.1.1 Contractor Furnished Mix Design: Design concrete mix in accordance with ACI 211.1 Slump shall be between 2 inches and 4 inches. The concrete shall have a 28-day compressive strength of 3,000 pounds per square inch.

2.1.2 Ready-Mixed Concrete: Ready-mixed concrete shall conform to ASTM C 94 as modified herein. Ready-mixed concrete is defined in this specification as concrete produced regularly by a commercial establishment and delivered to the purchaser in the plastic state. Ready-mixed concrete may be used provided that (a) the plant has sufficient capacity and transportation equipment to deliver the concrete at the rate desired, and (b) the plant meets the requirements specified herein for equipment, measurement of materials, and mixing, except as modified herein. The cement, aggregates, water, and admixtures shall conform to all applicable requirements of this specification.

2.2 MATERIALS:

2.2.1 Cement: ASTM C 150, Type I or II for all concrete. All cement for exposed concrete surfaces shall be of the same manufacture.

2.2.2 Water: Water, including free moisture and water in the aggregates, shall be fresh, clean, and potable.

2.2.3 Aggregates: ASTM C 33, size no. 57, except as modified herein. Obtain all aggregates for exposed concrete surfaces from one source. Aggregates shall be free from any substance which may be deleteriously reactive with the alkalies in the cement.

2.2.4 Materials for Forms: Wood, plywood, steel, or other suitable material. Wood forms, for surfaces exposed to view in the finished structure, shall be boards or plywood. Dress boards to a uniform thickness, evenly match, and provide boards free from loose knots, holes, and other defects. Plywood shall be B-B concrete form panels conforming to PS-1. Surfaces of steel forms shall be free from irregularities, dents, and sags.

2.2.5 Reinforcement:

2.2.5.1 Reinforcing Bars: ASTM A 615, Grade 40. All bars shall be deformed.

2.2.5.2 Welded Wire Fabric: ASTM A 185, 6 by 6 - W2.9 by W2.9, unless otherwise indicated.

2.2.6 Materials for Curing Concrete:

2.2.6.1 Liquid Chemical Compound: A suitable sealer-hardener designed for sealing and hardening in addition to curing of the concrete, applied by the method and at the rate recommended by the manufacturer. It shall not reduce the adhesion of tile, paint, roofing, waterproofing, or other material to be applied to the concrete. The chemical compound shall be free of petroleum resins or waxes.

2.2.7 Vapor Barrier Material: Polyethylene sheeting of not less than 6-mil nominal thickness.

2.2.8 Preformed Joint Filler: ASTM D 1751 or ASTM D 1752.

2.2.9 Joint Sealing Materials: ASTM D 1190 or ASTM D 1850 inside buildings; ASTM D 1190 outside of buildings.

2.2.10 Epoxy Bonding Compound: Shall conform to ASTM C 881, Type II, Grade 1, Class A (if placement temperature is below 40 degrees Fahrenheit) or Class B (if placement temperature is between 40 degrees and 60 degrees Fahrenheit) or Class C (if placement temperature is above 60 degrees Fahrenheit).

2.2.10.1 Placement of Epoxy Bonding Compound: After surfaces have been prepared and thoroughly cleaned, a coat of epoxy bonding compound shall be applied to the dry, cleaned surface of all surfaces of the cavity. The epoxy bonding compound shall be applied in a thin coating and scrubbed into the surface with a stiff-bristle brush. Placement of the concrete shall be delayed until the prime coat become stringy or approaches dry to touch.

2.2.10.2 Safety and Health Precautions: Epoxy-resins may present health hazards to some individuals; therefore, it is mandatory that the printed recommendations of the epoxy-resin manufacturer, with regard to safety and health precautions, be followed when working with epoxy-resins.

PART 3 - EXECUTION

3.1 FORMS:

3.1.1 General: Provide forms for all concrete not indicated or specified otherwise. Set forms true to line and grade and maintain so as to insure completed work within the allowable tolerances specified, and make mortar-tight. Construct forms so that they can be removed without damaging the concrete. Chamfer all exposed joints, edges, and external corners of concrete 3/4 inch unless otherwise indicated.

3.1.2 Coating: Before placing the concrete, coat the contact surfaces of forms with a non-staining mineral oil, non-staining form coating compound, or two coats of nitro-cellulose lacquer. Do not use mineral oil on forms for surfaces which are to be painted.

3.1.3 Tolerances and Variations: Set and maintain concrete forms to ensure that after removal of the forms no portion of the concrete work will exceed any of the tolerances specified in ACI 347.

3.2 PLACING REINFORCEMENT AND MISCELLANEOUS MATERIALS:

3.2.1 General: Provide all bars, wire fabric, and other reinforcing materials as indicated or specified, together with all necessary wire ties, supports, and other devices necessary to install and secure the reinforcement properly. All reinforcement, when placed, shall be free from rust, scale, oil, grease, clay, and other coating, and foreign substances that would reduce or destroy the bond. Rusting of reinforcement shall not be a basis of rejection, provided that the rusting has not reduced the effective cross sectional area of the reinforcement, and provided that loose rust shall be removed prior to placing. Where cover over reinforcing steel is not indicated, it shall be in accordance with ACI 318.

3.2.2 Vapor Barrier: Provide beneath the entire concrete floor slab of the building. Use the greatest widths and lengths practicable so as to eliminate joints wherever possible. Where joints are necessary, lap not less than 6 inches and seal with approved adhesive. Torn, punctured, or damaged vapor barrier material shall be removed and replaced as directed, prior to the placing of concrete. Place concrete in such a manner as to preclude damage to the vapor barrier material.

3.2.3 Placing: Place reinforcement accurately and secure in place on suitable chairs, spacers, or metal hangers. On the ground, use concrete or other non-corrodible material for supporting reinforcement.

3.2.4 Splicing: Conform to ACI 318, except as otherwise indicated or specified. Where splices in addition to those indicated are necessary, they shall be approved prior to their use. Do not make splices at points of maximum stress. Make splices in welded wire fabric so that the overlap is not less than the spacing of the cross wires.

3.2.5 Setting Miscellaneous Material: Place and secure anchors and bolts, pipe sleeves, conduits, and other such items in position before the concrete is placed. Plumb anchor bolts, check for location and elevation, and secure rigidly in position. Fill voids in sleeves temporarily with readily removable material to prevent the entry of concrete into the voids.

3.2.6 Expansion Joints and Cleavage Joints: Make joints 1/2-inch wide except as indicated otherwise. Fill expansion joints not exposed to weather completely, and fill joints exposed to weather to a depth of one inch from the surface, with preformed joint material. Clean the one-inch deep space above the preformed material after the concrete has been cured and, when dry, fill flush with joint sealing material. Do not extend reinforcement or other embedded metal items bonded to the concrete through any expansion joint.

3.3 MEASURING, MIXING, TRANSPORTING, AND PLACING CONCRETE: In accordance with ACI 301, Chapters 7 & 8, except as modified herein.

3.3.1 Measuring: Make moisture, volumetric, and air determinations at intervals specified herein under testing requirements. Allowable tolerances for measuring cement and water shall be one percent; for aggregates, 2 percent; and for admixtures, 3 percent.

3.3.2 Mixing: Machine mix all concrete. Begin mixing within 30 minutes after the cement has been added to the aggregates. Introduce all mixing water in the drum before one-fourth of the mixing time has elapsed. The time elapsing between the introduction of the mixing water to the cement and aggregates or the cement to the aggregates and the start of placing of the concrete in final position in the forms shall not exceed 60 minutes if the the air temperature is less than 85 degrees Fahrenheit, and 45 minutes if the air temperature is equal or greater than 85 degrees F. On arrival at the job site, no addition of water will be allowed other than that required initially to adjust to the specified slump. Such an addition must not exceed the limits of the specified maximum water-cement ratio.

3.3.3 Conveying: Convey concrete from the mixer to the forms as rapidly as practicable and so as not to cause segregation or loss of ingredients. Deposit concrete as close as practicable to its final position in the forms. At any point in the conveying, the free vertical drop of the concrete shall not exceed 3 feet. Clean conveying equipment thoroughly before each run. Do not use aluminum pipe or chutes. Place concrete as soon as practicable after the forms and the reinforcement have been inspected and approved. Remove any concrete which has segregated in conveying and dispose of as directed.

3.3.4 Placing: Do not place concrete when weather conditions prevent proper placement and consolidation. Do not place concrete in uncovered areas during periods of precipitation. Do not place concrete in water. Prepare subgrades of earth or other material properly and, if necessary, cover with heavy building paper or other suitable material to prevent the concrete from becoming contaminated. Dampen porous subgrades as required to prevent water of hydration from being absorbed into the subgrade. Clean forms of dirt, construction debris, and water, snow, and ice. Place concrete in one continuous operation except where construction joints are provided. Place concrete in areas bounded by construction joints in one continuous operation. Remove water which accumulates on the surface of the concrete during placing by absorption with porous materials in a manner that prevents removal of cement.

3.3.5 Vibration: Compact all concrete, with the exception of concrete slabs 4 inches or less in depth, with high frequency, internal, mechanical vibrating equipment supplemented by hand spading and tamping. Consolidate concrete slabs 4 inches or less in depth by wood tampers, spading, and settling with a heavy leveling straight edge. Vibrators shall be designed to operate with vibratory element submerged in the concrete, and shall have a frequency of not less than 6,000 impulses per minute when submerged.

3.3.6 Cold Weather: Except with authorization, do not place concrete when the ambient temperature is below 40 degrees F or when the concrete is likely to be subjected to freezing temperatures within 24 hours. When so authorized, if concrete is likely to be subjected to freezing within 24 hours after placing, heat concrete materials so that the temperature of the concrete when deposited shall be between 65 and 80 degrees F. Methods of heating materials are subject to approval of the Contracting Officer. Do not heat mixing water above 165 degrees F. Remove lumps of frozen material and ice from the aggregates before placing aggregates in the mixer. When specifically approved by the Contracting Officer, the Contractor may add, not more than 2 pounds of Type I or not more than one pound, 10 ounces of Type II calcium chloride, ASTM D 98, per bag of cement. Dissolve the admixture in a portion of the mixing water and add to the mix at the drum in a manner that will ensure uniform distribution of the agent throughout the batch.

3.3.7 Hot Weather: Cool ingredients before mixing so as to prevent rapid drying of newly placed concrete. When the ambient temperature is more than 90 degrees F, the temperature of the concrete as placed shall not exceed 90 degrees F; shade the fresh concrete as soon as possible after placing; and start curing as soon as the surface of the fresh concrete is sufficiently hard to permit curing without damage to the concrete.

3.4 SURFACE FINISHES (EXCEPT FLOOR FINISHES):

3.4.1 Defects: Repair all formed surfaces by patching minor honeycombed or otherwise defective areas with cement mortar of the same composition as that used in the concrete. Patch concrete as soon as the forms are removed. Concrete with honeycombing or other defects which affect the structural strength of the member, will be rejected, or the defects corrected as directed by the Contracting Officer.

3.4.2 Standard Finish: Provide standard finish for exposed concrete not indicated or specified otherwise. The surface of the concrete shall not vary more than 1/4 inch when measured from a five-foot template. Exposed surfaces shall be uniform in appearance.

3.4.2.1 Against Forms: Remove fins and other projections and level abrupt irregularities. Fill surface pits having a dimension greater than 1/8 inch with cement mortar as specified.

3.4.2.2 Not Against Forms: Finish surfaces not otherwise specified with wood floats to even surfaces.

3.5 FLOOR AND SLAB FINISHES:

3.5.1 General: Interior slabs shall receive a sealer-hardener finish. Do not place dry cement directly upon the new concrete surface to absorb excess moisture.

3.5.2 Finishing: Place, consolidate and immediately strike off concrete to bring the top surface of the slab to proper contour, grade, and elevation. Immediately darby or bull float the surface with wooden tools so as to correct any uneveness. Complete striking-off and darbying before bleed water appears on the surface of the freshly-placed concrete. Permit the concrete to attain a set sufficient for floating and sufficient to support the weight of the finisher and equipment. If the bleed water has not disappeared by the time floating of the surface is to start, drag the excess water off using a rubber hose. Do not use dry cement to absorb bleed water.

3.5.2.1 Floated finish: At the proper time, float the surface by hand with a wood or magnesium float, or by a power-driven float. Floating of any one area shall be the minimum necessary to produce an even finish, level within 1/4 inch in 10 feet.

3.5.2.2 Troweled Finish: First, provide a floated finish. When slab has attained a proper set, hand- or machine-trowel to a smooth, hard, dense finish, level within 1/8 inch in 10 feet.

3.5.2.3 Sealer-hardener Finish: Provide trowelled finish and then apply liquid chemical compound as specified herein.

3.6 CURING AND PROTECTION:

3.6.1 General Requirements: Protect concrete adequately from injurious action by sun, rain, flowing water, frost, mechanical injury, tire marks and oil stains, and do not allow it to dry out from the time it is placed until the expiration of the minimum curing periods specified herein. Use impervious-sheeting curing, liquid chemical or liquid membrane-forming compound, except as specified otherwise herein. Do not use membrane-forming compound on surfaces where its appearance would be objectionable, on any surface to be painted, where coverings are to be bonded to the concrete, or on concrete to which other concrete is to be bonded. Begin curing immediately following the removal of forms. Maintain the temperature of the air next to the concrete at not less than 40 degrees F for the full curing periods.

3.6.2 Liquid Chemical Compound Curing: Provide for surfaces for which a sealer-hardener finish is specified, and, at the Contractor's option, provide in lieu of liquid membrane-forming compound curing for other surfaces. The application of the compound shall conform to the requirements for liquid membrane-forming compound curing except as specified otherwise herein. Sealing or covering of joints and openings in which joint sealer is to be applied will not be required. The coverage and number of applications shall be in accordance with the recommendations of the manufacturer of the compound.

3.6.3 Removal of Forms: Remove forms in a manner which will prevent damage to the concrete. Do not remove forms without approval, nor sooner than 24 hours after placement of concrete.

3.7 MISCELLANEOUS CONSTRUCTION:

3.7.1 Splash Blocks: Provide at outlets of downspouts emptying at grade. Splash blocks shall be of precast concrete, 24 inches long, 12 inches wide, and 6 inches thick, unless otherwise shown, with countersunk dishes finished smooth and sloped to drain away from the building. Compact the earth to provide firm bases for the blocks.

3.8 SAMPLING AND TESTING:

3.8.1 Sampling: Collect samples of fresh concrete in accordance with ASTM C 172 during each working day as required to perform all tests specified herein. Make test specimens in accordance with ASTM C 31.

3.8.2 Testing:

3.8.2.1 Consistency Tests: Determine slump in accordance with ASTM C 143. Take samples for slump determination from the concrete while it is being placed. Perform tests at the beginning of a concrete placement operation and at subsequent intervals to insure that the specification requirements are met. In addition, perform tests each time test cylinders are made.

3.8.2.2 Compressive Tests: Determine compressive strength in accordance with ASTM C 39. Make four test specimens for each set of tests. Test two specimens at 7 days, and the other two at 28 days. The strength of the concrete will be considered satisfactory if the average of the 28-day test results equals or exceeds the specified 28-day compressive strength (f'c) and no individual strength test is less than f'c by more than 300 pounds per square inch. Frequency of compressive tests on concrete cylinders shall be not less than four test cylinders for each day for each class of concrete placed that day.

3.8.2.3 Core Samples: If the foregoing criteria are not met, core samples shall be taken and tested at the Contractor's expense. The number of cores required shall be based on the results of each pair of cylinders broken at 28 days. Sampling, testing, and evaluation of drilled cores shall be in accordace with ACI 318, Part 3, chapter 4. Concrete which is defective according to ACI 318 shall be removed and replaced with acceptable concrete.

a. If both cylinders average below f'c, but no single cylinder is less than f'c - 300 psi, take three cores.

b. If average is below f'c, and only one cylinder is less than f'c - 300 psi, take three cores.

c. If average is below f'c, and both cylinders are less than f'c - 300 psi, take six cores.

*** END OF SECTION ***

SECTION 04200

UNIT MASONRY

PART 1 - GENERAL

1.1 APPLICABLE PUBLICATIONS: The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

1.1.1 American Society for Testing and Materials (ASTM) Publications:

A 82-79	Cold-Drawn Steel Wire for Concrete Reinforcement
A 90-81	Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles, Standard Test Method for
A 153-80	Zinc Coating (Hot-Dip) on Iron and Steel Hardware
A 167-81 (Rev. A)	Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
A 615-82	Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
A 616-82	Rail-Steel Deformed and Plain Bars for Concrete Reinforcement
B 370-81	Copper Sheet and Strip for Building Construction
C 62-81	Building Brick (Solid Masonry Units Made from Clay or Shale)
C 67-81	Sampling and Testing Brick and Structural Clay Tile, Standard Methods of
C 73-75	Calcium Silicate Face Brick (Sand-Lime Brick)
C 90-75 (R 1981)	Hollow Load-Bearing Concrete Masonry Units
C 91-78	Masonry Cement
C 144-81	Aggregate for Masonry Mortar
C 150-81	Portland Cement

C 207-79	Hydrated Lime for Masonry Purposes
C 270-80 (Rev. A)	Mortar for Unit Masonry
C 476-80	Grout for Reinforced and Nonreinforced Masonry
D 412-80	Rubber Properties in Tension, Standard Test Methods for
D 822-80 (R 1981)	Practice for Operating Light- and Water-Exposure Apparatus (Carbon-Arc Type) for Testing Paint, Varnish, Lacquer, and Related Products, Standard Practice for

1.2 SUBMITTALS:

1.2.1 Certified Test Reports: Submit certified efflorescence test reports on masonry units and mortar that are to be exposed to weathering. Schedule tests far enough in advance of starting masonry work to permit retesting if necessary.

a. Masonry Units: Test five pairs of specimens of each type of masonry unit for efflorescence in accordance with ASTM C 67. If any pair is rated "effloresced," reject the units represented by the samples.

b. Mortar: Prepare a 3-ounce mortar specimen of each proposed mix using as little water as possible. Place each mortar specimen in a glass or glazed receptacle prior to its initial set. Mix 4 ounces of distilled water with the mortar and stir thoroughly for 5 minutes. Size of the receptacle shall be such that when the mortar specimen and water are combined in solution and a masonry unit is placed in it, the solution will have a depth of 1/2 to 1 inch. Place a masonry unit tested and found free of efflorescence on end in the solution. Maintain the water level at 1/2 to 1 inch with distilled water. After 7 days in drying room, inspect, dry, examine, and rate the unit for efflorescence in accordance with ASTM C 67. If the unit is rated "effloresced," test the mortar components in separate receptacles, each containing a masonry unit which has been tested and found free of efflorescence. Thoroughly mix each mortar component with 4 ounces of distilled water using 1 ounce of each cementitious material and 3 ounces of each aggregate. Maintain the water level at a depth of 1/2 to 1 inch with distilled water. After 7 days in drying room, inspect, dry, examine, and rate the unit for efflorescence in accordance with ASTM C 67. Reject the component causing efflorescence.

1.2.2 Samples: Submit for approval two samples of each type of wall reinforcement and one strap of not less than five face brick units showing full range of color and texture.

1.2.3 Catalog Data: Submit complete descriptive literature for each type of masonry accessory, reinforcement, and flashing. Clearly mark the data to indicate which type, size, or item the Contractor intends to provide. Provide sufficient data to show conformance to specified requirements.

1.2.4 Manufacturer's Certificates of Conformance: Submit certificates attesting that masonry cement meets the requirements specified herein.

1.3 DELIVERY AND STORAGE: Deliver cement, lime, and other cementitious materials to the site in unbroken bags, barrels, or other approved containers, plainly marked and labeled with manufacturers' names and brands. Store cementitious materials in dry, weathertight sheds or enclosures and handle so as to prevent entry of foreign materials and damage by water or dampness. Handle masonry units with care to avoid chipping and breakage. Protect masonry materials from damage and, except for sand, keep dry until used. Do not use materials containing frost or ice.

1.4 ENVIRONMENTAL CONDITIONS:

1.4.1 Cold Weather Construction: Do not lay masonry when the air temperature is below 40 degrees F and falling, or when it appears that the air temperature will drop to 40 degrees F or below before the mortar has set, unless the work is protected from freezing as specified below. Work will not be permitted with or on frozen materials. Comply with the requirements specified below for the respective air temperatures:

a. Air Temperature 40 to 32 degrees F: Heat sand or mixing water to produce mortar temperature between 40 and 120 degrees F.

b. Air Temperature 32 to 25 degrees F: Heat sand and mixing water to produce mortar temperature between 40 and 120 degrees F.

c. Air Temperature 25 to 20 degrees F: Heat sand and mixing water to produce mortar temperature between 40 and 120 degrees F. Use salamanders or other heat sources on both sides of walls under construction. Use windbreaks when wind is in excess of 15 mph.

d. Air Temperature 20 degrees F and Below: Heat sand and mixing water to produce mortar temperature between 40 and 120 degrees F. Provide enclosures and auxiliary heat to maintain air temperature above 32 degrees F on both sides of walls under construction. Ascertain that temperatures of masonry units are not less than 20 degrees F when units are laid.

1.4.2 Cold Weather Protection: Protect newly laid masonry as specified below for the respective mean daily air temperature (MDAT):

a. MDAT 40 to 32 degrees F: Protect masonry from rain and snow by covering with weather-resistive membrane for 48 hours after laying.

b. MDAT 32 to 25 degrees F: Completely cover masonry with weather-resistive membrane for 48 hours.

c. MDAT 25 to 20 degrees F: Completely cover masonry with insulating blankets and weather-resistive membrane for 48 hours.

d. MDAT 20 degrees F and Below: Maintain temperature of masonry above 32 degrees F for 48 hours by providing enclosures and supplementary heat or other approved means.

PART 2 - PRODUCTS

2.1 MASONRY UNITS:

2.1.1 Building Brick: ASTM C 62; Grade SW for vertical surfaces in contact with the earth and for all nonvertical surfaces, Grade SW or MW for other locations. Average dimensions of brick shall be 3-3/4 inches thick, 2-1/4 inches high, and 8 inches long (standard), or 3-5/8 inches thick, 2-1/4 inches high, and 7-5/8 inches long (modular), subject to the tolerances specified in ASTM C 62. The color range of brick used in the exterior face of walls shall match as closely as possible the brick used in the other buildings in the area.

2.1.2 Concrete Masonry Units: Units of modular dimensions and air, water, or steam cured. Store Type II units at the site before use a minimum of 28 days for air cured units, 10 days for atmospheric steam or water cured units, and 3 days for units cured with steam at a pressure of 120 to 150 psi and at a temperature of 350 to 365 degrees F for at least 5 hours. [Surfaces of units which are to be plastered or stuccoed shall be sufficiently rough to provide a suitable bond; elsewhere, [exposed surfaces of units shall be comparatively smooth and of uniform texture.

a. Hollow Load-Bearing Units: ASTM C 90, Grade N-I or N-II, made with light weight or normal weight aggregate.

b. Concrete Building Brick: ASTM C 55, Grade S-I or S-II, except brick exposed to weather shall be Grade N-I or N-II, and made with light weight or normal weight aggregate. Concrete brick shall match the concrete masonry units as closely as practicable in color and surface characteristics.

c. Special Shapes: Provide special shapes such as closures, header units, and jamb units as necessary to complete the work. Special shapes shall conform to the requirements for the units with which they are used.

2.2 MORTAR:

2.2.1 Portland Cement: ASTM C 150, Type I, II, or III.

2.2.2 Hydrated Lime: ASTM C 207, Type S.

2.2.3 Masonry Cement: ASTM C 91, except that the air content of the mortar specimen shall be not more than 16 percent by volume in lieu of 22 percent. Containers shall bear complete instructions for proportioning and mixing to obtain the required types of mortar.

2.2.4 Sand: ASTM C 144.

2.2.5 Water: Clean, potable, and free from substances which could adversely affect the mortar.

2.2.6 Mortar Types: ASTM C 270, Type S. If masonry cement is used, submit the manufacturer's printed instructions on proportions of water and aggregates and on mixing to obtain the type of mortar required.

2.3 ACCESSORIES:

2.3.1 Horizontal Joint Reinforcement: Fabricate from cold drawn steel wire, ASTM A 82. Wire shall be zinc coated after fabrication by the hot-dip process in accordance with ASTM A 153. Reinforcement shall consist of two or more parallel longitudinal wires not lighter than 8 gage (0.1620 inch) weld connected with cross wires not lighter than 9 gage (0.1483 inch) at 16 inches o.c. Provide at least one longitudinal wire for each wythe and one longitudinal wire for each face shell of concrete masonry units more than 4 inches thick. Out-to-out spacing of the longitudinal wires shall be 1-1/2 to 1-3/4 inches less than the actual width of the masonry. Provide joint reinforcement in flat sections, not less than 10 feet long, except that corner reinforcements and other special shapes may be shorter.

2.3.2 Anchors and Ties: Provide approved designs of copper-clad steel, zinc-coated steel, or noncorrosive metal having the equivalent total strength of steel types. Zinc coat items by the hot-dip process after fabrication to a minimum of 1.25 ounces of zinc per square foot of surface when tested in accordance with ASTM A 90.

a. Wire Mesh Ties: Wire not lighter than 20-gage, galvanized, 1/2-inch mesh with width of 1 inch less than thickness of masonry.

b. Corrugated Metal Ties: Not less than 7/8-inch wide by approximately 6 inches long and not lighter than 22 gage.

2.3.3 Reinforcing Steel Rods: ASTM A 615 or ASTM A 616.

2.3.4 Through-Wall Flashing: Provide one of the following types.

a. Coated-Copper Flashing: 5-ounce, electrolytic copper sheet, uniformly coated on both sides with acidproof, alkaliproof, elastic bituminous compound. Factory apply coating to a weight of not less than 6 ounces per square foot (approximately 3 ounces per square foot on each side).

b. Six-Ounce Copper or Stainless Steel Flashing: Copper, ASTM B 370, 6-ounce weight; stainless steel, ASTM A 167, Type 301, 302, 304, or 316, 0.006-inch thick, No. 2 or No. 2D finish. Provide with factory-fabricated deformations that mechanically bond flashing against horizontal movement in all directions. Deformations shall consist of dimples, diagonal corrugations, or a combination of dimples and transverse corrugations.

c. Plastic Flashing: Homogeneous, waterproof, impermeable, elastomeric sheeting not less than 0.030-inch thick. Sheeting shall have not less than 1000 pounds per square inch tensile strength, nor more than 7 percent tension set at 50 percent elongation when tested in accordance with ASTM D 412. Suitably stabilize sheeting to resist exposure without visible deterioration when tested not less than 400 hours in accordance with ASTM D 822. The material, after being exposed for not less than 1/2 hour to a temperature of minus 20 degrees F, shall show no cracking or flaking when, at that temperature, it is bent 180 degrees over a 1/32-inch diameter mandrel and then bent at the same point over the same size mandrel in the opposite direction 360 degrees.

d. Reinforced Membrane Flashing: Polyester film core with a reinforcing fiberglass cloth mesh bonded to each side. The membrane shall be impervious to moisture, flexible, and not affected by caustic alkalis. The material, after being exposed for not less than 1/2 hour to a temperature of 32 degrees F, shall show no cracking when, at that temperature, it is bent 180 degrees over a 1/16-inch mandrel and then bent at the same point over the same size mandrel in the opposite direction 360 degrees.

PART 3 - EXECUTION

3.1 INSTALLATION: Coordinate masonry work with the work of other trades to accommodate built-in items and to avoid cutting and patching. Do not change source of supply of materials after the work has started if the appearance of the finished work would be affected.

3.1.1 Protection:

a. Stains: Protect exposed surfaces from mortar and other stains. When mortar joints are tooled, remove mortar from exposed surfaces with fiber brushes and wooden paddles. Protect base of walls from splash stains by covering adjacent ground with sand, sawdust, or polyethylene.

b. Loads: Do not apply uniform loads for at least 12 hours or concentrated loads for at least 72 hours after masonry is constructed.

3.1.2 Workmanship: Carry masonry up level and plumb all around. Furnish and use "story poles" or "gage rods" prior to starting the work and throughout the work. Changes in coursing or bonding after the work is started will not be permitted. Do not carry one section of the walls up in advance of the others. Step back unfinished work for joining with new work; toothing will not be permitted. Check heights of masonry with an instrument at each floor and at sills and heads of openings to maintain the level of the walls. Build in door and window frames, louvered openings, anchors, pipes, ducts, and conduits carefully and neatly as the masonry work progresses. Fill spaces around metal door frames solidly with mortar. Handle masonry units with care to avoid chipping, cracking, and spalling of faces and edges. Drilling, cutting, fitting, and patching to accommodate the work of others shall be performed by masonry mechanics. Cut masonry with masonry saws for exposed work. Structural steelwork, bolts, anchors, inserts, plugs, ties, lintels, and miscellaneous metalwork specified elsewhere shall be placed in position as the work progresses. Provide chases of approved dimensions for pipes and other purposes where indicated or necessary. Cover tops of exposed walls and partitions not being worked on with a waterproof membrane well secured in place and extended down at least 2 feet on both sides. Inspect scaffolding regularly to ensure that it is amply strong, well braced, and securely tied in position. Do not overload scaffolding.

3.1.3 Mortar Mixing: Measure mortar materials in proper containers to maintain control and accuracy of proportions. Do not measure materials with shovels. Unless specified otherwise, mix mortar in proportions by volume. Introduce and mix aggregate in such a manner that the materials will be distributed uniformly throughout the mass. Add water gradually and mix not less than 3 minutes, until proper plasticity is obtained. Machine mix mortar in mixers of the type in which the quantity of water can be controlled accurately and uniformly. [Hand mixing may be used only when specifically approved.] Keep mortar boxes, pans, and mixer drums clean and free of debris or dried mortar. Retemper mortar which has stiffened because of evaporation by adding water and mixing with a trowel to obtain the proper, workable consistency. Do not use or retemper mortar which has not been placed in its final position within 2-1/2 hours after the initial mixing. Do not use antifreeze compounds, salts, or any other substance to lower the freezing point of mortar.

a. Mortar: Mix mortar at the site using materials conforming to ASTM C 270 to obtain type mortar required. Measurement and mixing shall conform to ASTM C 270. When masonry cement is used, conform to printed mixing instructions of the masonry cement manufacturer.

b. Grout: ASTM C 476. Provide fine grout in grout spaces less than 2 inches in any horizontal dimension or in which clearance between reinforcing and masonry is less than 3/4 inch. Provide coarse grout in grout spaces 2 inches or greater in all horizontal dimensions provided the clearance between reinforcing and masonry is not less than 3/4 inch.

3.1.4 Mortar Joints: Uniform thickness of 3/8-inch unless otherwise indicated. Tool exposed joints slightly concave with a round or other suitable jointer when the mortar is thumbprint hard. Use jointer slightly larger than the width of the joint so that complete contact is made along the edges of the units, compressing and sealing the surface of the joint. Strike flush joints that will not be exposed. Tool horizontal joints first. Brush joints to remove all loose and excess mortar. All horizontal joints shall be level; vertical joints shall be plumb and in alignment from top to bottom of wall within a tolerance of plus or minus 1/2 inch in 40 feet.

3.1.5 Brickwork: Do not use overburned, underburned, warped, spalled, cracked, or broken brick. Brick, where exposed, shall be selected when placing for the better face for stretchers and the better end for headers.

a. Testing: Test clay or shale brick daily on the job, prior to laying, as follows: Using a wax pencil, draw a circle the size of a quarter on five randomly selected bricks. Apply 20 drops of water with a medicine dropper to the surface within the circle on each brick. If the average time that the water is completely absorbed in the five bricks is less than 1-1/2 minutes, wet bricks represented by the five bricks tested. During freezing weather, sprinkle units requiring wetting with warm water. Use method of wetting such as to ensure that each unit is nearly saturated, but surface dry when laid.

b. Application: Unless indicated or specified otherwise, lay brick in running bond. Fill joints between bricks completely with mortar. Form bed joints of a thick layer of mortar, smooth on top, not furrowed. Form head joints by applying a full coat of mortar on the entire end or on the entire side of the brick to be laid and then shoving the mortar-covered end or side of the brick tightly against the brick laid previously. The practice of buttering at the corners of brick and then throwing mortar or scrapings into the empty joints will not be permitted. Lay closure bricks with a bed joint and with head joints; place the brick carefully without disturbing the brick previously laid. Dry or butt joints will not be permitted.

c. Brick-Faced Walls: Bond the facing and the concrete masonry unit backing in every sixth brick course with horizontal joint reinforcement. Provide additional bonding ties spaced not more than 3 feet apart around the perimeter of and within 12 inches of all openings.

(1) Collar Joints: Parge the back of the facing or the outside face of the backing with a uniform trowel coat of mortar to fill the collar joint. Apply parging so as not to disturb the alignment and the bond of the masonry units. Do not fill collar joints by slushing.

(2) Brick Sills: Lay brick on edge, slope, and project not less than 1/2 inch beyond the face of the wall to form a wash and drip. Fill all joints solidly with mortar and tool.

3.1.6 Concrete Masonry Unit Work: Lay the first course in a full bed of mortar for the full width of the unit. Lay succeeding courses in running bond unless otherwise indicated. Form bed-joints by applying the mortar to the entire top surfaces of the inner and outer face shells. Form head joints by applying the mortar for a width of about 1 inch to the ends of the adjoining units laid previously. The mortar shall be smooth, not furrowed, and shall be of such thickness that it will be forced out of the joints as the units are being placed in position. Where anchors, bolts, and ties occur within the cells of the units, place metal lath in the joint at the bottom of such cells and fill the cells with mortar or grout as the work progresses. Use concrete brick for bonding walls, working out the coursing, topping out walls under sloping slabs, distributing concentrated loads, backing brick headers, and elsewhere as required. Do not dampen concrete masonry units before or during laying.

3.1.7 Bonding and Anchoring: Completely embed anchors in mortar joints.

a. Corners of Load-Bearing Walls: Provide a true masonry bond in each course.

3.1.8 Through-Wall Flashing: Provide as indicated. Unless indicated otherwise, extend flashing from the exterior face of walls, upward in collar joint not less than 6 inches and into mortar of bed joint for backing wythe. Flashing shall be terminated 3/4 inch back from interior face of walls and turned back on itself not less than 1/2 inch. Secure flashing a permanent watertight joint as indicated. Provide flashing in lengths as long as practicable. Lap ends not less than 1-1/2 inches for interlocking type and 4 inches for other types. Seal laps as necessary to provide watertight construction.

3.1.9 Horizontal Joint Reinforcement: Provide reinforcement where indicated of concrete masonry units. Reinforcement shall be continuous except at control joints and expansion joints. Reinforcement above and below openings shall extend not less than 24 inches beyond each side of openings. Provide reinforcement in the longest available lengths, utilizing the minimum number of splices. Overlap ends not less than 12 inches. Provide welded L-shaped assemblies not less than 40 by 48 inches and T-shaped assemblies not less than 32 by 32 inches, both of the same size members and the same construction as the straight reinforcement, at corners and intersections of walls and partitions. Place the reinforcement and apply mortar so as to provide mortar cover for the wire of at least 5/8 inch for exterior wall face and 1/2 inch for interior wall face.

3.1.10 Concrete Masonry Unit Lintels and Bond Beams: Provide special units, fill cells solidly with grout or concrete, and provide not less than two No. 5 reinforcing bars, unless indicated otherwise. Reinforcing shall overlap a minimum of 40 bar diameters at splices. Concrete masonry units used for lintels and bond beams shall have exposed surfaces of the same material and texture as the adjoining masonry units. Allow lintels to set at least 6 days before shoring is removed. Lintels shall be straight and true and shall have at least 8 inches of bearing at each end.

3.1.11 Grout Placement: Place grout from the interior side of walls, except as approved otherwise. Protect sills, ledges, offsets, and other surfaces from grout droppings. Remove grout from such surfaces immediately. Grout shall be well mixed to prevent segregation and shall be sufficiently fluid to flow into joints and around reinforcing without leaving voids. Place grout by pumping or pouring from buckets equipped with spouts in lifts not exceeding 4 feet. Keep pours at 1-1/2 inches below the top of masonry units in top course, except at the finish course. Puddle or agitate grout thoroughly to eliminate voids. Do not displace masonry from its original position. Remove masonry displaced by grouting operation and re-lay in alignment with fresh mortar.

3.2 CLEANING:

3.2.1 Protection: Protect work which may be damaged, stained, or discolored during cleaning operations.

3.2.2 Pointing: Upon completion of masonry work, cut out defective mortar joints and tuck point joints and all holes solidly with mortar.

3.2.3 Cleaning: Clean exposed masonry surfaces with clear water and stiff fiber brushes and rinse with clear water. Where stains, mortar, or other soil remain, continue cleaning as follows: Thoroughly wet exposed surfaces of dark-colored brickwork with clear water and scrub with stiff

fiber brushes and a solution of not more than 1 part of muriatic acid to 9 parts of water applied to an area of 15 to 20 square feet at a time. Immediately after cleaning each area, rinse thoroughly with clear water. Clean surfaces of light-colored brickwork with non-acid or buffered-acid cleaners as recommended by the brick manufacturer. Use these cleaners in accordance with the instructions and recommendations of the brick and cleaner manufacturers. Immediately after cleaning each area, rinse thoroughly with clear water. Clean other masonry surfaces by scrubbing with warm water and soap and rinsing thoroughly with clear water. Restore damaged, stained, and discolored work to its original condition or provide new work.

*** END OF SECTION ***

SECTION 06201

CARPENTRY AND WOODWORK

PART 1 - GENERAL

1.1 APPLICABLE PUBLICATIONS: The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

1.1.1 Federal Specifications (Fed. Spec.):

FF-B-588C & Am 1	Bolt, Toggle: and Expansion Sleeve, Screw
FF-N-105B & Am 4	Nails, Brads, Staples and Spikes: Wire, Cut and Wrought
FF-S-325 & Am 3	Shield, Expansion; Nail Expansion; and Nail, Drive Screw (Devices, Anchoring; Masonry)
FF-T-1813	Tack

1.1.2 U. S. Department of Commerce, Product Standards (PS):

1-74	Construction and Industrial Plywood
20-70 & Am 1	American Softwood Lumber Standard

1.1.3 American National Standards Institute (ANSI) Publications:

B 18.2.1-72	Square and Hex Bolts and Screws
B 18.5-78	Round Head Bolts
B 18.2.2-72	Square and Hex Nuts
B 18.6.1 (R 77)	Wood Screws

1.1.4 American Wood Preservers' Bureau (AWPB) Publications:

LP-2 (July 1975)	Standard for Softwood Lumber, Timber and Plywood Pressure Treated with Water-born Preservatives for Above Ground Use

LP-4 (July 1975) Standard for Softwood Lumber, Timber and Plywood Pressure Treated with Volatile Petroleum Solvent (LPG) Pental Solution for Above Ground Use

1.1.5 National Forest Products Association (NFPA) Publication:

1977 Edition National Design Specification for Wood Construction. Supplement-1978 Design Values for Wood Construction.

1.2 SUBMITTALS:

1.2.1 Certificates of Grade: Submit certificates on graded but unmarked lumber or plywood (unmarked for reasons of appearance) attesting that these materials meet the grade requirements specified herein. The acceptance of certificates shall in no case jeopardize the Government's right to have lumber or plywood graded by an independent inspection agency when deemed necessary to assure compliance.

1.3 DELIVERY AND STORAGE: Deliver lumber, plywood, trim, and millwork to the job site in an undamaged condition. Stack materials to insure proper ventilation and drainage and protect against dampness before and after delivery. Store materials under cover in a well-ventilated enclosure and protect against extreme changes in temperature and humidity. Do not store materials in the building until concrete and masonry are dry. Replace defective or damaged materials.

1.4 GRADEMARKING:

1.4.1 Lumber: Each piece or each bundle (include millwork and wood trim) shall be identified by the grade mark of a recognized association or independent inspection agency that specializes in the particular species used. Such association or independent inspection agency shall be certified by the Board of Review, American Lumber Standards Committee, to grade the species used.

1.4.2 Plywood: Each sheet of plywood shall bear the mark of a recognized association or independent inspection agency that maintains continuing control over the quality of the plywood. The mark for softwood plywood shall identify the plywood by species group or identification index, and shall show glue type, grade, and compliance with U. S. Department of Commerce PS 1.

1.5 SIZES AND PATTERNS OF WOOD PRODUCTS: Yard and board lumber sizes shall conform to U. S. Department of Commerce PS 20. Except as indicated or specified otherwise, sizes are nominal. Provide shaped lumber and millwork in the patterns indicated and which conform to standard patterns of the association recognized as covering the species used. Size references, unless otherwise specified, are nominal sizes, and actual sizes shall be within manufacturing tolerances allowed by the standard under which the product is produced.

1.6 MOISTURE CONTENT OF WOOD PRODUCTS: Air-dry or kiln-dry lumber. The maximum moisture content of wood products at time of delivery to the job site shall be not more than 15 percent.

1.7 PRESERVATIVE TREATMENT OF WOOD PRODUCTS:

1.7.1 Pressure Treatment: Pressure treat lumber and trim in accordance with AWPB LP-2 or AWPB LP-4.

PART 2 - PRODUCTS

2.1 WOOD:

2.1.1 Lumber: Lumber shall be any of the species and grades listed in NFPA National Design Specification for Wood Construction and Design Values for Wood Construction that have allowable unit stresses not less than 575 psi unit stress in bending (Fb) with 1,400,000 psi modulus of elasticity (E).

2.1.2 Trim and Finish Lumber: Southern Pine, Ponderosa Pine, White Pine, or Douglas Fir, second grade of the species. Casings, bases, and other trim shall be molded with hollow backs. Exposed edges of boards shall be eased. Trim to receive opaque finish may be finger jointed.

2.1.3 Softwood Plywood: U. S. Department of Commerce PS 1.

2.1.3.1 Plywood for Sheathing: Exterior type, C-C grade.

2.2 MISCELLANEOUS:

2.2.1 Hardware: Provide sizes, types, and spacings of manufactured building materials recommended by the product manufacturer except as otherwise indicated or specified. Provide hot-dipped galvanized steel or aluminum nails and fastenings where used on the exterior or exposed to the weather.

2.2.2 Expansion Shields: Fed. Spec. FF-S-325. Except as shown otherwise, maximum size of devices in Groups IV, V, VI, and VIII shall be 3/8 inch.

2.2.3 Toggle Bolts: Fed. Spec. FF-B-588.

2.2.4 Wood Screws: ANSI B 18.6.1.

2.2.5 Wire Nails and Staples: Fed. Spec. FF-N-105.

2.2.6 Tacks: Fed. Spec. FF-T-1813.

2.2.7 Bolts, Nuts, and Studs: ANSI B 18.2.1, ANSI B 18.5, and ANSI B 18.2.2.

2.2.8 Lag Screws and Lag Bolts: ANSI B 18.2.1.

PART 3 - EXECUTION

3.1 INSTALLATION:

3.1.1 General Finish Work: Provide sizes, materials, and designs as indicated or as specified herein. Joints shall be tight and constructed in a manner that will conceal shrinkage. Miter trim and moldings at exterior angles and cope at interior angles and at returns. Material shall show no excessive warp. Install millwork and trim in the maximum practical lengths. Fasten finish work with finish nails. Provide blind nailing where practicable. Set face nails for putty stopping.

3.1.2 General Rough Carpentry: Fit closely, set accurately to the required lines and levels, and secure in place in a rigid and substantial manner. Spiking, nailing, and bolting shall be done in an approved manner; spikes, nails and bolts shall be of the proper size, and care shall be taken so as not to split the members. Members shall be drilled accurately for bolting; suitable washers shall be provided under heads; and nuts and bolts shall be drawn up tight.

*** END OF SECTION ***

SECTION 07220

ROOF INSULATION

PART 1 - GENERAL

1.1 APPLICABLE PUBLICATIONS: The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

1.1.1 American Society for Testing and Materials (ASTM) Publications:

C 726-72 (R-1979)	Mineral Fiber Roof Insulation Board
C 728-72	Perlite Thermal Insulation Board
D 41-78	Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
D 226-77	Asphalt-saturated Organic Felt Used in Roofing and Waterproofing
D 312-78	Asphalt Used in Roofing
D 2626-73	Asphalt-Saturated and Coated Organic Felt Base Sheet Used in Roofing
D 2822-75	Asphalt Roof Cement

1.2 SUBMITTALS:

1.2.1 Samples: Submit one sample not larger than 12 inches square of each type of proposed insulating material. Also submit two samples each of nails and mechanical fasteners, when used to apply insulation.

1.2.2 Manufacturer's Certificates of Conformance or Compliance: Submit certificates for the following:

a. Roof insulation

b. Steep asphalt

c. Adhesive

d. Asphalt roof cement

e. Asphalt felt

1.2.3 Manufacturer's Recommendations: Submit two current copies of insulation manufacturer's recommendations for the following:

a. Application of adhesive for insulation

1.3 DELIVERY AND STORAGE:

1.3.1 Delivery: Deliver materials to the site in original sealed containers or packages bearing manufacturer's name and brand designation. Where materials are covered by a referenced specification, containers or packages shall bear specification number, type, and class as applicable. Each container of asphalt shall bear flash point (FP), equiviscous temperature (EVT), and finished blowing temperature (FBT) or this information shall be shown on the accompanying bills of lading. Deliver materials in sufficient quantity to allow continuity of work.

1.3.2 Storage: Store, handle, and install materials in a manner to protect them from damage and from wetting and moisture absorption during entire construction period. For 24 hours immediately before laying, store felt rolls on ends in an area maintained at a temperature no lower than 50 degrees F. Replace damaged material with new material.

1.4 ENVIRONMENTAL CONDITIONS: Do not install roof insulation during inclement weather or when air temperature is below 40 degrees F or is expected to go below 40 degrees F, within 24 hours after installation, or when there is ice, frost, or dampness visible on the roof deck.

1.5 PROTECTION OF PROPERTY: Provide protection as specified in Section 07511.

PART 2 - PRODUCTS

2.1 MATERIALS: Materials shall conform to the respective specifications and standards and to requirements specified herein.

2.1.1 Roof Insulation:

2.1.1.1 Roof insulation shall be one of the following materials:

a. Mineral fiber board: ASTM C 726, except that the top surface of the insulation shall have an impact-resistant, factory-applied facing.

b. Expanded perlite board: ASTM C 728.

2.1.1.2 Insulation Thickness: Not less than 1/2 inch.

2.1.2 Cants and Tapered Edge Strips: Preformed cants shall be of the same material as the roof insulation, unless unavailable. If cants or edge strips of the same material as the roof insulation are unavailable, provide pressure preservative treated wood or rigid perlite board cants and edge strips.

2.1.3 Asphalt Primer: ASTM D 41.

2.1.4 Steep Asphalt: ASTM D 312, Type III or IV.

2.1.5 Asphalt Roof Cement: ASTM D 2822 Type I.

2.1.6 Rosin-sized Building Paper or Unsaturated Felt: Building paper or felt shall weigh not less than 5 pounds per 100 square feet.

2.1.7 Asphalt-saturated Felts: ASTM D 226.

2.1.8 Asphalt-saturated Felt Base Sheet: ASTM D 2626.

2.1.9 Nails and Fasteners: Nails and fasteners shall be flush-driven through flat metal discs of not less than 1-3/8-inch diameter. Metal discs may be omitted when one-piece composite nails or fasteners with heads not less than one inch diameter are used.

2.1.9.1 Nails and Fasteners for Plywood Decks: Roofing nails for plywood decks shall be annular ring shank, square head, one-piece, composite nails. Nails shall be long enough to penetrate into plywood decks approximately 1/2 inch, but shall not protrude through underside of decking. Approved zinc coated staples, installed through metal caps, may be substituted for composite nails.

2.1.10 Metal Discs: Flat discs or caps of zinc coated steel not lighter than 28-gage and not less than 1-3/8-inch diameter. Disc shall be formed to prevent dishing. Bell or cup-shaped caps are not acceptable.

PART 3 - EXECUTION

3.1 CONDITION OF SURFACES:

3.1.1 Inspection of Surfaces: Surfaces on which vapor barrier and insulation is to be installed shall be clean, smooth, and dry. Surfaces receiving vapor barrier shall also be free of projections which might puncture the vapor barrier. Condition of surfaces will be inspected and approved by the Contracting Officer immediately before installation is started.

3.1.2 Preparation of Surfaces: Check roof deck surfaces for defects before work is started; correct defects and inaccuracies in roof deck surface to eliminate poor drainage, hollow, and low spots. Exercise care in the inspection of wood decks, to ascertain that deck boards have been properly nailed and that exposed nail heads have been set. Fill or cover knot holes in wood decks as necessary to form an unyielding surface for installation of vapor barrier and insulation.

3.2 APPLICATION: Keep roof insulating materials dry before, during, and after installation. Keep insulation 1/2 inch clear of vertical surfaces penetrating and projecting from the roof surface.

3.2.1 Temperature of Steep Asphalt: When installing vapor barrier and insulation, apply asphalt when temperature of asphalt is within 25 degrees F of equiviscous temperature (EVT). Do not heat asphalt to or above flash point (FP). Do not heat asphalt above the finish blowing temperature (FBT) for longer than 4 consecutive hours. Use thermometers to check temperatures during heating and application. Have kettlemen in attendance at all times during heating process to insure that maximum temperatures specified are not exceeded.

3.2.2 Wood Nailers: Pressure preservative treated wood nailers for securing insulation [or for nailing of roofing felts,] are specified in Section 06100, "Rough Carpentry." Verify prior to the installation of insulation that nailers the same thickness as insulation have been provided at eaves, edges, curbs, and roof openings for securing cant strips, gravel stops, gutters, and flashing flanges.

3.2.3 Vapor Barrier: Vapor barrier shall consist of two plies of No. 15 asphalt-saturated felt or one layer of asphalt-saturated felt base sheet, weighing not less than 35 pounds per 100 square feet. Lay vapor barrier at right angles to the direction of slope. Install first ply of felt or base sheet as specified herein for the specific deck. Solidly mop in place with steep asphalt the second ply of the two-ply vapor barrier system. Apply steep asphalt at the rate of at least 20 pounds per 100 square feet. Place vapor barrier free of wrinkles or buckles. Press out air bubbles to obtain complete adhesion between surfaces. At walls, edges, and other vertical projections, extend vapor barrier 6 inches to form a lap which shall later be wrapped around edge of insulation.

3.2.3.1 Vapor Barrier on Wood Decks: Before vapor barrier is installed, cover surfaces with a layer of rosin-sized building paper or unsaturated felt. Side and end laps of building paper or unsaturated felt shall be not less than 3 inches, and nailing shall be sufficient to prevent tearing or buckling the paper during installation. Lay dry the first ply of the two-ply vapor barrier system with each sheet lapping 2 inches over the preceding sheet. Provide end laps not less than 4 inches and stagger laps a minimum of 12 inches. Nail the felt at 6-inch intervals along the side laps and install two rows of nails approximately 11 inches apart down the longitudinal center of each sheet,

with nails staggered at 18 inches on centers. For vapor barrier, consisting of one layer of asphalt base sheet, lap each sheet 4 inches over the preceding sheet. Provide end laps not less than 4 inches and stagger laps a minimum of 12 inches. Cement together the side and end laps with a solid mopping of steep asphalt or asphalt roof cement and nail the side laps at 6-inch intervals. Install two rows of nails approximately 11 inches apart down the longitudinal center of each sheet, with nails staggered at 18 inches on centers.

3.2.4 Insulation:

3.2.4.1 Insulation Installation: Install insulation over a vapor barrier which has been installed as specified herein. Firmly embed each layer in a solid steep asphalt mopping; mop only sufficient area to provide complete embedment of one board at a time. Use not less than 25 pounds of asphalt per 100 square feet of roof deck for mopping each layer of insulation in place.

3.2.5 Cant Strips: Where indicated, provide cant strips at intersections of the roof with walls, parapets, and curbs extending above the roof. The face of cant strips shall have an incline of 45 degrees. Cant strips shall bear on the wood nailers and fit flush against vertical surfaces. Where possible, nail cant strips to adjoining surfaces. Where cant strips are installed against non-nailable materials, install cant strips in a heavy mopping of steep asphalt or set in asphalt roof cement.

*** END OF SECTION ***

SECTION 07511

AGGREGATE SURFACED BITUMINOUS BUILT-UP ROOFING

PART 1 - GENERAL

1.1 APPLICABLE PUBLICATIONS: The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

1.1.1 Federal Specification (Fed. Spec.):

SS-C-153C	Cement; Bituminous, Plastic

1.1.2 American Society for Testing and Materials (ASTM) Standards:

D 41-78	Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
D 250-80	Asphalt-Saturated Asbestos Felts Used in Roofing and Waterproofing
D 312-78	Asphalt Used in Roofing
D 1863-80	Mineral Aggregate for Use On Built-Up Roofs
D 2170-76	Kinematic Viscosity of Asphalt (Bitumen)
D 2178-76	Asphalt-Impregnated Glass Mat Used in Roofing and Waterproofing
D 3378-80	Asphalt-Saturated and Coated Asbestos Felt Base Sheet Used in Roofing
D 3672-78	Venting Inorganic Base Sheet In Built-up Roofing

1.2 PRE-ROOFING CONFERENCE: Prior to starting the application of the roofing system and insulation, there will be a pre-roofing conference with the Contracting Officer to assure a clear understanding of drawings and specifications. The conference shall be attended by the Contractor, roofing and insulation subcontractor and flashing and sheetmetal subcontractor.

1.3 SUBMITTALS:

1.3.1 Certificates of Conformance or Compliance: Submit certificates from the manufacturers certifying that materials to be provided comply with the physical and chemical properties and values required by the referenced publications.

1.3.2 Descriptive Literature: Submit manufacturers' application instructions and technical data sheets or catalog cuts on materials specified herein.

1.3.3 Bill of Lading for Roofing Asphalt: Submit 2 copies of the bill of lading for the roofing asphalt when labels of asphalt containers do not bear the flash point, finish blowing temperature, and equiviscous temperature.

1.4 DELIVERY, STORAGE, AND HANDLING:

1.4.1 Delivery: Deliver materials in manufacturers' original unopened containers and rolls with manufacturer's labels intact and legible. Where materials are covered by a referenced specfication, the container shall bear the specification number, type, and class, as applicable. Labels or bill of lading for roofing asphalt shall indicate bitumen type, flash point (FP), finish blowing temperature (FBT), and equiviscous temperature (EVT), i.e., the temperature at which the viscosity is 125 centistokes when tested in accordance with the requirements of ASTM D 2170. Deliver materials in sufficient quantity to allow continuity of work.

1.4.2 Storage: Protect roll materials against moisture absorption. Store roll materials on end on clean raised platforms in dry locations with adequate ventilation. Do not store roll materials in buildings under construction until concrete, mortar, and plaster work is finished and dry. Immediately before application, store roll materials for 24 hours in an area maintained at temperatures above 50 degrees F. Completely cover felt stored outdoors with waterproof protective coverings. Tie covering securely to the pallets in such a way as to be completely weathertight and yet provide sufficient ventilation to prevent condensation. Polyethylene coverings are not permitted. Do not store more materials on the roof than can be installed the same day. Locate materials temporarily stored on the roof in approved areas and distribute the load to stay within the live load limits of the roof construction.

1.4.3 Handling: Select and operate material handling equipment so as not to damage existing construction and applied roofing. Handle roll materials in a manner to prevent damage to edges and ends.

1.5 ENVIRONMENTAL CONDITIONS: Application will not be permitted during inclement weather or when air temperature is below 40 degrees Fahrenheit (F) or is expected to go below 40 degrees F within 24 hours after application, or when there is ice, frost, surface moisture, or visible dampness on the roof deck.

1.6 PROTECTION OF PROPERTY:

1.6.1 Protective Coverings: Install protective coverings at paving and building walls adjacent to hoist and kettles prior to starting the work. Lap protective coverings not less than 6 inches, secure against wind, and vent to prevent collection of moisture on covered surfaces. Protective coverings shall remain in place for the duration of the roofing work.

1.6.2 Flame-heated Equipment: Locate and use flame-heated equipment at locations that will not endanger the structure or other materials on the site or adjacent property. Do not place flame-heated equipment on the roof. Provide and maintain one fire extinguisher of appropriate type and size adjacent to flame-heated equipment.

1.7 WARRANTY: The Contractor shall warrant for 5 years from the Beneficial Occupancy Date (BOD) that the built-up roofing is free of defective materials and workmanship. Repairs that become necessary because of defective materials and workmanship while the roofing is under warranty shall be performed by the Contractor within 72 hours of notification, unless additional time is approved by the Contracting Officer. Failure to perform repairs within the specified period of time will constitute grounds for having repairs performed by others and the cost billed to the Contractor.

PART 2 - PRODUCTS

2.1 DESCRIPTION OF ROOFING SYSTEMS: Provide one of the following roofing systems:

2.1.1 SYSTEM AAA: Asbestos felt, asphalt bitumen, aggregate surfaced.

Substrate: Roof Insulation	
Components:	Quantity:
Plying Felt (AA15) 4 Plies	
Asphalt:	
Between Substrate and First Ply	15-20 Lbs/100 sq. ft.
Between Adjacent Plies	15-20 Lbs/100 sq. ft.
Top Coat:	55-65 Lbs/100 sq. ft.
Surfacing:	
Gravel	400 Lbs/100 sq. ft.
or other	
Aggregate	300 Lbs/100 sq. ft.

2.1.2 SYSTEM GAA: Glass mat, asphalt bitumen, aggregate surfaced.

Substrate: Roof Insulation	
Components:	Quantity:
Plying Felt (GA)	4 Plies
Asphalt:	
Between Substrate and First Ply	20-30 Lbs/100 sq. ft.
Between Adjacent Plies	20-30 Lbs/100 sq. ft.
Top Coat	55-65 Lbs/100 sq. ft.
Surfacing:	
Gravel or other Aggregate	400 Lbs/100 sq. ft. 300 Lbs/100 sq. ft.

2.2 MATERIALS: Shall conform to the respective specifications and to the requirements specified herein.

2.2.1 Bitumen:

2.2.1.1 Asphalt:

Specification	Softening Point (deg. F)
ASTM D 312, Type III	185-205

2.2.2 Felts: Felts for built-up roofing and flashing shall conform to the specifications and requirements listed in the following table:

Designation	Use	Felt or Mat	Saturant or Impregnant	Coating	Specification
AA15	Plying Felt	Asbestos	Asphalt	None	ASTM D 250, Type I, Min. Wt. 13 lbs./sq.
GA	Plying Felt	Glass	Asphalt	None	ASTM D 2178, Type IV
AB	Base Felt	Asbestos	Asphalt	Asphalt	ASTM D 3378 Type I or II
VB	Venting Base Felt	Asbestos or Glass	Asphalt	Asphalt	ASTM D 3672, Type I for use with asbestos felts, Type II for use with glass felts

FF	Flashing Felt	None (see Note (1))

Note (1) Flashing felt shall be of a type specifically prepared in the manufacturing process for use in two-ply base flashing construction and shall be one of two types; (A) A single thickness of glass felt conforming to the properties listed in ASTM D 2178, for Type IV, modified as described below or (B) Felt reinforced with a woven glass fiber scrim or cotton fabric manufactured with a single thickness of asbestos felt impregnated with asphalt. Both types, i.e., (A) and (B) are then coated in the manufacturing process on both sides with an asphaltic coating which may include a fine mineral stabilizer insoluble in water and surfaced on both sides with a fine mineral surfacing.

2.2.3 Primer: ASTM D 41 for asphalt.

2.2.4 Bituminous Plastic Cement: Fed. Spec. SS-C-153, Type I, for asphalt saturated or coated materials.

2.2.5 Aggregate for Surfacing Built-up Roofing: Water-worn gravel, crushed stone, crushed slag, all conforming to ASTM D1863, or marble, expanded slag, or expanded shale, all conforming to ASTM D 1863 except that density is not less than 55 pcf. Aggregate shall be opaque.

2.2.6 Unsaturated Felt or Rosin-sized Building Paper: Minimum weight, 5 pounds per 100 square feet.

2.2.7 Fasteners: Provide fasteners of nonferrous metal or galvanized steel, except for fastening metal items of copper, aluminum, and stainless steel. Use hard copper fasteners for copper items, aluminum or stainless steel fasteners for aluminum items, and stainless steel fasteners for stainless steel items. For roofing felts, use fasteners flush-driven through metal disc, or one-piece composite fasteners with heads not less than one inch in diameter or one inch square with rounded or 45-degree tapered corners.

2.2.7.1 Fasteners for Securing Felts and Metal Items to Wood Nailers: 11-gage annular threaded shank nails with 7/16- to 5/8-inch diameter heads; or one-piece composite nails with annular threaded shanks not less than 11-gage. Fasteners shall be long enough to penetrate the wood nailer not less than one inch, when driven through the material to be fastened.

2.2.8 Metal Discs (Tin-caps): Flat discs or caps of zinc-coated sheet metal not lighter than 28-gage and not less than 1-3/8 inches in diameter. Discs shall be formed to prevent dishing. Bell or cup-shaped caps are not acceptable. Omit disc when one-piece composite fasteners are used.

PART 3 - EXECUTION

3.1 CONDITION OF SURFACES: Insure that the following conditions exist prior to application of the roofing materials:

a. Surfaces are rigid, dry, smooth, and free from cracks, holes, and sharp changes in elevation.

b. The plane of the substrate does not vary more than 1/4 inch within an area 10 feet by 10 feet.

c. Substrate is sloped as indicated to provide drainage.

d. Treated wood nailers are securely fastened in place at eaves, gable ends, openings, and intersections with vertical surfaces for securing of felts, edging strips, gravel stops, and roof fixtures. Nailers are the same thickness as the insulation.

e. Cants are securely fastened in place in the angles formed by walls and other vertical surfaces. The angle of the cant is 45 degrees and the height of the vertical leg is not less than nominal 4 inches. Cants are constructed of wood or insulation board.

f. Insulation boards are installed smooth and even, and are not broken, cracked, or curled.

3.2 PREPARATION: Coordinate the work with that of the other trades to assure that components which are to be secured to or stripped into the roofing system are available and that flashing and counterflashing is installed as the work progresses.

3.2.1 Priming of Surfaces:

3.2.1.1 Priming of Metal Surfaces: Prime flanges of metal gravel stops, edging strips, flashing collars, and accessories with bituminous plastic cement prior to stripping into the roofing system.

3.2.2 Heating of Asphalt: Break up solid bitumen on a surface free of dirt and debris. Heat bitumen in a kettle or tanker designed to prevent contact of flame with surfaces in contact with the bitumen. Kettles and tankers shall have visible thermometer and thermostatic controls set to the temperature limits specified herein. Maintain controls in working order and calibrated. Use immersion thermometer accurate to "plus or minus 2 degrees" to check temperatures of the bitumen frequently. If temperatures exceed maximums specified, the bitumen shall be removed from the site. Upon determination that the temperature of the bitumen, at the instant of application, is below the minimum specified, the affected roofing shall be removed and replaced with new material. Cutting back, adulterating, or fluxing of bitumen is not permitted.

3.3 APPLICATION: Apply roofing materials as specified herein unless specified or recommended otherwise by the manufacturer's printed application instructions. Keep roofing materials dry before, during, and after application. Apply only as much roofing in one day as can be protected the same day. Maintain the specified temperatures for the bitumen. Do not apply top surfacing until the other roofing application procedures specified herein are completed.

3.3.1 Bitumen Stops: Provide bitumen stops at roof edges, openings, and at vertical projections prior to application of the felts. Form bitumen stops with two 12-inch wide strips of plying felt. Strips shall be laminated with, and set into, a coating of bituminous plastic 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 12 inches o.c. in addition to embedding in bituminous plastic cement. After the plies of felt are in place, fold the free portion of the strips back over the roofing membrane and embed in a continuous coating of bituminous plastic cement. Secure with roofing nails spaced 3 inches o.c. The optional use of sheet metal bitumen stops is permitted as approved.

3.3.2 Plying Felts: Apply plying felts shingle fashion in hot-moppings of bitumen as specified herein. Apply felts in a continuous operation. Phased construction is not permitted. Provide starter sheets of felt to maintain the specified number of plies of felt throughout the roofing. Apply felts of 36-inch widths, as specified herein, with side laps not less than 27-1/2 inches and starter sheets of not less than 9, 18, 27, and 36 inch widths. Provide end laps of not less than 6 inches and staggered a minimum of 12 inches. 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 2 inches above the tops of cant strips and fasten at approximately 8 inches o.c. Trim felts to a neat fit around vent pipes, and other projections through the roof.

3.3.2.1 Hot-Mopping of Plying Felts: Use hot bitumen for bonding of plies of felt to each other and to the substrate. Apply the felts immediately following the application of the hot bitumen. Working ahead with the bitumen is not permitted. The bitumen shall be completely fluid, with mop temperatures within the range specified, at the instant the felts come into contact with the bitumen. Embed felts in the bitumen. As felts are being rolled into the hot bitumen, immediately and thoroughly broom down to eliminate trapped air and to provide tight smooth laminations resulting in a composite roofing membrane without wrinkles, buckles, kinks, and fish mouths. The completed roofing system shall be free of pockets and blisters. The practice of laying the felts dry and turning back the laps for mopping between plies is not permitted.

3.3.2.2 Temperature Limitations for Bitumen: Heat and apply bitumen at the temperatures specified below unless specified otherwise by the manufacturer. Use thermometer to check temperature during heating and application. Have kettleperson in attendance at all times during heating process to insure that temperatures specified are maintained.

3.3.2.2.1 Asphalt: Do not heat asphalt more than 25 degrees F above the finish blowing temperature (FBT), and do not heat asphalt above the FBT for longer than 4 consecutive hours. Do not heat asphalt above the flash point (FP). Apply asphalt and embed roofing felts when the temperature of the asphalt is not lower than 25 degrees F below the equiviscous temperature (EVT) and not higher than 25 degrees F above the EVT. Before heating and application of the asphalt refer to the asphalt manufacturer's label or bill of lading for the FBT, FP, and EVT of the asphalt used.

3.3.3 Flashing: Provide built-up bituminous flashing in the angles formed where the roof deck abuts curbs, pipes, and other vertical surfaces, and where necessary to make the work watertight. Install flashing after plies of felt have been applied but before the top surfacing is applied.

3.3.3.1 Base Flashing: Use one of the following base flashing systems as recommended by the manufacturer of the plying felt used in the roofing membrane:

3.3.3.1.1 Three-ply Bituminous Built-up Base Flashing: Provide three plies of AA15 plying felt conforming to the requirements specified herein. Embed each ply in a uniform trowelling of bituminous plastic cement not less than 1/8 inch thick. Smooth and press felts firmly into place so that a uniformly attached and completely laminated membrane results. Extend felts not less than 6, 9, and 12 inches, respectively, over the roofing membrane beyond the toe of the cant, and not less than 4 inches or more than 10 inches above the top of the cant on vertical surfaces. Lap ends of felts not less than 12 inches and seal watertight with bituminous plastic cement. Stagger end laps. Nail top edges of base flashing to wood nailers with large head roofing nails through metal discs or one-piece composite fasteners spaced not more than 8 inches o.c. on a line 1-1/2 inches below the top edge of the base flashing. Coat the finished base flashing with bituminous plastic cement 1/8 inch thick, extending from one inch above the top of the base flashing on the vertical surface to one inch beyond the edge of the base flashing on the roofing membrane.

3.3.3.1.2 Two-ply Bituminous Built-up Base Flashing: Provide one ply of plying felt, AA15 or GA, and one ply of flashing felt, FF, in accordance with the manufacturer's printed installation instructions.

3.3.3.2 Strip Flashing: Set flanges of sheet metal work to be incorporated into the roofing system into a uniform coating of bituminous plastic cement not less than 1/16 inch thick, and strip-in with two layers of plying felt cemented to the tops of the flanges, roofing membrane, and to each other with coatings of bituminous plastic cement not less than 1/16 inch thick. Extend felts 3 and 6 inches, respectively, beyond the edges of the flanges and onto the roofing membrane. Coat the finished strip flashing with bituminous plastic cement 1/8 inch thick.

3.3.4 Top Surfacing: Provide aggregate surfacing materials after felt flashings, tests, repairs, and corrective action have been completed and approved. Embed aggregate surfacing in a top coat of hot bitumen poured from a dipper or approved bitumen spreading device.

3.4 CLEANUP: Each day remove from the job site debris, scraps, containers, and other rubbish and trash resulting from the installation of the roofing system.

3.5 INFORMATION CARD: Provide a typewritten card, framed under glass, in a weathertight frame, for each roof. This card shall contain the information listed on the attached Form 1. Install the card near the point of access to the roof, as directed. Submit a duplicate card to the Contracting Officer.

*** END OF SECTION ***

SECTION 07600

FLASHING AND SHEET METAL

1. APPLICABLE PUBLICATIONS: The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

1.1 Federal Specifications (Fed. Spec.):

O-F-506C	Flux Soldering; Paste and Liquid
QQ-S-571E & Am 2	Solder; Tin Alloy; Lead-Tin Alloy; and Lead Alloy
SS-C-153C	Cement; Bituminous, Plastic
UU-B-790A & Am 1	Building Paper, Vegetable Fiber; (Kraft, Waterproofed, Water Repellent and Fire Resistant)

1.2 American Society for Testing and Materials (ASTM) Publications:

A167-77	Stainless and Heat Resisting, Chromium-Nickel Steel Plate, Sheet and Strip
B209-77	Aluminum-alloy Sheet and Plate
B221-76A	Aluminum-alloy Extruded Bars, Rods, Wire Shapes, and Tubes
D41-73	Primer for Use with Asphalt in Dampproofing and Waterproofing

1.3 American Welding Society (AWS) Publications:

A6.1-66	Recommended Safe Practices for Gas-shielded Arc Welding
D1.1-75	Structural Welding Code, with Rev. 1-1976 and Rev. 2-1977

1.4 Sheet Metal and Air Conditioning Contractors National Association, Incorporated (SMACNA) Publications:

Architectural Sheet Metal Manual (Second Edition 1968).

1.5 American National Standards Institute (ANSI) Publications:

Z49.1-1973 Safety in Welding and Cutting

2. SUBMITTALS:

2.1 Shop Drawings: Submit shop drawings for approval indicating thicknesses, dimensions, fastenings and anchoring methods, expansion joints, and other provisions necessary to provide for thermal expansion and contraction. Scaled catalog cuts may be submitted for factory fabricated items. Submit shop drawings for the following items.

Covering on minor flat, pitched, or curved surfaces.

Gutters and downspouts.

Gravel stops and fascias.

2.2 Certificates of Conformance or Compliance: Submit for approval certificates from the manufacturer attesting that materials meet the requirements specified herein.

3. DELIVERY, HANDLING, AND STORAGE: Materials shall be adequately packaged and protected during shipment and shall be inspected for damage, dampness, and wet-storage stains upon delivery to the job site. Damaged or permanently stained materials that cannot be restored to like-new condition shall be removed from the site and replaced. Carefully handle sheet metal items to avoid damage to surfaces, edges, and ends. Crated materials shall not be uncrated until ready for use. Store materials in dry, weather-tight, ventilated areas until immediately before installation.

4. MATERIALS: Materials shall conform to the respective specifications and to the requirements specified herein. Furnish sheet metal items in 8 to 10 foot lengths. Single pieces less than 8 feet long may be used to connect to factory fabricated inside and outside corners, and at ends of runs. Accessories and other items essential to complete the sheet metal installation shall be provided and shall be of the same materials as the items to which they are applied.

4.1 Stainless Steel: ASTM A167, type 302 or 304, finish 2D, fully annealed, dead soft temper.

4.2 Aluminum Alloy Sheet and Plate: ASTM B209, Alclad 3003, Alclad 3004, or Alclad 3005, embossed finish, clad on one side unless indicated otherwise; temper appropriate to end use. Exposed exterior sheet metal items of aluminum shall have a baked-on, factory-applied color coating of polyvinylidene fluoride (PVF2) or other equivalent fluorocarbon coating after metal substrates have been properly cleaned and pretreated; finish coating dry-film thickness to be 0.8 - 1.3 mils; color to be white.

4.3 Aluminum Alloy, Extruded Bars, Rods, Shapes, and Tubes: ASTM B221.

4.4 Soldering Flux: Fed. Spec. O-F-506, type I, form A or B.

4.5 Solder: Fed. Spec. QQ-S-571, composition Sn 60 for stainless steel.

4.6 Bituminous Plastic Cement: Fed. Spec. SS-C-153, type I with asphalt roofing felts.

4.7 Building Paper: Fed. Spec. UU-B-790, style 4, grade B.

4.8 Asphalt Primer: ASTMD 41.

4.9 Fasteners: Fasteners shall be the same metal or a metal compatible with the item fastened. Use aluminum fasteners with aluminum and stainless steel fasteners with stainless steel.

5. OPTIONAL MATERIALS: Optional materials are listed in Table I. Any of the optional materials specified therein may be selected by the Contractor; however, all exposed sheet metal items shall be of the same material. The following items shall be considered as exposed sheet metal: gutters, including hangers; downspouts and leaders; gravel stops and fascias.

6. SHEET METAL: Provide flashing in the angles formed where roof decks abut walls, curbs, ventilators, pipes or other vertical surfaces and wherever indicated and necessary to make the work watertight. All sheet metal shall have mill finish unless specified otherwise herein. Tempers of metals shall be suitable for their respective forming conditions. Fabricate sheet metal items to the gage, thickness or weight shown in Table I and join multiple lengths of items together as shown in Table II.

7. INSTALLATION:

7.1 General: Surfaces to receive sheet metal must be plumb and true, clean, even, smooth, dry and free from defects and projections which might affect the application. Installation of items not shown in detail or not covered by specifications shall meet the applicable requirements of the SMACNA Architectural Sheet Metal Manual.

7.2 Workmanship: Install sheet metal work with lines, arrises, and angles sharp and true. Exposed surfaces shall be free from visible wave, warp, and buckle, and tool marks. Exposed edges shall be folded back neatly to form a 1/2-inch hem on the concealed side. Sheet metal exposed to the weather shall be watertight with provisions for expansion and contraction.

7.3 Nailing: Nailing of sheet metal shall be confined generally to sheet metal having a maximum width of 18 inches. Nailing or flashings shall be confined to one edge only. Nails shall be evenly spaced not over 3 inches on centers and approximately 1/2-inch from edge unless otherwise specified or indicated. Face nailing will not be permitted. Where sheet metal is applied to other than wood surfaces, detailed shop drawings shall include locations for sleepers and nailing strips required to properly secure the work.

7.4 Cleats: Provide cleats for sheet metal 18 inches and over in width. Space cleats evenly not over 12 inches on centers unless otherwise specified or indicated. Unless otherwise specified, cleats shall be not less than 2 inches wide by 3 inches long and of the same material and thickness as the sheet metal being installed. One end of the cleat shall be secured with two nails and the cleat folded back over the nailheads. The other end shall be locked into the seam. Cleats for soldered seams shall be pretinned.

7.5 Bolts, Rivets, and Screws: Install bolts, rivets, and screws where indicated or required. Provide compatible washers where required to protect surface of sheet metal and to provide a watertight connection.

7.6 Seams: Straight and uniform in width and height with no solder showing on the face.

7.6.1 Flat-lock Seams: Finish not less than 3/4-inch wide.

7.6.2 Lap Seams: Finish soldered seams not less than one inch wide. Overlap seams not soldered, not less than 3 inches.

7.6.3 Loose-lock Expansion Seams: Not less than 3 inches wide, and shall provide minimum one inch movement within the joint. Joint shall be completely filled with the specified sealant, applied at not less than 1/8-inch thick bed. Sealants are specified in Section CALKING AND SEALANTS.

7.6.4 Standing Seams: Not less than one inch high, double locked without solder.

7.6.5 Flat Seams: Make seams in the direction of the flow.

7.7 Soldering, Welding, and Mechanical Fastening: Where soldering is specified herein it shall apply to stainless steel items. Welding is specified for aluminum of thickness greater than 0.040inch. Aluminum 0.040-inch or less in thickness shall be butted with space and backed with formed flashing plate; or lock joined, mechanically fastened, and filled with sealant as recommended by the aluminum manufacturer.

7.7.1 Soldering: Pretin edges of sheet metals before soldering is begun. Soldering shall be done slowly with well heated soldering irons so as to thoroughly heat the seams and completely sweat the solder through the full width of the seam. Edges of lead-coated material to be soldered shall be scraped or wire-brushed to produce a bright surface, and seams shall have a liberal amount of flux brushed in before soldering is begun. Edges of stainless steel to be pretinned shall be treated with soldering acid flux. Soldering shall follow immediately after application of the flux. Upon completion of soldering the acid flux residue shall be thoroughly cleaned from the sheet metal with a solution of washing soda in water and rinsed with clean water. Joints in aluminum sheets 0.040-inch or less in thickness shall be made mechanically and sealed with the sealant specified. Aluminum shall not be soldered.

7.7.2 Welding of Aluminum: Joints in aluminum sheets more than 0.040-inch thick shall be welded. Welding shall be of the inertgas, shield-arc type. The procedures, the appearance and quality of welds made, and the methods used in correcting welding work shall conform to AWS Standard D1.1. Health and safety procedures shall conform to AWS A6.1 and ANSI Z49.1.

7.7.3 Mechanical Fastening of Aluminum: No. 12 aluminum alloy sheet metal screws or other suitable aluminum alloy or stainless steel fasteners driven in holes made with a No. 26 drill, shall be used in securing side laps, end laps, and flashings. Maximum spacing for fasteners shall be 12 inches O.C. Where end lap fasteners are required to improve closure, they shall be located not more than 2 inches from the end of the overlapping sheet.

7.8 Protection from Contact of Dissimilar Materials:

7.8.1 Aluminum: Surfaces shall not contact other metals except stainless steel, zinc, or zinc coating. Where aluminum contacts another metal, the dissimilar metal shall be painted with a primer followed by two coats of aluminum paint.

7.8.2 All Metal: Surfaces in contact with mortar, concrete, or other masonry materials shall be painted with alkali-resistant coatings such as heavy-bodied bituminous paint.

7.8.3 Wood or Other Absorptive Materials: Surfaces that may become repeatedly wet and in contact with metal shall be painted with two coats of aluminum paint or a coat of heavy-bodied bituminous paint.

7.9 Provision for Expansion and Contraction: Provide expansion and contraction joints at not more 32-foot intervals for aluminum and at not more than 40-foot intervals for other metals, except that where the distance between the last expansion joint and the end of the continuous run is more than half the required interval spacing an additional joint shall be provided. Space joints evenly. Extruded aluminum gravel stops and fascias shall be joined by expansion and contraction joints at not more than 12-foot spacing.

7.10 Gravel Stops and Roof Edge Fascias: Prefabricate in the shapes and sizes indicated and in lengths not less than 8 feet. Extend flange at least 4 inches onto roof deck. Provide prefabricated mitered corners for internal and external corners. Install gravel stops and fascias after all plies of the roofing membrane have been applied, but before the flood coat of bitumen is applied. Prime roof flange of gravel stops and fascias on both sides with an asphalt primer. After primer has dried, set flange on top of the roofing felts in a 1/8-inch thick bed of plastic cement. Nail flange securely to wood nailer with large-head barbed-shank roofing nails 1-1/2 inches long spaced not more than 3 inches on centers.

7.10.1 Hook Strips: The lower edge of fascias shall be hooked at least 3/4-inch over a continuous hook strip of the same material bent outward at an angle of 45 degrees to form a drip. Nail hook strip to a wood nailer at 6 inches maximum on centers. Where fastening is made to concrete or masonry, screws spaced 12 inches O.C. shall be used and shall be driven in expansion shields set in the concrete or masonry. Where horizontal wood nailers are slotted to provide for insulation venting, install hook strips in such a manner that vent slots are not obstructed. Where necessary, install hook strips over 1/16-inch thick compatible spacer or washers.

7.10.2 Joints: Section ends of gravel stops and fascias shall be left open 1/4-inch and backed with a formed flashing plate, mechanically fastened in place and lapping each section end a minimum of 4-inches; set laps in plastic cement. Face nailing will not be permitted. Extruded aluminum gravel stops and fascias shall be installed in accordance with the manufacturer's printed instructions and details.

7.11 Gutters: The hung type of shape indicated and supported on underside by brackets that permit free thermal movement of the gutter. Provide gutters in sizes indicated complete with mitered corners, end caps, outlets, brackets, and other accessories necessary for installation. Gutters shall be fabricated of aluminum, or stainless steel. The outer edge of gutter shall be beaded or reinforced with a stiffening bar not less than 3/4 by 3/16-inch of material compatible with gutter. Gutters shall be fabricated in sections not less than 8 feet long. The sections shall be lapped a minimum of one inch in the direction of flow. Gutters, other than aluminum shall be joined by riveted and soldered joints. Aluminum gutters shall be joined with riveted sealed joints. Expansion-type slip joints shall be provided midway between outlets. Install gutters below slope line of the roof so that snow and ice can slide clear. Support gutters on approved type adjustable hangers spaced not more than 30 inches on centers. Gutters shall be adjusted to slope uniformly to outlets, with high points occuring midway between outlets. Hangers and fastenings shall be fabricated from metals compatible with the gutters.

7.12 Downspouts: The corrugated type, of the shapes and sizes indicated, and provided complete including elbows and offsets. Downspouts shall be provided in approximately 10-foot lengths; end joints shall telescope not less than 1/2-inches, and longitudinal joints shall be locked. Gutter outlets shall be provided with wire ball strainers of a standard type for each outlet. Strainers shall fit tightly into outlets and shall be of the same material used for gutters. Downspouts shall be kept not less than one inch away from walls and shall be fastened to the walls at top, bottom, and at not to exceed 5 foot centers intermediately between, with approved type leader straps or concealed rack-and-pin type fasteners; straps and fasteners shall be formed from metal compatible with the downspouts. Downspouts terminating in splash blocks shall be provided with elbow-type fittings. Splash blocks shall be concrete.

7.13 Bitumen Stops: May be provided at eaves and rakes in lieu of felt envelopes. Bitumen stops shall be either (a) the rigid type with a 3/4-inch minimum vertical leg extending up into the gravel stops or (b) the folded type with a 3-inch minimum vertical leg folding back over the roofing felts. Provide bitumen stops in the form of a vertical sleeve 3 inches high with flange for all pipes projecting through roof. Horizontal flanges of bitumen stops shall be not less than 4 inches wide. Prior to installation of roofing felts, bitumen stops shall be nailed to wood nailers at not more than 3 inches on centers.

8. CLEANING: Clean all exposed sheet metal work at completion of installation. Grease and oil films, handling marks, contamination from steel wool, fittings and drilling debris shall be removed, and the work scrubbed clean. All exposed metal surfaces shall be free of dents, creases, waves, scratch marks, and solder or weld marks.

9. REPAIRS TO FINISH: Scratches, abrasions, and minor surface defects of finish may be repaired in accordance with the manufacturer's printed instructions and as approved. Finish repaired surfaces shall be uniform and free from scratches, blemishes, and from variations of color and surface texture.

TABLE I. SHEET METAL WEIGHTS, THICKNESSES, AND GAGES

	Aluminum, Inch	Stainless Steel, Inch
Covering on Downspouts and leaders	.032	.015
Downspout clips and anchor	.040 clip .125 anchor	- -
Downspout straps, 2-inch	.060	.050
Strainers, wire diameter or gage	.144 dia.	.109 dia.
Gravel stops and fascias:		
Extrusions	.075	-
Sheets, smooth	.050	.018
Gutters:		
Gutter section	.032	.015
Continuous cleat	.032	.015
Hangers, dimensions	1"x.080"	1"x.037"
Bitumen stops:		
Rigid	.032	.018
Folded	.020	.015

TABLE II. SHEET METAL JOINTS

Designation	TYPE OF JOINT		
	Stainless Steel	Aluminum	Remarks
Edge strip.	Butt.	Butt.	- - -
Gravel stops:			
Extrusions.	- - -	Butt with 1/2-inch space.	Use sheet flashing beneath and a cover plate.
Sheet, smooth	Butt with space	Butt with space	Use sheet flashing back-up plate.
Gutters.	1-1/2 inch lap, riveted and soldered.	One-inch flat locked, riveted, and sealed.	Aluminum producers recommended hard setting sealant for locked aluminum joints.

*** END OF SECTION ***

SECTION 07920

SEALANTS AND CALKINGS

PART 1 - GENERAL

1.1 APPLICABLE PUBLICATIONS: The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

1.1.1 American Society for Testing and Materials (ASTM) Publications:

C 920-79 Elastomeric Joint Sealants

1.2 SUBMITTALS:

1.2.1 Certificates of Conformance or Compliance: Submit certificates from the manufacturers attesting that materials meet the specified requirements.

1.2.2 Manufacturers' Descriptive Data: Submit complete descriptive data for each type of material. Clearly mark data to indicate the type the Contractor intends to provide. Data shall state conformance to specified requirements. Data for sealant and calking shall include application instructions, shelf life, mixing instructions for multicomponent sealants, and recommended cleaning solvents.

1.3 ENVIRONMENTAL CONDITIONS: The ambient temperature shall be within the limits of 40 and 100 degrees F when the sealant and calking are applied.

1.4 DELIVERY AND STORAGE: Deliver materials to the job site in the manufacturers' external shipping containers, unopened, with brand names, date of manufacture, and material designation clearly marked thereon. Containers of elastomeric sealant shall be labeled as to type, class, grade, and use. Carefully handle and store all materials to prevent inclusion of foreign materials or subjection to sustained temperatures exceeding 100 degrees or less than 40 degrees F.

PART 2 - PRODUCTS

2.1 MATERIALS: Products shall conform to the reference documents listed for each use. Color of sealant and calking shall match adjacent surface color unless specified otherwise. For ASTM C 920 sealants, use a sealant that has been tested on the types of substrate to which it will be applied.

2.1.1 Sealant: For joints in vertical surfaces, provide ASTM C 920, Type S or M, Grade NS, Class 25, Use NT. For joints in horizontal surfaces, provide ASTM C 920, Type S or M, Grade P, Class 25, Use T. Color of sealant shall be gray or white.

2.1.2 Primer for Sealant: Use a non-staining, quick-drying type and consistency recommended by the sealant manufacturer for the particular application.

2.1.3 Bond Breakers: Use the type and consistency recommended by the sealant manufacturer for the particular application.

2.1.4 Backstops: Use glass fiber roving or neoprene, butyl, polyurethane, or polyethylene foams free from oil or other staining elements as recommended by the sealant manufacturer. Backstop material shall be compatible with the sealant. Do not use oakum and other types of absorptive materials as backstops.

PART 3 - EXECUTION

3.1 SURFACE PREPARATON: Surfaces shall be clean, dry to the touch, and free from frost, moisture, grease, oil, wax, lacquer, paint, or other foreign matter that would tend to destroy or impair adhesion. Where adequate grooves have not been provided, clean out grooves to a depth of 1/2 inch and grind to a minimum width of 1/4 inch without damage to the adjoining work. No grinding shall be required on metal surfaces.

3.1.1 Steel Surfaces: Remove loose mill scale by sandblasting or, if sandblasting is impractical or would damage finish work, scraping and wire brushing. Remove protective coatings by sandblasting or using a solvent that leaves no residue.

3.1.2 Aluminum or Bronze Surfaces: Remove temporary protective coatings from surfaces that will be in contact with sealant. When masking tape is used as a protective coating, remove tape and any residual adhesive just prior to sealant application. Use non-staining solvents recommended by the item manufacturer.

3.2 SEALANT PREPARATION: Do not modify the sealant by addition of liquids, solvents, or powders. Mix multicomponent elastomeric sealants in accordance with manufacturer's printed instructions.

3.3 APPLICATION:

3.3.1 Backstops: Where joint cavities are constructed deeper than indicated, tightly pack the back or bottom with backstop material to provide a joint of the depth indicated. Install backstops dry and free of tears or holes.

3.3.2 Primer: Just prior to application of the sealant or calking compound, clean out all loose particles from joints. Apply primer in accordance with compound manufacturer's directions. Do not apply primer to exposed finish surfaces.

3.3.3 Bond Breaker: Provide bond breakers as recommended by the sealant manufacturer for each type of joint and sealant used.

3.3.4 Sealant and Calking Compounds: Use a compound that is compatible with the material to and against which it is applied. Do not use a compound that has exceeded its shelf life or has become too jelled to be discharged in a continuous flow from the gun. Apply the compound in accordance with the manufacturer's printed instructions. Force the compound into joints with sufficient pressure to fill the joints solidly. Compound shall be uniformly smooth and free of wrinkles.

3.3.4.1 Sealant: Provide sealant at all joints around the perimeter of openings and at all exposed joints in or on the building and at all joints indicated to receive sealant or calking.

3.4 PROTECTION AND CLEANING:

3.4.1 Protection: Protect areas adjacent to joints from compound smears. Masking tape may be used for this purpose if removed 5 to 10 minutes after the joint is filled.

3.4.2 Cleaning: Immediately scrape off fresh compound that has been smeared on masonry and rub clean with a solvent as recommended by the compound manufacturer. Upon completion of compound application, remove all remaining smears and stains resulting therefrom and leave the work in a clean and neat condition.

*** END OF SECTION ***

SECTION 08110

HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 APPLICABLE PUBLICATIONS: The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

1.1.1 Federal Specification (Fed. Spec.):

HH-I-524C	Insulation Board, Thermal (Polystyrene)

1.1.2 Military Specification (Mil. Spec.):

DOD-P-21035A	Paint, High Zinc Dust Content, Galvanizing Repair (Metric)

1.1.3 American Society for Testing and Materials (ASTM) Publications:

A 591-77	Steel Sheet, Cold-Rolled, Electrolytic Zinc-Coated
D 1621-73 (R 1979)	Compressive Properties of Rigid Cellular Plastics
D 1622-63 (R 1975)	Apparent Density of Rigid Cellular Plastics
D 1623-78	Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics
D 2126-75	Response of Rigid Cellular Plastics to Thermal and Humid Aging
D 2863-77	Measuring the Minimum Oxygen Concentration to Support Candle-Like Combustion of Plastics (Oxygen Index)

1.1.4 American National Standards Institute, Inc. (ANSI) Publications:

A115.2-80	Door and Frame Preparation for Bored or Cylindrical Locks for 1-3/8-Inch and 1-3/4-Inch Doors

1.1.5 The Steel Door Institute (SDI) Publications:

100-80	Recommended Specifications - Standard Steel Doors and Frames
107-72	Hardware on Steel Doors (Reinforcement-Application)

1.2 SUBMITTALS:

1.2.1 Catalog Data: Submit manufacturer's descriptive literature for all doors and frames. Include data and details on door construction, panel (internal) reinforcement, insulation, and door edge construction.

1.2.2 Shop Drawings: Submit shop drawings for doors and frames showing elevations, construction details, metal gages, hardware provisions, and installation details.

1.2.3 Certificates of Conformance or Compliance: Submit manufacturer's certificates attesting that doors, frames, and accessories meet the requirements specified herein.

1.2.4 Samples: Submit two color samples of each color for prefinished doors. Where colors are not indicated, submit manufacturer's standard colors and patterns to the Contracting Officer for selection.

1.3 DELIVERY AND STORAGE: Deliver doors, frames, and accessories undamaged and with protective wrappings or packaging. Store doors and frames on platforms under cover in clean, dry, ventilated, and accessible locations, with 1/4-inch air space between doors. Remove damp or wet packaging immediately and wipe all affected surfaces dry. Replace damaged materials with new.

PART 2 - PRODUCTS

2.1 STANDARD HOLLOW METAL DOORS: SDI-100, except as specified otherwise for Type II and III doors. Prepare doors to receive hardware specified in Section 08710, "Finish Hardware." Exterior doors shall have top edge closed flush. Doors shall be 1-3/4 inches thick, unless otherwise indicated.

2.1.1 Door Types:

2.1.1.1 Heavy Duty Doors: SDI-100, Type II, Style 2, 3, or 4, of size and design indicated. Plastic foam panel reinforcement shall be as specified herein. Fill exterior doors with mineral fiber insulation or plastic foam panel reinforcement.

2.2 CUSTOM HOLLOW METAL DOORS: Provide custom hollow metal doors where non-standard hollow metal doors are indicated. At the Contractor's option, custom hollow metal doors may be provided in lieu of Type II standard hollow metal doors. Door size, design, materials, gages, and finish shall be as specified for standard hollow metal doors. Provide panel reinforcement consisting of continuous vertical formed steel stiffeners, not lighter than 22 gage, spaced not more than 6 inches apart, and welded to both face sheets at not more than 5 inches o.c. Fill spaces between stiffeners of exterior doors with insulation. Close top and bottom edges with steel channels not lighter than 16 gage. Close tops of exterior doors flush with an additional channel. Prepare doors to receive hardware specified in Section 08710, "Finish Hardware." Doors shall be 1-3/4 inches thick, unless otherwise indicated.

2.3 LOUVERS FOR DOORS:

2.3.1 Louvers: Louvers for exterior doors shall be inverted Y type. Weld or tenon louver blades to frame and fasten the entire louver assembly to the door with moldings. Moldings on the room or nonsecurity side of the door shall be detachable; moldings on the security side shall be an integral part of the louver. Form louvers 16 gage steel for exterior doors and panels. Louvers for exterior doors shall have steel-framed insect screens secured to louvers in a rigid manner to permit ready removal. Provide aluminum wire cloth, 18 by 18 regular mesh or 18 by 14 heavy mesh, for insect screens. Louvers for exterior doors shall have a minimum of 30 percent net free opening.

2.3.2 Moldings: Provide moldings around louvered panels for a rigid and secure installation. Provide nonremovable panel moldings on the outside of exterior doors and on the corridor side of interior doors. Other moldings around side panels may be stationary or removable. Secure moldings on the inside of louver panels to the stationary moldings and muntins with ovalhead countersunk sheet metal or machine screws having small heads.

2.4 PLASTIC FOAM PANEL REINFORCEMENT: Provide plastic foam core panel reinforcement by one of the following methods:

a. A continuous rigid polyurethane plastic foam core, foamed-in-place or in board form bonded to the steel face sheets, and free of voids or other defects that could affect serviceability. The foam shall have the following properties when tested in accordance with the listed test methods:

Property	Requirement	Test Method
Flammability (Oxygen Index)	24 percent min.	ASTM D 2863
Density, core	2 lb. per cu. ft., nom.	ASTM D 1622

Compressive strength	20 psi, min., at 10 percent deformation or at yield point, whichever occurs first	ASTM D 1621, Procedure A
Tensile strength	20 psi, min., and not greater than foam to steel face sheet bond strength	ASTM D 1623, Type B Specimen (Board form polyurethane shall be bonded with adhesive used for bonding in door.)
Dimensional stability	Plus or minus 5 percent volume change, max., and no visible distortion after 7 days exposure at minus 15 degrees F and 200 degrees F	ASTM D 2126, dimensions and visual examination measurements only
Holes and voids	No single hole or void larger than 1/4 inch in any direction, and no more than 8 holes up to 1/4 inch in size in any direction per 8 square feet of surface area	Visual examination

b. A rigid, molded polystyrene plastic foam bead board core bonded to the steel face sheets with a thermosetting adhesive. The foam core shall have the following properties when tested in accordance with the listed test methods:

Property	Requirement	Test Method
Flammability (Oxygen Index)	AEB 60 mm. max., ATB 50 Sec. max.	ASTM D 2863
Density	1.0 lb. per cu. ft., nom.	ASTM D 1622
Compressive strength	10 psi, min., at 10 percent deformation or at yield point, whichever occurs first	ASTM D 1621, Procedure A
Tensile strength	18 psi, min., and not greater than foam to steel face sheet bond strength	ASTM D 1623, Type B specimen (Polystyrene foam shall be bonded with adhesive used for bonding in door.)

Dimensional stability	Plus or minus 5 percent volume change, max., and no visible distortion after 7 days exposure at minus 15 degrees F and 165 degrees F	ASTM D 2126, dimensions and visual examination measurements only
Holes and voids	No single hole or void larger than 1/4 inch in any direction, and no more than 8 holes up to 1/4 inch in size in any direction per 8 square feet of surface area	Visual examination
Bead fusion	Essentially fused bead structure indicated by an excess of broken or sheared beads	Fed. Spec. HH-I-524, bead fusion test

2.5 HOLLOW METAL FRAMES: SDI-100, except as otherwise specified. Form frames for standard and custom hollow metal doors to sizes and shapes indicated, with full-welded unit or knockdown field-assembled type construction at corners. Provide hollow metal frames for doors, where indicated.

2.5.1 Joints:

2.5.1.1 Welded-Type Frames: Miter or butt and face weld corner joints from the outside. Head and jamb rabbets shall have mechanically interlocked or welded joints with all contact edges closed tight. Dress welds flush and smooth.

2.5.1.2 Knock-Down Type Frames: Design corner joints for simple field assembly by concealed tenons, splice plates, or interlocking joint that will produce square, rigid corners and a tight fit and maintain the alignment of adjoining members. Provide locknuts for all bolted connections.

2.5.2 Anchors: Provide anchors to secure the frame to adjoining construction. Provide steel anchors zinc-coated or painted with rust-inhibitive paint, not lighter than 18 gage.

2.5.2.1 Wall Anchors: Provide a minimum of three anchors for each jamb. Locate anchors opposite top and bottom hinges and midway between.

a. Masonry: Provide anchors of corrugated or perforated steel straps or 3/16-inch diameter steel wire, adjustable or "T" shaped.

2.5.2.2 Floor Anchors: Provide floor anchors at bottom of each jamb member. Provide fixed or adjustable anchors, drilled for 3/8-inch diameter anchor bolts.

2.6 HARDWARE PREPARATION: Reinforce, drill, and tap doors and frames to receive finish hardware. Prepare doors and frames for hardware in accordance with the applicable requirements of ANSI A115.1 through A115.14 and SDI-107. Drill and tap for surface-applied hardware at the project site. Build additional reinforcing for surface-applied hardware into the door at the factory. Locate hardware in accordance with the requirements of SDI-100, as applicable. Punch door frames to receive a minimum of two rubber or vinyl door silencers on lock side of single doors. Set lock strikes out to provide clearance for silencers.

2.7 FINISHES:

2.7.1 Electrolytic Zinc-Coated and Factory-Primed Finish: Fabricate doors and frames from electrolytic zinc-coated steel, ASTM A 591, Commercial Quality, Coating Class A. Phosphate treat and factory prime zinc-coated surfaces as specified in SDI-100.

2.8 FABRICATION AND WORKMANSHIP: Finished doors and frames shall be strong and rigid, neat in appearance, and free from defects, waves, scratches, cuts, dents, ridges, holes, warp, and buckle. Molded members shall be clean cut, straight, and true, with joints coped or mitered, well formed, and in true alignment. Dress exposed welded and soldered joints smooth. Design door frame sections for use with the wall construction indicated. Corner joints shall be well formed and in true alignment. Conceal fastenings where practicable. Design frames in exposed masonry walls to allow sufficient space between the inside back of trim and masonry to receive calking compound.

PART 3 - EXECUTION

3.1 INSTALLATION:

3.1.1 Hollow Metal Frames: Set frames accurately in position and plumb, align, and brace securely until permanent anchors are set. Anchor bottoms of frames securely to floors with expansion bolts or powder-actuated fasteners. Build in or secure wall anchors to adjoining construction. Backfill frames in masonry construction with mortar.

3.1.2 Hinged Doors: Calk metal-to-metal joints in exterior framing members as specified in Section 07920, "Sealants and Calking," and remove excess calking. Hang doors in accordance with clearances specified in SDI-100. After erection and glazing, clean and adjust hardware.

3.2 PROTECTION: Protect doors and frames from damage. Repair damaged doors and frames prior to completion and acceptance of the project or replace with new, as directed. Wire brush frames that have rusted until all rust is removed, clean thoroughly, and apply an all-over coat of rust-inhibitive paint of the same type used for shop coat.

3.3 CLEANING: Upon completion, clean exposed surfaces of doors and frames thoroughly. Remove all mastic smears and other unsightly marks.

*** END OF SECTION ***

SECTION 07511

AGGREGATE SURFACED BITUMINOUS BUILT-UP ROOFING

PART 1 - GENERAL

1.1 APPLICABLE PUBLICATIONS: The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

1.1.1 Federal Specification (Fed. Spec.):

SS-C-153C	Cement; Bituminous, Plastic

1.1.2 American Society for Testing and Materials (ASTM) Standards:

D 41-78	Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
D 250-80	Asphalt-Saturated Asbestos Felts Used in Roofing and Waterproofing
D 312-78	Asphalt Used in Roofing
D 1863-80	Mineral Aggregate for Use On Built-Up Roofs
D 2170-76	Kinematic Viscosity of Asphalt (Bitumen)
D 2178-76	Asphalt-Impregnated Glass Mat Used in Roofing and Waterproofing
D 3378-80	Asphalt-Saturated and Coated Asbestos Felt Base Sheet Used in Roofing
D 3672-78	Venting Inorganic Base Sheet In Built-up Roofing

1.2 PRE-ROOFING CONFERENCE: Prior to starting the application of the roofing system and insulation, there will be a pre-roofing conference with the Contracting Officer to assure a clear understanding of drawings and specifications. The conference shall be attended by the Contractor, roofing and insulation subcontractor and flashing and sheetmetal subcontractor.

1.3 SUBMITTALS:

1.3.1 Certificates of Conformance or Compliance: Submit certificates from the manufacturers certifying that materials to be provided comply with the physical and chemical properties and values required by the referenced publications.

1.3.2 Descriptive Literature: Submit manufacturers' application instructions and technical data sheets or catalog cuts on materials specified herein.

1.3.3 Bill of Lading for Roofing Asphalt: Submit 2 copies of the bill of lading for the roofing asphalt when labels of asphalt containers do not bear the flash point, finish blowing temperature, and equiviscous temperature.

1.4 DELIVERY, STORAGE, AND HANDLING:

1.4.1 Delivery: Deliver materials in manufacturers' original unopened containers and rolls with manufacturer's labels intact and legible. Where materials are covered by a referenced specfication, the container shall bear the specification number, type, and class, as applicable. Labels or bill of lading for roofing asphalt shall indicate bitumen type, flash point (FP), finish blowing temperature (FBT), and equiviscous temperature (EVT), i.e., the temperature at which the viscosity is 125 centistokes when tested in accordance with the requirements of ASTM D 2170. Deliver materials in sufficient quantity to allow continuity of work.

1.4.2 Storage: Protect roll materials against moisture absorption. Store roll materials on end on clean raised platforms in dry locations with adequate ventilation. Do not store roll materials in buildings under construction until concrete, mortar, and plaster work is finished and dry. Immediately before application, store roll materials for 24 hours in an area maintained at temperatures above 50 degrees F. Completely cover felt stored outdoors with waterproof protective coverings. Tie covering securely to the pallets in such a way as to be completely weathertight and yet provide sufficient ventilation to prevent condensation. Polyethylene coverings are not permitted. Do not store more materials on the roof than can be installed the same day. Locate materials temporarily stored on the roof in approved areas and distribute the load to stay within the live load limits of the roof construction.

1.4.3 Handling: Select and operate material handling equipment so as not to damage existing construction and applied roofing. Handle roll materials in a manner to prevent damage to edges and ends.

1.5 ENVIRONMENTAL CONDITIONS: Application will not be permitted during inclement weather or when air temperature is below 40 degrees Fahrenheit (F) or is expected to go below 40 degrees F within 24 hours after application, or when there is ice, frost, surface moisture, or visible dampness on the roof deck.

1.6 PROTECTION OF PROPERTY:

1.6.1 Protective Coverings: Install protective coverings at paving and building walls adjacent to hoist and kettles prior to starting the work. Lap protective coverings not less than 6 inches, secure against wind, and vent to prevent collection of moisture on covered surfaces. Protective coverings shall remain in place for the duration of the roofing work.

1.6.2 Flame-heated Equipment: Locate and use flame-heated equipment at locations that will not endanger the structure or other materials on the site or adjacent property. Do not place flame-heated equipment on the roof. Provide and maintain one fire extinguisher of appropriate type and size adjacent to flame-heated equipment.

1.7 WARRANTY: The Contractor shall warrant for 5 years from the Beneficial Occupancy Date (BOD) that the built-up roofing is free of defective materials and workmanship. Repairs that become necessary because of defective materials and workmanship while the roofing is under warranty shall be performed by the Contractor within 72 hours of notification, unless additional time is approved by the Contracting Officer. Failure to perform repairs within the specified period of time will constitute grounds for having repairs performed by others and the cost billed to the Contractor.

PART 2 - PRODUCTS

2.1 DESCRIPTION OF ROOFING SYSTEMS: Provide one of the following roofing systems:

2.1.1 SYSTEM AAA: Asbestos felt, asphalt bitumen, aggregate surfaced.

Substrate: Roof Insulation	
Components:	Quantity:
Plying Felt (AA15) 4 Plies	
Asphalt:	
Between Substrate and First Ply	15-20 Lbs/100 sq. ft.
Between Adjacent Plies	15-20 Lbs/100 sq. ft.
Top Coat:	55-65 Lbs/100 sq. ft.
Surfacing:	
Gravel	400 Lbs/100 sq. ft.
or other	
Aggregate	300 Lbs/100 sq. ft.

2.1.2 SYSTEM GAA: Glass mat, asphalt bitumen, aggregate surfaced.

Substrate: Roof Insulation	
Components:	Quantity:
Plying Felt (GA)	4 Plies
Asphalt:	
Between Substrate and First Ply	20-30 Lbs/100 sq. ft.
Between Adjacent Plies	20-30 Lbs/100 sq. ft.
Top Coat	55-65 Lbs/100 sq. ft.
Surfacing:	
Gravel or other Aggregate	400 Lbs/100 sq. ft. 300 Lbs/100 sq. ft.

2.2 MATERIALS: Shall conform to the respective specifications and to the requirements specified herein.

2.2.1 Bitumen:

2.2.1.1 Asphalt:

Specification	Softening Point (deg. F)
ASTM D 312, Type III	185-205

2.2.2 Felts: Felts for built-up roofing and flashing shall conform to the specifications and requirements listed in the following table:

Designation	Use	Felt or Mat	Saturant or Impregnant	Coating	Specification
AA15	Plying Felt	Asbestos	Asphalt	None	ASTM D 250, Type I, Min. Wt. 13 lbs./sq.
GA	Plying Felt	Glass	Asphalt	None	ASTM D 2178, Type IV
AB	Base Felt	Asbestos	Asphalt	Asphalt	ASTM D 3378 Type I or II
VB	Venting Base Felt	Asbestos or Glass	Asphalt	Asphalt	ASTM D 3672, Type I for use with asbestos felts, Type II for use with glass felts

FF	Flashing Felt	None (see Note (1))

Note (1) Flashing felt shall be of a type specifically prepared in the manufacturing process for use in two-ply base flashing construction and shall be one of two types; (A) A single thickness of glass felt conforming to the properties listed in ASTM D 2178, for Type IV, modified as described below or (B) Felt reinforced with a woven glass fiber scrim or cotton fabric manufactured with a single thickness of asbestos felt impregnated with asphalt. Both types, i.e., (A) and (B) are then coated in the manufacturing process on both sides with an asphaltic coating which may include a fine mineral stabilizer insoluble in water and surfaced on both sides with a fine mineral surfacing.

2.2.3 Primer: ASTM D 41 for asphalt.

2.2.4 Bituminous Plastic Cement: Fed. Spec. SS-C-153, Type I, for asphalt saturated or coated materials.

2.2.5 Aggregate for Surfacing Built-up Roofing: Water-worn gravel, crushed stone, crushed slag, all conforming to ASTM D1863, or marble, expanded slag, or expanded shale, all conforming to ASTM D 1863 except that density is not less than 55 pcf. Aggregate shall be opaque.

2.2.6 Unsaturated Felt or Rosin-sized Building Paper: Minimum weight, 5 pounds per 100 square feet.

2.2.7 Fasteners: Provide fasteners of nonferrous metal or galvanized steel, except for fastening metal items of copper, aluminum, and stainless steel. Use hard copper fasteners for copper items, aluminum or stainless steel fasteners for aluminum items, and stainless steel fasteners for stainless steel items. For roofing felts, use fasteners flush-driven through metal disc, or one-piece composite fasteners with heads not less than one inch in diameter or one inch square with rounded or 45-degree tapered corners.

2.2.7.1 Fasteners for Securing Felts and Metal Items to Wood Nailers: 11-gage annular threaded shank nails with 7/16- to 5/8-inch diameter heads; or one-piece composite nails with annular threaded shanks not less than 11-gage. Fasteners shall be long enough to penetrate the wood nailer not less than one inch, when driven through the material to be fastened.

2.2.8 Metal Discs (Tin-caps): Flat discs or caps of zinc-coated sheet metal not lighter than 28-gage and not less than 1-3/8 inches in diameter. Discs shall be formed to prevent dishing. Bell or cup-shaped caps are not acceptable. Omit disc when one-piece composite fasteners are used.

PART 3 - EXECUTION

3.1 CONDITION OF SURFACES: Insure that the following conditions exist prior to application of the roofing materials:

a. Surfaces are rigid, dry, smooth, and free from cracks, holes, and sharp changes in elevation.

b. The plane of the substrate does not vary more than 1/4 inch within an area 10 feet by 10 feet.

c. Substrate is sloped as indicated to provide drainage.

d. Treated wood nailers are securely fastened in place at eaves, gable ends, openings, and intersections with vertical surfaces for securing of felts, edging strips, gravel stops, and roof fixtures. Nailers are the same thickness as the insulation.

e. Cants are securely fastened in place in the angles formed by walls and other vertical surfaces. The angle of the cant is 45 degrees and the height of the vertical leg is not less than nominal 4 inches. Cants are constructed of wood or insulation board.

f. Insulation boards are installed smooth and even, and are not broken, cracked, or curled.

3.2 PREPARATION: Coordinate the work with that of the other trades to assure that components which are to be secured to or stripped into the roofing system are available and that flashing and counterflashing is installed as the work progresses.

3.2.1 Priming of Surfaces:

3.2.1.1 Priming of Metal Surfaces: Prime flanges of metal gravel stops, edging strips, flashing collars, and accessories with bituminous plastic cement prior to stripping into the roofing system.

3.2.2 Heating of Asphalt: Break up solid bitumen on a surface free of dirt and debris. Heat bitumen in a kettle or tanker designed to prevent contact of flame with surfaces in contact with the bitumen. Kettles and tankers shall have visible thermometer and thermostatic controls set to the temperature limits specified herein. Maintain controls in working order and calibrated. Use immersion thermometer accurate to "plus or minus 2 degrees" to check temperatures of the bitumen frequently. If temperatures exceed maximums specified, the bitumen shall be removed from the site. Upon determination that the temperature of the bitumen, at the instant of application, is below the minimum specified, the affected roofing shall be removed and replaced with new material. Cutting back, adulterating, or fluxing of bitumen is not permitted.

3.3 APPLICATION: Apply roofing materials as specified herein unless specified or recommended otherwise by the manufacturer's printed application instructions. Keep roofing materials dry before, during, and after application. Apply only as much roofing in one day as can be protected the same day. Maintain the specified temperatures for the bitumen. Do not apply top surfacing until the other roofing application procedures specified herein are completed.

3.3.1 Bitumen Stops: Provide bitumen stops at roof edges, openings, and at vertical projections prior to application of the felts. Form bitumen stops with two 12-inch wide strips of plying felt. Strips shall be laminated with, and set into, a coating of bituminous plastic 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 12 inches o.c. in addition to embedding in bituminous plastic cement. After the plies of felt are in place, fold the free portion of the strips back over the roofing membrane and embed in a continuous coating of bituminous plastic cement. Secure with roofing nails spaced 3 inches o.c. The optional use of sheet metal bitumen stops is permitted as approved.

3.3.2 Plying Felts: Apply plying felts shingle fashion in hot-moppings of bitumen as specified herein. Apply felts in a continuous operation. Phased construction is not permitted. Provide starter sheets of felt to maintain the specified number of plies of felt throughout the roofing. Apply felts of 36-inch widths, as specified herein, with side laps not less than 27-1/2 inches and starter sheets of not less than 9, 18, 27, and 36 inch widths. Provide end laps of not less than 6 inches and staggered a minimum of 12 inches. 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 2 inches above the tops of cant strips and fasten at approximately 8 inches o.c. Trim felts to a neat fit around vent pipes, and other projections through the roof.

3.3.2.1 Hot-Mopping of Plying Felts: Use hot bitumen for bonding of plies of felt to each other and to the substrate. Apply the felts immediately following the application of the hot bitumen. Working ahead with the bitumen is not permitted. The bitumen shall be completely fluid, with mop temperatures within the range specified, at the instant the felts come into contact with the bitumen. Embed felts in the bitumen. As felts are being rolled into the hot bitumen, immediately and thoroughly broom down to eliminate trapped air and to provide tight smooth laminations resulting in a composite roofing membrane without wrinkles, buckles, kinks, and fish mouths. The completed roofing system shall be free of pockets and blisters. The practice of laying the felts dry and turning back the laps for mopping between plies is not permitted.

3.3.2.2 Temperature Limitations for Bitumen: Heat and apply bitumen at the temperatures specified below unless specified otherwise by the manufacturer. Use thermometer to check temperature during heating and application. Have kettleperson in attendance at all times during heating process to insure that temperatures specified are maintained.

3.3.2.2.1 Asphalt: Do not heat asphalt more than 25 degrees F above the finish blowing temperature (FBT), and do not heat asphalt above the FBT for longer than 4 consecutive hours. Do not heat asphalt above the flash point (FP). Apply asphalt and embed roofing felts when the temperature of the asphalt is not lower than 25 degrees F below the equiviscous temperature (EVT) and not higher than 25 degrees F above the EVT. Before heating and application of the asphalt refer to the asphalt manufacturer's label or bill of lading for the FBT, FP, and EVT of the asphalt used.

3.3.3 Flashing: Provide built-up bituminous flashing in the angles formed where the roof deck abuts curbs, pipes, and other vertical surfaces, and where necessary to make the work watertight. Install flashing after plies of felt have been applied but before the top surfacing is applied.

3.3.3.1 Base Flashing: Use one of the following base flashing systems as recommended by the manufacturer of the plying felt used in the roofing membrane:

3.3.3.1.1 Three-ply Bituminous Built-up Base Flashing: Provide three plies of AA15 plying felt conforming to the requirements specified herein. Embed each ply in a uniform trowelling of bituminous plastic cement not less than 1/8 inch thick. Smooth and press felts firmly into place so that a uniformly attached and completely laminated membrane results. Extend felts not less than 6, 9, and 12 inches, respectively, over the roofing membrane beyond the toe of the cant, and not less than 4 inches or more than 10 inches above the top of the cant on vertical surfaces. Lap ends of felts not less than 12 inches and seal watertight with bituminous plastic cement. Stagger end laps. Nail top edges of base flashing to wood nailers with large head roofing nails through metal discs or one-piece composite fasteners spaced not more than 8 inches o.c. on a line 1-1/2 inches below the top edge of the base flashing. Coat the finished base flashing with bituminous plastic cement 1/8 inch thick, extending from one inch above the top of the base flashing on the vertical surface to one inch beyond the edge of the base flashing on the roofing membrane.

3.3.3.1.2 Two-ply Bituminous Built-up Base Flashing: Provide one ply of plying felt, AA15 or GA, and one ply of flashing felt, FF, in accordance with the manufacturer's printed installation instructions.

3.3.3.2 Strip Flashing: Set flanges of sheet metal work to be incorporated into the roofing system into a uniform coating of bituminous plastic cement not less than 1/16 inch thick, and strip-in with two layers of plying felt cemented to the tops of the flanges, roofing membrane, and to each other with coatings of bituminous plastic cement not less than 1/16 inch thick. Extend felts 3 and 6 inches, respectively, beyond the edges of the flanges and onto the roofing membrane. Coat the finished strip flashing with bituminous plastic cement 1/8 inch thick.

3.3.4 Top Surfacing: Provide aggregate surfacing materials after felt flashings, tests, repairs, and corrective action have been completed and approved. Embed aggregate surfacing in a top coat of hot bitumen poured from a dipper or approved bitumen spreading device.

3.4 CLEANUP: Each day remove from the job site debris, scraps, containers, and other rubbish and trash resulting from the installation of the roofing system.

3.5 INFORMATION CARD: Provide a typewritten card, framed under glass, in a weathertight frame, for each roof. This card shall contain the information listed on the attached Form 1. Install the card near the point of access to the roof, as directed. Submit a duplicate card to the Contracting Officer.

*** END OF SECTION ***

SECTION 07600

FLASHING AND SHEET METAL

1. APPLICABLE PUBLICATIONS: The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

1.1 Federal Specifications (Fed. Spec.):

O-F-506C	Flux Soldering; Paste and Liquid
QQ-S-571E & Am 2	Solder; Tin Alloy; Lead-Tin Alloy; and Lead Alloy
SS-C-153C	Cement; Bituminous, Plastic
UU-B-790A & Am 1	Building Paper, Vegetable Fiber; (Kraft, Waterproofed, Water Repellent and Fire Resistant)

1.2 American Society for Testing and Materials (ASTM) Publications:

A167-77	Stainless and Heat Resisting, Chromium-Nickel Steel Plate, Sheet and Strip
B209-77	Aluminum-alloy Sheet and Plate
B221-76A	Aluminum-alloy Extruded Bars, Rods, Wire Shapes, and Tubes
D41-73	Primer for Use with Asphalt in Dampproofing and Waterproofing

1.3 American Welding Society (AWS) Publications:

A6.1-66	Recommended Safe Practices for Gas-shielded Arc Welding
D1.1-75	Structural Welding Code, with Rev. 1-1976 and Rev. 2-1977

1.4 Sheet Metal and Air Conditioning Contractors National Association, Incorporated (SMACNA) Publications:

Architectural Sheet Metal Manual (Second Edition 1968).

1.5 American National Standards Institute (ANSI) Publications:

Z49.1-1973 Safety in Welding and Cutting

2. SUBMITTALS:

2.1 Shop Drawings: Submit shop drawings for approval indicating thicknesses, dimensions, fastenings and anchoring methods, expansion joints, and other provisions necessary to provide for thermal expansion and contraction. Scaled catalog cuts may be submitted for factory fabricated items. Submit shop drawings for the following items.

Covering on minor flat, pitched, or curved surfaces.

Gutters and downspouts.

Gravel stops and fascias.

2.2 Certificates of Conformance or Compliance: Submit for approval certificates from the manufacturer attesting that materials meet the requirements specified herein.

3. DELIVERY, HANDLING, AND STORAGE: Materials shall be adequately packaged and protected during shipment and shall be inspected for damage, dampness, and wet-storage stains upon delivery to the job site. Damaged or permanently stained materials that cannot be restored to like-new condition shall be removed from the site and replaced. Carefully handle sheet metal items to avoid damage to surfaces, edges, and ends. Crated materials shall not be uncrated until ready for use. Store materials in dry, weather-tight, ventilated areas until immediately before installation.

4. MATERIALS: Materials shall conform to the respective specifications and to the requirements specified herein. Furnish sheet metal items in 8 to 10 foot lengths. Single pieces less than 8 feet long may be used to connect to factory fabricated inside and outside corners, and at ends of runs. Accessories and other items essential to complete the sheet metal installation shall be provided and shall be of the same materials as the items to which they are applied.

4.1 Stainless Steel: ASTM A167, type 302 or 304, finish 2D, fully annealed, dead soft temper.

4.2 Aluminum Alloy Sheet and Plate: ASTM B209, Alclad 3003, Alclad 3004, or Alclad 3005, embossed finish, clad on one side unless indicated otherwise; temper appropriate to end use. Exposed exterior sheet metal items of aluminum shall have a baked-on, factory-applied color coating of polyvinylidene fluoride (PVF2) or other equivalent fluorocarbon coating after metal substrates have been properly cleaned and pretreated; finish coating dry-film thickness to be 0.8 - 1.3 mils; color to be white.

4.3 Aluminum Alloy, Extruded Bars, Rods, Shapes, and Tubes: ASTM B221.

4.4 Soldering Flux: Fed. Spec. O-F-506, type I, form A or B.

4.5 Solder: Fed. Spec. QQ-S-571, composition Sn 60 for stainless steel.

4.6 Bituminous Plastic Cement: Fed. Spec. SS-C-153, type I with asphalt roofing felts.

4.7 Building Paper: Fed. Spec. UU-B-790, style 4, grade B.

4.8 Asphalt Primer: ASTMD 41.

4.9 Fasteners: Fasteners shall be the same metal or a metal compatible with the item fastened. Use aluminum fasteners with aluminum and stainless steel fasteners with stainless steel.

5. OPTIONAL MATERIALS: Optional materials are listed in Table I. Any of the optional materials specified therein may be selected by the Contractor; however, all exposed sheet metal items shall be of the same material. The following items shall be considered as exposed sheet metal: gutters, including hangers; downspouts and leaders; gravel stops and fascias.

6. SHEET METAL: Provide flashing in the angles formed where roof decks abut walls, curbs, ventilators, pipes or other vertical surfaces and wherever indicated and necessary to make the work watertight. All sheet metal shall have mill finish unless specified otherwise herein. Tempers of metals shall be suitable for their respective forming conditions. Fabricate sheet metal items to the gage, thickness or weight shown in Table I and join multiple lengths of items together as shown in Table II.

7. INSTALLATION:

7.1 General: Surfaces to receive sheet metal must be plumb and true, clean, even, smooth, dry and free from defects and projections which might affect the application. Installation of items not shown in detail or not covered by specifications shall meet the applicable requirements of the SMACNA Architectural Sheet Metal Manual.

7.2 Workmanship: Install sheet metal work with lines, arrises, and angles sharp and true. Exposed surfaces shall be free from visible wave, warp, and buckle, and tool marks. Exposed edges shall be folded back neatly to form a 1/2-inch hem on the concealed side. Sheet metal exposed to the weather shall be watertight with provisions for expansion and contraction.

7.3 Nailing: Nailing of sheet metal shall be confined generally to sheet metal having a maximum width of 18 inches. Nailing or flashings shall be confined to one edge only. Nails shall be evenly spaced not over 3 inches on centers and approximately 1/2-inch from edge unless otherwise specified or indicated. Face nailing will not be permitted. Where sheet metal is applied to other than wood surfaces, detailed shop drawings shall include locations for sleepers and nailing strips required to properly secure the work.

7.4 Cleats: Provide cleats for sheet metal 18 inches and over in width. Space cleats evenly not over 12 inches on centers unless otherwise specified or indicated. Unless otherwise specified, cleats shall be not less than 2 inches wide by 3 inches long and of the same material and thickness as the sheet metal being installed. One end of the cleat shall be secured with two nails and the cleat folded back over the nailheads. The other end shall be locked into the seam. Cleats for soldered seams shall be pretinned.

7.5 Bolts, Rivets, and Screws: Install bolts, rivets, and screws where indicated or required. Provide compatible washers where required to protect surface of sheet metal and to provide a watertight connection.

7.6 Seams: Straight and uniform in width and height with no solder showing on the face.

7.6.1 Flat-lock Seams: Finish not less than 3/4-inch wide.

7.6.2 Lap Seams: Finish soldered seams not less than one inch wide. Overlap seams not soldered, not less than 3 inches.

7.6.3 Loose-lock Expansion Seams: Not less than 3 inches wide, and shall provide minimum one inch movement within the joint. Joint shall be completely filled with the specified sealant, applied at not less than 1/8-inch thick bed. Sealants are specified in Section CALKING AND SEALANTS.

7.6.4 Standing Seams: Not less than one inch high, double locked without solder.

7.6.5 Flat Seams: Make seams in the direction of the flow.

7.7 Soldering, Welding, and Mechanical Fastening: Where soldering is specified herein it shall apply to stainless steel items. Welding is specified for aluminum of thickness greater than 0.040inch. Aluminum 0.040-inch or less in thickness shall be butted with space and backed with formed flashing plate; or lock joined, mechanically fastened, and filled with sealant as recommended by the aluminum manufacturer.

7.7.1 Soldering: Pretin edges of sheet metals before soldering is begun. Soldering shall be done slowly with well heated soldering irons so as to thoroughly heat the seams and completely sweat the solder through the full width of the seam. Edges of lead-coated material to be soldered shall be scraped or wire-brushed to produce a bright surface, and seams shall have a liberal amount of flux brushed in before soldering is begun. Edges of stainless steel to be pretinned shall be treated with soldering acid flux. Soldering shall follow immediately after application of the flux. Upon completion of soldering the acid flux residue shall be thoroughly cleaned from the sheet metal with a solution of washing soda in water and rinsed with clean water. Joints in aluminum sheets 0.040-inch or less in thickness shall be made mechanically and sealed with the sealant specified. Aluminum shall not be soldered.

7.7.2 Welding of Aluminum: Joints in aluminum sheets more than 0.040-inch thick shall be welded. Welding shall be of the inertgas, shield-arc type. The procedures, the appearance and quality of welds made, and the methods used in correcting welding work shall conform to AWS Standard D1.1. Health and safety procedures shall conform to AWS A6.1 and ANSI Z49.1.

7.7.3 Mechanical Fastening of Aluminum: No. 12 aluminum alloy sheet metal screws or other suitable aluminum alloy or stainless steel fasteners driven in holes made with a No. 26 drill, shall be used in securing side laps, end laps, and flashings. Maximum spacing for fasteners shall be 12 inches O.C. Where end lap fasteners are required to improve closure, they shall be located not more than 2 inches from the end of the overlapping sheet.

7.8 Protection from Contact of Dissimilar Materials:

7.8.1 Aluminum: Surfaces shall not contact other metals except stainless steel, zinc, or zinc coating. Where aluminum contacts another metal, the dissimilar metal shall be painted with a primer followed by two coats of aluminum paint.

7.8.2 All Metal: Surfaces in contact with mortar, concrete, or other masonry materials shall be painted with alkali-resistant coatings such as heavy-bodied bituminous paint.

7.8.3 Wood or Other Absorptive Materials: Surfaces that may become repeatedly wet and in contact with metal shall be painted with two coats of aluminum paint or a coat of heavy-bodied bituminous paint.

7.9 Provision for Expansion and Contraction: Provide expansion and contraction joints at not more 32-foot intervals for aluminum and at not more than 40-foot intervals for other metals, except that where the distance between the last expansion joint and the end of the continuous run is more than half the required interval spacing an additional joint shall be provided. Space joints evenly. Extruded aluminum gravel stops and fascias shall be joined by expansion and contraction joints at not more than 12-foot spacing.

7.10 Gravel Stops and Roof Edge Fascias: Prefabricate in the shapes and sizes indicated and in lengths not less than 8 feet. Extend flange at least 4 inches onto roof deck. Provide prefabricated mitered corners for internal and external corners. Install gravel stops and fascias after all plies of the roofing membrane have been applied, but before the flood coat of bitumen is applied. Prime roof flange of gravel stops and fascias on both sides with an asphalt primer. After primer has dried, set flange on top of the roofing felts in a 1/8-inch thick bed of plastic cement. Nail flange securely to wood nailer with large-head barbed-shank roofing nails 1-1/2 inches long spaced not more than 3 inches on centers.

7.10.1 Hook Strips: The lower edge of fascias shall be hooked at least 3/4-inch over a continuous hook strip of the same material bent outward at an angle of 45 degrees to form a drip. Nail hook strip to a wood nailer at 6 inches maximum on centers. Where fastening is made to concrete or masonry, screws spaced 12 inches O.C. shall be used and shall be driven in expansion shields set in the concrete or masonry. Where horizontal wood nailers are slotted to provide for insulation venting, install hook strips in such a manner that vent slots are not obstructed. Where necessary, install hook strips over 1/16-inch thick compatible spacer or washers.

7.10.2 Joints: Section ends of gravel stops and fascias shall be left open 1/4-inch and backed with a formed flashing plate, mechanically fastened in place and lapping each section end a minimum of 4-inches; set laps in plastic cement. Face nailing will not be permitted. Extruded aluminum gravel stops and fascias shall be installed in accordance with the manufacturer's printed instructions and details.

7.11 Gutters: The hung type of shape indicated and supported on underside by brackets that permit free thermal movement of the gutter. Provide gutters in sizes indicated complete with mitered corners, end caps, outlets, brackets, and other accessories necessary for installation. Gutters shall be fabricated of aluminum, or stainless steel. The outer edge of gutter shall be beaded or reinforced with a stiffening bar not less than 3/4 by 3/16-inch of material compatible with gutter. Gutters shall be fabricated in sections not less than 8 feet long. The sections shall be lapped a minimum of one inch in the direction of flow. Gutters, other than aluminum shall be joined by riveted and soldered joints. Aluminum gutters shall be joined with riveted sealed joints. Expansion-type slip joints shall be provided midway between outlets. Install gutters below slope line of the roof so that snow and ice can slide clear. Support gutters on approved type adjustable hangers spaced not more than 30 inches on centers. Gutters shall be adjusted to slope uniformly to outlets, with high points occuring midway between outlets. Hangers and fastenings shall be fabricated from metals compatible with the gutters.

7.12 Downspouts: The corrugated type, of the shapes and sizes indicated, and provided complete including elbows and offsets. Downspouts shall be provided in approximately 10-foot lengths; end joints shall telescope not less than 1/2-inches, and longitudinal joints shall be locked. Gutter outlets shall be provided with wire ball strainers of a standard type for each outlet. Strainers shall fit tightly into outlets and shall be of the same material used for gutters. Downspouts shall be kept not less than one inch away from walls and shall be fastened to the walls at top, bottom, and at not to exceed 5 foot centers intermediately between, with approved type leader straps or concealed rack-and-pin type fasteners; straps and fasteners shall be formed from metal compatible with the downspouts. Downspouts terminating in splash blocks shall be provided with elbow-type fittings. Splash blocks shall be concrete.

7.13 Bitumen Stops: May be provided at eaves and rakes in lieu of felt envelopes. Bitumen stops shall be either (a) the rigid type with a 3/4-inch minimum vertical leg extending up into the gravel stops or (b) the folded type with a 3-inch minimum vertical leg folding back over the roofing felts. Provide bitumen stops in the form of a vertical sleeve 3 inches high with flange for all pipes projecting through roof. Horizontal flanges of bitumen stops shall be not less than 4 inches wide. Prior to installation of roofing felts, bitumen stops shall be nailed to wood nailers at not more than 3 inches on centers.

8. CLEANING: Clean all exposed sheet metal work at completion of installation. Grease and oil films, handling marks, contamination from steel wool, fittings and drilling debris shall be removed, and the work scrubbed clean. All exposed metal surfaces shall be free of dents, creases, waves, scratch marks, and solder or weld marks.

9. REPAIRS TO FINISH: Scratches, abrasions, and minor surface defects of finish may be repaired in accordance with the manufacturer's printed instructions and as approved. Finish repaired surfaces shall be uniform and free from scratches, blemishes, and from variations of color and surface texture.

TABLE I. SHEET METAL WEIGHTS, THICKNESSES, AND GAGES

	Aluminum, Inch	Stainless Steel, Inch
Covering on Downspouts and leaders	.032	.015
Downspout clips and anchor	.040 clip .125 anchor	- -
Downspout straps, 2-inch	.060	.050
Strainers, wire diameter or gage	.144 dia.	.109 dia.
Gravel stops and fascias:		
Extrusions	.075	-
Sheets, smooth	.050	.018
Gutters:		
Gutter section	.032	.015
Continuous cleat	.032	.015
Hangers, dimensions	1"x.080"	1"x.037"
Bitumen stops:		
Rigid	.032	.018
Folded	.020	.015

TABLE II. SHEET METAL JOINTS

Designation	TYPE OF JOINT		Remarks
	Stainless Steel	Aluminum	
Edge strip.	Butt.	Butt.	- - -
Gravel stops:			
Extrusions.	- - -	Butt with 1/2-inch space.	Use sheet flashing beneath and a cover plate.
Sheet, smooth	Butt with space	Butt with space	Use sheet flashing back-up plate.
Gutters.	1-1/2 inch lap, riveted and soldered.	One-inch flat locked, riveted, and sealed.	Aluminum producers recommended hard setting sealant for locked aluminum joints.

*** END OF SECTION ***

SECTION 07920

SEALANTS AND CALKINGS

PART 1 - GENERAL

1.1 APPLICABLE PUBLICATIONS: The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

1.1.1 American Society for Testing and Materials (ASTM) Publications:

C 920-79 Elastomeric Joint Sealants

1.2 SUBMITTALS:

1.2.1 Certificates of Conformance or Compliance: Submit certificates from the manufacturers attesting that materials meet the specified requirements.

1.2.2 Manufacturers' Descriptive Data: Submit complete descriptive data for each type of material. Clearly mark data to indicate the type the Contractor intends to provide. Data shall state conformance to specified requirements. Data for sealant and calking shall include application instructions, shelf life, mixing instructions for multicomponent sealants, and recommended cleaning solvents.

1.3 ENVIRONMENTAL CONDITIONS: The ambient temperature shall be within the limits of 40 and 100 degrees F when the sealant and calking are applied.

1.4 DELIVERY AND STORAGE: Deliver materials to the job site in the manufacturers' external shipping containers, unopened, with brand names, date of manufacture, and material designation clearly marked thereon. Containers of elastomeric sealant shall be labeled as to type, class, grade, and use. Carefully handle and store all materials to prevent inclusion of foreign materials or subjection to sustained temperatures exceeding 100 degrees or less than 40 degrees F.

PART 2 - PRODUCTS

2.1 MATERIALS: Products shall conform to the reference documents listed for each use. Color of sealant and calking shall match adjacent surface color unless specified otherwise. For ASTM C 920 sealants, use a sealant that has been tested on the types of substrate to which it will be applied.

2.1.1 Sealant: For joints in vertical surfaces, provide ASTM C 920, Type S or M, Grade NS, Class 25, Use NT. For joints in horizontal surfaces, provide ASTM C 920, Type S or M, Grade P, Class 25, Use T. Color of sealant shall be gray or white.

2.1.2 Primer for Sealant: Use a non-staining, quick-drying type and consistency recommended by the sealant manufacturer for the particular application.

2.1.3 Bond Breakers: Use the type and consistency recommended by the sealant manufacturer for the particular application.

2.1.4 Backstops: Use glass fiber roving or neoprene, butyl, polyurethane, or polyethylene foams free from oil or other staining elements as recommended by the sealant manufacturer. Backstop material shall be compatible with the sealant. Do not use oakum and other types of absorptive materials as backstops.

PART 3 - EXECUTION

3.1 SURFACE PREPARATON: Surfaces shall be clean, dry to the touch, and free from frost, moisture, grease, oil, wax, lacquer, paint, or other foreign matter that would tend to destroy or impair adhesion. Where adequate grooves have not been provided, clean out grooves to a depth of 1/2 inch and grind to a minimum width of 1/4 inch without damage to the adjoining work. No grinding shall be required on metal surfaces.

3.1.1 Steel Surfaces: Remove loose mill scale by sandblasting or, if sandblasting is impractical or would damage finish work, scraping and wire brushing. Remove protective coatings by sandblasting or using a solvent that leaves no residue.

3.1.2 Aluminum or Bronze Surfaces: Remove temporary protective coatings from surfaces that will be in contact with sealant. When masking tape is used as a protective coating, remove tape and any residual adhesive just prior to sealant application. Use non-staining solvents recommended by the item manufacturer.

3.2 SEALANT PREPARATION: Do not modify the sealant by addition of liquids, solvents, or powders. Mix multicomponent elastomeric sealants in accordance with manufacturer's printed instructions.

3.3 APPLICATION:

3.3.1 Backstops: Where joint cavities are constructed deeper than indicated, tightly pack the back or bottom with backstop material to provide a joint of the depth indicated. Install backstops dry and free of tears or holes.

3.3.2 Primer: Just prior to application of the sealant or calking compound, clean out all loose particles from joints. Apply primer in accordance with compound manufacturer's directions. Do not apply primer to exposed finish surfaces.

3.3.3 Bond Breaker: Provide bond breakers as recommended by the sealant manufacturer for each type of joint and sealant used.

3.3.4 Sealant and Calking Compounds: Use a compound that is compatible with the material to and against which it is applied. Do not use a compound that has exceeded its shelf life or has become too jelled to be discharged in a continuous flow from the gun. Apply the compound in accordance with the manufacturer's printed instructions. Force the compound into joints with sufficient pressure to fill the joints solidly. Compound shall be uniformly smooth and free of wrinkles.

3.3.4.1 Sealant: Provide sealant at all joints around the perimeter of openings and at all exposed joints in or on the building and at all joints indicated to receive sealant or calking.

3.4 PROTECTION AND CLEANING:

3.4.1 Protection: Protect areas adjacent to joints from compound smears. Masking tape may be used for this purpose if removed 5 to 10 minutes after the joint is filled.

3.4.2 Cleaning: Immediately scrape off fresh compound that has been smeared on masonry and rub clean with a solvent as recommended by the compound manufacturer. Upon completion of compound application, remove all remaining smears and stains resulting therefrom and leave the work in a clean and neat condition.

*** END OF SECTION ***

SECTION 08110

HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 APPLICABLE PUBLICATIONS: The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

1.1.1 Federal Specification (Fed. Spec.):

HH-I-524C	Insulation Board, Thermal (Polystyrene)

1.1.2 Military Specification (Mil. Spec.):

DOD-P-21035A	Paint, High Zinc Dust Content, Galvanizing Repair (Metric)

1.1.3 American Society for Testing and Materials (ASTM) Publications:

A 591-77	Steel Sheet, Cold-Rolled, Electrolytic Zinc-Coated
D 1621-73 (R 1979)	Compressive Properties of Rigid Cellular Plastics
D 1622-63 (R 1975)	Apparent Density of Rigid Cellular Plastics
D 1623-78	Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics
D 2126-75	Response of Rigid Cellular Plastics to Thermal and Humid Aging
D 2863-77	Measuring the Minimum Oxygen Concentration to Support Candle-Like Combustion of Plastics (Oxygen Index)

1.1.4 American National Standards Institute, Inc. (ANSI) Publications:

A115.2-80	Door and Frame Preparation for Bored or Cylindrical Locks for 1-3/8-Inch and 1-3/4-Inch Doors

1.1.5 The Steel Door Institute (SDI) Publications:

100-80	Recommended Specifications - Standard Steel Doors and Frames
107-72	Hardware on Steel Doors (Reinforcement-Application)

1.2 SUBMITTALS:

1.2.1 Catalog Data: Submit manufacturer's descriptive literature for all doors and frames. Include data and details on door construction, panel (internal) reinforcement, insulation, and door edge construction.

1.2.2 Shop Drawings: Submit shop drawings for doors and frames showing elevations, construction details, metal gages, hardware provisions, and installation details.

1.2.3 Certificates of Conformance or Compliance: Submit manufacturer's certificates attesting that doors, frames, and accessories meet the requirements specified herein.

1.2.4 Samples: Submit two color samples of each color for prefinished doors. Where colors are not indicated, submit manufacturer's standard colors and patterns to the Contracting Officer for selection.

1.3 DELIVERY AND STORAGE: Deliver doors, frames, and accessories undamaged and with protective wrappings or packaging. Store doors and frames on platforms under cover in clean, dry, ventilated, and accessible locations, with 1/4-inch air space between doors. Remove damp or wet packaging immediately and wipe all affected surfaces dry. Replace damaged materials with new.

PART 2 - PRODUCTS

2.1 STANDARD HOLLOW METAL DOORS: SDI-100, except as specified otherwise for Type II and III doors. Prepare doors to receive hardware specified in Section 08710, "Finish Hardware." Exterior doors shall have top edge closed flush. Doors shall be 1-3/4 inches thick, unless otherwise indicated.

2.1.1 Door Types:

2.1.1.1 Heavy Duty Doors: SDI-100, Type II, Style 2, 3, or 4, of size and design indicated. Plastic foam panel reinforcement shall be as specified herein. Fill exterior doors with mineral fiber insulation or plastic foam panel reinforcement.

2.2 CUSTOM HOLLOW METAL DOORS: Provide custom hollow metal doors where non-standard hollow metal doors are indicated. At the Contractor's option, custom hollow metal doors may be provided in lieu of Type II standard hollow metal doors. Door size, design, materials, gages, and finish shall be as specified for standard hollow metal doors. Provide panel reinforcement consisting of continuous vertical formed steel stiffeners, not lighter than 22 gage, spaced not more than 6 inches apart, and welded to both face sheets at not more than 5 inches o.c. Fill spaces between stiffeners of exterior doors with insulation. Close top and bottom edges with steel channels not lighter than 16 gage. Close tops of exterior doors flush with an additional channel. Prepare doors to receive hardware specified in Section 08710, "Finish Hardware." Doors shall be 1-3/4 inches thick, unless otherwise indicated.

2.3 LOUVERS FOR DOORS:

2.3.1 Louvers: Louvers for exterior doors shall be inverted Y type. Weld or tenon louver blades to frame and fasten the entire louver assembly to the door with moldings. Moldings on the room or nonsecurity side of the door shall be detachable; moldings on the security side shall be an integral part of the louver. Form louvers 16 gage steel for exterior doors and panels. Louvers for exterior doors shall have steel-framed insect screens secured to louvers in a rigid manner to permit ready removal. Provide aluminum wire cloth, 18 by 18 regular mesh or 18 by 14 heavy mesh, for insect screens. Louvers for exterior doors shall have a minimum of 30 percent net free opening.

2.3.2 Moldings: Provide moldings around louvered panels for a rigid and secure installation. Provide nonremovable panel moldings on the outside of exterior doors and on the corridor side of interior doors. Other moldings around side panels may be stationary or removable. Secure moldings on the inside of louver panels to the stationary moldings and muntins with ovalhead countersunk sheet metal or machine screws having small heads.

2.4 PLASTIC FOAM PANEL REINFORCEMENT: Provide plastic foam core panel reinforcement by one of the following methods:

a. A continuous rigid polyurethane plastic foam core, foamed-in-place or in board form bonded to the steel face sheets, and free of voids or other defects that could affect serviceability. The foam shall have the following properties when tested in accordance with the listed test methods:

Property	Requirement	Test Method
Flammability (Oxygen Index)	24 percent min.	ASTM D 2863
Density, core	2 lb. per cu. ft., nom.	ASTM D 1622

Compressive strength	20 psi, min., at 10 percent deformation or at yield point, whichever occurs first	ASTM D 1621, Procedure A
Tensile strength	20 psi, min., and not greater than foam to steel face sheet bond strength	ASTM D 1623, Type B Specimen (Board form polyurethane shall be bonded with adhesive used for bonding in door.)
Dimensional stability	Plus or minus 5 percent volume change, max., and no visible distortion after 7 days exposure at minus 15 degrees F and 200 degrees F	ASTM D 2126, dimensions and visual examination measurements only
Holes and voids	No single hole or void larger than 1/4 inch in any direction, and no more than 8 holes up to 1/4 inch in size in any direction per 8 square feet of surface area	Visual examination

b. A rigid, molded polystyrene plastic foam bead board core bonded to the steel face sheets with a thermosetting adhesive. The foam core shall have the following properties when tested in accordance with the listed test methods:

Property	Requirement	Test Method
Flammability (Oxygen Index)	AEB 60 mm. max., ATB 50 Sec. max.	ASTM D 2863
Density	1.0 lb. per cu. ft., nom.	ASTM D 1622
Compressive strength	10 psi, min., at 10 percent deformation or at yield point, whichever occurs first	ASTM D 1621, Procedure A
Tensile strength	18 psi, min., and not greater than foam to steel face sheet bond strength	ASTM D 1623, Type B specimen (Polystyrene foam shall be bonded with adhesive used for bonding in door.)

Dimensional stability	Plus or minus 5 percent volume change, max., and no visible distortion after 7 days exposure at minus 15 degrees F and 165 degrees F	ASTM D 2126, dimensions and visual examination measurements only
Holes and voids	No single hole or void larger than 1/4 inch in any direction, and no more than 8 holes up to 1/4 inch in size in any direction per 8 square feet of surface area	Visual examination
Bead fusion	Essentially fused bead structure indicated by an excess of broken or sheared beads	Fed. Spec. HH-I-524, bead fusion test

2.5 HOLLOW METAL FRAMES: SDI-100, except as otherwise specified. Form frames for standard and custom hollow metal doors to sizes and shapes indicated, with full-welded unit or knockdown field-assembled type construction at corners. Provide hollow metal frames for doors, where indicated.

2.5.1 Joints:

2.5.1.1 Welded-Type Frames: Miter or butt and face weld corner joints from the outside. Head and jamb rabbets shall have mechanically interlocked or welded joints with all contact edges closed tight. Dress welds flush and smooth.

2.5.1.2 Knock-Down Type Frames: Design corner joints for simple field assembly by concealed tenons, splice plates, or interlocking joint that will produce square, rigid corners and a tight fit and maintain the alignment of adjoining members. Provide locknuts for all bolted connections.

2.5.2 Anchors: Provide anchors to secure the frame to adjoining construction. Provide steel anchors zinc-coated or painted with rust-inhibitive paint, not lighter than 18 gage.

2.5.2.1 Wall Anchors: Provide a minimum of three anchors for each jamb. Locate anchors opposite top and bottom hinges and midway between.

a. Masonry: Provide anchors of corrugated or perforated steel straps or 3/16-inch diameter steel wire, adjustable or "T" shaped.

2.5.2.2 Floor Anchors: Provide floor anchors at bottom of each jamb member. Provide fixed or adjustable anchors, drilled for 3/8-inch diameter anchor bolts.

2.6 HARDWARE PREPARATION: Reinforce, drill, and tap doors and frames to receive finish hardware. Prepare doors and frames for hardware in accordance with the applicable requirements of ANSI A115.1 through A115.14 and SDI-107. Drill and tap for surface-applied hardware at the project site. Build additional reinforcing for surface-applied hardware into the door at the factory. Locate hardware in accordance with the requirements of SDI-100, as applicable. Punch door frames to receive a minimum of two rubber or vinyl door silencers on lock side of single doors. Set lock strikes out to provide clearance for silencers.

2.7 FINISHES:

2.7.1 Electrolytic Zinc-Coated and Factory-Primed Finish: Fabricate doors and frames from electrolytic zinc-coated steel, ASTM A 591, Commercial Quality, Coating Class A. Phosphate treat and factory prime zinc-coated surfaces as specified in SDI-100.

2.8 FABRICATION AND WORKMANSHIP: Finished doors and frames shall be strong and rigid, neat in appearance, and free from defects, waves, scratches, cuts, dents, ridges, holes, warp, and buckle. Molded members shall be clean cut, straight, and true, with joints coped or mitered, well formed, and in true alignment. Dress exposed welded and soldered joints smooth. Design door frame sections for use with the wall construction indicated. Corner joints shall be well formed and in true alignment. Conceal fastenings where practicable. Design frames in exposed masonry walls to allow sufficient space between the inside back of trim and masonry to receive calking compound.

PART 3 - EXECUTION

3.1 INSTALLATION:

3.1.1 Hollow Metal Frames: Set frames accurately in position and plumb, align, and brace securely until permanent anchors are set. Anchor bottoms of frames securely to floors with expansion bolts or powder-actuated fasteners. Build in or secure wall anchors to adjoining construction. Backfill frames in masonry construction with mortar.

3.1.2 Hinged Doors: Calk metal-to-metal joints in exterior framing members as specified in Section 07920, "Sealants and Calking," and remove excess calking. Hang doors in accordance with clearances specified in SDI-100. After erection and glazing, clean and adjust hardware.

3.2 PROTECTION: Protect doors and frames from damage. Repair damaged doors and frames prior to completion and acceptance of the project or replace with new, as directed. Wire brush frames that have rusted until all rust is removed, clean thoroughly, and apply an all-over coat of rust-inhibitive paint of the same type used for shop coat.

3.3 CLEANING: Upon completion, clean exposed surfaces of doors and frames thoroughly. Remove all mastic smears and other unsightly marks.

*** END OF SECTION ***

SECTION 08520

ALUMINUM WINDOWS

PART 1 - GENERAL

1.1 APPLICABLE PUBLICATIONS: The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

1.1.1 Federal Specifications (Fed. Spec.):

L-S-125B	Screening, Nonmetallic, Insect
FF-H-111C	Hardware, Builders'; Shelf and Miscellaneous
RR-W-365A	Wire Fabric (Insect Screening)

1.1.2 Aluminum Association (AA) Publication:

(6th Edition)	Designation System for Aluminum Finishes

1.1.3 American National Standards Institute (ANSI) Publications:

ANSI/AAMA 302.9-1977	Aluminum Prime Windows

1.1.4 Architectural Aluminum Manufacturers Association (AAMA) Publications:

603.8-1980	Performance Requirements and Test Procedures for Pigmented Organic Coatings on Extruded Aluminum

1.2 SUBMITTALS:

1.2.1 Catalog Data: Shall describe each type of window, hardware, fastener, accessory, operator, screen, and finish. Submit color chart of factory color coatings when factory-finished color coating is to be provided.

1.2.2 Shop Drawings: Shall indicate elevations of windows, full-size sections, thicknesses and gages of metal, fastenings, proposed method of anchoring, size and spacing of anchors, details of construction, method of glazing, details of operating hardware, method of attachment of screens, installation details, and other related items.

1.2.3 Window Schedule: Submit schedule with erection drawings indicating location of each window unit.

1.3 DELIVERY AND STORAGE: Deliver windows to project site in an undamaged condition. Use care in handling and hoisting windows during transportation and at the job site. Store windows and components out of contact with the ground, under a weathertight covering, so as to prevent bending, warping, or otherwise damaging the windows. Damaged windows shall be repaired to an "as new" condition as approved. If windows can not be repaired, a new unit shall be provided.

1.4 PROTECTION: Finished surfaces shall be protected during shipping and handling using the manufacturer's standard method, except that no coatings or lacquers shall be applied to surfaces to which calking and glazing compounds must adhere.

1.5 CERTIFICATION: Each prime window unit shall bear the AAMA 302.9 "QUALITY CERTIFIED" label warranting that the product complies with ANSI/AAMA 302.9. Window units without "QUALITY CERTIFIED" labels shall be tested for conformance with ANSI/AAMA 302.9 and the test reports shall be furnished.

PART 2 - PRODUCTS

2.1 MATERIALS: Prime windows shall conform to the requirements of ANSI/AAMA 302.9 and the specifications listed below. Provide windows of combinations, types and sizes indicated or specified. Each window shall consist of a unit including frame, sash, hardware, glass, trim, insect screen, and anchors, complete. Design windows indicated to have screens or storm units to accommodate the items to be furnished. Window units shall be prime windows of the types specified. Dimensions shown are minimum.

2.1.1 Projected Windows: Type P-A2. Where fixed screens occur at projected-out ventilators, provide underscreen pushbar operators.

2.1.2 Glass and Glazing: ANSI/AAMA 302.9, wired glass, 1/4-inch thick.

2.1.3 Weatherstripping: ANSI/AAMA 302.9.

2.1.4 Insect Screening: Fed. Spec. RR-W-365, Type VII (aluminum alloy) or L-S-125, Type II, Class 2 (plastic-coated or impregnated fibrous glass yarn) of standard color as approved.

2.2 FABRICATION: Window units shall conform to the requirements of Master Specification, Part A, "Architectural," of ANSI/AAMA 302.9.

2.2.1 Weathering Surfaces: Roll integrally to provide two-point parallel-surface contact with an overlap at both inside and outside points of closure.

2.2.2 Drips and Weep Holes: Provide as required to return water to outside.

2.2.3 Glazing: Glaze windows double-strength glass.

2.2.4 Fasteners: Use flathead, cross-recessed type, exposed head screws and bolts with standard threads on windows, trim, and accessories. Screw heads shall finish flush with adjoining surfaces. Self-tapping sheet-metal screws are not acceptable for material more than 1/16-inch in thickness.

2.2.5 Provisions for Glazing: Design sash for inside or outside glazing and for securing glass with metal beads and glazing compound. Provide rabbets of adequate weight and depth to receive and properly support the glass and glazing accessories.

2.2.6 Accessories: Provide windows complete with necessary hardware, fastenings, clips, fins, anchors, glazing beads, and other appurtenances necessary for complete installation and proper operation.

2.2.6.1 Anchors: Build into, bolt to, or otherwise secure anchors and fastenings to the heads, jambs, and sills of openings, and fasten securely to the windows or frames. Use concealed anchors of the type recommended by the window manufacturer for the specific type of construction. Use fasteners compatible with the fastened materials. Anchor each frame at jambs with a minimum of three adjustable anchors. Provide perforated anchor stems for mortar keying with anchor flanges of sufficient width to provide a sliding friction fit inside frames. Extend perforated stems not less than 4 inches into masonry.

2.2.6.2 Weatherstripping: Provide for ventilating sections of all windows to insure a weather-tight seal meeting the infiltration tests specified herein. Use easily replaceable factory-applied weatherstripping of manufacturer's stock type. Use molded vinyl, molded or molded-expanded neoprene for weatherstripping for compression contact surfaces. Do not use neoprene or polyvinylchloride weatherstripping where they will be exposed to direct sun light.

2.2.6.3 Hardware: Shall conform to the requirements of ANSI/AAMA 302.9. Equip all operable sash with a locking or latching device which can be secured from the inside. The item, type, and function of hardware required is specified under each individual window type. Provide hardware of suitable design and of sufficient strength to perform the function for which it is used.

2.2.7 Finishes: Exposed aluminum surfaces shall be factory finished with anodic coating or organic coating.

2.2.7.1 Anodic Coating: Exposed aluminum surfaces shall be cleaned and given an anodized finish conforming to AA "Designation System for Aluminum Finishes." Finish shall be clear (natural) designation AA-M10-C22-A31, Architectural Class II (0.4 mil to 0.7 mil).

2.2.7.2 Organic Coating: Exposed aluminum surfaces shall be thoroughly cleaned, primed, and given a baked enamel finish, in accordance with AAMA 603.8, with total dry film thickness not less than 0.8 mil. The finish color shall be white.

2.2.8 Drips: Provide continuous drips over heads of top ventilators. When fixed sections adjoin ventilators, drips shall be continuous across tops of fixed sections.

2.2.9 Screens: Provide one insect screen unit for each operable exterior sash or ventilator. Locate screen units either inside or outside, depending upon window type and method of operation. Provide full-length top-hung type screens. Design screens to fit closely around entire perimeter of each ventilator or opening, to be rewirable, easily removable from inside building, and interchangeable for same size ventilators of similar type windows, with a minimum of exposed fasteners and latches. Provide all guides, stops, clips, bolts, and screws, as necessary, for a secure and insect-tight attachment to window. Insofar as practicable, design screens without the necessity of wickets for hardware access.

2.2.9.1 Frames: Provide same quality, material, and finish as the window unit. Frames shall have extruded sections not less than 7/16-inch by 1-inch by 0.062-inch thick or cold-rolled sections with equivalent properties, and shall have removable aluminum or vinyl splines. Hardware, attachment devices, and accessories shall be manufacturer's standard type and of same quality, material, and finish as hardware on window unit.

2.2.9.2 Screening: Install screening with weave parallel to frame and stretch sufficiently tight to present a smooth appearance. Conceal edges of screening in the spline channel.

PART 3 - EXECUTION

3.1 INSTALLATION:

3.1.1 Method of Installation: Install in strict accordance with the window manufacturer's printed instructions and details, except as specified otherwise herein. Build in windows as the work progresses or install without forcing into prepared window openings. Set windows at proper elevation, location, and reveal; plumb, square, level, and in

alignment; and brace, strut, and stay properly to prevent distortion and misalignment. Protect ventilators and operating parts against accumulation of dirt, and building materials by keeping ventilators tightly closed and locked to frame. Bed screws or bolts in sill members, joints at mullions, contacts of windows with sills, built-in fins, and subframes in mastic sealant of a type recommended by the window manufacturer. Install windows in a manner that will prevent entrance of water. Fasten insect screens securely in place. Fasten hardware to windows.

3.1.2 Anchors and Fastenings: Make ample provision for securing units to each other, to masonry, and to other adjoining construction. Windows installed in direct contact with masonry wall shall have head and jamb members designed to recess into masonry wall not less than 7/16 inch.

3.1.3 Adjustments After Installation: After installation of windows and completion of glazing and field painting, adjust all ventilators and hardware to operate smoothly and to provide weathertight sealing when ventilators are closed and locked. Lubricate hardware and operating parts as necessary.

3.1.4 Protection: Where aluminum surfaces are in contact with, or fastened to masonry, wood, or dissimilar metals, except stainless steel or zinc, the aluminum surface shall be protected from dissimilar materials as recommended in the Appendix to ANSI/AAMA 302.9. Surfaces in contact with sealants after installation shall not be coated with any type of protective material.

3.2 CLEANING: Clean interior and exterior surfaces of window units of mortar, plaster, paint spattering spots, and other foreign matter to present a neat appearance and to prevent fouling of weathering surfaces and weatherstripping, and to prevent interference with the operation of hardware. Replace with new windows all stained, discolored, or abraded windows that cannot be restored to their original condition.

*** END OF SECTION ***

SECTION 08710

FINISH HARDWARE

PART 1 - GENERAL

1.1 APPLICABLE PUBLICATIONS: The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

1.1.1 American National Standards Institute, Inc. (ANSI) Publication:

A156.1-1976	Butts and Hinges
A156.2-1976	Locks and Lock Trim
A156.6-1979	Architectural Door Trim
A156.8-1974	Door Controls-Overhead Holders

1.1.2 Builders Hardware Manufacturers Association (BHMA) Publications:

1301-1980	Materials and Finishes

1.2 SUBMITTALS:

1.2.1 Hardware Schedule: Before hardware is delivered to job site, submit for approval a hardware schedule in triplicate. Schedule shall include for each item quantities, manufacturer's catalog numbers, descriptive information and location and hardware set identification, corresponding reference publication type number to manufacturer's catalog number, size, finish, and list of abbreviations.

1.3 DELIVERY AND MARKING: Deliver items of hardware to job site in their original individual containers, complete with necessary appurtenances including screws, keys, and instructions. Mark each individual container with manufacturer's name and catalog number as they appear in hardware schedule.

PART 2 - PRODUCTS

2.1 HARDWARE MANUFACTURERS AND MODIFICATIONS: Provide, as far as practicable, locks of one lock manufacturer's make and hinges of one hinge manufacturer's make. Modifications to hardware that are necessary to conform to construction shown or specified shall be provided as required for the specified operative and functional features.

2.2 HARDWARE DESIGNATIONS: Hardware items covered by ANSI or BHMA standards are specified by BHMA designations. Items covered by Federal Specifications are specified by federal designations.

2.3 TEMPLATE HARDWARE: Hardware to be applied to metal and to prefinished doors shall be made to template. Promptly furnish template information or templates to metal door, and frame manufacturers in order to avoid delay in door and frame manufacturing. Effect proper coordination between manufacturers of different hardware items in order that each manufacturer may furnish templates which allow installation of hardware without interference to installation and operation of other hardware.

2.4 HARDWARE ITEMS: Hardware items shall conform to respective specifications and standards and to requirements specified herein.

2.4.1 Hinges: ANSI A156.1. Construct loose pin hinges for exterior doors and reverse-bevel interior doors so that pins will be nonremovable when door is closed. Nylon or oil impregnated bearing hinges may be provided in lieu of ball-bearing hinges. Hinges shall bear name or trademark of manufacturer. Provide types of hinges, sizes, finish, design options, and quantity per door for specific openings as specified herein under paragraph entitled "Hardware Sets."

2.4.2 Locks and Latches: ANSI A156.2, series 4,000. Locks and latchsets of the same series shall be the product of the same manufacturer. Lock cylinders shall have not less than 5 pin tumblers. Provide trim for locks and latchsets of wrought construction and of commercial plain design. Knobs and roses of Series 4000, Grade 1 cylindrical locks shall be 0.05 inch thick, exclusive of reinforcement, or shall have minimum 0.035 inch thick outer shell with a combined shell and reinforcement thickness of 0.070 inch, except that knob shank shall be 0.06 inch thick. Series 4000, Grade 1 locks shall have threaded roses and knobs and roses shall not have exposed screws. Latch retractor shall have a positive bearing nylon-to-steel bearings and shall have two compression springs. Legibly mark on the lock and latches where it can be seen after installation the name of the manufacturer, or a trademark by which it can be readily identified. Provide series, grade(s) and function of locks and latchsets for specific openings as specified herein under paragraph entitled "Hardware Sets."

2.4.3 Overhead Holders: ANSI A156.8

2.5 KEYING SYSTEM: Key doors alike. Provide 4 keys.

2.6 FASTENERS: Supply fasteners of proper type, quality, size, quantity, and finish with hardware. Supply fasteners exposed to weather of nonferrous metal or stainless steel and match finish of trim as closely as possible. Where hardware is of stainless steel, provide screws and fastenings also of stainless steel. Use fasteners of type necessary to accomplish a permanent installation.

2.7 FINISHES: Hardware shall have BHMA 630 finish (satin stainless steel), unless specified otherwise herein. Provide items not normally manufactured in stainless steel in BHMA 626 finish (satin chromium. BHMA finishes are defined in BHMA 1301.

PART 3 - EXECUTION

3.1 INSTALLATION OF HARDWARE: Install hardware following manufacturers' instructions. Except as indicated or specified otherwise, use fasteners furnished with hardware to fasten hardware in place. Fasten hardware to wood surfaces with full-threaded wood screws or sheet metal screws. Use machine screws set in expansion shields for fastening hardware to solid concrete and masonry surfaces. Use toggle bolts where required for fastening to hollow core construction. Use through bolts where indicated or specified and where necessary for satisfactory installation.

3.2 ACCEPTANCE: After installation, protect hardware from paint, stains, blemishes, and other damage until acceptance of work. Hinges, locks, holders and other items shall be adjusted to operate properly. Demonstrate that tagged keys operate respective locks. After hardware is checked, deliver tagged keys to Contracting Officer. Correct, repair, and finish as directed errors in cutting and fitting and damage to adjoining work.

3.3 LOCATION OF HARDWARE ON HINGED DOORS: Locate as follows, unless indicated or specified otherwise herein:

a. Locks: Locate knobs so that center line of strike is 40-5/16 inches (nominal) above bottom of door frame.

b. Hinges: Locate as follows:

Top Hinge	Not over 11-3/4 inches from inside of frame rabbet at head to center line of hinge
Bottom Hinge	Not over 13 inches above bottom of door frame to center line of hinge
Center Hinge	Midway between top and bottom hinges

3.4 DOOR SILENCERS: On hollow metal frames for single doors, locate silencers directly opposite hinges.

3.5 HARDWARE SETS:

HW-1 (Each Door)

1-1/2 Pair Hinges:	A5112 (Temp. w/special swaying), 4-1/2" by 4-1/2"
1 Ea. Lockset:	Series 4000, Grade 1, Function F84
1 Ea. Holder:	C01511

*** END OF SECTION ***

SECTION 09910

PAINTING OF BUILDINGS (FIELD PAINTING)

PART 1 - GENERAL

1.1 APPLICABLE PUBLICATIONS: The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

1.1.1 Federal Specifications (Fed. Spec.):

TT-E-489G	Enamel, Alkyd, Gloss (for Exterior and Interior Surfaces)
TT-P-98C	Paint, Stencil, Flat
TT-P-645A	Primer, Paint, Zinc-chromate, Alkyd Type
TT-S-176E & Am 1	Sealer, Surface, Varnish Type, Floor, Wood or Cork

1.1.2 Federal Commercial Item Description (Fed. CID):

A-A-1500	Latex (Water Reducible) Block Filler

1.1.3 Military Specifications (Mil. Spec.):

MIL-S-12935D	Sealer, Surface, for Knots
DOD-P-15328D	Primer (Wash), Pretreatment (Formula No. 117) for Metals)(Metric)
MIL-P-28582	Primer Coating, Exterior, Lead Pigment-free, (Undercoat for Wood, Ready-mixed, White and Tints)

1.1.4 Federal Standard (Fed. Std.):

Fed. Std. 595A & Notice 4	Colors

1.1.5 Military Standard (Mil. Std.):

MIL-STD-101B	Color Code for Pipelines and for Compressed-gas Cylinders

1.1.6 American Society for Testing and Materials (ASTM) Publications:

D 96-73 (R77)	Test Method for Water and Sediment In Crude Oils
D 523-78	Test Method for Specular Gloss
D 562-55 (R76)	Consistency of Paints Using the Stormer Viscometer
D 1640-69 (R74)	Test Method for Drying, Curing, or Film Formation of Organic Coatings at Room Temperature
D 1737-62 (R79)	Test for Elongation of Attached Organic Coatings With Cylindrical Mandral Apparatus
D 3273-76	Test Method for Resistance to Growth of Mold in the Surface of Interior Coatings in an Environmental Chamber
D 3274-76	Method of Evaluating Degree of Surface Disfigurements of Paint Films By Fungal Growth or Soil and Dirt Accumulation

1.2 SUBMITTALS:

1.2.1 Certificates of Conformance: Submit certificates of compliance from the manufacturer stating that previously manufactured materials have been tested by recognized laboratories; that such materials meet testing requirements in referenced specifications; and that the material furnished for this project is of the same type, quality, manufacture, and make as that tested. Copies of the test reports need not be submitted except as specifically requested by the Contracting Officer. The Government will take one pint samples from coatings being used on the job for testing by the Government.

1.3 APPROVAL OF MATERIALS: Do not apply any coating before required test reports, certificates, and requests for substitutions have been submitted and the respective material approved for use on this project. Submit all requests for substitutions to the Contracting Officer. Each such request shall include specific identification of the proposed substitute; justification for the necessity of the substitution; certified test reports of the proposed substitute, including all tests required by the specification for the substituted material; and a tabulation of the specified material compared to the proposed substitute. The tabulation shall include all tests, composition of both pigment and vehicle, and quantitative and qualitative requirements for both the specified and the proposed material; clearly indicate any deviations from specified requirements.

1.4 DELIVERY AND STORAGE: Deliver coatings and coating materials in unbroken original packages bearing the manufacturer's name and brand designation, specification number, batch number, color, date of manufacture, and manufacturer's instructions for application. Restrict storage of coatings and coating materials and the mixing of coatings to the locations directed.

1.5 SELECTION OF COLORS: Colors of finish coats shall be as indicated. Where colors are not indicated, the colors shall be as selected by the Contracting Officer from Fed. Std. No. 595. Manufacturers' names and color designations, if indicated, are used for the purpose of color designations only and are acceptable for use on this project only if they conform to all specified requirements. Products of other manufacturers are acceptable if the colors closely approximate colors indicated and the product conforms to all specified requirements.

1.6 DESCRIPTION OF WORK: Surfaces concealed by portable objects and by surface mounted articles readily detachable by removal of fasteners such as screws and bolts are included in the work. Surfaces concealed and made inaccessible by panelboards, fixed ductwork, machinery, and equipment fixed in place are not included. Remove articles obstructing access to those surfaces specified to be included in the work and restore to their original position on completion. Do not coat surfaces in concealed spaces unless specifically so stated. Concealed spaces are defined as spaces above suspended ceilings, furred spaces, attic spaces, crawl spaces, and chases. Do not coat surfaces of steel to be imbedded in concrete. Do not coat copper, stainless steel, and aluminum except where specifically so stated. Do not coat new factory finished materials except those that require identification or color coding and those factory-finished surfaces which are damaged during installation. Restore damaged factory-finished surfaces to their original condition. Do not paint zinc-coated ducts, zinc-coated pipe, or copper pipe under insulation or in concealed spaces.

1.6.1 Exterior Painting: Includes new surfaces.

1.6.2 Interior Painting: Includes new surfaces of the buildings and appurtenances of the types listed. Where a space or surface is indicated to be painted, include the painting of exposed piping, ductwork, and all other contiguous surfaces in the work unless indicated otherwise.

1.6.3 Mechanical and Electrical Painting: Includes the field coating of interior and exterior new piping, conduit, ductwork, supports, hangers, air grilles, registers, miscellaneous metalwork, and insulation coverings, except as specified otherwise herein. Do not coat new zinc-coated, aluminum and copper surfaces under insulation. Do not coat new aluminum jacket on piping.

PART 2 - PRODUCTS

2.1 MATERIALS: Conform to the respective specifications and standards listed for use in PART 3 and to the following requirements.

2.1.1 Latex Block Filler: Fed. CID A-A-1500 (see Appendix A).

2.1.2 Lead Content: Do not use coatings having a lead content of over 0.06 percent by weight of nonvolatile content.

PART 3 - EXECUTION

3.1 PROTECTION OF AREAS AND SPACES: Remove, mask, or otherwise protect prior to surface preparation and painting operations such items as hardware, hardware accessories, machined surfaces, radiator covers, plates, lighting fixtures, and similar items in contact with coated surfaces. Following completion of painting, reinstall removed items utilizing workmen skilled in the trades involved for such removal and reinstallation. Protect from contamination by coating materials all surfaces not to be coated. Restore surfaces that are contaminated by painting materials to original condition.

3.2 PREPARATION OF SURFACES: Remove all dirt, rust, scale, splinters, loose particles, grease, oil, and other deleterious substances from all surfaces which are to be coated or otherwise finished. Allow putty to set one week before coating. Calking and glazing compounds shall be allowed to cure for times stated in manufacturers' literature prior to being coated. Inspect surfaces after preparation and receive approval before application of any coatings.

3.2.1 Wood Surfaces:

3.2.1.1 Wood Surfaces: Surfaces shall be free from dust and in an approved condition to receive the paint or other finish. Do not use water on uncoated wood. Prior to application of paint, treat knots and resinous wood with an application of knot sealer, Mil. Spec. MIL-S-12935. Putty cracks and nailholes after the priming coat has been applied and has dried properly. Set and putty stop all nail heads. Where checking of the wood is present, sand the surface down smooth, wipe, and apply a coat of pigmented orange shellac and allow to dry before additional paint is applied. Fill open joints and all other openings with whiting putty, Fed. Spec. TT-P-791, and sand smooth after it has dried.

3.2.2 Concrete and Masonry: Remove dirt, fungus, grease, and oil prior to application of coatings. Wash new surfaces with a solution composed of from 2 to 8 ounces of trisodium phosphate per gallon of hot water and then rinse thoroughly with fresh water. Remove glaze, all loose particles, and scale by wire brushing. Remove efflorescence by

scraping, wire brushing, and washing with a 5- to 10-percent by weight aqueous solution of hydrochloric (muriatic) acid and then wash thoroughly with fresh water, removing all traces of the acid. Give all new surfaces to be painted a neutralizing treatment consisting of 2 pounds of zinc sulphate in one gallon of warm water. Apply the neutralizer liberally and allow to dry, then rinse the surfaces thoroughly with clean water and allow to dry for not less than 48 hours before paint is applied.

3.2.3 New Unprimed Metal Surfaces: Solvent clean zinc-coated surfaces with mineral spirits and wipe dry with clean, dry cloths. Treat aluminum surfaces to be painted with a 10 percent aqueous solution of chromic acid at a temperature of not less than 140 degrees F for 3 to 5 minutes and rinse thoroughly with clean warm water. Immediately after cleaning and treating, apply pretreatment wash primer, Mil. Spec. DOD-P-15328, to a dry film thickness of 0.2 to 0.5 mil on zinc-coated, aluminum, brass, copper, and ferrous surfaces. Apply primer as soon as practicable after pretreatment has dried.

3.3 APPLICATION: Provide finished surfaces free from runs, drops, ridges, waves, laps, brush marks, and variations in colors. Avoid contamination of other surfaces and public and private property in the area; repair all damage thereto. Allow sufficient time between coats to permit thorough drying and provide each coat in proper condition to receive the next coat. Each coat shall cover the surface of the preceding coat or surface completely; there shall be an easily perceptible difference in shades of successive coats. Thoroughly clean surfaces to be coated. Interior areas shall be broom-clean and dust-free before and during the application of coating material. Prior to erection, use two coats of the designated primer to treat and prime wood and metal surfaces which will be inaccessible after erection. Thoroughly work painting materials into all joints, crevices, and open spaces. Finished surfaces shall be smooth, even, and free of defects. Retouch damaged painting before applying succeeding coats of paint. Procure and utilize the engineering controls and/or personal protective equipment necessary for safe and effective application of specified paint systems.

3.3.1 Equipment: Apply coatings carefully with good, clean brushes, except as specified otherwise.

3.3.2 Thinning of Paints: Reduce paints to proper brushing consistency by adding fresh paint, except that when thinning is mandatory for the type of paint being used, obtain written permission from the Contracting Officer to use thinners. The written permission shall include quantities and types of thinners to use.

3.3.3 Environmental Conditions: Do not apply exterior coatings in foggy or rainy weather or when the temperature of the air at the surface is below 45 degrees F or over 95 degrees F, unless approved by the Contracting Officer. Apply interior coatings when the surfaces to be painted are dry and the temperature can be kept above 45 degrees F and below 95 degrees F during the application of ordinary paints and between 65 degrees F and 95 degrees F during the application of enamels and varnishes.

3.3.4 Paint Systems: New surfaces shall receive the following coatings conforming to the respective specifications listed. Apply paints, primers, varnishes, enamels, undercoats, and other coatings to a dry film thickness of not less than 1.0 mil each coat except as specified otherwise. Where coating thickness is specified, it is the minimum dry film thickness.

3.3.4.1 Exterior Surfaces:

a. Wood Surfaces:

One coat of primer, Mil. Spec. MIL-P-28582
Two coats of enamel, Fed. Spec. TT-E-489

b. Metal Surfaces:

Touch up shop prime coat on shop primed surfaces
Primer, Fed. Spec. TT-P-645, two coats on surfaces not shop primed, one coat on shop primed surfaces
Two coats of alkyd enamel, Fed. Spec. TT-E-489

3.3.4.2 Interior Surfaces Not Specified Otherwise:

a. Wood and Plywood Surfaces Not Specified Otherwise:

One coat of sealer, Fed. Spec. TT-S-176 on all softwood plywood
Two coats of enamel, Fed. Spec. TT-E-489

b. Metal Surfaces:

Touch up shop primer coat on shop primed surfaces
One coat of alkyd primer, Fed. Spec. TT-P-645, on surfaces not shop primed
Two coats of enamel, Fed. Spec. TT-E-489

c. Concrete Masonry:

One coat of latex block filler
Two coats of enamel, Fed. Spec. TT-E-489

3.3.4.3 Mechanical, Electrical, and Miscellaneous Metal Items, Except Hot Metal Surfaces and New Prefinished Equipment: Prefinishing of new mechanical and electrical equipment is specified in the section covering the particular item. Paint copper pipe exposed in interior spaces.

Coating systems as specified hereinbefore
Color of finish coat to match adjacent surfaces

a. Surfaces Not Adjacent to Painted Surfaces:

One coat of primer, Fed. Spec. TT-P-645
Two coats of enamel, Fed. Spec. TT-E-489

b. Piping and Conduit Identification, Including Surfaces In Concealed Spaces: Conform to MIL-STD-101, using black stencil paint, Fed. Spec. TT-P-98. Place stenciling in clearly visible locations. Stencil all piping and conduits not covered by MIL-STD-101 with approved names or code letters, not less than 1/2 inch high for piping and not less than 2 inches high elsewhere. Paint arrow-shaped markings on the lines to indicate the direction of flow. Provide two copies of the complete color and stencil codes used.

3.3.4.4 Coat other surfaces for which the type of coating has not been specified herein as specified for surfaces having similar conditions of exposure.

APPENDIX A
Salient Characteristics and Certification
Required for CID A-A-1500

Salient characteristics.

The filler shall be readily dispersible by hand stirring to form a homogeneous mixture. The filler shall brush easily and without pulling and shall not sag when applied at the rate of 50 square feet per gallon to vertical surfaces. The film shall be smooth and uniform and without pin holes or craters. The color shall be white or a tint as specified. The total solids shall be at least 60 percent by weight.

(1) Viscosity. The viscosity shall be between 110 and 125 K.U. (ASTM D 562).

(2) Drying time. 1/ The dry-to-touch time shall be within 1 hour and dry-hard time within 2 hours (ASTM D 1640).

(3) Adhesion. 2/ The filler shall not separate from the substrate at less than 150 psi when tested with an Elcometer adhesion tester.

(4) Appearance. 1/ There shall be no lifting, pinholes, craters, or other irregularities when an exterior 100% acrylic house paint (TT-P-19) is applied at a spreading rate of 300 square feet per gallon over the filler.

(5) Flexibility. 2/ The filler shall bend over 1/4 in mandrel without cracking, chipping, or flaking (ASTM D 1737).

(6) Fungus resistance. The maximum disfigurement rating shall be 9 (ASTM D 3273, D 3274).

(7) Permeability. The filler shall have a maximum permeance of 0.003 perms (ASTM D 96, (Procedure A).

(8) Accelerated storage stability. When the filler is exposed for 2 weeks at 50 ± 2 degrees C followed by 8 hours at 25 ± 1 degrees C, the increase in viscosity shall be less than 8 K.U. and when brushed to wallboard the coating shall be smooth and uniform.

(9) Freeze-thaw resistance. When exposed to three cycles consisting of 16 hours at minus 9± 1 degree C followed by 8 hours at 25 ± 1 degree C, the increase in viscosity shall be less than 8 K.U. and when brushed to wallboard the coating shall be smooth and uniform.

(10) Alkali resistance. 1/ The coating shall be unchanged after immersion for 14 days in 0.5 percent aqueous sodium hydroxide solution to such a depth that the coated surface is 4 mm above the solution level.

The issue of the ASTM test method in effect on the date of the solicitation shall be used to determine compliance with the stated requirements.

Certification. The contractor shall certify that the product offered meets the salient characteristics of this description and that the product conforms to the producer's own drawings, specificatons, standards, and quality assurance practices and is the same product offered for sale in the commercial marketplace. The Government reserves the right to require proof of such conformance prior to first delivery and thereafter as may be otherwise provided for under the provisions of the contract.

ASTM standards are available from the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103

Notes: Procedures for the preparation of block filler relative to the above salient characteristics.

1/ Brush the filler to patio blocks at a spreading rate of 50 square feet per gallon and allow to cure for 24 hours at standard conditions.

2/ Apply the filler with a draw-down blade to electrolitic tin panels at a rate of 100 square feet per gallon and allow to cure for 48 hours at standard conditions followed by two hours in an oven at 50 ± 2 degrees C.

Appendix A

*** END OF SECTION ***

SECTION 15011

MECHANICAL GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 APPLICABLE PUBLICATIONS: The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

1.1.1 Federal Specifications (Fed. Spec.):

TT-E-489F & Am 1	Enamel, Alkyd, Gloss (for Exterior and Interior Surfaces)
TT-E-496B & Am 2	Enamel, Heat-Resisting (400 Degrees Fahrenheit), Black
TT-P-28F	Paint, Aluminum, Heat Resisting (1200 Degrees Fahrenheit)
TT-P-645A	Primer, Paint, Zinc-Chromate, Alkyd Type

1.1.2 Military Specifications (Mil. Spec.):

DOD-P-15328D	Primer (Wash), Pretreatment (Formula No. 117 for Metals) (Metric)

1.1.3 American Society for Testing and Materials (ASTM) Publication:

B117-73 (R79)	Salt Spray (Fog) Testing, Method of

1.2 APPLICATION: This section applies to the piping sections of Division 2, "Site Work" and all sections of Division 15, "Mechanical" of this project except as specified otherwise in each individual section.

1.3 SUBMITTALS: Submit shop drawings, manufacturers data and certificates for equipment, materials and finish, and pertinent details for each system where specified in each individual section, and have them approved before procurement, fabrication or delivery of the items to the job site. Submittals shall include the manufacturer's name, trade name, catalog model or number, nameplate data, size, layout dimensions, capacity, project specification and paragraph reference, applicable Federal, Military, industry and technical society publication references, and other information necessary to establish contract compliance of each item the Contractor proposes to furnish.

1.3.1 Shop Drawings: Drawings shall be a minimum of 8.5-inches by 11-inches in size, except as specified otherwise. Drawings shall include floor plans, sectional views, wiring diagrams, and installation details of equipment; and equipment spaces identifying and indicating proposed location, layout and arrangement of items of equipment, control panels, accessories, piping, ductwork, and other items that must be shown to assure a coordinated installation. Wiring diagrams shall identify circuit terminals, and indicate the internal wiring for each item of equipment and the interconnection between each item of equipment. Drawings shall indicate adequate clearance for operation, maintenance and replacement of operating equipment devices. If equipment is disapproved, drawings shall be revised to show acceptable equipment and be resubmitted.

1.3.2 Manufacturer's Data: Submittals for each manufactured item shall be manufacturer's descriptive literature of cataloged products, equipment drawings, diagrams, performance and characteristic curves, and catalog cuts.

1.3.3 Publication Compliance: Where equipment or materials are specified to conform to industry and technical society publications of organizations such as American National Standard Institute (ANSI), American Society for Testing and Materials (ASTM), and Underwriters Laboratories, Inc. (UL), proof of such compliance shall be submitted. The label or listing by the specified organization will be acceptable evidence of compliance. Submit a certificate from an independent testing organization adequately equipped and competent to perform such services, and approved by the Contracting Officer, stating that the item has been tested in accordance with the specified organization's test methods and that the item conforms to the specified organization's publication.

1.3.4 Certified Test Reports: The testing requirements in referenced publications for materials will be waived provided the manufacturer's original certificates are submitted stating that previously manufactured materials have been tested by approved laboratories, that such materials meet testing requirements specified, and that the materials furnished for this project are of the same type, quality, manufacture, and make as that tested; copies of the test reports need not be submitted except as specifically requested by the Contracting Officer.

1.3.5 Certificates of Compliance: Submit certification from the manufacturer attesting that materials and equipment to be furnished for this project comply with the requirements of this specification and of the reference publications. Pre-printed certifications will not be acceptable; certifications shall be the manufacturer's original. The certification shall not contain statements that could be interpreted to imply that the product does not meet all requirements specified, such as "as good as"; "achieve the same end use and results as materials formulated in accordance with the referenced publications"; "equal or exceed the service and performance of the specified material".

1.4 OPERATION AND MAINTENANCE MANUAL: Furnish an operation and maintenance manual for each item of equipment. Furnish three copies of the manual bound in hardback binders or an approved equivalent. Furnish one complete manual prior to the time that equipment tests are performed, and furnish the remaining manuals before the contract is completed. Inscribe the following identification on the cover: the words OPERATION AND MAINTENANCE MANUAL, the name and location of the equipment or the building, the name of the Contractor, and the contract number. The manual shall include the names, addresses, and telephone numbers of each subcontractor installing equipment, and of the local representatives for each item of equipment. The manual shall have a table of contents and be assembled to conform to the table of contents with the tab sheets placed before instructions covering the subject. The instructions shall be legible and easily read, with large sheets of drawings folded in. The manual shall include: wiring and control diagrams with data to explain detailed operation and control of each item of equipment; a control sequence describing start-up, operation and shut-down; description of the function of each principal item of equipment; the procedure for starting; the procedure for operating; shut-down instructions; installation instructions; maintenance instructions; lubrication schedule including type, grade, temperature range, and frequency; safety precautions, diagrams, and illustrations; test procedures; performance data; and parts list. The parts lists for equipment shall indicate the sources of supply, recommended spare parts, and the service organization which is reasonably convenient to the project site. The manual shall be complete in all respects for equipment, controls, accessories, and associated appurtenances provided.

1.5 POSTED OPERATING INSTRUCTIONS: Furnish approved operating instructions for each principal item of equipment for the use of the operation and maintenance personnel. The operating instructions shall include wiring diagrams, control diagrams, and control sequence for each principal item of equipment. Operating instructions shall be printed or engraved, and shall be framed under glass or in approved laminated plastic and posted where directed by the Contracting Officer. Operating instructions shall be attached to or posted adjacent to each principal item of equipment including start up, proper adjustment, operating, lubrication, shut-down, safety-precautions, procedure in the event of equipment failure, and other items of instruction as recommended by the manufacturer of each item of equipment. Operating instructions exposed to the weather shall be made of weather-resisting materials or shall be suitably enclosed to be weather protected. Operating instructions shall not fade when exposed to sunlight and shall be secured to prevent easy removal or peeling.

1.6 INSTRUCTION TO GOVERNMENT PERSONNEL: Furnish the services of competent instructors to give full instruction to the Government personnel in the adjustment, operation and maintenance, including pertinent safety requirements of each item of equipment and each system. Each instructor shall be thoroughly familiar with all parts of the installation and shall be trained in operating theory as well as

practical operation and maintenance work. Instruction shall be given during the first regular work week after the equipment or system has been accepted and turned over to the Government for regular operation. The number of mandays (8-hours) of instruction furnished shall be as specified in each individual section.

1.7 DELIVERY AND STORAGE: Properly store, adequately protect and carefully handle equipment and materials to prevent damage before and during installation. Handle, store, and protect equipment and materials in accordance with the manufacturer's recommendations. Replace damaged or defective items.

1.8 CATALOGED PRODUCTS: Materials and equipment shall be cataloged products of manufacturers regularly engaged in production of such materials or equipment and shall be manufacturer's latest design that complies with the specification requirements. Materials and equipment shall duplicate items that have been in satisfactory commercial or industrial use. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer; however, the component parts of the items need not be the products of the same manufacturer. Each item of equipment shall have the manufacturer's name, address, model number and serial number on the nameplate securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

1.9 VERIFICATION OF DIMENSIONS: Coordinate the proper relation of the work to the building structure and to the work of all trades. Visit the premises and become familiar with the dimensions in the field, and advise the Contracting Officer of the discrepancy before performing any work.

1.10 MANUFACTURER'S RECOMMENDATIONS: Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations shall be furnished to the Contracting Officer prior to installation. Installation of the item will not be allowed to proceed until the recommendations are received. Failure to furnish these recommendations can be cause for rejection of the material.

1.11 ELECTRICAL REQUIREMENTS: Furnish motors, controllers, contactors, and disconnects with their respective pieces of equipment. Motors, controllers, contactors, and disconnects shall conform to and shall have electrical connections provided under Section 16402, "Interior Wiring Systems". Furnish internal wiring for components of packaged equipment as an integral part of the equipment. Extended voltage range motors will not be permitted. Controllers and contactors shall have a maximum of 120 volt control circuits, and auxiliary contacts for use with the controls furnished. When motors and equipment furnished are larger than sizes indicated, the cost of additional electrical service and related work shall be included under the section that specified that motor or equipment. Power wiring and conduit for field installed equipment shall be provided under and conform to the requirements of Section 16402, "Interior Wiring Systems".

PART 2 - PRODUCTS

2.1 PAINTING OF NEW EQUIPMENT: New equipment painting, factory applied or shop applied, shall be as specified herein, and provided under each individual section of this specification.

2.1.1 Factory Painting Systems: Manufacturer's standard factory painting systems may be provided subject to certification that the factory painting system applied will withstand 125 hours in a salt-spray fog test, except that equipment located outdoors shall withstand 500 hours in a salt spray fog test. Salt spray fog test shall be in accordance with ASTM B117. Immediately after completion of the test, the paint shall show no signs of blistering, wrinkling or cracking; and no loss of adhesion; and the specimen shall show no signs of rust creepage beyond 0.125 inch on either side of the scratch mark. The film thickness of the factory painting system applied on the equipment shall not be less than the film thickness used on the test specimen. If manufacturer's standard factory painting system is being proposed for use in lieu of the shop painting systems using Fed. Spec. TT-E-496 or TT-P-28, certifications that the manufacturer's standard factory painting system will conform to the heat resistance requirement of Fed. Spec. TT-E-496 or TT-P-28 as applicable, shall be submitted in addition to other certifications.

2.1.2 Shop Painting Systems: Clean, pretreat, prime and paint metal surfaces; except aluminum surfaces may not be painted. Apply coatings to clean dry surfaces. Clean the surfaces to remove dust, dirt, rust, oil and grease by wire brushing and solvent degreasing prior to application of paint, except metal surfaces subject to temperatures in excess of 120 degrees Fahrenheit (F) shall be cleaned to bare metal. Where more than one coat of paint is specified, apply the second coat after the preceding coat is thoroughly dry. Lightly sand damaged painting and retouch before applying the succeeding coat.

2.1.2.1 Metal Surfaces Subject to Temperatures Less Than 120 Degrees F.: Immediately after cleaning, the metal surfaces shall receive one coat of Mil. Spec. DOD-P-15328 pretreatment primer applied to a minimum dry film thickness of 0.3 mil, one coat of Fed. Spec. TT-P-645 primer applied to a minimum dry film thickness of one mil; and two coats of Fed. Spec. TT-E-489 enamel applied to a minimum dry film thickness of one mil per coat.

2.1.2.2 Metal Surfaces Subject to Temperatures Between 120 and 400 Degrees F.: Surfaces shall receive two coats of Fed. Spec. TT-E-496, Type II, heat-resisting enamel applied to a total minimum thickness of 2 mils.

2.1.2.3 Metal Surfaces Subject to Temperatures Greater Than 400 Degrees F.: Surfaces shall receive two coats of Fed. Spec. TT-P-28 heat-resisting aluminum paint applied to a total minimum dry film thickness of 2 mils.

*** END OF SECTION ***

SECTION 15410

WELL WATER PUMPS

PART 1 - GENERAL

1.1 APPLICABLE PUBLICATIONS: The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

1.1.1 Federal Specifications (Fed. Spec.):

L-P-387A & Am 2	Plastic Sheet, Laminated, Thermosetting (For Designation Plates)
WW-V-58B & Am 3	Valve, Gate, Cast Iron Threaded and Flange, for Land Use

1.1.2 Military Specifications (Mil. Spec.):

MIL-V-18436E	Valves, Check; Bronze, Cast Iron and Steel Body

1.1.3 American National Standards Institute (ANSI) Publications:

B16.1-75	Cast-Iron Pipe Flanges and Flanged Fittings
B16.5-77	Steel Pipe Flanges and Flanged Fittings
B16.9-78	Factory-Made Wrought Steel Buttwelding Fittings
B16.11-80	Forged Steel Fittings, Socket-Welding and Threaded
B16.18-78	Cast Copper Alloy Solder-Joint Pressure Fittings
B16.21-78	Nonmetallic Flat Gaskets for Pipe Flanges
B16.22-80	Wrought Copper and Bronze Solder-Joint Pressure Fittings
B16.26-75	Cast Copper Alloy Fittings for Flared Copper Tubes
B16.39-77	Malleable-Iron Threaded Pipe Unions
B31.1-80 & Am 80 & Am 81	Power Piping

1.1.4 American Society for Testing and Materials (ASTM) Publications:

A 53-80	Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
A 120-80	Pipe, Steel, Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless, for Ordinary Uses
A 193-80	Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
A 194-80	Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service
B 32-76	Solder Metal
B 88-81	Seamless Copper Water Tube
C 533-80	Calcium Silicate Block and Pipe Thermal Insulation
C 610-67 (R74)	Expanded Perlite Block and Pipe Thermal Insulation

1.1.5 American Water Works Association (AWWA) Publications:

C104-80	Cement-Mortar Lining for Cast-Iron and Ductile-Iron Pipe and Fittings for Water
C110-77	Gray-Iron and Ductile-Iron Fittings, 3 in. through 48 in. for Water and Other Liquids
C111-80	Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings
C115-75	Flanged Cast Iron and Ductile-Iron Pipe with Threaded Flanges
C151-76	Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids
C500-80	Gate Valves, 3 Through 48 Inch NPS for Water and Sewage Systems
C701-78	Cold-Water Meters, Turbine Type for Customer Service
E101-77	Vertical Turbine Pumps - Line Shaft and Submersible Types

1.1.6 Manufacturers Standardization Society of the Valve and Fittings Industry (MSS) Publications:

SP-58-75	Pipe Hangers and Supports - Materials, Design and Manufacture
SP-69-76	Pipe Hangers and Supports - Selection and Application

1.1.7 National Fire Protection Association (NFPA) Publications:

20-80	Centrifugal Fire Pumps
37-79	Stationary Combustion Engines and Gas Turbines
70-81	National Electrical Code

1.1.8 Underwriters' Laboratories, Inc. (UL) Publications:

262-80	Gate Valves for Fire Protection Service

1.2 GENERAL REQUIREMENTS: Section 15011, "Mechanical General Requirements," applies to this section, with the additions and modifications specified herein.

1.3 DESCRIPTION OF WORK: The work includes providing electric motor driven and diesel engine driven centrifugal vertical shaft turbine type pumps, and related work. This section covers the water piping aboveground and buried except water piping more than 5 feet outside the pump house walls is specified in under Section 02713, "Exterior Water Distribution System". Each system shall be complete and ready for operation. Equipment, materials, installation, and workmanship shall be in accordance with NFPA 70, except as modified herein. In the NFPA publication referred to herein, the advisory provisions shall be considered to be mandatory, as though the word "shall" had been substituted for "should" wherever it appears; reference to the "authority having jurisdiction" shall be interpreted to mean the Contracting Officer.

1.4 SUBMITTALS:

1.4.1 Manufacturer's Data:

a. Pumps, drivers, and controllers
b. Valves including gate, check, and relief valves
c. Gages
d. Meters
e. Pipe hangers (supports)
f. Devices and associated equipment

1.4.2 Certificates of Compliance:

a. Pipe and fittings
b. Insulation

1.4.3 Certified Data:

a. Manufacturer's pump discharge curves

1.4.4 Operation and Maintenance Manuals:

a. Pumps, drivers, and controllers

1.4.5 Posted Operating Instructions:

a. Pumps, drivers, and controllers

1.5 ELECTRICAL MOTORS, CONTROLLERS, CONTACTORS, AND DISCONNECTS: Furnish motors, controllers, contactors, and disconnects with their respective pieces of equipment. Motors, controllers, contactors, and disconnects shall conform to and shall have electrical connections provided under Section 16402, "Interior Wiring Systems." Controllers and contactors shall have a maximum of 120-volt control circuits, and auxiliary contacts for use with the controls furnished. When motors and equipment furnished are larger than sizes indicated, the cost of providing additional electrical service and related work shall be included under this section.

1.6 ELECTRICAL WORK: Work associated with this section shall be provided under Section 16402, "Interior Wiring Systems," except for control wiring. Provide control wiring under this section in accordance with NFPA 70. Provide rigid metal conduit or intermediate metal conduit, except electrical metallic tubing conduit may be used in dry locations not enclosed in concrete or where not subject to mechanical damage.

1.7 EXCAVATION, TRENCHING, AND BACKFILLING: Provide under this section as specified in Section 02200, "Earthwork."

1.8 SEQUENCE OF OPERATION: The pumps shall start manually when the starter is operated. Pumps shall continue to run until shut down manually.

PART 2 - PRODUCTS

2.1 SYSTEM COMPONENTS:

2.1.1 Pumps: The pumps shall be manual pushbutton start and manual stop. Each pump capacity at rated head shall be not less than that indicated. Pumps shall be of the centrifugal water lubricated, vertical shaft turbine type conforming to AWWA E101, except as modified herein.

2.1.2 Electric Motor Driver: Provide electrical motors, controllers, contactors, and disconnects as specified herein. Power supply to each motor and controller shall be as indicated.

2.1.2.1 Motors: Motor horsepower shall be not less than pump horsepower requirements at all points on the pump operating curve.

2.1.2.2 Controllers: Controllers shall be arranged for manual pushbutton pump starting and manual pushbutton pump shutdown. Controller shall be completely terminally wired, ready for field connections, and mounted in a moisture resistant enclosure arranged so that controller current carrying parts will not be less than 12 inches above the floor.

2.1.3 Diesel Engine Driver: Engine horsepower shall be adequate to drive the pump at all conditions of speed and load over the full range of the pump performance curve. Diesel engine shall be of the compression ignition type with electric starting device taking current from two battery units mounted not less than 12 inches above the floor. Provide lead-acid or lead-calcium type batteries.

2.1.3.1 Controller: Mount not less than 12 inches above the floor. Controller shall be manual pushbutton starting, and manual pushbutton shutdown.

2.1.3.2 Battery Charger: Charger shall be an integral part of the controller or a separate wall-mounted unit. Provide voltmeter to indicate the state of the battery charge and provide ammeter to indicate rate of charge.

2.1.3.3 Fuel System External to Engine: Provide engine mounted or engine skid mounted steel day tank with minimum 5 gallon capacity.

2.1.3.4 Exhaust System External to Engine: Provide in accordance with NFPA 20 and NFPA 37.

2.1.3.4.1 Steel Pipe: ASTM A 53 or ASTM A 120, standard weight, black steel, welding end pipe. Provide ANSI B16.9 or ANSI B16.11 welding fittings of the same material and weight as the piping.

2.1.3.4.2 Flanges: ANSI B16.5, Class 150. Provide flanges for connections to diesel engines, exhaust mufflers, and flexible connections. Gaskets shall be ANSI B16.21, composition ring, 0.0625 inch thick. Provide ASTM A 193, Grade B7 bolts and ASTM A 194, Grade 7 nuts.

2.1.3.4.3 Piping Insulation: Do not use products containing asbestos. Provide exhaust piping system inside the building with ASTM C 533 calcium silicate insulation or ASTM C 610 perlite insulation, minimum of 3 inches thick. Provide insulation with aluminum jacket, minimum thickness of 0.016 inch, with factory-applied polyethylene and kraft paper moisture barrier on inside surface. Secure jacket with aluminum or stainless steel bands or screws spaced 8 inches on centers.

2.2 MATERIALS FOR WATER PIPING: (Piping 4-inch diameter and larger)

2.2.1 Ductile-Iron Pipe and Fittings: AWWA C115 flanged pipe, minimum Class 53. Fittings shall be AWWA C110 with a pressure rating not less than that of the pipe. Provide AWWA C104 standard thickness cement-mortar lining for pipe and fittings. Provide AWWA C111 rubber gaskets for each flange in water piping.

2.2.2 Insulating Joints: Joints between pipe of dissimilar metals shall have a rubber gasket or other approved type of insulating joint or dielectric coupling which will effectively prevent metal-to-metal contact between adjacent sections of piping.

2.2.3 Accessories: Provide flanges, connecting pieces, transition glands, transition sleeves, and other adapters as required.

2.3 MATERIALS FOR WATER PIPING: (Piping smaller than 4-inch diameter)

2.3.1 Copper Tubing and Associated Fittings: ASTM B 88, Type K; ANSI B16.18 or ANSI B16.22 solder joint fittings using ASTM B 32, 50-50 tin-lead solder; ANSI B16.26 flared joint fittings.

2.3.2 Insulating Joints: Provide between pipes of dissimilar metals a rubber gasket or other approved type of insulating joint or dielectric coupling which shall effectively prevent metal-to-metal contact between adjacent sections of piping.

2.3.3 Accessories: Provide flanges, connecting pieces, transition glands, transition sleeves, and other adapters as required.

2.4 VALVES AND OTHER WATER PIPING ACCESSORIES:

2.4.1 Gate Valves: Fed. Spec. WW-V-58 or UL 262. Valves shall be of outside-screw-and-yoke configuration. Valves shall have flanged end connections unless otherwise indicated or specified herein. Fed. Spec. WW-V-58 valves shall be double disc, with a water pressure rating of 200 psig. UL 262 valves shall be designed for a hydraulic working pressure of 175 psig.

2.4.2 Check Valves: Mil. Spec. MIL-V-18436 or UL 312. Valves shall have flanged end connections in valve chambers, valve pits, or in aboveground locations. Swing check valves shall have clear-port opening. Mil. Spec. MIL-V-18436 valves shall be swing check, cast-iron or steel bodies with bronze trim, and designed for a hydraulic working pressure of 175 psig.

2.4.3 Air Release Valve: Provide a large orifice type automatic air release valve, cast-iron bodies, with the only moving part being a stainless steel buoy ball. The area throughout the valve body must be equal to full pipe area. The valve must be guaranteed not to stick or leak in a closed position. The valve shall be suitable for operating under a working pressure of 150 pounds per square inch WOG. The valve shall be designed such that when the large orifice is open, the ball remains in the throat area without the possibility of the valve blowing shut or collapsing the ball. The valve shall close when water rises in the valve to lift the ball to the orifice seat.

2.4.4 Water Meters: AWWA C701 Class II, turbine type for customer service. Meter shall register in U.S. gallons. Furnish certificate of testing water meters for conformance to accuracy and capacity requirements in accordance with the applicable AWWA standard.

2.4.5 Gages: ANSI B40.1, single style pressure gage for water with 4.5-inch dial, brass or aluminum case, bronze tube, gage cock, pressure snubber, and syphon. Provide scale range suitable for intended service.

2.4.6 Pipe Sleeves: Provide where piping passes through walls, floors, roofs, and partitions. Secure sleeves in proper position and location. Provide sleeves of sufficient length to pass through entire thickness of walls, floors, roofs, and partitions. Provide not less than 0.25-inch space between exterior of piping or pipe insulation and interior of sleeve. Firmly pack space with insulation and calk at both ends of the sleeve with plastic waterproof cement which will dry to a firm but pliable mass, or provide a segmented elastomeric seal.

2.4.6.1 Sleeves in Masonry and Concrete Walls, Floors, and Roofs: Provide ASTM A 53 or ASTM A 120, Schedule 40 or Standard Weight, zinc-coated steel pipe sleeves. Extend sleeves in floor slabs 3 inches above the finished floor.

2.4.6.2 Sleeves in Partitions and Other Than Masonry and Concrete Walls, Floors, and Roofs: Provide zinc-coated steel sheet having a nominal weight of not less than 0.90 pounds per square foot.

2.4.7 Escutcheon Plates: Provide one piece or split hinge type metal plates for piping passing through floors, walls, and ceilings in exposed areas. Provide chromium-plated finish on plates in finished areas. Provide paint finish on plates in unfinished areas. Securely anchor plates in place with setscrews or other approved positive means.

2.4.8 Buried Utility Warning and Identification Tape: Provide detectable aluminum foil plastic-backed tape or detectable magnetic plastic tape manufactured specifically for warning and identification of buried piping. Tape shall be detectable by an electronic detection instrument. Provide tape in rolls, 3 inches minimum width, color coded for the utility involved, with warning and identification imprinted in

bold black letters continuously and repeatedly over entire tape length. Warning and identification shall be CAUTION BURIED WATER PIPING BELOW or similar. Use permanent code and letter coloring unaffected by moisture and other substances contained in trench backfill material. Bury tape with the printed side up at a depth of 6 inches below the top surface of earth or the top surface of the subgrade under pavements.

PART 3 - EXECUTION

3.1 INSTALLATION: Equipment, materials, installation, and workmanship shall be in accordance with NFPA 20, except as modified herein. Install piping straight and true to bear evenly on supports.

3.1.1 Cleaning of Piping: Keep the interior and ends of new piping and existing piping affected by the Contractor's operations thoroughly cleaned of water and foreign matter. Keep piping systems clean during installation by means of plugs or other approved methods. When work is not in progress, securely close open ends of piping and fittings so that water and foreign matter will not enter the pipes or fittings. Inspect piping before placing into position.

3.2 PIPE AND FITTINGS: Inspect, test, and approve piping before burying, covering, or concealing. Provide fittings for changes in direction of piping and for all connections. Make changes in piping sizes through tapered reducing pipe fittings; do not use bushings.

3.2.1 Threaded Connections: Jointing compound for pipe threads shall be polytetrafluoroethylene (PTFE) pipe thread tape, pipe cement and oil, or PTFE powder and oil; apply only on male threads. Provide exposed ferrous pipe threads with one coat of Fed. Spec. TT-P-645 primer applied to a minimum dry film thickness of one mil.

3.2.2 Pipe Hangers (Supports): Provide additional hangers to support the concentrated loads in piping between hangers, such as for flanged valves.

3.2.2.1 Piping to Receive Insulation: Provide temporary wood spacers between the insulation protection shield and the pipe in order to properly slope the piping and to establish final elevations. Temporary wood spacers shall be of the same thickness as the insulation to be provided.

3.2.2.2 Maximum Spacing Between Hangers:

3.2.2.2.1 Vertical Piping: Support metal piping at each floor, but at not more than 10-foot intervals.

3.2.2.2.2 Horizontal Piping: Support ductile iron piping at 5-foot intervals, except that for pipe exceeding 5-foot length, provide supports at intervals equal to the pipe length but not exceeding 10 feet.

3.3 NAMEPLATES: Provide laminated plastic nameplates for equipment, gages, thermometers, and valves; stop valves in supplies to fixtures will not require nameplates. Laminated plastic shall be 0.125 inch thick Melamine plastic conforming to Fed. Spec. L-P-387, black with white center core. Surface shall be a matte finish. All corners shall be square. Accurately align lettering and engrave into the white core. Minimum size of nameplates shall be one inch by 2.5 inches. Lettering shall be minimum of 0.25-inch high normal block lettering. Key the nameplates to a chart and schedule for each system. Frame charts and schedules under glass and place where directed near each system. Furnish two copies of each chart and schedule. Each inscription shall identify its function. Equipment nameplates shall show the following information:

a. Manufacturer, type, and model number
b. Contract number and accepted date
c. Capacity or size
d. System in which installed
e. System which it controls

3.4 INSTRUCTING OPERATING PERSONNEL: Upon completion of the work and at a time designated by the Contracting Officer, provide for a period of not less than one 8-hour working day the services of experienced technicians regularly employed by the manufacturer of the pumps and the drivers to instruct Government operating personnel in the proper operation and maintenance of the equipment.

3.5 FLUSHING: Flush all new pump suction and discharge piping at 150 percent of rated pump capacity. Where the pump installation involves more than one pump, the flushing volume shall be the total quantity of water flowing when all pumps are discharging at 150 percent of their rated capacities. The new pumps may be used to attain the required flushing volume. Continue flushing operations until water is clear, but for not less than 10 minutes. Submit a signed and dated flushing certificate with a request for field testing.

3.6 FIELD TESTING: Hydrostatically test each piping system at 200 psig for a period of 2 hours. Perform tests on pumps, drivers, and equipment, including visual equipment checks to insure compliance with approved shop drawings; pump start-run to insure proper operation and to detect any leakage of piping, valves, and fittings; sequence of operation check; verification that all required pump accessories have been provided; test of pump alarm devices; and additional inspections and tests necessary to insure that the entire pump installation is correct, complete, and ready for operation.

*** END OF SECTION ***

SECTION 16011

ELECTRICAL GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 APPLICABLE PUBLICATIONS: The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

1.1.1 American Society for Testing and Materials (ASTM) Publication:

B117-73 (R79)	Salt Spray (Fog) Testing, Method of

1.2 APPLICATION: This section applies to all sections of Division 16, "Electrical" of this project except as specified otherwise in each individual section.

1.3 SUBMITTALS: Submit shop drawings, manufacturers data and certificates for equipment, materials and finish, and pertinent details for each system where specified in each individual section, and have them approved before procurement, fabrication or delivery of the items to the job site. Partial submittals will not be acceptable and will be returned without review. Submittals shall include the manufacturer's name, trade name, catalog model or number, nameplate data, size, layout dimensions, capacity, project specification and paragraph reference, applicable Federal, Military, industry and technical society publication references, and other information necessary to establish contract compliance of each item the Contractor proposes to furnish.

1.3.1 Shop Drawings: Drawings shall be a minimum of 8.5-inches by 11-inches in size, except as specified otherwise. Drawings shall include floor plans, sectional views, wiring diagrams, and installation details of equipment; and equipment spaces identifying and indicating proposed location, layout and arrangement of items of equipment, control panels, accessories, piping, ductwork, and other items that must be shown to assure a coordinated installation. Wiring diagrams shall identify circuit terminals, and indicate the internal wiring for each item of equipment and the interconnection between each item of equipment. Drawings shall indicate adequate clearance for operation, maintenance and replacement of operating equipment devices. If equipment is disapproved, drawings shall be revised to show acceptable equipment and be resubmitted.

1.3.2 Manufacturer's Data: Submittals for each manufactured item shall be manufacturer's descriptive literature of cataloged products, equipment drawings, diagrams, performance and characteristic curves, and catalog cuts.

1.3.3 Publication Compliance: Where equipment or materials are specified to conform to industry and technical society publications of organizations such as American National Standard Institute (ANSI), American Society for Testing and Materials (ASTM), and Underwriters Laboratories, Inc. (UL), proof of such compliance shall be submitted. The label or listing by the specified organization will be acceptable evidence of compliance. Submit a certificate from an independent testing organization adequately equipped and competent to perform such services, and approved by the Contracting Officer, stating that the item has been tested in accordance with the specified organization's test methods and that the item conforms to the specified organization's publication.

1.3.4 Certified Test Reports: The testing requirements in referenced publications for materials will be waived provided the manufacturer's original certificates are submitted stating that previously manufactured materials have been tested by approved laboratories, that such materials meet testing requirements specified, and that the materials furnished for this project are of the same type, quality, manufacture, and make as that tested; copies of the test reports need not be submitted except as specifically requested by the Contracting Officer.

1.3.5 Certificates of Compliance: Submit certification attesting that materials and equipment to be furnished for this project comply with the requirements of this specification and of the reference publications. Pre-printed certifications will not be acceptable; certifications shall be the manufacturer's original. The certification shall not contain statements that could be interpreted to imply that the product does not meet all requirements specified, such as "as good as"; "achieve the same end use and results as materials formulated in accordance with the referenced publications"; "equal or exceed the service and performance of the specified material". The certification shall simply state that the product conforms to the requirements specified.

1.4 DELIVERY AND STORAGE: Properly store, adequately protect and carefully handle equipment and materials to prevent damage before and during installation. Handle, store, and protect equipment and materials in accordance with the manufacturer's recommendations. Replace damaged or defective items.

1.5 CATALOGED PRODUCTS: Materials and equipment shall be cataloged products of manufacturers regularly engaged in production of such materials or equipment and shall be manufacturer's latest design that complies with the specification requirements. Materials and equipment shall duplicate items that have been in satisfactory commercial or industrial use. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer; however, the component parts of the items need not be the products of the same manufacturer. Each item of equipment shall have the manufacturer's name, address, model number and serial number on the nameplate securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

1.6 VERIFICATION OF DIMENSIONS: Coordinate the proper relation of the work to the building structure and to the work of all trades. Visit the premises and become familiar with the dimensions in the field, and advise the Contracting Officer of the discrepancy before performing any work.

1.7 MANUFACTURER'S RECOMMENDATIONS: Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations shall be furnished to the Contracting Officer prior to installation. Installation of the item will not be allowed to proceed until the recommendations are received. Failure to furnish these recommendations can be cause for rejection of the material.

1.8 ELECTRICAL REQUIREMENTS: Furnish motors, controllers, contactors, and disconnects with their respective pieces of equipment. Motors, controllers, contactors, and disconnects shall conform to and shall have electrical connections provided under Section 16402, "Interior Wiring Systems". Furnish internal wiring for components of packaged equipment as an integral part of the equipment. Extended voltage range motors will not be permitted. Controllers and contactors shall have a maximum of 120 volt control circuits. When motors and equipment furnished are larger than sizes indicated, the cost of additional electrical service and related work shall be included under the section that specified that motor or equipment. Power wiring and conduit for field installed equipment, and conduit and wiring connecting power sources to equipment shall be provided under and conform to the requirements of Section 16402, "Interior Wiring Systems".

PART 2 - PRODUCTS

2.1 PAINTING OF EQUIPMENT: Equipment painting, shall be factory applied and shall be as specified herein, and provided under each individual section of this specification.

2.1.1 Factory Painting Systems: Manufacturer's standard factory painting systems may be provided subject to certification that the factory painting system applied will withstand 125 hours in a salt-spray fog test, except that equipment located outdoors shall withstand 500 hours in a salt spray fog test. Salt spray fog test shall be in accordance with ASTM B117. Immediately after completion of the test, the paint shall show no signs of blistering, wrinkling or cracking; and no loss of adhesion; and the specimen shall show no signs of rust creepage beyond 0.125 inch on either side of the scratch mark. The film thickness of the factory painting system applied on the equipment shall not be less than the film thickness used on the test specimen.

*** END OF SECTION ***

SECTION 16301

UNDERGROUND ELECTRICAL WORK

PART 1 - GENERAL

1.1. APPLICABLE PUBLICATIONS: The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

1.1.1 American National Standards Institute (ANSI) Publication:

C2-1981	National Electrical Safety Code (NESC)

1.1.2 American Society for Testing and Materials (ASTM) Publications:

B 1-81	Hard-Drawn Copper Wire
B 8-81	Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
D 698-78	Moisture Density Relations of Soils and Soil-Aggregate Mixtures Using 5.5-lb. (2.49-KG) Rammer and 12-in. (305-MM) Drop
D 1556-64 (R 1974)	Density of Soil in Place by the Sand Cone Method

1.1.3 National Electrical Manufacturer's Association (NEMA) Publications:

TC2-1978 (REV 4-81)	Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80)
TC3-1978	PVC Fittings for Use with Rigid PVC Conduit and Tubing
TC9-1978 (REV 1-78)	Fittings for ABS and PVC Plastic Utilities Duct for Underground Installation

1.1.4 National Fire Protection Association (NFPA) Publication:

70-1981	National Electrical Code (NEC)

1.1.5 Underwriter's Laboratories, Inc. (UL) Publications:

467-1972 (R MAR 82)	Grounding and Bonding Equipment
510-1982	Insulating Tape

514-1979 (R JUN 82) Outlet Boxes and Fittings

854-1979 (R NOV 81) Service-Entrance Cables

1.2 GENERAL REQUIREMENTS: Section 16011, "Electrical General Requirements," applies to this section with additions and modifications specified herein.

1.2.1 Underground Service: Underground service into buildings shall terminate at a point 5 feet outside the building and projections thereof, except that service conductors shall be continuous to the interior terminating point indicated. Conduit from the service power pole to within 5 feet of the building shall be as specified in this section. Connections of the underground service to the service switch, panelboard, or load center is included in Section 16402, "Interior Wiring Systems." Ends of the underground conduit shall be protected by threaded metal caps until connections are made.

1.2.2 Electrical Characteristics: See Section 16302, Overhead Electrical Work.

1.2.3 Laboratory Tests:

1.2.3.1 Determine soil-density relationships as specified for soil tests in Section 02200, "Earthwork."

1.3 SUBMITTALS REQUIRED:

1.3.1 Manufacturer's Data:

Type EPC-80 PVC Conduit
Insulating Tape
600 Volt Type Use Cables

1.3.2 Manufacturer's Instructions:

a. Manufacturer's directions for use of ground megger with proposed method indicated

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT: Provide materials and equipment listed by UL or approved by Factory Mutual (FM) System, when such equipment is listed or approved.

2.1.1 Conduit: Shall be plastic conforming to the following:

2.1.1.1 Plastic conduit for direct burial shall be PVC conforming to NEMA TC2 conduit and TC3 fittings Type EPC-40-PVC or EPC-80-PVC, as specified.

2.1.2 Tape: Plastic insulating tape shall conform to the requirements of UL 510.

2.1.3 Wire and Cable:

2.1.3.1 Wire and cable conductor sizes are designated by American Wire Gauge (AWG). Conductor and conduit sizes indicated are for copper conductors. Insulated conductors shall bear the date of manufacture imprinted on the wire insulation with other identification. Wire and cable manufactured more than 12 months before delivery to the job site shall not be used.

2.1.3.2 Conductors rated 600 volts and less, including service entrances, shall conform to UL 854, Type USE. Conductors shall be copper. Conductor size and number of conductors in each cable shall be as indicated. Cable shall be color coded. Conductor identification shall be provided within each enclosure where a tap, splice, or termination is made. Conductor identification shall be by color-coded insulated conductors, plastic-coated self-sticking printed markers, colored nylon cable ties and plates, or heat shrink type sleeves.

a. Colors for coding conductors shall be:

480-VOLT SYSTEM

Neutral - White
Phase A - Brown
Phase B - Orange
Phase C - Yellow
Grounding Conductor - Green

2.1.3.3 Pull Wire: Pull wire shall be plastic, having a minimum tensile strength of 200 pounds.

2.1.3.4 Connectors and Terminals: Connectors and terminals shall be designed and approved for use with the associated conductor material, and shall provide a uniform compression over the entire contact surface. Solderless terminal lugs shall be used on all stranded conductors.

2.1.4 Grounding: Grounding and bonding equipment shall conform to UL 467. Ground rods shall be copperweld type copper clad steel with diameter adequate to permit driving to full length of the rod, but not less than 3/4 inch in diameter and 10 feet long unless otherwise indicated.

PART 3 - EXECUTION

3.1 INSTALLATION: Underground installation shall conform to ANSI C2 and NFPA 70 except as otherwise specified or indicated.

3.1.1 Contractor Damage: The Contractor shall promptly repair any indicated utility lines or systems damaged by his operations. Damages to lines or systems not indicated, which are caused by his operations, shall be treated as "Changes" under the terms of the General Provisions of the contract. If the Contractor is advised in writing of the location of a nonindicated line or system, such notice shall provide that portion of the line or system with "indicated" status in determining liability for damages. In any event, the Contractor shall immediately notify the Contracting Officer of any such damage.

3.1.2 Underground Duct Without Concrete Encasement: Conduits shall be PVC, Type EPC-40, except exposed conduit risers shall be EPC-80.

3.1.2.1 The top of the duct shall be not less than 24 inches below grade, shall have a minimum slope of 3 inches in each 100 feet away from buildings and toward manholes and other necessary drainage points, and shall run in straight lines except where a change of direction is necessary. As each conduit run is completed, a testing mandrel not less than 12 inches long with a diameter 1/4 inch less than the inside diameter of the duct shall be drawn through each duct conduit; after which a brush, having stiff bristles, shall be drawn through until the conduit is clear of all particles of earth, sand, or gravel; conduit plugs shall then immediately be installed. There shall be not less than 3 inches clearance from the conduit to each side of the trench. The bottom of the trenches shall be graded smooth; where rock, soft spots, or sharp-edged materials are encountered, excavate the bottom for an additional 3 inches; fill with sand or earth, free from particles that would be retained on a 1/4-inch sieve; and tamp level with the original bottom.

3.1.3 Underground Conduit for Service Feeders Into Buildings: Shall be rigid steel from the service equipment to a point 5 feet beyond the building and projections thereof, see Section 16402. The ends of the conduit shall be protected by threaded metal caps or bushings; the threads shall be coated with graphite grease or other suitable coating. Conduit shall be cleaned and plugged until conductors are installed.

3.1.4 Warning Tapes in Earth Trenches: For the purposes of early warning and identification during future trenching or other excavation, continuous identification tapes shall be provided in the trench above direct buried conduits. Tape shall be nonmagnetic plastic tape or aluminum foil plastic-backed tape manufactured for the purpose of early warning and identification of utilities buried below the tape. Tape shall be at least 3 inches in width. Color of tape shall be standard, with the manufacturer for the type of utility buried below the tape.

Tape shall have lettering at least 1 inch high with not less than the following identification on the tape: "BURIED ELECTRIC LINE BELOW". Tape shall be installed according to the printed recommendations of the tape manufacturer, as modified herein. Tapes shall be buried at a depth of 6 inches below the top surface of earth.

3.1.5 Reconditioning of Surfaces:

3.1.5.1 Unpaved surfaces disturbed during the installation of duct or direct burial cable shall be restored to their original elevation and condition. Sod or topsoil shall be preserved carefully and replaced after the backfilling is completed. Sod that is damaged shall be replaced by sod of quality equal to that removed.

3.1.5.2 Paving Repairs: Where trenches, pits, or other excavations are made in existing roadways and other areas of pavement where surface treatment of any kind exists, such surface treatment or pavement shall be restored to the same thickness and in the same kind as previously existed, except as otherwise specified, and to match and tie into the adjacent and surrounding existing surfaces in a neat and acceptable manner.

3.1.5.3 Paving repairs shall be made as specified in Section 02690, "Pavement Removal and Replacement" of these specifications.

3.1.6 Cable Pulling: Cable lubricants shall be those specifically recommended by the cable manufacturer. Cable-pulling tensions shall not exceed the maximum pulling tension recommended by the cable manufacturer. If basket-grip type cable-pulling devices are used to pull cable in place, cut off the section of cable under the grip before splicing and terminating.

3.1.6.1 Secondary cable runs, 600 volts and less, shall include an insulated copper equipment grounding conductor sized as required by the rating of the overcurrent device supplying the phase conductors.

3.1.7 Earthwork shall be in accordance with Section 02200, "Earthwork."

3.1.7.1 Backfilling Trenches: Backfill shall be placed in layers not more than 6 inches thick and each layer shall be compacted. Backfilling shall progress as rapidly as the construction, testing, and acceptance of the work permits. Backfill shall be free from roots, wood scrap material, and other vegetable matter and refuse. The first layer shall be earth or sand, free from particles that would be retained on a 1/4-inch sieve and extending not less than 3 inches above the top of the conduit or cables. The succeeding layers shall be excavated material having stones no larger than would pass through a 4-inch ring. The backfill may be moistened. The backfill shall be level with the adjacent surface except that in sodded areas a space equal to the thickness of the sod shall be left.

3.1.8 Cable Terminating: Terminations of insulated power and lighting cables shall be protected from accidental contact, deterioration of coverings, and moisture by the use of terminating devices and materials. Terminations shall be made using materials and methods as indicated or specified herein or as designated by the written instruction of the cable manufacturer and termination kit manufacturer.

3.1.9 Splices for 600-Volt Class Cables: No splices in underground conductor systems shall be permitted.

3.1.10 Grounding: See Sections 16302 and 16402.

3.2 FIELD TESTS: As an exception to requirements that may be stated elsewhere in the contract, the Contracting Officer shall be given 5 working days notice prior to each test. The Contractor shall provide all labor, equipment, and incidentals required for testing, except that the Government will provide electric power required for the tests. All defective material and workmanship disclosed as the result of the tests given herein shall be corrected by the Contractor at no cost to the Government. The Contractor shall show by demonstration in service that all circuits and devices are in good operating condition. Tests shall be such that each item of control equipment will function not less than five times.

3.2.1 Distribution Conductors 600-Volt Class: After wiring is completed and connected ready for operation, but prior to placing systems in service and before any branch circuit breakers are closed, insulation resistance tests shall be made in all circuits. The insulation resistance between conductors and between each conductor and ground shall be measured. Measurements shall be made with an instrument capable of making measurements at an applied potential of 500 volts. Readings shall be taken after the voltage has been applied for a minimum of 1 minute. The minimum insulation resistance for circuits of No. 12 AWG conductors shall be 1 000 000 ohms. For circuits of No. 10 AWG or larger conductors, a resistance based on the allowable ampacity of the conductor as fixed by NFPA 70 shall be as follows:

25 through 50 amperes.....250 000 ohms
51 through 100 amperes.....100 000 ohms

3.2.2 Ground Rods: See Section 16302L.

3.2.3 Compaction: Backfill shall be tested in accordance with ASTM D 1556, one test per lift per 2000 square feet.

3.2.4 Test Report:

a. 600-Volt Cables: Identify each cable and test result.

*** END OF SECTION ***

SECTION 16302

OVERHEAD ELECTRICAL WORK

PART 1 - GENERAL

1.1 APPLICABLE PUBLICATIONS: The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

1.1.1 American National Standards Institute (ANSI) Publications:

C2-81	National Electrical Safety Code
C29.5-77	Wet Process Porcelain Insulators (Low and Medium Voltage Pin Type)
C37.42-69 (R1974)	Distribution Enclosed, Open and Open-Link Cutouts
C37.43-69 (R1974)	Distribution Fuse Cutout Links for Use in Distribution Enclosed, Open, and Open-Link Cutouts
C57.12.20-74	Overhead Type Distribution Transformers 67,000 Volts and Below: 500 KVA and Smaller, Including Supplement C57.12.20A-78
05.1-79	Specifications and Dimensions for Wood Poles

1.1.2 American Society for Testing and Materials (ASTM) Publications:

A 153-78	Zinc-coating (Hot-Dip) on Iron and Steel Hardware
B 3-74(R1980)	Soft or Annealed Copper Wire
B 8-77	Concentric-Lay-Stranded Copper Conductors, Hard, Medium Hard, or Soft

1.1.3 American Wood-Preservers' Association (AWPA) Publications:

C.4-77	Standard for the Preservative Treatment of Poles by the Pressure Process
C.25-76	Standard for the Preservative Treatment of Crossarms by the Pressure Process

1.1.4 National Electrical Manufacturers' Association (NEMA) Publications:

LA1-76 (R1980)	Surge Arresters
TC 2-78 (Rev 2-80)	Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80)
TC 3-78	PVC Fittings for Use with Rigid PVC Conduit and Tubing
TR1-80 (Rev 1-82)	Transformers, Regulators, and Reactors

1.1.5 National Fire Protection Association (NFPA) Publication:

70-1981	National Electrical Code

1.1.6 Rural Electrification Administration (REA) Publications:

44-3 (DEC 1975)	Wood Crossarms (Solid and Laminated), Transmission Timbers and Pole Keys (DT-5B/PE-16)
43-5 (JULY 1979) Supplements 2 & 3	List of Materials Acceptable for Use on Electric Systems of REA Borrowers

1.1.7 Underwriter's Laboratories (UL) Publications:

510-76 (R Jun 80)	Insulating Tape

1.2 GENERAL REQUIREMENTS: Section 16011, "Electrical General Requirements" applies to this section with additions and modifications specified herein.

1.2.1 Underground Service: Underground service into buildings shall terminate at a point 5 feet outside the building and projections thereof, except that service conductors shall be continuous to the interior terminating point indicated. Connections of the underground service to the service switch, panelboard or load center is included in Section 16402, "Interior Wiring Systems." Ends of the underground conduit shall be protected by threaded caps until connections are made. Underground service from 5 feet outside the building to the underground terminal pole shall be provided under this section and shall have materials and installation as specified in Section 16402, "Interior Wiring Systems."

1.2.2 Electrical Characteristics: Electrical characteristics for this project shall be 12470 V primary, three phase, three or four wire, as indicated, 60 hertz, and 480Y/277 volts secondary, three phase, four wire, wye connected. Final connections to the power distribution system at the existing power pole shall be made by the Contractor as directed by the Contracting Officer.

1.2.3 Connections to Existing Electrical Systems: Notify the Contracting Officer in writing at least 15 days prior to the date the connections are required; approval shall be received before any service is interrupted. Furnish all material required to make connections into the existing systems, and perform all excavating, backfilling, and other incidental labor as required.

1.2.4 Submittals: Submit following information for approval:

1.2.4.1 Catalog Information:

a. Conductor (list each size and type)
b. Insulator (list each size and type)
c. Cutouts
d. Transformers
e. Tapes

1.2.4.2 Shop Drawings:

a. Transformers

1.2.4.3 Manufacturer's Certification:

a. Transformer tests: Certify that routine tests per NEMA TR1 have been made on each transformer.

1.2.4.4 Manufacturer's Directions:

a. Cable terminations
b. Manufacturer's directions for use of ground megger with proposed method indicated

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT: Materials specified herein or shown on the contract drawings which are identical to materials listed in REA 43-5 shall be considered as conforming to all requirements.

2.1.1 Poles: Provide wood pole machine trimmed by turning, Douglas Fir or Southern Yellow Pine conforming to ANSI 05.1. Poles must be gained, bored and roofed before treatment. Poles shall be full length pressure treated with Chromated Copper Arsenate (CCA) or Ammoniacal Copper Arsenate (ACA) conforming to AWPA C4. Poles shall be branded by the manufacturer with his mark and date of treatment, height and class of pole, wood species, preservation code, and retention. Place the brand so that the bottom of the brand or disc is 10 feet from the pole butt for poles up to 50 feet long.

2.1.2 Crossarms: Provide solid type wood crossarms conforming to REA DT-5B. Crossarms shall be pressure treated with Chromated Copper Arsenate (CCA) or Ammoniacal Copper Arsenate (ACA). Treatment shall conform to AWPA C25.

2.1.2.1 Provide crossarm braces as indicated on Overhead Sketches.

2.1.3 Hardware: Pole line hardware shall be hot dip galvanized conforming to ASTM A 153.

2.1.4 Insulators: Provide wet-process porcelain insulators which are radio interference freed.

a. Pin insulators shall be class 55-5 per ANSI C29.5.

2.1.4.1 Solid copper conductors, soft drawn shall conform to ASTM B 3. Stranded conductors shall conform to ASTM B 8.

2.1.5 Ground Rods: Provide copperweld type copper-clad steel ground rods at least 3/4 inch in diameter and 10 feet long unless otherwise indicated. Die-stamp each near the top with the name or trademark of the manufacturer and the length of the rod in feet. The rods shall have a hard, clean, smooth, continuous, surface throughout the length of the rod.

2.1.6 Ground Wire: Provide soft-drawn copper wire ground conductors no smaller than No. 4 AWG. Ground wire protectors shall be PVC or half round wood molding.

2.1.7 Surge Arresters: Provide valve type surge arresters conforming to NEMA LA1 arranged for crossarm mounting. Rating shall be 9 kV or 12 kV as indicated.

2.1.8 Fused Cutouts: Provide heavy duty open type fused cutouts rated 100 amperes at 14.4 kV ungrounded, conforming to ANSI C37.42. Provide type k fuses conforming to ANSI C37.43 with ampere ratings as indicated. Open link type fuses and fuse cutouts are not acceptable.

2.1.9 Conduit Risers: Provide PVC conduit conforming to NEMA TC2, Type EPC-80-PVC and NFPA 70 of no less than 2-1/2-inch diameter, with fittings conforming to NEMA TC3 for the entire portion of the riser.

2.1.9.1 600 volt secondary conductors shall be as specified in 16301L, Underground Electrical Work.

2.1.10 Transformers (Pole-Type): ANSI C57.12.20 self-cooled, 65 degrees C continuous temperature rise, mineral oil-immersed type. Transformers shall be rated 15 kVA, 95 kV BIL, 15 kV class for operation on a 12.47 kV system. Minimum impedance shall be manufacturer's standard. Transformers shall have four 2-1/2 percent rated kVA high voltage taps, two above and two below rated primary voltage. Tank finish coat shall be light gray, ANSI color No. 70.

2.1.11 Electrical Tapes: UL 510 and shall be UL listed for electrical insulation and other purposes in wire and cable splices, terminations, repairs and miscellaneous purposes.

2.1.12 Calking Compound: Compound for the sealing of conduit risers shall be of a putty like consistency workable with the hands at temperatures as low as 35 degrees F, shall not slump at a temperature of 300 degrees F, and shall not harden materially when exposed to air. The compound shall readily calk or adhere to clean surfaces of the materials with which it is designed to be used. The compound shall have no injurious effects upon the hands of workmen or upon the materials.

PART 3 - EXECUTION

3.1 INSTALLATION: Provide overhead pole line installation conforming to the requirements of ANSI C2 (NESC) for Grade B construction of overhead lines in heavy loading districts and NEC for overhead services. Regard NESC statements using the term "should" as mandatory unless an exception therefrom in writing is granted by the Contracting Officer. All streets, alleys, roads, and drives shall be considered "public." Pole configurations shall be as indicated and as shown on the following sketches:

NUMBER	TITLE
TS-16302L-1.1	Symbol Legend & General Notes
TS-16302L-1.2	List of Symbols
TS-16302L-1.3	Method of Showing Symbols
TS-16302L-1.3a	Explanation of Notes Symbols
TS-16302L-1.4	Basic Vertical Spacing Requirements
TS-16302L-1.5	Pole Line Material List
TS-16302L-1.5a	Pole Line Material List
TS-16302L-2	X-FB, X-AB
TS-16302L-12	FR3-N, FR3 (0-50KV)
TS-16302L-31	TTT
TS-16302L-37	CONDUIT RISER
TS-16302L-43	GROUND

3.1.1 Pole Setting: Pole holes shall be at least as large at the top as at the bottom and shall be large enough to provide 4 inches clearance between the pole and the side of the hole.

3.1.1.1 Pole setting depths shall be as follows:

Length of Pole (feet)	Setting in Soil (feet)
40	6.0

3.1.1.2 On sloping ground, always measure the depth of the hole from the low side of the hole.

3.1.1.3 Thoroughly tamp pole backfill for the full depth of the hole and mound the excess fill around the pole.

3.1.1.4 Set poles so that alternate crossarm gains face in the opposite directions. On unusually long spans, set the poles so that the crossarm comes on the side of the pole away from the long span. Where pole top pins are used, they shall be on the opposite side of the pole from the gain, with the flat side against the pole.

3.1.1.5 Set poles in alignment and plumb except at corners, terminals, angles, junctions, or other points of strain, where they shall be set and raked against the strain, not less than 2 inches for each 10 feet of pole length above grade, nor more than 4 inches for each 10 feet of pole length after conductors are installed at the required tension. When ground is uneven, poles differing in length shall be kept to a minimum by locating poles to avoid the highest and lowest ground points. If it becomes necessary to shorten a pole, a piece shall be sawed off the top and the shortened end of the pole given an application of hot preservative. Holes shall be dug large enough to permit the proper use of tampers to the full depth of the hole.

3.1.1.6 Provide plastic pole cap with 1/4-inch sealing rings and four nailing tabs. Fill sealing area with elastigum to the level of the sealing ring, place on pole top and nail each tab down with a 1-1/4-inch aluminum nail. No nails or holes shall be permitted on top of pole.

3.1.1.7 Storage and Handling of Poles: Poles held in storage for more than 2 weeks shall be stored in accordance with ANSI 05.1. The handling of poles shall be in accordance with ANSI 05.1, except that pointed tools capable of producing indentations more than one inch in depth shall not be used.

3.1.2 Hardware: Install hardware with washer against the wood and with nuts and lock nuts applied wrench tight.

3.1.3 Grounding: Provide grounding for pole lines conforming to ANSI C2 except that each separate ground electrode shall have a resistance to the solid earth not exceeding 10 ohms. When work in addition to that indicated or specified, is directed in order to obtain the specified ground resistance the provisions of the contract covering "changes" shall apply.

3.1.3.1 Make ground rod connections on pole lines by thermit weld for all ground wire or wire to rod connections.

3.1.3.2 Make thermit welds strictly in accordance with the manufacturer's written recommendations. Welds which have puffed up or which show convex surfaces indicating improper cleaning, are not acceptable. No mechanical connectors are required at thermit weldments.

3.1.3.3 Ground noncurrent carrying metal parts of equipment or enclosures, and grounding terminal of each arrester.

3.1.3.4 The primary and secondary neutrals and the tank of each transformer shall be interconnected and connected to ground.

3.1.3.5 Protect grounding conductors which are run on the surface of wood poles by plastic molding extending from the ground line throughout communication and transformer spaces.

3.1.4 Conductors: Conductors shall be handled with all care necessary to prevent nicking, kinking, gouging, flattening, or otherwise deforming or weakening the conductor or impairing its conductivity. Remove all damaged sections of conductor and splice the conductor.

3.1.4.1 Conductor splices, as installed, shall exceed the ultimate rated strength of the conductor and shall be of the type recommended by the conductor manufacturer. No splice shall be permitted within 10 feet of any support.

3.1.4.2 Ties on pin insulators shall be tight against the conductor and insulator and ends shall be turned down flat against the conductor so that no wire ends project.

3.1.4.3 Existing conductors to be reinstalled or resagged shall be strung to "FINAL" sag table values for the particular conductor type and size involved.

3.1.4.4 String new conductors to "INITIAL" sag table values recommended by the manufacturer for the conductor type and size of conductor and ruling span indicated. Conductor sags shall adhere as closely as possible to the values given in the chart but may be adjusted where required by proximity of other existing circuits to provide ample clearance between conductors. Changes in the values of sag shall be subject to the approval of the Contracting Officer.

3.1.5 Risers: Secure conduits on poles as indicated on Sketch TS-16302L-37.

3.1.6 Transformer Installations: Provide one primary fuse cutout and one surge arrester for each ungrounded phase conductor. The transformer's kVA rating shall be conspicuously displayed on its tank.

3.2 FIELD TESTS: As an exception to requirements that may be stated elsewhere in the contract, the Contracting Officer shall be given 5 working days notice prior to each test.

3.2.1 Ground Rod Tests: Do not connect the ground rods until they have been tested for ground resistance value. Make ground resistance measurements in normally dry weather, not less than 48 hours after rainfall. Ground resistance shall also be measured from each piece of equipment to the ground electrode. Use a portable ground testing megger to test each ground or group of grounds. The instrument shall be equipped with a meter reading directly in ohms or fractions thereof to indicate the ground value of the electrode under test. Follow the directions provided by the equipment manufacturer for proper use of the equipment. Provide one copy of the directions for the use of the observing inspectors.

3.2.2 Test Transformer: Test transformer secondary voltages and adjust the voltage at the transformer to provide a secondary voltage of 277/480.

3.2.3 Devices Subject to Manual Operation: Each device subject to manual operation shall be operated at least five times, demonstrating satisfactory operation each time.

*** END OF SECTION ***

SYMBOL LEGEND

A	ANGLE
AB	ANGLE BRACE
D	DOUBLE
DE	DEADEND
F	FLAT (HORIZONTAL)
FB	FLAT BRACE
LP	LINE POST
N	NEUTRAL
R	RIDGE OR POLE TOP PIN
S	SECONDARY, OPEN WIRE
St	SECONDARY, TRIPLEX
SQ	SECONDARY, QUADRUPLEX
T	TRANSFORMER
TERM	TERMINAL
UG	UNDERGROUND
V	VERTICAL
X	CROSSARM, 8'
X10	CROSSARM, 10'

GENERAL NOTES:

1. Symbols comprising the overhead sketches are not intended to be "all inclusive" for use on every distribution pole line configuration. Only sketches which reflect typical arrangements are included. For other desired arrangements, sketches should be modified or separate details drawn to reflect the specific conditions.

2. Each sketch contains material items which comprise a part of each individual symbol referenced by that sketch. These items are indicated by circled numerals which are identified by Sketches TS-16302L-1.5 and TS-16302L-1.5a.

3. Spacing requirements related to individual components of a symbol are indicated on the appropriate sketch. Vertical spacing requirements between circuits and/or systems are indicated on Sketch TS-16302L-1.4. All other separations between circuits, equipment, etc., shall conform to the National Electrical Safety Code- ANSI C2.

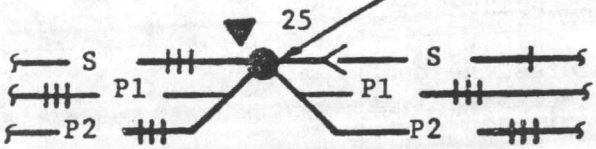
Symbol Legend & General Notes

SKETCH TS-16302L- 1.1

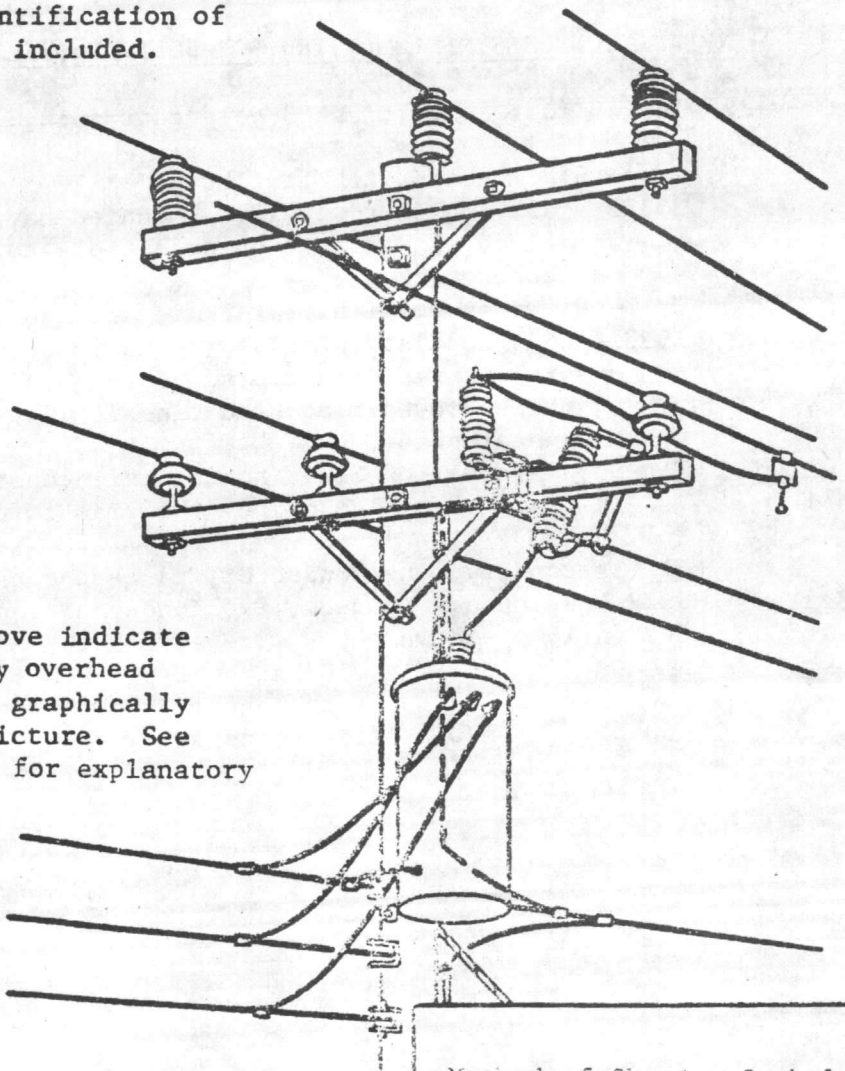
LIST OF SYMBOLS

SKETCH NUMBER			CATEGORY
TS 16302L-2	THRU	TS 16302L-11	CROSSARM SYMBOLS
TS 16302L-12	THRU	TS 16302L-15	HORIZONTAL (TANGENT OR ANGLE) CONSTRUCTION SYMBOLS
TS 16302L-16	THRU	TS 16302L-20	HORIZONTAL DEADEND CONSTRUCTION SYMBOLS
TS 16302L-21	THRU	TS 16302L-25	VERTICAL CONSTRUCTION SYMBOLS
TS 16302L-26	THRU	TS 16302L-27	ARMLESS CONSTRUCTION SYMBOLS
TS 16302L-28	THRU	TS 16302L-31	TRANSFORMER SYMBOLS
TS 16302L-32	THRU	TS 16302L-34	UNDERGROUND TERMINAL SYMBOLS
TS 16302L-35	THRU	TS 16302L-36	GUY SYMBOLS
TS 16302L-37			CONDUIT RISER SYMBOL
TS 16302L-38	THRU	TS 16302L-42	SECONDARY SYMBOLS
TS 16302L-43			GROUND SYMBOL

Pole # _____ (45'-3)
X-FB,35FR3
X-FB,15F3
TF (25KVA, 7.6KV - 120/240V)
S1, SDE2
GUY (5/16")
ANCHOR (10" Screw)
GROUND



DESIGN NOTE:
Method of showing information on plan view is optional and shall be coordinated with legend on individual design basis. However, characteristics & identification of all circuits shall be included.



NOTE:
The symbols listed above indicate material (described by overhead sketches) which is graphically illustrated by this picture. See Sketch TS-16302L-1.3a for explanatory notes.

Method of Showing Symbols

SKETCH TS-16302L- 1.3

EXPLANATORY NOTES - METHOD OF SHOWING SYMBOLS

1. Symbols are shown in the basic order as they appear on the pole, by starting at the top and working down.

2. Numerals preceding the symbol indicate the minimum required voltage rating of the assembly, if applicable.

3. Numeral following the symbol indicates the number of conductor associated with the assembly, if applicable.

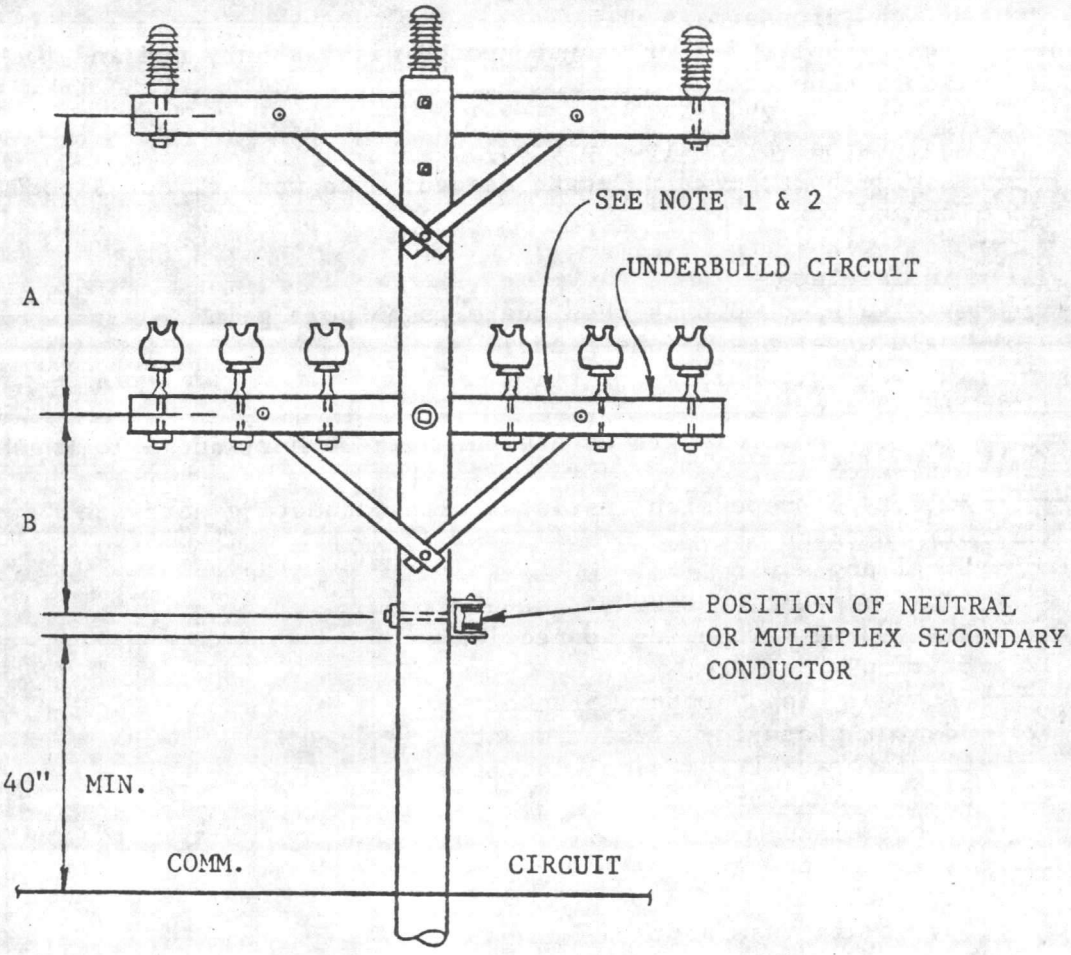
4. Numeral in parenthesis following the symbol denotes the number of assemblies required, if more than one.

5. Data in parenthesis following the symbol provides information relative to the symbol.

EXPLANATION OF SYMBOLS LISTED FOR POLE ON SKETCH TS-16302L-1.3

Provide 45 foot long, class 3 pole containing:

X-FB- 8' crossarm with flat brace
35FR3 - 35KV insulators, flat (mounted horizontal on crossarm), ridge pin (center phase on pole top pin), three conductors
X-FB- 8' crossarm with flat brace
15F3 - 15KV insulators, flat (mounted horizontal on crossarm), three conductors. Note: this symbol calls for three crossarm mounted pins in lieu of ridge pin on center phase.
TF - transformer on flat (horizontal) construction. Data in parenthesis describes the transformer characteristics.
S1 - secondary, one conductor, tangent construction
SDE2 - secondary deadend, two conductors, open wire
GUY (5/16") - down guy - wire size 5/16"
ANCHOR (10" SCREW) - 10" screw type anchor. Note: No plate is included for the anchor symbol
GROUND - no explanation necessary



NOTES:

1. For new construction or operating voltages greater than 5KV, limit the number of conductors on crossarm to a maximum of three.
2. Use 10' crossarms for all underbuild circuits with operating voltages greater than 15KV.
3. For horizontal spacing requirements for conductors on same support, refer to the National Electrical Safety Code, ANSI C 2.

Ø - Ø VOLTAGE	0 - 15KV	15 - 50KV
SPACING A	40"	48" *
SPACING B	40"	40"

* Provide 60" clearance when operating voltage of underbuild circuit is greater than 15KV

SKETCH TS-16302L-1.4

Basic Vertical Spacing Requirements

POLE LINE MATERIAL LIST

TS-16302L (SEPTEMBER 1980)

1. Flat steel brace (two pieces)
2. Machine bolt, 3/8" x length needed with washer, nut and lockwasher
3. 8' wood crossarm
4. Machine bolt, 5/8" x length needed with washer, nut and lockwasher
5. Timber connector
6. Lagscrew, 1/2" x 4"
7. Angle steel brace (two pieces)
8. Machine bolt, 1/2" x length needed, with washer, nut & lockwasher
9. Deadend box
10. Steel pin
11. Pin insulator
12. Grid gain, used only when there is no pole gain
13. Angle steel brace (one piece)
14. 10' wood crossarm
15. 5/8" eye nut
16. 5/8" eye bolt, length as needed, with washer, nut & lockwasher
17. Extension link
18. Bell type suspension insulator with connecting hardware
19. Strain clamp
20. Steel angle pin
21. Cluster mounting bracket, steel
22. Transformer grounding connection
23. Stirrup
24. Secondary lead support bracket
25. Adapter plate for cluster mounting
26. Clevis bracket for spool insulator
27. Spool insulator
28. U bolt clamp
29. Preformed guy grip
30. Guy hook
31. Guy strain insulator
32. Guy wire, size as specified
33. #4 WP Cu. soft drawn ground wire
34. Ground clamp
35. Conduit coupling
36. Conduit bend
37. Insulated bushing
38. Perforated strapping, 1 1/2" wide
39. Hot line clamp
40. Fused cutout, as specified
41. Surge arrester, as specified
42. Pole top pin
43. Crossarm angle pin
44. Angle pole top pin
45. Wire, #4 WP Cu., (unless otherwise specified) soft drawn
46. Tri-mount bracket
47. Terminator, porcelain housed
48. Mounting bracket
49. Cable grip hanger
50. Hose clamp

SKETCH TS-16302L-1.5

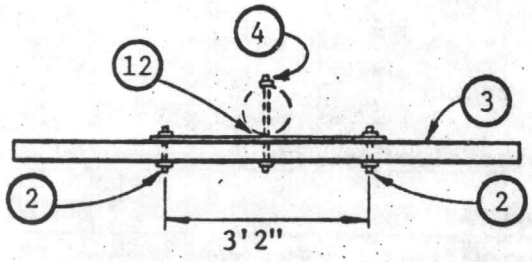
Pole Line Material List

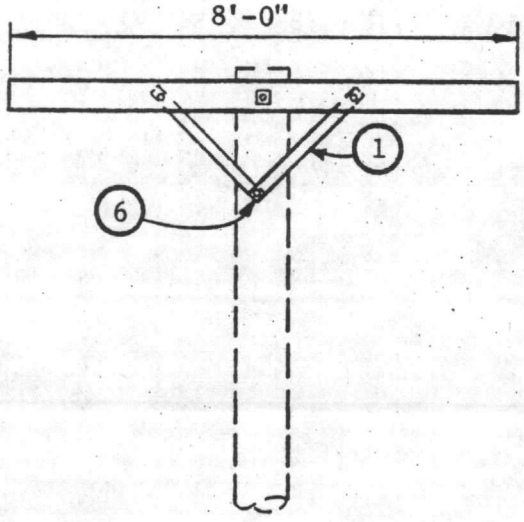
POLE LINE MATERIAL LIST

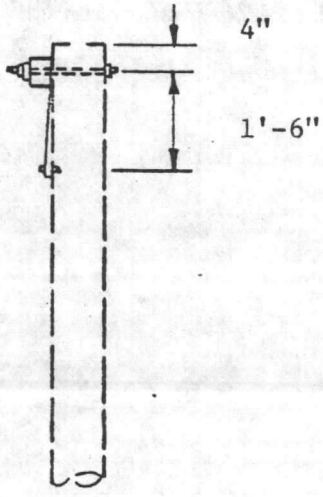
51 Stud, 3/4" x 1 3/4"
52 Line post insulator
53 Triple insulator bracket
54 Angle clamp
55 Insulator, line post clamp
56 4' crossarm
57 Crossarm gain bracket
58 Pulley bracket
59 Wedge clamp
60 Midspan service clamp
61 Stud, 7"
62 Saddle, angle
63 Saddle, crossarm
64 Fitting, pole top
65 Connector
66 Suspension clamp
67 Tie, service cable
68 54" Fiberglass strain insulator

Pole Line Material List

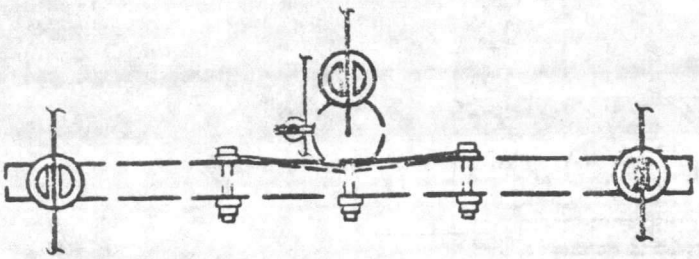
SKETCH TS-16302L-1.5a

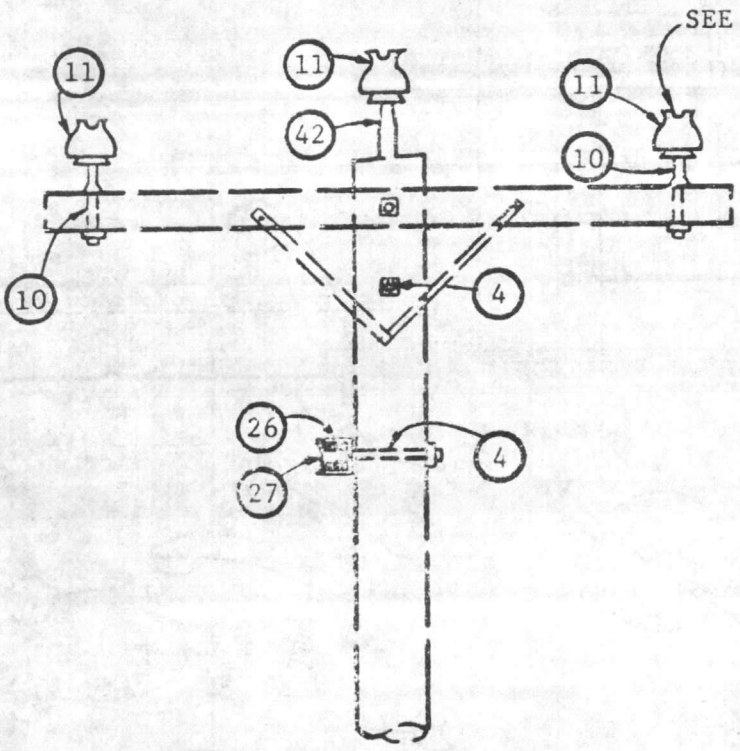






NOTE: DRAWING INDICATES X-FB. SUBSTITUTE (7) FOR (1) AND (8) FOR (6) ON X-AB.





NOTES:

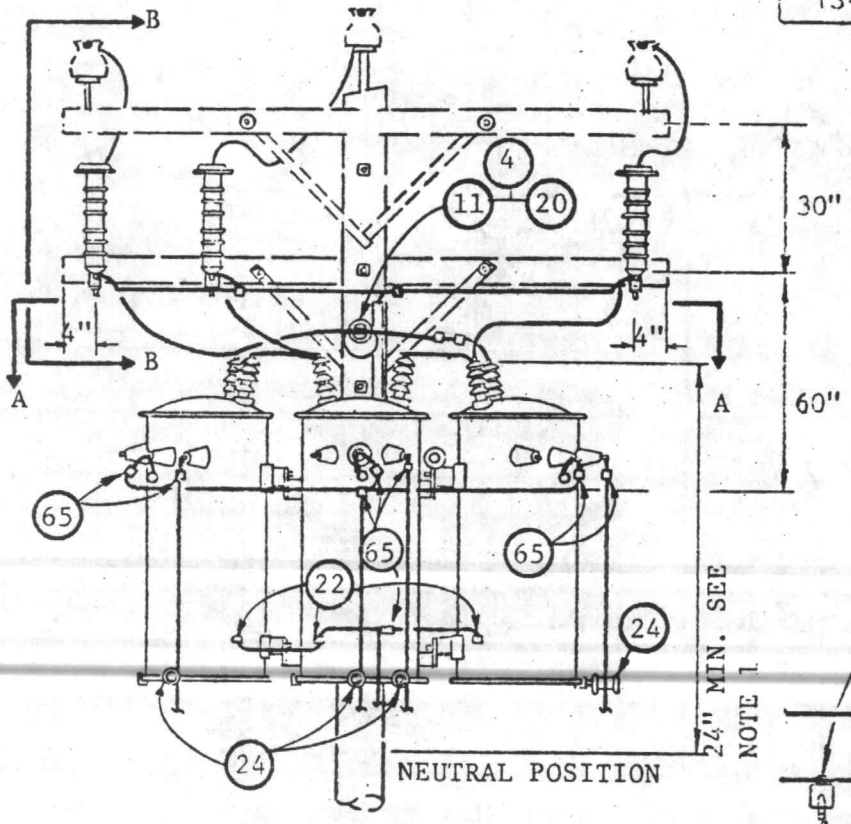
1. DRAWING REPRESENTS FR3-N. ELIMINATE (4), (26), AND (27) FOR NEUTRAL POSITION ON FR3.

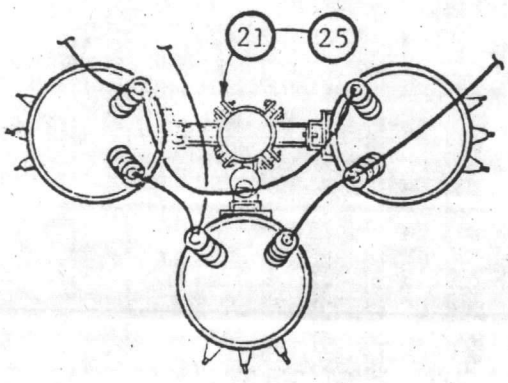
2. ON CIRCUIT VOLTAGE OPERATING LEVELS GREATER THAN 15 KV, SUBSTITUTE (52) FOR (11), (64) FOR (42) AND (62) FOR (10).

3. REFER TO SPECIFICATIONS FOR REQUIRED CLASS OF INSULATORS.

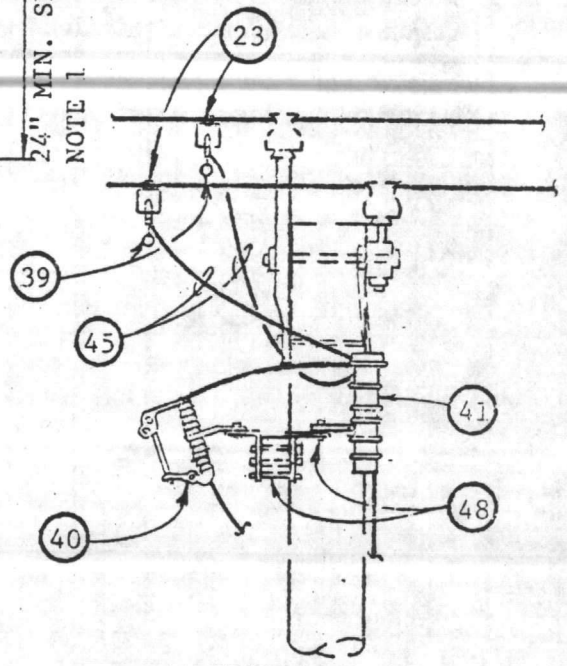
FR3-N, FR3 (0-15 KV)

SKETCH TS-16302L-12





SECTION A - A



SECTION B - B

NOTES:

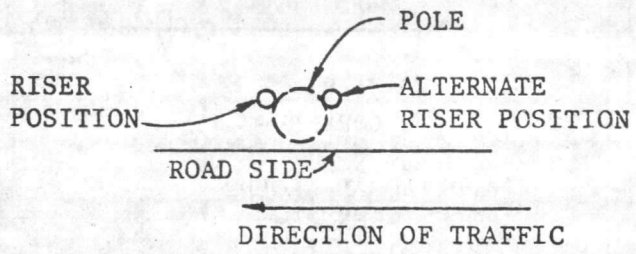
1. This dimension shall be measured on pocket bushing type transformer from lowest energized point on lead or bushing.
2. When transformer secondary leads connect to open wire or quadruplex secondary, conductor shall have 600 volt insulation rating and minimum ampacity of 125% of transformer full load secondary current.
3. When transformer provides underground service, size secondary or service conductors as indicated.
4. Modify connections as required to accomodate transformers with primary bushing arrangements other than shown.

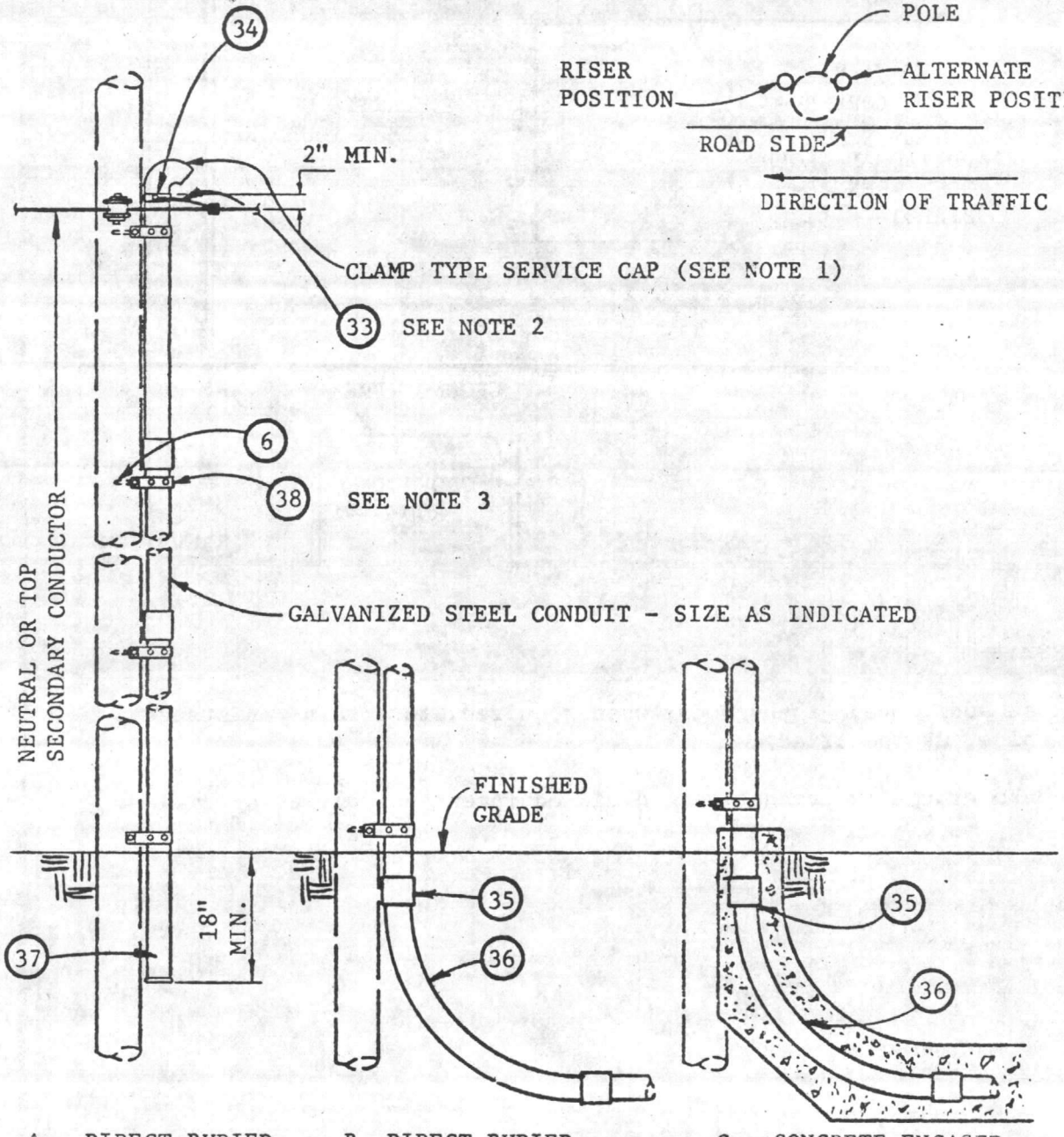
TTT

SKETCH TS-16302L-31

05-82-2541

CONDUIT LOCATION





A. DIRECT BURIED CABLE

B. DIRECT BURIED CONDUIT

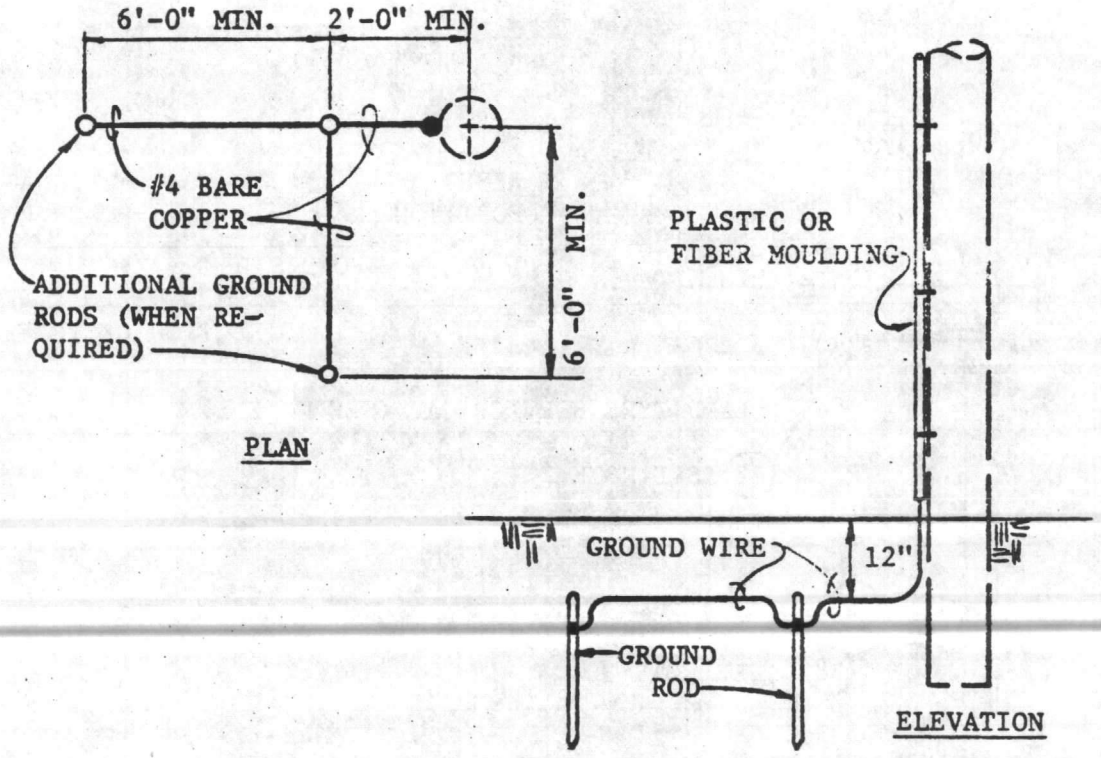
C. CONCRETE ENCASED CONDUIT

NOTES:

1. On conduit riser for primary circuits, eliminate service cap and provide grounding type insulating bushing.
2. Connect to grounded neutral or provide ground per specifications.
3. Space straps at maximum of 4' intervals.

SKETCH TS-16302L-37

CONDUIT RISER (SIZE AS INDICATED)



NOTES:

1. Use additional ground rods, when required, to obtain resistance value, as specified.

2. Make grounding connections to all equipment on pole as specified.

SECTION 16402

INTERIOR WIRING SYSTEMS

PART 1 - GENERAL

1.1 APPLICABLE PUBLICATIONS: The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

1.1.1 Federal Specifications (Fed. Spec.):

W-C-375B	Circuit Breaker, Molded Case, Branch-Circuit and Service
W-S-896E(1)	Switch, Toggle (Toggle and Lock), Flush Mounted

1.1.2 American National Standards Institute (ANSI) Publications:

C80.1-1977	Specification for Rigid Steel Conduit, Zinc-coated
C80.3-1977	Specification for Electrical Metallic Tubing, Zinc-coated

1.1.3 American Society for Testing and Materials (ASTM) Publications:

B 1-70 (R 1976)	Hard-Drawn Copper Wire
B 8-77	Concentric-Lay-Stranded Copper Conductor, Hard, Medium-Hard, or Soft

1.1.4 National Electrical Manufacturers Association (NEMA) Publications:

ICS1-1978 (Rev. 3-80)	General Standards for Industrial Control and Systems
ICS2-1978 (Rev. 2-80)	Industrial Control Devices, Controllers and Assemblies
ICS4-1977 (Rev. 1-78)	Terminal Blocks for Industrial Control Equipment and Systems

ICS6-1978 (Rev. 1-80)	Enclosures for Industrial Controls and Systems
KS1-1975	Enclosed Switches
MG1-1978 (Rev. 5-80)	Motors and Generators
ST20-1972 (R 1978)	Dry-Type Transformers for General Applications
WD1-1979 (Rev. 1-79)	General Purpose Wiring Devices

1.1.5 National Fire Protection Association (NFPA) Publication:

70-1981	National Electrical Code (NEC)

1.1.6 Underwriters' Laboratories, Inc. (UL) Publications:

1-1979 (Mar 80)	Flexible Metal Conduit
50-1980	Cabinets and Boxes
67-1979 (Dec 80)	Panelboards
83-1980	Thermoplastic-Insulated Wires and Cables
198B-1975 (Aug 78)	Class H Fuses
467-1972 (May 79)	Grounding and Bonding Equipment
486A-1980	Wire Connectors and Soldering Lugs for Use with Copper Conductors
510-1976 (Jun 80)	Insulating Tape
514-1979 (Apr 80)	Outlet Boxes and Fittings
869-1977 (Nov 80)	Service Equipment
943-1972 (Jan 77)	Ground-Fault Circuit Interrupters

1.2 GENERAL REQUIREMENTS: Section 16011, "Electrical General Requirements," applies to this section with additions and modifications specified herein. In each of the standards referred to herein, consider the advisory provisions to be mandatory, as though the word "shall" had been substituted for "should" wherever it appears. Interpret reference in these standards to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer.

1.2.1 Underground Service: Underground service into buildings shall terminate at a point 5 feet outside the building and projections thereof, except that service conductors shall be continuous to the interior terminating point indicated. The underground portion of the conduit from within 5 feet of the building to the service panel shall be hot dip galvanized rigid steel and shall be encased in a concrete envelope having a wall thickness of not less than three inches and shall be buried not less than 24 inches. Where a conduit enters through a concrete floor, the curved portion shall not be visible above the finished floor and the entire conduit below the floor slab shall be encased in a concrete envelope having a wall thickness of not less than three inches. Ends of the underground conduit shall be protected by threaded metal caps until connections are made. Underground service from 5 feet outside the building to the connection to the existing power system shall be provided under Section 16301, "Underground Electrical Work."

1.2.2 Electrical Characteristics: See Section 16302, "Overhead Electrical Work".

1.3 SUBMITTALS:

1.3.1 Manufacturer's Data:

a. Receptacles
b. Motor Controllers
c. Circuit Breakers
d. Switches
e. Intermediate Metal Conduit
f. Conduit Supports
g. Fuses
h. Weatherproof Pushbutton Switch with Pilot Light

1.3.2 Shop Drawings:

a. Panelboards
b. Dry Type Transformers

1.3.3 Certificates of Conformance or Compliance:

a. Conduit (except IMC)
b. Ground Rods
c. Outlet and Junction Boxes
d. Insulating Tapes
e. Conduit Fittings
f. Device Plates
g. Conductors

1.4 TRANSFORMER TESTS AND TEST REPORTS: Perform tests classified as "routine" per NEMA ST20 on each transformer and submit the results for approval in report form. Submittal shall also contain the results of NEMA "design" and "prototype" tests that were made on transformers electrically and mechanically equal to those specified.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT: All materials, equipment, and devices shall, as a minimum, meet the requirements of UL where UL Standards are established for those items and the requirements of NFPA-70. All items shall be new unless specified or indicated otherwise.

2.1.1 Conduit and Fittings:

2.1.1.1 Rigid Steel Conduit (Zinc-coated): ANSI C80.1

2.1.1.2 Intermediate Metal Conduit (IMC): UL 1242, zinc-coated steel only

2.1.1.3 Electrical Metallic Tubing (EMT): ANSI C80.3

2.1.1.4 Flexible Metal Conduit: UL 1, zinc-coated steel only

2.1.1.5 Fittings for Metal Conduit, Electrical Metallic Tubing, and Flexible Metal Conduit: Ul 514. All ferrous fittings shall be cadmium- or zinc-coated per UL 514.

2.1.1.5.1 Fittings for rigid metal conduit and IMC shall be threaded type. Split couplings are not acceptable.

2.1.1.5.2 Fittings for electrical metallic tubing (EMT) shall be the compression type.

2.1.2 Outlet Boxes and Covers: UL 514, cadmium or zinc-coated if of ferrous metal.

2.1.3 Cabinets, Junction Boxes, and Pull Boxes (With Volume Greater than 100 Cubic Inches): UL 50, hot-dip zinc-coated if of sheet steel.

2.1.4 Wires and Cables: Wires and cables shall meet the applicable requirements of NFPA 70 and UL for the type of insulation, jacket, and conductor specified or indicated. Conductor sizes are based on copper. Conductors No. 10 AWG and smaller shall be solid copper. Conductors No. 8 AWG and larger shall be stranded copper. Wires and cables manufactured more than twelve months prior to date of delivery to the site shall not be used.

2.1.4.1 Color coding is required for all service, feeder, branch, control, and signalling circuit conductors. Color shall be white for neutrals and green for grounding conductors. The color of the ungrounded conductors in different voltage systems shall be as follows:

a. 277/480 volt, 3-phase: yellow, brown, and orange

b. 120 volt, single phase: black

All ungrounded conductors of the same color shall be connected to the same ungrounded feeder conductor.

2.1.4.2 Conductor sizes are expressed in American Wire Gage (AWG) or in circular mils. Minimum size for branch circuits shall be No. 12 AWG; for Class 1 remote-control and signal-ciruits - No. 14 AWG; for Class 2 low-energy remote control and signal-circuits - No. 16 AWG.

2.1.4.3 Power and Lighting Conductors: UL 83, type THW or THWN (or XHHW)

2.1.4.4 Service Entrance and Underground Secondary Conductors: See Section 16301.

2.1.4.5 Grounding and Bonding Conductors: ASTM B 1, solid bare copper wire for sizes No. 8 AWG and smaller; ASTM B 8, class B, stranded bare copper wire for sizes No. 6 AWG and larger. Grounding and bonding conductors shall be insulated type where indicated or specified.

2.1.4.6 Flexible Connections: Connections to movable equipment shall be flexible metal conduit with the number of conductors indicated.

2.1.5 Splices and Termination Components: UL 486A for wire connectors, and UL 510 for insulating tapes. Connectors for wires No. 10 and smaller shall be insulated pressure-type or wirenut-type. Provide solderless terminal lugs on stranded conductors.

2.1.6 Device Plates: Provide one-piece device plates for outlets and fittings to suit the devices installed. Plates on unfinished walls and on fittings shall be of zinc-coated sheet steel or cast metal having round or beveled edges.

2.1.7 Switches:

2.1.7.1 Toggle Switches: Fed. Spec. W-S-896, totally enclosed with bodies of thermosetting plastic and a mounting strap. Handles shall be ivory. Wiring terminals shall be of the screw type, side wired. Switches shall be rated quiet-type AC only, 20 ampere, 120-277 volts, with the number of poles indicated.

2.1.7.2 Disconnect Switches: NEMA KS1, general duty fused or nonfused as indicated, single throw, quick-make quick-break, 600 volts, and the number of poles indicted. Provide switches in NEMA 1 enclosure per NEMA ICS6. Provide fused switches with fuse-holders to accept the specified fuse type. Switches serving as motor-disconnect means shall be horsepower rated.

2.1.7.3 Push Button Switch: 20 ampere, 120-277 volt, maintained contact. Provide yellow single piece neoprene cover plate with bubble over button. Plate shall come complete with neon pilot light. Entire switch assembly shall be weatherproof.

2.1.8 Receptacles: NEMA WD 1,heavy duty, grounding type. Ratings and configurations shall be as indicated. Bodies shall be of ivory thermosetting plastic supported on a metal mounting strap. Wiring terminals shall be of the screw type, side wired. Connect grounding pole to the mounting strap.

2.1.8.1 Duplex Receptacles: 20 amperes, 125 volts, No. 5342

2.1.8.2 Ground Fault Circuit Interrupter Receptacles: UL 943, as applicable, and shall be duplex feedthrough-type for mounting in a standard outlet box. The device shall be capable of detecting a current leak of 5 milliamperes. Connect receptacle for non-feedthrough operation.

2.1.9 Panelboards: UL 67 and UL 50, as applicable. Panelboards for use as service disconnecting means shall additionally conform to UL 869. Panelboards shall be circuit breaker equipped. Design complete panelboard assembly so that any individual breaker can be removed without disturbing adjacent units or without loosening or removing supplemental insulation supplied as a means of obtaining clearances as required by UL. Where "space only" is indicated, make provisions for the future installation of a breaker sized as indicated.

2.1.9.1 Panelboard Buses: Provide copper bus bars supported on bases independent of the circuit breakers. Design main buses and back pans so that breakers may be changed without machining, drilling, or tapping. Provide an insulated neutral bus in each panel for connection of circuit neutral conductors. Provide a separate ground bus marked with a green stripe along its front and bonded to the steel cabinet for connecting grounding conductors.

2.1.9.2 Circuit Breakers: Fed. Spec. W-C-375 thermal magnetic type with interrupting capacity of 10,000 amperes symmetrical minimum. Design breakers to accept copper, copper-clad, and aluminum conductors. Plug-in circuit breakers are not acceptable.

2.1.9.2.1 Multipole Breakers: Provide common-trip type with a single operating handle. Design breakers so that an overload in one pole automatically causes all poles to open. Maintain phase sequence throughout each panel so that any three adjacent breaker poles are connected to Phases A, B, and C respectively.

2.1.10 Fuses: Provide a complete set of fuses for each fusible switch as indicated. Fuses shall have a voltage rating not less than the circuit voltage.

2.1.10.1 Cartridge Fuses, Standard Type (Class H): UL 198B, non-renewable, rated 600 volts. Fuses shall be time-delay type.

2.1.11 Transformers: NEMA ST20, general purpose, dry-type, self cooled, ventilated. Provide transformers in a NEMA 1 enclosure. Transformer shall have 220 degrees C insulation system with a temperature rise not exceeding 115 degrees C under full rated load in a maximum ambient of 40 degrees C. Transformer shall be capable of carrying continuously 115 percent of the nameplate KVA without exceeding the insulation rating. Transformers shall be the quiet type with an average sound level of at least 3 decibels lower than NEMA Standard level for the transformer size indicated.

2.1.12 Motors: NEMA MG1. The approximate size of each motor is indicated. Determine specific motor characteristics to insure provision of correctly sized starters and overload heaters. Motors for operation on 480-volts, 3-phase shall have voltage rating of 460 volts. Motors shall be designed to operate at full capacity with a voltage variation of plus or minus 10 percent of the motor voltage rating. Motors shall be of sufficient size for the duty to be performed and shall not exceed their full load nameplate current rating when driven equipment is operated at specified capacity under the most severe conditions likely to be encountered.

2.1.13 Motor Controllers: NEMA ICS1 and ICS2. All controllers shall have thermal overload protection in each phase. Magnetic type motor controller shall have under voltage release. The controller shall have a hand-off-automatic selector switch. Connections to the selector switch shall be such that only the normal automatic regulatory control devices will be by-passed when the switch is in the "hand" position. All safety control devices such as motor overload protective devices shall be connected in the motor control circuit in both the "hand" and the "automatic" positions. The selector switch shall have means for locking in any position. Overload protective devices shall give adequate protection to the motor windings, be of the thermal inverse-time-limit type, and include a manual-reset type push button on the outside of the motor controller case.

2.1.13.1 Enclosures for Starters and Controllers: NEMA 1 per NEMA ICS6, unless indicated otherwise.

2.1.13.2 Pilot and Indicating Lights: Provide transformer, resistor, or diode type.

2.1.13.3 Terminal Blocks: NEMA ICS4.

2.1.14 Grounding and Bonding Equipment: UL 467

2.1.14.1 Equipment Grounds: Provide a green-colored equipment grounding conductor which shall be separate from the electrical system neutral conductor. Provide equipment ground conductors in branch circuits serving receptacles, equipment, apparatus, and other miscellaneous metal-enclosing bodies (including light switch boxes) normally within contact of personnel.

2.1.14.2 Ground Rods: Copperweld type, 3/4 inch in diameter and 10 feet long unless otherwise indicated.

PART 3 - EXECUTION

3.1 INSTALLATION:

3.1.1 General Requirements: Electrical installations shall conform to the requirements of NFPA 70 and to the requirements specified herein. Measure mounting heights specified or indicated to the center of the device or outlet.

3.1.2 Wiring Methods: Wiring method shall be insulated conductors installed in conduit. Conduit shall be rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).

3.1.2.1 Electrical Metallic Tubing: Do not install underground, encase in concrete, use in areas where subject to severe physical damage, or use in outdoor work.

3.1.2.2 Conduit In or Under Floor Slabs: Rigid steel or steel IMC.

3.1.2.3 Service Entrance Conduit: See Section 16301.

3.1.3 Conduit Installation: Unless indicated otherwise, conceal conduit within floors and run conduit exposed on ceiling and walls. Keep conduit at least 6 inches away from parallel runs of pipes. Install conduit parallel with or at right angles to ceilings, walls, and structural members where located above accessible ceilings and where conduit will be visible after completion of project.

3.1.3.1 Support Conduit by pipe straps, wall brackets, hangers, or ceiling trapeze. Fasten by wood screws to wood; by toggle bolts on hollow masonry units; by concrete inserts or expansion bolts on concrete or brick; by machine screws, welded threaded studs, or spring-tension clamps on steel work. Threaded studs driven in by a powder charge and provided with lock washers and nuts may be used in lieu of expansion bolts or machine or wood screws. Threaded C-clamps may be used on rigid steel conduit only. Do not weld conduits or pipe straps to steel structures. The load applied to fasteners shall not exceed one-fourth of the proof test load. Holes cut to a depth of more than 1-1/2 inches in reinforced concrete beams or to a depth of more than 3/4-inch in concrete joints shall not cut the main reinforcing bars. Fill holes that are not used.

3.1.3.2 Make changes in direction of runs with symmetrical bends or cast-metal fittings. Make field-made bends and offsets with a hickey or conduit-bending machine. Do not install crushed or deformed conduits. Avoid trapped conduits. Prevent plaster, dirt, or trash from lodging in conduits, boxes, fittings, and equipment during construction. Free clogged conduits of all obstructions.

3.1.3.3 Install pull wires in empty conduits in which wire is to be installed by others. The pull wire shall be plastic having not less than 200-pounds tensile strength. Leave not less than 12 inches of slack at each end of the pull wire.

3.1.3.4 Conduit Installed in Concrete Floor Slabs: Locate so as not to adversely affect the structural strength of the slabs. Install conduit within the middle one-third of the concrete slab. Do not stack conduits. Space conduits horizontally not closer than three diameters except at cabinet locations. Curved portions of bends shall not be visible above the finish slab. Increase slab thickness as necessary to provide a minimum one inch cover over conduit. Where embedded conduits cross expansion joints, provide suitable watertight expansion fittings and bonding jumpers. Conduit larger than one inch trade size shall be parallel with or at right angles to the main reinforcement; when at right angles to the reinforcement, the conduit shall be close to one of the supports of the slab. Encase conduit installed beneath floor slabs in a minimum of 3 inches of concrete.

3.1.3.5 Fasten conduits to sheet metal boxes and cabinets with two locknuts where required by NFPA 70, where insulated bushings are used, and where bushings cannot be brought into firm contact with the box; otherwise, use at least a single locknut and bushing. Locknuts shall be the type with sharp edges for digging into the wall of metal enclosures. Install bushings on the ends of conduits and provide insulating type where required by NFPA 70.

3.1.3.6 Stub-Ups: Provide conduits stubbed up through concrete floor for connection to free-standing equipment with an adjustable top or coupling threaded inside for plugs, set flush with the finished floor. Extend conductors to equipment in rigid steel conduit, except that flexible metal conduit may be used 6 inches above the floor. Where no equipment connections are made, install screwdriver-operated threaded flush plugs in conduit end.

3.1.3.7 Flexible connections of short length shall be provided for lighting fixtures, equipment subject to vibration, noise transmission, or movement and for all motors. Liquid-tight flexible conduit shall be used in wet locations. A separate ground conductor shall be provided across flexible connections.

3.1.4 Boxes, Outlets, and Supports: Provide boxes in the wiring or raceway systems wherever required for pulling of wires, making connections, and mounting of devices or fixtures. Boxes for metallic raceways shall be of the cast-metal hub type when located in normally wet locations, when surface mounted on outside of exterior surfaces, and when installed exposed up to 7 feet above interior floors and walkways. Boxes in other locations shall be sheet steel. Each box shall have the volume required by the NEC for the number of conductors enclosed in the box. Boxes for mounting lighting fixtures shall be not less than 4 inches square (or octagonal), except that smaller boxes may be installed as required by fixture configurations, as approved. Provide boxes installed for concealed wiring with suitable extension rings or plaster covers, as required. Boxes for use in masonry-block or tile walls shall be square-cornered tile-type or standard boxes having square-cornered tile-type covers. Provide gaskets for cast-metal boxes installed in wet locations and boxes installed flush with the outside of exterior surfaces. Provide separate boxes for flush or recessed fixtures when required by the fixture terminal operating temperature; fixtures shall be readily removable for access to the boxes. Fasten boxes and supports with wood screws on wood, with bolts and expansion shields on concrete or brick, with toggle bolts on hollow masonry units, and with machine screws or welded studs on steel work. Threaded studs driven in by powder charge and provided with lockwashers and nuts or nail-type nylon anchors may be used in lieu of wood screws, expansion shields, or machine screws. In open overhead spaces, cast boxes threaded to raceways need not be separately supported except where used for fixture support; support sheet metal boxes directly from the building structure or by bar hangers. Where bar hangers are used, attach the bar to raceways on opposite sides of the box and support the raceway with an approved type fastener not more than 24 inches from the box. When penetrating reinforced-concrete members, avoid cutting any reinforcing steel.

3.1.4.1 Boxes for use with raceway systems shall not be less than 1-1/2 inches deep except where shallower boxes required by structural conditions are approved. Boxes for other than lighting-fixture outlets shall be not less than 4 inches square except that 4 by 2 inch boxes may be used where only one raceway enters the outlet.

3.1.4.2 Pull Boxes: Construct of not less than the minimum size required by the NEC of code-gage aluminum or galvanized sheet steel except where cast-metal boxes are required in locations specified above. Furnish boxes with screw-fastened covers. Where several feeders pass through a common pull box, tag the feeders to indicate clearly the electrical characteristics, circuit number, and panel designation.

3.1.5 Mounting Heights: Mount panelboards so the height of the top operating handle will not exceed 78 inches from the floor. Mount lighting switches 3 feet, 10 inches above finished floor, receptacles, and other devices as indicated.

3.1.6 Conductor Identification: Provide conductor identification within each enclosure where a tap, splice, or termination is made. Make identification with color-coded insulated conductors, plastic-coated self-sticking printed markers, colored nylon cable ties and plates, or heat-shrink type sleeves. Identify control circuit terminations.

3.1.7 Splices: Make splices in accessible locations. Make splices in conductors No. 10 AWG and smaller with an insulated pressure type connector. Make splices in conductors No. 8 AWG and larger with a solderless connector and cover with an insulation material equivalent to the conductor insulation.

3.1.8 Covers and Device Plates: Install with all four edges in continuous contact with finished wall surfaces without the use of mats or similar devices. Plaster fillings will not be permitted. Plates shall be installed with an alignment tolerance of 1/16 inch. The use of sectional type device plates will not be permitted. Plates installed in wet locations shall be gasketed.

3.1.9 Grounding and Bonding: In accordance with NFPA 70. Ground all exposed non-current-carrying metallic parts of electrical equipment, metallic raceway systems, and neutral conductor of wiring systems. Make ground connection at the main service equipment and extend grounding conductor to the point of entrance of the metallic water service. Make connection to the water pipe by a suitable ground clamp or lug connection to a plugged tee. If flanged pipes are encountered, make connection with the lug bolted to the street side of the flanged connection. If metallic water service is used as the grounding electrode system, supplement it by an additional electrode in compliance with NFPA 70. Where ground fault protection is employed, take care that the connection of ground and neutral does not interfere with the correct operation of the fault protection.

3.1.9.1 Equipment Grounds: Equipment grounds shall be solid and continuous from a connection at earth to panelboards. Make ground connections at panelboards, outlets, equipment, and apparatus in an approved and permanent manner.

3.1.9.2 Resistance: The maximum resistance to ground of a driven ground rod shall not exceed 25 ohms under normally dry conditions. Where the resistance obtained with one ground rod exceeds 25 ohms, provide additional ground rods not less than 6 feet on centers.

3.2 FIELD TESTS: As an exception to requirements that may be stated elsewhere in the contract, the Contracting Officer shall be given 5 working days notice prior to each test.

3.2.1 Devices Subject to Manual Operation: Each device subject to manual operation shall be operated at least five times, demonstrating satisfactory operation each time.

3.2.2 Test on 600-Volt Wiring: Test all 600-volt wiring to verify that no short circuits or accidental grounds exist. Tests shall be made using an instrument which applies a voltage of approximately 500 volts to provide a direct reading of resistance.

3.2.3 Grounding System Test: Test the grounding system to assure continuity and that the resistance to ground is not excessive. Test each ground rod for resistance to ground. Make resistance measurements in normally dry weather, not less than 48 hours after rainfall, and with the ground rod under test isolated from other grounds. Submit written results of each test to the Contracting Officer and indicate the location of the rod as well as the resistance and soil conditions at the time the measurements were made.

*** END OF SECTION ***

SECTION 16510

LIGHTING, INTERIOR

PART 1 - GENERAL

1.1 APPLICABLE PUBLICATIONS: The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

1.1.1 American National Standards Institute (ANSI) Publications:

C82.1-1977 Specifications for Fluorescent Lamp Ballasts

1.1.2 Illuminating Engineering Society (IES) Publication:

(1981 Edition) Lighting Handbook

1.1.3 National Electrical Manufacturers Association (NEMA) Publications:

ICS 6-1978 (REV 1-80) Enclosures for Industrial Controls and Systems

1.1.4 National Fire Protection Association (NFPA) Publications:

70-1981 National Electrical Code (NEC)

1.1.5 Underwriters' Laboratories, Inc., (UL) Standards:

57-1972 (R JUL 82) Electric Lighting Fixtures

935-1978 (R SEP 80) Fluorescent Lamp Ballasts

1.2 GENERAL REQUIREMENTS: Section 16011, "Electrical General Requirements," applies with the following additions and modifications. The work includes the provision of new lighting fixtures for interior use, including lighting fixtures and accessories mounted on the exterior surfaces of buildings. Materials not normally furnished by manufacturers of these devices are specified in Section 16402, "Interior Wiring Systems."

1.3 SUBMITTALS: Data, shop drawings, and reports shall employ the terminology, classifications, and methods prescribed by the IES Lighting Handbook, as applicable, for the lighting system specified.

1.3.1 Manufacturer's Data:

a. Lighting fixtures, including lamps and ballasts

PART 2 - PRODUCTS

2.1 FLUORESCENT LIGHTING FIXTURES: UL 57.

2.1.1 Fluorescent Lamps: Provide the number, type, and wattage indicated.

2.1.2 Fluorescent Ballasts: UL 935, ANSI C82.1, and shall be labeled Certified Ballast Manufacturers (CBM) certified by Electrical Testing Laboratories (ETL). Ballasts shall be high power factor type and shall be designed to operate on the voltage system to which they are connected. Ballasts shall be Class P and shall have sound rating "A". Fixtures and ballasts shall be designed and constructed to limit the ballast case temperature to 90 degrees Celcius (C) when installed in an ambient temperature of 40 degrees C.

2.1.2.1 Low Temperature Ballasts: Provide fluorescent ballasts having a minimum starting temperature of minus 20 degrees C in fixtures mounted as indicated.

2.2 INCANDESCENT LIGHTING FIXTURES: UL 57.

2.2.1 Incandescent Lamps: Provide the number, type, and wattage indicated.

PART 3 - EXECUTION

3.1 INSTALLATION: Set lighting fixtures plumb, square, and level with ceiling and walls, and secure in accordance with manufacturers' directions and approved shop drawings. The installation shall meet with the requirements of NFPA 70. Mounting heights specified or indicated shall be to bottom of fixture. Obtain approval of the exact mounting of lighting fixtures on the job before installation is commenced.

3.2 GROUNDING: Ground noncurrent-carrying parts of equipment as specified in Section 16402, "Interior Wiring Systems." Where the copper grounding conductor is connected to a metal other than copper, provide specially treated or lined connectors suitable for this purpose.

3.3 FIELD TESTS: Perform the following field tests. The Government will provide electric power required for field tests.

3.3.1 Operating Test: After the installation has been completed, conduct an operating test to show that the equipment operates in accordance with the requirements of this section.

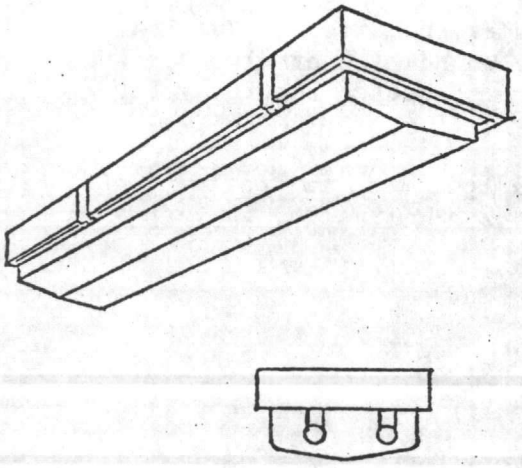
3.3.2 Insulation Resistance Test: Perform as specified in Section 16402, "Interior Wiring Systems," both before connection of fixtures and equipment and after fixtures and equipment are connected and ready for use.

3.3.3 Ground Resistance Tests: Perform as specified in Section 16402, "Interior Wiring Systems."

LIST OF SKETCHES

SKETCH NUMBER	TITLE
NFGS-16510-8	Wet/Damp Location Luminaire
NFGS-16510-45	Exterior Incandescent Luminaire

*** END OF SECTION ***



LUMINAIRE REQUIREMENTS

1. MOLDED 100% ACRYLIC DIFFUSE LENS (NOT CLEAR) FULLY GASKETED.

2. PLATED BRASS OR STAINLESS STEEL LATCHES. (PLASTIC LATCHES MAY BE SUPPLIED WITH TYPE A LUMINAIRE.)

3. BALLAST SHALL BE HIGH POWER FACTOR ($\geq .9$) ETL CBM APPROVED RAPID START CLASS P ENERGY SAVING BALLAST WITH A SOUND RATING OF A. SECURE BALLAST TO HOUSING WITH AT LEAST ONE SCREW AND SLIP-ON BRACKET OR 2 SCREWS - ONE AT EACH END.

4. UL LISTED FOR DAMP LOCATION. PROVIDE UL "WET" LABEL WHEN INDICATED.

5. OVERALL LUMINAIRE LENGTH SHALL BE 48" NOMINAL.

6. MINIMUM COEFFICIENT OF UTILIZATION (CU) WITH CAVITY REFLECTANCES OF 80% CEILING, 50% WALLS AND 20% FLOOR SHALL BE:

RCR	CU
1	0.67
2	0.55
3	0.50
4	0.45

7. MINIMUM SPACING TO MOUNTING HEIGHT RATIO SHALL BE 1.3.

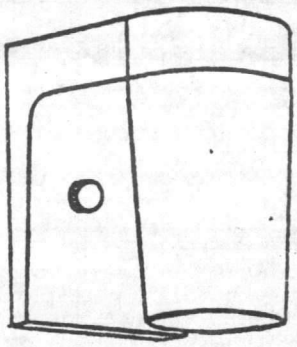
WET/DAMP LOCATION LUMINAIRE

TYPE A FIBERGLASS OR PLASTIC HOUSING
TYPE B ALUMINUM HOUSING

STYLE
NL-8

SKETCH NFGS-16510-8

SKETCH DATE: MARCH 1983



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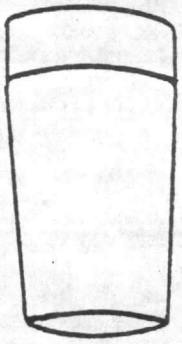

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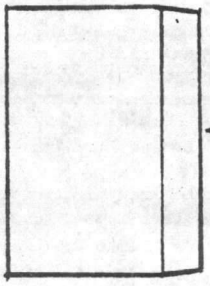


TYPE B

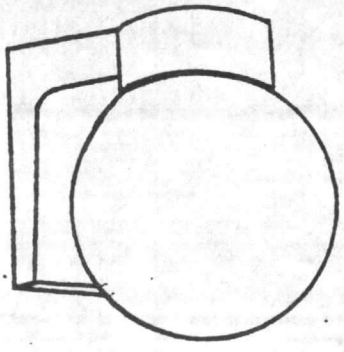
LUMINAIRE REQUIREMENTS

1. CAST ALUMINUM HOUSING SATIN FINISH AND A CLEAR LACQUER COATING. TYPE B MAY HAVE A POLYCARBONATE OR 0.055 INCH MINIMUM THICK STEEL BACKPLATE. PROVIDE PORCELAIN SOCKET WITH FULL METAL SCREW SHELL SUITABLE FOR A 100 WATT INCANDESCENT LAMP.

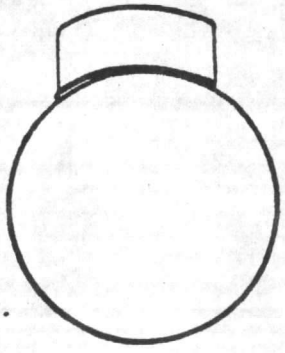
2. GLOBE SHALL BE WHITE POLYCARBONATE.

3. PROVIDE HEAT RESISTANT VAPORTIGHT GASKET BETWEEN GLOBE AND HOUSING. PROVIDE NEOPRENE GASKET BETWEEN LUMINAIRE AND WALL OR CEILING.

4. PROVIDE INTERNAL PROVISIONS FOR GROUNDING.



TYPE C



TYPE C1

EXTERIOR INCANDESCENT LUMINAIRE

STYLE

NL-45

SKETCH NFGS-16510-45

SECTION 16852

ELECTRIC SPACE HEATING EQUIPMENT

PART 1 - GENERAL

1.1 APPLICABLE PUBLICATIONS: The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

1.1.1 Air Movement and Control Association (AMCA) Standard:

210-74	Laboratory Methods of Testing Fans for Rating Purposes

1.1.2 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE) Publication:

1979 Edition	ASHRAE Handbook and Product Directory - Equipment

1.1.3 National Fire Protection Association (NFPA) Standard:

70-81	National Electrical Code

1.1.4 Underwriters' Laboratories, Inc. (UL) Standards:

1025-73 (R 9-79)	Electric Air Heaters

1.2 GENERAL REQUIREMENTS: As specified in Section 16011, "General Requirements, Electrical."

1.3 SUBMITTALS:

1.3.1 Manufacturers' Data: Submit manufacturers' data for the following:

Unit Heater

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT: All materials, equipment, and devices shall, as a minimum, meet the requirements of UL where UL Standards are established for those items, and the requirements of NFPA 70. Provide equipment grounding terminal or lead. Equipment design shall provide easy access to electrical and mechanical components for removal and replacement.

2.2 ELECTRIC UNIT HEATERS (HORIZONTAL AND VERTICAL PROPELLER FAN TYPE):

2.2.1 Electric Unit Heaters: Heaters shall have wattage, voltage, phase, and mounting height as indicated. Heater shall comply with UL 1025. Provide with terminals for control circuits as necessary and for a single source of power supply. Factory install control transformers of adequate capacity, where required. Balance three-phase heater load on the three phases. Maximum leaving air temperature shall not exceed 140 degrees F with 60 degrees F entering air.

2.2.2 Heating Elements: Heating elements shall consist of nickel chromium heating wire embedded in magnesium oxide or ceramic insulating refractory and sealed in corrosion-resisting metallic sheath with fins. Seal ends of elements and enclose in terminal box. Mechanically press magnesium oxide element sheath after filling to insure maximum compaction. Sheath and fins shall be aluminum or steel. Protect steel sheath and fins from corrosion by copper plating, high-temperature ceramic coating or high-temperature aluminized finish. Heat transfer between sheath and fins shall be uniform. Surface temperature of fins shall not exceed 550 degrees F during normal operation. Elements shall be free from expansion noise and 60 hertz hum.

2.2.3 Enclosure: Contain heater, fan, motor, and auxiliaries in a 20 US gauge steel housing, factory galvanized, bonderized, or prime painted and finished with baked-on enamel. Brace with steel plates or structural steel shapes to prevent vibration and to maintain alignment. Provide ready access to interior parts without unfastening housing from mounting bracket. Provide swivel mounting brackets for wall or ceiling mounting as indicated.

2.2.4 Louvers: Provide individually adjustable horizontal louvers for horizontal air discharge, with louvered back, heavy grill, or wire guard for inlet air.

2.2.5 Fans and Motors: Provide propeller type direct connected fans dynamically balanced, and designed specifically for unit heater application and low noise level. Provide sleeve type bearings with ample provisions for lubrication, an oil reservoir, and effectively sealed against loss of oil and entrance of dirt or self-aligning and permanently lubricated ball and roller type bearings. Fan motor shall be totally enclosed, continuous duty with built-in automatic reset thermal overload protection. Single-phase motors shall be permanent split capacitor or capacitor-start type. Motor may be for operation on line voltage, or less when factory-furnished step-down transformer is provided. Motor speed shall not exceed 1800 revolutions per minute. Wire motors to the heater power supply source.

2.2.6 Limit Controls: Provide the following: (a) automatic reset thermal overheat protection; (b) thermally activated fan switch to delay fan until warm air is discharged, and to maintain fan operation until residual heat is dissipated; and (c) air flow interlock to shut off the heater for low air flow condition.

2.2.7 Remote Controls: Provide room thermostat for pilot duty as indicated. Thermostat range: approximately 40 to a maximum of 55 degrees F; operating differential of 3 degrees F or less. Provide a fused safety disconnect or circuit breaker, and a low-voltage-release stop-start push button station.

2.2.8 Wiring: Factory prewire heaters to terminal strips, ready to receive branch circuit and control connections for 60 degrees C copper or aluminum wiring.

PART 3 - EXECUTION

3.1 Installation: Install in conformance with NFPA 70, UL listing, and manufacturer's instructions, with necessary clearances for air circulation, maintenance, and repair. Connect to electrical supply in accordance with Section 16402, "Interior Wiring Systems."

3.1.1 Electric Unit Heaters (Horizontal Propeller Fan Type): Wall mount remote room thermostats 4 feet, 6 inches above finished floor as indicated. Connect control devices to the unit heater with wire in conduit.

3.2 FIELD TESTS AND INSPECTIONS: Perform all field tests and inspections in accordance with Division 1, except that the Government will provide electric power required for the tests at no charge when available.

3.2.1 Insulation Resistance Tests: Test all 600-volt wiring to verify that no short circuits or grounds exist as specified in Section 16402, "Interior Wiring Systems," before connection to branch circuit.

3.2.2 Operational Tests: Service test all equipment circuits and devices to demonstrate proper operation. Test each item of control equipment not less than five times.

*** END OF SECTION ***