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**SECTION 00100
INSTRUCTIONS TO BIDDERS & NOTICES**

INFORMATION REGARDING BIDDING MATERIAL, BID GUARANTEE AND BONDS

(a) Bidding material is only available electronically on www.fedbizopps.gov. Bidding material consists of drawings, specifications and contract forms.

(b) A bid guarantee is required in an amount not less than 20 percent of the bid price but shall not exceed \$3,000,000. Failure to furnish the required bid guarantee in the proper form and amount, by the time set for opening of bids, will require rejection of the bid in all cases except those listed in FAR 28.101-4, and may be cause for rejection even then.

(c) If the contract will exceed \$100,000 (see FAR 28.102-1 for lesser amount), the bidder to whom award is made will be required to furnish two bonds, a Payment Bond, SF 25A, and a Performance Bond, SF 25, each in the penal sum as noted in the General Conditions of the Specification. Copies of SFs 25 and 25A may be obtained upon application to the issuing office.

DESCRIPTION OF WORK:

Cost Range: \$5,000,000 to \$10,000,000

VAAR 852.236-89 BUY AMERICAN ACT (JUL 2002)

(a) Reference is made to the clause entitled "Buy American Act - Balance of Payments Program - Construction Materials," FAR 52.225-9.

(b) Notwithstanding a bidder's right to offer identifiable foreign construction material in its bid pursuant to FAR 52.225-9, VA does not anticipate accepting an offer that includes foreign construction material.

(c) If a bidder chooses to submit a bid that includes foreign construction material, that bidder must provide a listing of the specific foreign construction material he/she intends to use and a price for said material. Bidders must include bid prices for comparable domestic construction material. If VA determines not to accept foreign construction material and no comparable domestic construction material is provided, the entire bid will be rejected.

(d) Any foreign construction material proposed after award will be rejected unless the bidder proves to VA's satisfaction: (1) it was impossible to request the exemption prior to award, and (2) said domestic construction material is no longer available, or (3) where the price has escalated so dramatically after the contract has been awarded that it would be unconscionable to require performance at that price. The determinations required by (1), (2), and (3) of this paragraph shall be made in accordance with subpart 825.2 and FAR 25.2.

(e) By signing this bid, the bidder declares that all articles, materials and supplies for use on the project shall be domestic unless specifically set forth on the Bid Form or addendum thereto.

(End of Clause)

REPRESENTATIONS AND CERTIFICATIONS

52.203-2 CERTIFICATE OF INDEPENDENT PRICE DETERMINATION (APR 1985)

(a) The offeror certifies that--

(1) The prices in this offer have been arrived at independently, without, for the purpose of restricting competition, any consultation, communication, or agreement with any other offeror or competitor relating to--

(i) those prices;

(ii) the intention to submit an offer;, or

(iii) the methods or factors used to calculate the prices offered;

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

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

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

(1) Is the person in the offeror's organization responsible for determining the prices being offered in this bid or proposal, and that the signatory has not participated and will not participate in any action contrary to subparagraphs (a) (1) through (a) (3) above; or

(2) (i) Has been authorized, in writing, to act as agent for the following principals in certifying that those principals have not participated, and will not participate in any action contrary to subparagraphs (a) (1) through (a) (3) above

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

(ii) As an authorized agent, does certify that the principals named in subdivision (b) (2) (i) above have not participated, and will not participate, in any action contrary to subparagraphs (a) (1) through (a) (3) above; and

(iii) As an agent, has not personally participated, and will not participate, in any action contrary to subparagraphs (a) (1) through (a) (3) above.

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

(End of Provision)

**52.203-11 CERTIFICATION AND DISCLOSURE REGARDING PAYMENTS
TO INFLUENCE CERTAIN FEDERAL TRANSACTIONS (APR 1991)**

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

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

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

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

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

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

(End of Provision)

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52.204-3 TAXPAYER IDENTIFICATION (OCT 1998)

(a) Definitions.

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

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

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

(c) The TIN may be used by the Government to collect and report on any delinquent amounts arising out of the offeror's relationship with the Government (31 U.S.C. 7701(c)(3)). If the resulting contract is subject to the payment reporting requirements described in FAR 4.904, the TIN provided hereunder may be matched with IRS records to verify the accuracy of the offeror's TIN.

(d) Taxpayer Identification Number (TIN).

TIN:.. _____

TIN has been applied for.

TIN is not required because:

Offeror is a nonresident alien, foreign corporation, or foreign partnership that does not have income effectively connected with the conduct

of a trade or business in the United States and does not have an office or place of business or a fiscal paying agent in the United States;

Offeror is an agency or instrumentality of a foreign government;

Offeror is an agency or instrumentality of the Federal Government.

(e) Type of organization.

Sole proprietorship;

Partnership;

Corporate entity (not tax-exempt);

Corporate entity (tax-exempt);

Government entity (Federal, State, or local);

Foreign government;

International organization per 26 CFR 1.6049-4;

Other _____

(f) Common parent.

Offeror is not owned or controlled by a common parent as defined in paragraph (a) of this provision.

Name and TIN of common parent:

Name _____

TIN _____

(End of Provision)

**52.209-5 CERTIFICATION REGARDING DEBARMENT, SUSPENSION,
PROPOSED DEBARMENT, AND OTHER RESPONSIBILITY MATTERS
(DEC 2001)**

(a) (1) The Offeror certifies, to the best of its knowledge and belief,
that -

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

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

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

(C) Are [] are not [] presently indicted for, or otherwise
criminally or civilly charged by a governmental entity with, commission of
any of the offenses enumerated in subdivision (a) (1) (i) (B) of this provision.

(ii) The Offeror has [] has not [], within a 3-year period
preceding this offer, had one or more contracts terminated for default by any
Federal agency.

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

THIS CERTIFICATION CONCERNS A MATTER WITHIN THE JURISDICTION OF AN AGENCY
OF THE UNITED STATES AND THE MAKING OF A FALSE, FICTITIOUS, OR FRAUDULENT

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CERTIFICATION MAY RENDER THE MAKER SUBJECT TO PROSECUTION UNDER SECTION 1001, TITLE 18, UNITED STATES CODE.

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

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

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

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

(End of Provision)

52.219-1 SMALL BUSINESS PROGRAM REPRESENTATIONS
(MAY 2004)
ALTERNATE I (APR 2002)

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

(2) The small business size standard is .

(3) The small business size standard for a concern which submits an offer in its own name, other than on a construction or service contract, but

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which proposes to furnish a product which it did not itself manufacture, is 500 employees.

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

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

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

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

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

(6) [Complete only if the offeror represented itself as a small business concern in paragraph (b)(1) of this provision.] The offeror represents, as part of its offer, that--

(i) It is, is not a HUBZone small business concern listed, on the date of this representation, on the List of Qualified HUBZone Small Business Concerns maintained by the Small Business Administration, and no material change in ownership and control, principal office, or HUBZone employee percentage has occurred since it was certified by the Small Business Administration in accordance with 13 CFR part 126; and

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

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

_____ Black American.

_____ Hispanic American.

_____ Native American (American Indians, Eskimos, Aleuts, or Native Hawaiians).

_____ Asian-Pacific American (persons with origins from Burma, Thailand, Malaysia, Indonesia, Singapore, Brunei, Japan, China, Taiwan, Laos, Cambodia (Kampuchea), Vietnam, Korea, The Philippines, U.S. Trust Territory of the Pacific Islands (Republic of Palau), Republic of the Marshall Islands, Federated States of Micronesia, the Commonwealth of the Northern Mariana Islands, Guam, Samoa, Macao, Hong Kong, Fiji, Tonga, Kiribati, Tuvalu, or Nauru).

_____ Subcontinent Asian (Asian-Indian) American (persons with origins from India, Pakistan, Bangladesh, Sri Lanka, Bhutan, the Maldives Islands, or Nepal).

_____ Individual/concern, other than one of the preceding.

(c) Definitions. As used in this provision--

Service-disabled veteran-owned small business concern--

(1) Means a small business concern-- (i) Not less than 51 percent of which is owned by one or more service-disabled veterans or, in the case of any publicly owned business, not less than 51 percent of the stock of which is owned by one or more service-disabled veterans; and

(ii) The management and daily business operations of which are controlled by one or more service-disabled veterans or, in the case of a service-disabled veteran with permanent and severe disability, the spouse or permanent caregiver of such veteran.

(2) Service-disabled veteran means a veteran, as defined in 38 U.S.C. 101(2), with a disability that is service-connected, as defined in 38 U.S.C. 101(16).

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

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

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

(2) The management and daily business operations of which are controlled by one or more veterans.

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

(1) That is at least 51 percent owned by one or more women; or in the case of any publicly owned business, at least 51 percent of the stock of which is owned by one or more women; and

(2) Whose management and daily business operations are controlled by one or more women.

(d) Notice. (1) If this solicitation is for supplies and has been set aside, in whole or in part, for small business concerns, then the clause in this solicitation providing notice of the set-aside contains restrictions on the source of the end items to be furnished.

(2) Under 15 U.S.C. 645(d), any person who misrepresents a firm's status as a small, HUBZone small, small disadvantaged, or women-owned small business concern in order to obtain a contract to be awarded under the preference programs established pursuant to section 8(a), 8(d), 9, or 15 of the Small Business Act or any other provision of Federal law that specifically references section 8(d) for a definition of program eligibility, shall--

(i) Be punished by imposition of fine, imprisonment, or both;

(ii) Be subject to administrative remedies, including suspension and debarment; and

(iii) Be ineligible for participation in programs conducted under the authority of the Act.

(End of Provision)

**52.219-19 SMALL BUSINESS CONCERN REPRESENTATION FOR THE
SMALL BUSINESS COMPETITIVENESS DEMONSTRATION PROGRAM
(OCT 2000)**

(a) Definition.

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

(b) (Complete only if the Offeror has represented itself under the provision at 52.219-1 as a small business concern under the size standards of this solicitation.)

The Offeror [] is, [] is not an emerging small business.

(c) (Complete only if the Offeror is a small business or an emerging small business, indicating its size range.)

Offeror's number of employees for the past 12 months (check this column if size standard stated in solicitation is expressed in terms of number of employees) or Offeror's average annual gross revenue for the last 3 fiscal years (check this column if size standard stated in solicitation is expressed in terms of annual receipts). (Check one of the following.)

No. of Employees	Avg. Annual Gross Revenues
___ 50 or fewer	___ \$1 million or less

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_____ 51 - 100	_____ \$1,000,001 - \$2 million
_____ 101 - 250	_____ \$2,000,001 - \$3.5 million
_____ 251 - 500	_____ \$3,500,001 - \$5 million
_____ 501 - 750	_____ \$5,000,001 - \$10 million
_____ 751 - 1,000	_____ \$10,000,001 - \$17 million
_____ Over 1,000	_____ Over \$17 million

(End of Provision)

**52.222-22 PREVIOUS CONTRACTS AND COMPLIANCE REPORTS
(FEB 1999)**

The offeror represents that--

(a) It [] has, [] has not participated in a previous contract or subcontract subject to the Equal Opportunity clause of this solicitation; the clause originally contained in Section 310 of Executive Order No. 10925, or the clause contained in Section 201 of Executive Order No. 11114;

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

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

(End of Provision)

**52.223-13 CERTIFICATION OF TOXIC CHEMICAL RELEASE
REPORTING (AUG 2003)**

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

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

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

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

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

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

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

(iv) The facility does not fall within the following Standard Industrial Classification (SIC) codes or their corresponding North American Industry Classification System sectors: (A) Major group code 10 (except 1011, 1081, and 1094). (B) Major group code 12 (except 1241). (C) Major group codes 20 through 39. (D) Industry code 4911, 4931, or 4939 (limited to facilities that combust coal and/or oil for the purpose of generating power for distribution in commerce). (E) Industry code 4953 (limited to facilities regulated under the Resource Conservation and Recovery Act, Subtitle C (42 U.S.C. 6921, et seq.), 5169, 5171, or 7389 (limited to facilities primarily engaged in solvent recovery services on a contract or fee basis); or

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

(End of Provision)

SECTION 00101
INSTRUCTIONS, CONDITIONS, AND NOTICES TO OFFERORS

**SECTION 00101
INSTRUCTIONS, CONDITIONS, AND NOTICES TO OFFERORS**

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

(a) Definitions. As used in this provision—

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

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

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

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

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

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

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

- (1) Unless other methods (e.g., electronic commerce or facsimile) are permitted in the solicitation, proposals and modifications to proposals shall be submitted in paper media in sealed envelopes or packages (i) addressed to the office specified in the solicitation, and (ii) showing the time and date specified for receipt, the solicitation number, and the name and address of the offeror. Offerors using commercial carriers should ensure that the proposal is marked on the outermost wrapper with the information in paragraphs (c) (1) (i) and (c) (1) (ii) of this provision.

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

- (i) The solicitation number;
 - (ii) The name, address, and telephone and facsimile numbers of the offeror (and electronic address if available);
 - (iii) A statement specifying the extent of agreement with all terms, conditions, and provisions included in the solicitation and agreement to furnish any or all items upon which prices are offered at the price set opposite each item;
 - (iv) Names, titles, and telephone and facsimile numbers (and electronic addresses if available) of persons authorized to negotiate on the offeror's behalf with the Government in connection with this solicitation; and
 - (v) Name, title, and signature of person authorized to sign the proposal. Proposals signed by an agent shall be accompanied by evidence of that agent's authority, unless that evidence has been previously furnished to the issuing office.
- (3) Submission, modification, revision, and withdrawal of proposals. (i) Offerors are responsible for submitting proposals, and any modifications or revisions, so as to reach the Government office designated in the solicitation by the time specified in the solicitation. If no time is specified in the solicitation, the time for receipt is 4:30 p.m., local time, for the designated Government office on the date that proposal or revision is due.
- (ii) (A) Any proposal, modification, or revision received at the Government office designated in the solicitation after the exact time specified for receipt of offers is "late" and will not be considered unless it is received before award is made, the Contracting Officer determines that accepting the late bid would not unduly delay the acquisition; and-
- (1) If it was transmitted through an electronic commerce method authorized by the solicitation, it was received at the initial point of entry to the Government infrastructure not later than 5:00 p.m. one working day prior to the date specified for receipt of proposals; or
 - (2) There is acceptable evidence to establish that it was received at the Government installation designated for receipt of offers

and was under the Government's control prior to the time set for receipt of offers; or

(3) It is the only proposal received.

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

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

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

(v) Proposals may be withdrawn by written notice received at any time before award. Oral proposals in response to oral solicitations may be withdrawn orally. If the solicitation authorizes facsimile proposals, proposals may be withdrawn via facsimile received at any time before the award, subject to the conditions specified in the provision at 52.215-5, Facsimile Proposals. Proposals may be withdrawn in person by a offeror or an authorized representative, if the identity of the person requesting withdrawal is established and the person signs a receipt for the proposal before award.

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

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

- (6) Offerors may submit modifications to their proposals at any time before the solicitation closing date and time, and may submit modifications in response to an amendment, or to correct a mistake at any time before award.
- (7) Offerors may submit revised proposals only if requested or allowed by the Contracting Officer.
- (8) Proposals may be withdrawn at any time before award. Withdrawals are effective upon receipt of notice by the Contracting Officer.

SPEC WRITER NOTE: If VA is willing to accept alternate proposals, add the following paragraph.

- (9) Offerors may submit proposals that depart from stated requirements. Such proposals shall clearly identify why the acceptance of the proposal would be advantageous to the Government. Any deviations from the terms and conditions of the solicitation, as well as the comparative advantage to the Government, shall be clearly identified and explicitly defined. The Government reserves the right to amend the solicitation to allow all offerors an opportunity to submit revised proposals based on the revised requirements.
- (d) **Offer expiration date.** Proposals in response to this solicitation will be valid for the number of days specified on the solicitation cover sheet (unless a different period is proposed by the offeror).
- (e) **Restriction on disclosure and use of data.** Offerors that include in their proposals data that they do not want disclosed to the public for any purpose, or used by the Government except for evaluation purposes, shall-
- (1) Mark the title page with the following legend: This proposal includes data that shall not be disclosed outside the Government and shall not be duplicated, used, or disclosed-in whole or in part- for any purpose other than to evaluate this proposal. If, however, a contract is awarded to this offeror as a result of-or in connection with-the submission of this data, the Government shall have the right to duplicate, use, or disclose the data to the extent provided in the resulting contract. This restriction does not limit the Government's right to use information contained in this data if it

is obtained from another source without restriction. The data subject to this restriction are contained in sheets [insert numbers or other identification of sheets]; and

- (2) Mark each sheet of data it wishes to restrict with the following legend: Use or disclosure of data contained on this sheet is subject to the restriction on the title page of this proposal.

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

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

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

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

SPEC WRITER NOTE: If VA intends to award this contract after discussions with offerors within the competitive range, substitute the following paragraph (f) (4) for paragraph (f) (4) of the basic provision.

//(4) The Government intends to evaluate proposals and award a contract after conducting discussions with offerors whose proposals have been determined to be within the competitive range. If the Contracting Officer determines that the number of proposals that would otherwise

- be in the competitive range exceeds the number at which an efficient competition can be conducted, the Contracting Officer may limit the number of proposals in the competitive range to the greatest number that will permit an efficient competition among the most highly rated proposals. Therefore, the offeror's initial proposal should contain the offeror's best terms from a price and technical standpoint. //
- (5) The Government reserves the right to make an award on any item for a quantity less than the quantity offered, at the unit cost or prices offered, unless the offeror specifies otherwise in the proposal.
 - (6) The Government reserves the right to make multiple awards if, after considering the additional administrative costs, it is in the Government's best interest to do so.
 - (7) Exchanges with offerors after receipt of a proposal do not constitute a rejection or counteroffer by the Government.
 - (8) The Government may determine that a proposal is unacceptable if the prices proposed are materially unbalanced between line items or subline items. Unbalanced pricing exists when, despite an acceptable total evaluated price, the price of one or more contract line items is significantly overstated or understated as indicated by the application of cost or price analysis techniques. A proposal may be rejected if the Contracting Officer determines that the lack of balance poses an unacceptable risk to the Government.
 - (9) If a cost realism analysis is performed, cost realism may be considered by the source selection authority in evaluating performance or schedule risk.
 - (10) A written award or acceptance of proposal mailed or otherwise furnished to the successful offeror within the time specified in the proposal shall result in a binding contract without further action by either party.
 - (11) If a post-award debriefing is given to requesting offerors, the Government shall disclose the following information, if applicable:
 - (i) The agency's evaluation of the significant weak or deficient factors in the debriefed offeror's offer.

- (ii) The overall evaluated cost or price and technical rating of the successful and the debriefed offeror and past performance information on the debriefed offeror.
- (iii) The overall ranking of all offerors, when any ranking was developed by the agency during source selection.
- (iv) A summary of the rationale for award.
- (v) For acquisitions of commercial items, the make and model of the item to be delivered by the successful offeror.
- (vi) Reasonable responses to relevant questions posed by the debriefed offeror as to whether source-selection procedures set forth in the solicitation, applicable regulations, and other applicable authorities were followed by the agency.

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

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

SPEC WRITER NOTE: In paragraph (b) insert the applicable goals in accordance with Appendix B-80 that was issued by OFCCP of DOL. In paragraph (e) include a description of the applicable geographical area as described in the same appendix.

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

- (a) The offeror's attention is called to the Equal Opportunity clause and the Affirmative Action Compliance Requirements for Construction clause of this solicitation.
- (b) The goals for minority and female participation, expressed in percentage terms for the Contractor's aggregate workforce in each trade on all construction work in the covered area, are as follows:

Goals for minority participation for each trade	Goals for female participation for each trade
	6.9%

These goals are applicable to all the Contractor's construction work performed in the covered area. If the Contractor performs construction work in a geographical area located outside of the covered area, the Contractor shall apply the goals established for the geographical area

where the work is actually performed. Goals are published periodically in the Federal Register in notice form, and these notices may be obtained from any Office of Federal Contract Compliance Programs office.

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

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

- (1) Name, address, and telephone number of the subcontractor;
- (2) Employer's identification number of the subcontractor;
- (3) Estimated dollar amount of the subcontract;
- (4) Estimated starting and completion dates of the subcontractors;

and

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

(e) As used in this Notice, and in any contract resulting from this solicitation, the "covered area" is _____

_____.

4. BID GUARANTEE (FAR 52.228-1) (SEP 1996)

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

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

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

SPEC WRITER NOTE: The following provision has been written for use on an FM solicitation. For station level solicitations, the basic address information must be revised.

- (1) Mailing Address: Project Manager (), Office of Facilities Management, Department of Veterans Affairs, 810 Vermont Ave., N.W., Washington, D.C. 20420.
- (2) Address for Hand Delivery: Project Manager (), Room No. _____ 811 Vermont Ave., N.W., Washington, D.C.
- (3) The copy of any protest shall be received in the office designated above within one day of filing a protest with the GAO.

6. PROTEST CONTENT (VAAR 852.233-70) (JAN 1998)

- (a) Any protest filed by an interested party shall:
 - (1) Include the name, address, fax number and telephone number of the protester;
 - (2) Identify the solicitation and/or contract number;
 - (3) Include an original signed by the protester or his/her representative and at least one copy;
 - (4) Set forth a detailed statement of the legal and factual ground of the protest, a description of resulting prejudice to the protester; and provide including copies of relevant documents;
 - (5) Specifically request a ruling of the individual upon whom the protest is served; and
 - (6) State the form of relief requested; and
 - (7) Provide all information establishing the timeliness of the protest.
- (b) Failure to comply with the above may result in dismissal of the protest without further consideration.

7. REPRESENTATIVES OF CONTRACTING OFFICER (VAAR 852-270-1) (APR 1984)

The Contracting Officer reserves the right to designate representatives to act for him/her in furnishing technical guidance and advice or generally supervise the work to be performed under this contract. Such designation will be in writing and will define the scope and limitations of the designee's authority. A copy of the designation shall be furnished the contractor.

8. PARTNERING

- (a) In order to most effectively accomplish this contract, the Government proposes to form a cohesive partnership with the Contractor and its subcontractors. This partnership would strive to draw on the

strengths of each organization in an effort to achieve a quality project, done right the first time, within the budget and on schedule.

(b) This partnership will be totally voluntary. The focus of partnering is to build cooperative relationships with the private sector and avoid or minimize disputes and to nurture a more collaborative ethic characterized by trust, cooperation and teamwork. Partnering is defined as the creation of a relationship between the owner and contractor that promotes mutual and beneficial goals. It is a non-contractual, but formally structured agreement between the parties. The ultimate goal is the elimination of the "us" versus "them" thinking, and formation of a "we" mentality for the benefit of the project.

(c) Any cost associated with effectuating this partnership will be agreed to by both parties and will be shared equally with no change in contract price.

- - - E N D - - -

SOL 663-01-05
 VA Seattle Building 100
 Ambulatory Clinic Expansion

SOLICITATION, OFFER AND AWARD

SOLICITATION, OFFER, AND AWARD (Construction, Alteration, or Repair)	1. SOLICITATION NO.	2. TYPE OF SOLICITATION	3. DATE ISSUED	PAGE OF PAGES
	663-01-05	<input type="checkbox"/> QUOTE <input checked="" type="checkbox"/> SEALED BID (IFB)	09/15/2004	1 of 3

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

4. CONTRACT NO. V663-	5. REQUISITION/PURCHASE REQUEST NO.	6. PROJECT NO.
--------------------------	-------------------------------------	----------------

7. ISSUED BY Contracting Officer S138 P&C VA Puget Sound Health Care System 1660 S. Columbian Way Seattle, WA 98108	CODE	8. ADDRESS OFFER TO Same as Block 7 or handcarry to: Building 18, Room 107
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9. FOR INFORMATION CALL:	A. NAME Gloria D. Cahill	B. TELEPHONE NO. (Include area code) (NO COLLECT CALLS) 206 764-2206
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SOLICITATION

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

10. THE GOVERNMENT REQUIRES PERFORMANCE OF THE WORK DESCRIBED IN THESE DOCUMENTS (Title, identifying no., date):
 Building 100 D&T Expansion. Contractor shall completely prepare the site for building operations, including demolition and removal of existing structures, and furnish labor and materials and perform work for the Bldg. 100 D&T Expansion Floor 2 at the Seattle Division of the VA Puget Sound Health Care System.

THIS SOLICITATION IS SET ASIDE FOR 8A CONCERNS WITHIN THE FOLLOWING GEOGRAPHICAL AREA:

11. The Contractor shall begin performance within <u>10</u> calendar days and complete it within 270 calendar days after receiving <input type="checkbox"/> award, <input checked="" type="checkbox"/> notice to proceed. This performance is <input checked="" type="checkbox"/> mandatory, <input type="checkbox"/> negotiable. (See ____.)	
12A. THE CONTRACTOR MUST FURNISH ANY REQUIRED PERFORMANCE AND PAYMENT BONDS? (If "YES", indicate within how many days after award in Item 12B.) <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	12B. CALENDAR DAYS 10

13. ADDITIONAL SOLICITATION REQUIREMENTS:

- A. Sealed offers in original and 1 copy to perform the work are due at the place specified in Item 8 by 2:00PM (hour) local time 10-14-04. If this is a sealed bid solicitation, offers will be publicly opened at that time. Sealed envelopes containing offers shall be marked to show the offeror's name and address, the solicitation number, and the date and time offers are due.
- B. An offer guarantee is, is not required.
- C. All offers are subject to the (1) work requirements, and (2) other provisions and clauses incorporated in the solicitation in full text or by reference.
- D. Offers providing less than 60 calendar days for Government acceptance after the date offers are due will not be considered and will be rejected.

NSN 7540-01-155-3212

1442-101

STANDARD FORM 1442 (REV. 4-85)

Prescribed by GSA

FAR (48 CFR) 53.236.1 (d)

OFFER (Must be fully completed by offeror)

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

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

	(See page 3 for description of Base Bid and Deductive Bid Alternates)
AMOUNTS →	AMOUNT \$ _____ Base bid AMOUNT \$ _____ AMOUNT \$ _____ Base Bid less Deductive Bid Alternate #1 Base Bid less Deductive Bid Alternates #1 & #2

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

19. ACKNOWLEDGMENT OF AMENDMENTS

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

Amendment Number										
DATE										

20A. NAME AND TITLE OF PERSON AUTHORIZED TO SIGN OFFER (Type or Print)	20B. SIGNATURE	20C. OFFER DATE
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AWARD (To be completed by Government)

21. ITEMS ACCEPTED:

22. AMOUNT	23. ACCOUNTING AND APPROPRIATION DATA
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SOL 663-01-05
 VA Seattle Building 100
 Ambulatory Clinic Expansion

24. SUBMIT INVOICES TO ADDRESS SHOWN IN  ITEM (4 copies unless otherwise specified)		25. OTHER THAN FULL AND OPEN COMPETITION PURSUANT TO <input type="checkbox"/> 10 U.S.C. 2304(c) () <input type="checkbox"/> 41 U.S.C. 253(c) () <input type="checkbox"/>
26. ADMINISTERED BY CODE SAME AS BLOCK 7	27. PAYMENT WILL BE MADE BY Chief, Fiscal Service VA Puget Sound Health Care System 1660 South Columbia Way Seattle, WA 98108-1595	

CONTRACTING OFFICER WILL COMPLETE ITEM 28 OR 29 AS APPLICABLE

<input type="checkbox"/> 28. NEGOTIATED AGREEMENT (Contractor is required to sign this document and return _____ copies to issuing office.) Contractor agrees to furnish and deliver all terms or perform all work requirements identified on this form and any continuation sheets for the consideration stated in this contract. The rights and obligations of the parties to this contract shall be governed by (a) this contract award, (b) the solicitation, and (c) the clauses, representations, certifications, and specifications incorporated by reference in or attached to this contract.	<input type="checkbox"/> 29. AWARD (Contractor is not required to sign this document.) Your offer on this solicitation is hereby accepted as to the items listed. This award consummates the contract, which consists of (a) the Government solicitation and your offer, and (b) this contract award. No further contractual document is necessary.
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30A. NAME AND TITLE OF CONTRACTOR OR PERSON AUTHORIZED TO SIGN (Type or print)	31A. NAME OF CONTRACTING OFFICER (Type or print) Gloria D. Cahill
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30B. SIGNATURE	30C. DATE	31B. UNITED STATES OF AMERICA BY	31C. AWARD DATE
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DESCRIPTIONS

As part of Solicitation No. 663-01-01, the Veterans Administration (VA) intends to make an award on the Base Bid unless the bids exceed the available funding. The Base Bid includes all work indicated on the Drawings and in the Specifications.

If bids exceed available funding, the VA intends to make an award on the Base Bid less Deductive Bid Alternate #1.

If funding is not available for Base Bid less Deductive Bid #11, the VA intends to make an award on the Base Bid less Deductive Bid Alternates #1 & #2.

Deductive Bid Alternate #1: Do all the Work except delete the supply and installation of the Room Status system specified in Section 167, ROOM STATUS. Work to furnish and install conduit and junction boxes for installation of the system remains in the Base Bid.

Deductive Bid Alternate #2: Do all the Work except delete the work on the Pneumatic Tube System specified in Section 14590, PNEUMATIC TUBE SYSTEM. Work to supply power for the system and to construct walls around the station and tube remain in the Base Bid.

SOL 663-01-05
 VA Seattle Building 100
 Ambulatory Clinic Expansion

LABOR STANDARDS PROVISIONS

General Decision Number: WA030002 08/20/2004 WA2
 Superseded General Decision Number: WA020002
 State: Washington
 Construction Types: Building
 Counties: Chelan, Clallam, Grays Harbor, Jefferson, King, Kitsap, Kittitas,
 Lewis, Mason, Pacific, Pierce, Snohomish and Thurston Counties in
 Washington.

BUILDING CONSTRUCTION PROJECTS (does not include residential construction
 consisting of single family homes and apartments up to and including 4
 stories)

Modification Number	Publication Date
0	06/13/2003
1	02/06/2004
2	02/13/2004
3	03/05/2004
4	03/12/2004
5	05/14/2004
6	06/18/2004
7	06/25/2004
8	07/02/2004
9	07/23/2004
10	08/06/2004
11	08/20/2004

ASBE0007-001 06/01/2004

Rates Fringes

Asbestos Workers/Insulator (Includes application of all insulating
 materials, protective coverings, coating and finishes to all types of
 mechanical systems).....\$ 32.16 9.77

 BOIL0242-003 01/01/2004

CHELAN AND KITTITAS COUNTIES

Rates Fringes

Boilermaker.....\$ 28.10 15.37

 BOIL0502-001 01/01/2004

CLALLAM, GRAYS HARBOR, JEFFERSON, KING, KITSAP, LEWIS, MASON,
 PACIFIC, SNOHOMISH AND THURSTON COUNTIES

Rates Fringes

Boilermaker.....\$ 28.10 15.37

 SECTION 00101
 INSTRUCTIONS, CONDITIONS, AND NOTICES TO OFFERORS

SOL 663-01-05
VA Seattle Building 100
Ambulatory Clinic Expansion

BRWA0001-001 06/01/2004

CLALLAM, GRAYS HARBOR, JEFFERSON, KING, KITSAP, LEWIS, MASON,
PACIFIC (northern part), PIERCE, SNOHOMISH AND THURSTON COUNTIES

	Rates	Fringes
Bricklayer.....	\$ 29.21	10.66

BRWA0001-005 06/01/2004

PACIFIC COUNTY (SOUTHERN PART)

	Rates	Fringes
Bricklayer.....	\$ 27.92	11.05
Marble Mason.....	\$ 28.92	11.05

BRWA0001-006 05/01/2004

PACIFIC (SOUTHERN PORTION) COUNTY

	Rates	Fringes
Terrazzo Worker & Tile Setter..	\$ 24.55	9.18
Tile & Terrazzo Finisher.....	\$ 18.41	6.95

BRWA0001-007 06/01/2004

CLALLAM, GRAYS HARBOR, JEFFERSON, KING, KITSAP, LEWIS, MASON,
PACIFIC (NORTHERN HALF), PIERCE, THURSTON AND SNOHOMISH COUNTIES

	Rates	Fringes
Tile & Terrazzo Finisher.....	\$ 20.90	9.98
Tile & Terrazzo Worker.....	\$ 26.62	10.41

BRWA0003-001 06/01/2004

CHELAN AND KITTITAS COUNTIES

	Rates	Fringes
Bricklayer.....	\$ 23.56	9.46

BRWA0003-005 06/01/2003

CHELAN AND KITTITAS

	Rates	Fringes
Tile & Terrazzo Finisher.....	\$ 14.70	7.13

BRWA0003-006 06/01/2003

SOL 663-01-05
 VA Seattle Building 100
 Ambulatory Clinic Expansion

CHELAN AND KITTITAS

	Rates	Fringes
Tile Layer/Terrazzo Worker.....	\$ 18.50	7.13

CARP0770-004 06/01/2004		

Fringes		Rates
Carpenters:		
	CENTRAL WASHINGTON: CHELAN AND KITTITAS COUNTIES	
	ACCOUSTICAL WORKERS.....	\$ 20.98 10.27
	CARPENTERS AND DRYWALL APPLICATORS.....	\$ 20.72
10.27		
	CARPENTERS ON CREOSOTED MATERIALS.....	\$ 20.82
10.27		
	DIVERS TENDER.....	.\$ 31.17
10.55		
	DIVERS.....	\$ 70.07
10.55		
	INSULATION APPLICATORS.....	\$ 20.72 10.27
	MILLWRIGHTS AND MACHINE ERECTORS.....	\$ 29.40
10.27		
	PILDRIVER, DRIVING, PULLING, CUTTING, PLACING COLLARS, SETTING, WELDING, OR CREOSOTE TREATED MATERIAL, ALL PILING.....	\$ 28.60
10.27		
	PILEDRIVER, BRIDGE DOCK & WHARF CARPENTERS.....	\$ 28.40 10.27
	SAWFILER, STATIONARY POWER SAW OPERATORS, FLOOR FINISHER, FLOOR LAYER, SHINGLERS, FLOOR SANDER OPERATOR AND OPERATORS OF OTHER STATIONARY WOOD WORKING TOOLS.....	\$ 20.85
10.27		
	WESTERN WASHINGTON: CLALLAM, GRAYS HARBOR, JEFFERSON, KING, KITSAP, LEWIS, MASON, PACIFIC (NORTH), PIERCE, SNOHOMISH AND THURSTON COUNTIES	
	ACOUSTICAL WORKERS.....	\$ 28.56 10.55
	CARPENTERS AND DRYWALL APPLICATORS.....	\$ 28.40
10.55		
	CARPENTERS ON CREOSOTE	

SECTION 00101
 INSTRUCTIONS, CONDITIONS, AND NOTICES TO OFFERORS

SOL 663-01-05
 VA Seattle Building 100
 Ambulatory Clinic Expansion

	MATERIAL.....		\$ 28.50
10.55			
	DIVERS TENDER.....	\$ 31.17	
10.55			
	DIVERS.....		\$ 70.07
10.55			
	INSULATION APPLICATORS.....	\$ 28.40	10.55
	MILLWRIGHT AND MACHINE		
	ERECTORS.....		\$ 29.40
10.55			
	PILDRIVER, BRIDGE DOCK & WHARF CARPENTERS.....	\$ 28.40	10.55
	PILEDRIVER, DRIVING, PULLING, CUTTING, PLACING COLLARS, SETTING, WELDING OR CRESOTE TREATED		
	MATERIAL, ALL PILING.....	\$ 28.60	
10.55			
	SAWFILERS, STATIONARY POWER SAW OPERATORS, FLOOR FINISHER, FLOOR LAYER, SHINGLER, FLOOR SANDER OPERATORS OF OTHER STATIONARY WOOD WORKING TOOLS.....		\$ 28.53

(HOURLY ZONE PAY:WESTERN WASHINGTON AND CENTRAL WASHINGTON
 CARPENTERS ONLY)

Hourly Zone Pay shall be paid on jobs located outside of the free zone
 computed from the city center of the following listed cities:

Seattle	Olympia	Bellingham
Auburn	Bremerton	Anacortes
Renton	Shelton	Yakima
Aberdeen-Hoquiam	Tacoma	Wenatchee
Ellensburg	Everett	Port Angeles
Centralia	Mount Vernon	Sunnyside
Chelan	Pt. Townsend	

Zone Pay:

0 -25	radius miles	Free
25-35	radius miles	\$1.00/hour
35-45	radius miles	\$1.15/hour
45-55	radius miles	\$1.35/hour
Over 55	radius miles	\$1.55/hour

(HOURLY ZONE PAY:WESTERN AND CENTRAL WASHINGTON-MILLWRIGHTS
 AND PILEDRIVERS ONLY)

Hour Zone Pay shall be computed from Seattle Union Hall, Tacoma City
 center, and Everett City center

Zone Pay:

0 -25	radius miles	Free
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25-45 radius miles \$.70/hour
 Over 45 radius miles \$1.50/hour

Millwrights and Piledrivers who reside in Aberdeen, Bellingham, Port Angeles, Mount Vernon, Olympia, Wenatchee, or Yakima Local Union jurisdiction areas, working on jobs in their respective area, shall have their Zone Pay measured from their respective city center

 CARP9003-001 06/01/2004

PACIFIC COUNTY (South of a straight line made by extending the north boundary line of Wahkiakum County west to Willapa Bay to the Pacific Ocean, and thence north through the natural waterway to the Pacific Ocean (this will include the entire peninsula west of Willapa Bay)

SEE ZONE DESCRIPTION FOR CITIES BASE POINTS

ZONE 1:

	Rates	Fringes
Carpenters:		
CARPENTERS.....	\$ 27.72	10.70
DIVERS TENDERS.....	\$ 30.27	10.70
DIVERS.....	\$ 65.51	10.70
DRYWALL, ACOUSTICAL & LATHERS.....	\$ 27.72	10.70
FLOOR LAYERS & FLOOR FINISHERS (the laying of all hardwood floors nailed and mastic set, parquet and wood-type tiles, and block floors, the sanding and finishing of floors, the preparation of old and new floors when the materials mentioned above are to be installed;		
INSULATORS (fiberglass and similar irritating material)	\$ 27.87	10.70
MILLWRIGHTS.....	\$. 28.22	10.70
PILEDRIVERS.....	\$. 28.22	10.70

Zone Differential (Add to Zone 1 rates):

- Zone 2 - \$0.85
- Zone 3 - 1.25
- Zone 4 - 1.70
- Zone 5 - 2.00
- Zone 6 - 3.00

BASEPOINTS: GOLDENDALE, LONGVIEW, AND VANCOUVER

ZONE 1: Projects located within 30 miles of the respective city hall of the above mentioned cities

ZONE 2: Projects located more than 30 miles and less than 40 miles of the respective city of the above mentioned cities

ZONE 3: Projects located more than 40 miles and less than 50 miles of the respective city of the above mentioned cities

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ZONE 4: Projects located more than 50 miles and less than 60 miles of the respective city of the above mentioned cities.

ZONE 5: Projects located more than 60 miles and less than 70 miles of the respective city of the above mentioned cities

ZONE 6: Projects located more than 70 miles of the respected city of the above mentioned cities

ELEC0046-002 12/01/2003

CALLAM, JEFFERSON, KING AND KITSAP COUNTIES

	Rates	Fringes
Cable splicer.....	\$ 36.85	3%+10.55
Electrician.....	.\$ 33.50	3%+10.55

* ELEC0046-003 08/02/2004

CALLAM, JEFFERSON, KING, KITSAP COUNTIES

	Rates	Fringes
Sound & Communication Technician.....	\$ 21.59	5.54

SCOPE OF WORK:

Includes the installation, testing, service and maintenance, of the following systems which utilize the transmission and/or transference of voice, sound vision and digital for commercial, education, security and entertainment purposes for the following: TV monitoring and surveillance, background-foreground music, intercom and telephone interconnect, inventory control systems, microwave transmission, multi-media, multiplex, nurse call system, radio page, school intercom and sound, burglar alarms, fire alarms and life safety systems (hang, terminate devices and panels and to conduct functional and systems tests), and low voltage master clock systems. Install chases and/or nipples, not to exceed ten (10) feet, on systems not in conduit.

WORK EXCLUDED:

Raceway systems are not covered (excluding Ladder-Rack for the purpose of the above listed systems). Chases and/or nipples (over 10 feet) may be installed on open wiring systems.

ELEC0076-001 07/01/2003

GRAYS HARBOR, LEWIS, MASON, PACIFIC, PIERCE, THURSTON COUNTIES

	Rates	Fringes
Cable splicer.....	\$ 33.32	3%+12.06

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Electrician.....\$ 30.02 3%+12.06

ELEC0076-003 06/01/2001

GRAYS HARBOR, LEWIS, MASON, PACIFIC, PIERCE AND THURSTON
COUNTIES

	Rates	Fringes
Sound & Communication Technician.....	\$ 18.77	5.97

SCOPE OF WORK

Includes the installation, testing, service and maintenance, of the following systems which utilize the transmission and/or transference of voice, sound, vision and digital for commercial, education, security and entertainment purposes for the following: TV monitoring and surveillance, background-foreground music, intercom and telephone interconnect, inventory control systems, microwave transmission, multi-media, multiplex, nurse call system, radio page, school intercom and sound, burglar alarms and low voltage master clock systems.

A. Communication systems that transmit or receive information and/or control systems that are intrinsic to the above listed systems:

- SCADA (Supervisory control/data acquisition
- PCM (Pulse code modulation) Inventory control systems
- Digital data systems Broadband & baseband and carriers
- Point of sale systems VSAT data systems Data communication systems RF and remote control systems Fiber optic data systems

B. Sound and Voice Transmission/Transference Systems:

- Background-Foreground Music Intercom and Telephone
- Interconnect Systems Sound and Musical Entertainment
- Systems Nurse Call Systems Radio Page Systems School
- Intercom and Sound Systems Burglar Alarm Systems
- Low-Voltage Master Clock Systems Multi-Media/Multiplex
- Systems Telephone Systems RF Systems and Antennas and Wave
- Guide

C. *Fire Alarm Systems-installation, wire pulling and testing.

D. Television and Video Systems: Television Monitoring and Surveillance Systems Video Security Systems Video Entertainment Systems Video Educational Systems Microwave Transmission Systems CATV and CCTV

E. Security Systems: Perimeter Security Systems Vibration Sensor Systems Sonar/Infrared Monitoring Equipment Access Control Systems Card Access Systems

F. Energy Management Systems.

1. Install all low voltage devices or equipment.
2. Install all low voltage wire not in conduit.

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3. Make all low voltage wire terminations that are properly separated from the line voltage side.

4. Install any panel or equipment that contains only low voltage control elements, but has line voltage as a power source.

5. Install chases and /or nipples, not to exceed ten (10) feet, on systems not in conduit.

6. Install all low voltage wire through chases and/or nipples on systems not in conduit.

*Fire Alarm Systems:

1. Fire Alarms-In Raceways

a. Wire and cable pulling, in raceways, performed at the current electrician wage rate and fringe benefits.

b. Installation and termination of devices, panels, startup, testing and programming performed by the technician.

2. Fire Alarms-Open Wire Systems

a. Open wire systems installed by the technician.

 ELEC0112-002 06/01/2004

KITTITAS COUNTY

	Rates	Fringes
Cable splicer.....	\$ 31.24	3%+12.28
Electrician.....	\$ 29.75	3%+12.28

 ELEC0112-007 06/01/2002

KITTTITAS COUNTY

	Rates	Fringes
Sound & Communication Technician.....	\$ 19.97	5.93

SCOPE OF WORK

The work covered shall include the installation, testing, service and maintenance, of the following systems that utilize the transmission and/or transference of voice, sound, vision and digital for commercial, education, security and entertainment purposes for TV monitoring and surveillance, background foreground music, intercom and telephone interconnect, inventory control systems, microwave transmission, multi-media, multiplex, nurse call system, radio page, school intercom and sound, burglar alarms and low voltage master clock systems.

A. Communication systems that transmit or receive information and/or control systems that are intrinsic to the above listed systems: SCADA (Supervisory control/data acquisition
 PCM (Pulse code modulation) Inventory control systems
 Digital data systems Broadband & baseband and carriers
 Point of sale systems VSAT data systems Data communication systems RF and remote control systems

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Fiber optic data systems

B. Sound and Voice Transmission/Transference Systems: Background-Foreground Music Intercom and Telephone Interconnect Systems Sound and Musical Entertainment Systems Nurse Call Systems Radio Page Systems School Intercom and Sound Systems Burglar Alarm Systems Low-Voltage Master Clock Systems Multi-Media/Multiplex Systems Telephone Systems RF Systems and Antennas and Wave Guide

C. *Fire Alarm Systems-installation, wire pulling and testing.

D. Television and Video Systems: Television Monitoring and Surveillance Systems Video Security Systems Video Entertainment Systems Video Educational System Microwave Transmission Systems CATV and CCTV

E. Security Systems: Perimeter Security Systems Vibration Sensor Systems Sonar/Infrared Monitoring Equipment Access Control Systems Card Access Systems

F. Energy Management Systems.

1. Install all low voltage devices or equipment.
2. Install all low voltage wire not in conduit.
3. Make all low voltage wire terminations that are properly separated from the line voltage side.
4. Install any panel or equipment that contains only low voltage control elements, but has line voltage as a power source.
5. Install chases and /or nipples, not to exceed ten (10) feet, on systems not in conduit.
6. Install all low voltage wire through chases and/or nipples on systems not in conduit.

*Fire Alarm Systems:

1. Fire Alarms-In Raceways
 - a. Wire and cable pulling, in raceways, performed at the current electrician wage rate and fringe benefits.
 - b. Installation and termination of devices, panels, startup, testing and programing performed by the technician.
2. Fire Alarms-Open Wire Systems
 - a. Open wire systems installed by the technician.

ELEC0191-001 09/01/2003

CHELAN COUNTY

	Rates	Fringes
Cable splicer.....	\$ 29.33	3%+9.78
Electrician.....	\$ 26.66	3%+9.78

ELEC0191-005 06/01/2003

CHELAN AND SNOHOMISH COUNTIES

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	Rates	Fringes
Sound & Communication Technician.....	\$ 22.50	4.87

SCOPE OF WORK

The work covered shall include the installation, testing, service and maintenance, of the following systems that utilize the transmission and/or transference of voice, sound, vision and digital for commercial, education, security and entertainment purposes for TV monitoring and surveillance, background foreground music, intercom and telephone interconnect, inventory control systems, microwave transmission, multi-media, multiplex, nurse call system, radio page, school intercom and sound, burglar alarms and low voltage master clock systems.

A. Communication systems that transmit or receive information and/or control systems that are intrinsic to the above listed systems: SCADA (Supervisory control/data acquisition

PCM (Pulse code modulation) Inventory control systems
Digital data systems Broadband & baseband and carriers
Point of sale systems VSAT data systems Data communication systems RF and remote control systems Fiber optic data systems

B. Sound and Voice Transmission/Transference Systems:

Background-Foreground Music Intercom and Telephone Interconnect Systems
Sound and Musical Entertainment Systems Nurse Call Systems Radio Page Systems
School Intercom and Sound Systems Burglar Alarm Systems Low-Voltage Master Clock Systems Multi-Media/Multiplex Systems Telephone Systems RF Systems and Antennas and Wave Guide

C. *Fire Alarm Systems-installation, wire pulling and testing.

D. Television and Video Systems: Television Monitoring and Surveillance Systems Video Security Systems Video Entertainment Systems Video Educational Systems Microwave Transmission Systems CATV and CCTV

E. Security Systems:

Perimeter Security Systems Vibration Sensor Systems Sonar/Infrared Monitoring Equipment Access Control Systems Card Access Systems

F. Energy Management Systems.

1. Install all low voltage devices or equipment.
2. Install all low voltage wire not in conduit.
3. Make all low voltage wire terminations that are properly separated from the line voltage side.
4. Install any panel or equipment the contains only low voltage control elements, but has line voltage as a power source.
5. Install chases and /or nipples, not to exceed ten (10) feet, on systems not in conduit.
6. Install all low voltage wire through chases and/or nipples on systems not in conduit.

*Fire Alarm Systems:

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1. Fire Alarms-In Raceways

- a. Wire and cable pulling, in raceways, performed at the current electrician wage rate and fringe benefits.
- b. Installation and termination of devices, panels, startup, testing and programming performed by the technician.

2. Fire Alarms-Open Wire Systems

- a. Open wire systems installed by the technician.

ELEC0191-010 09/01/2003

SNOHOMISH COUNTY

	Rates	Fringes
Cable splicer.....	\$ 33.72	3%+9.83
Electrician.....	\$ 30.66	3%+9.83

ELEV0019-001 01/01/2004

CHELAN, CLALLAM, GRAYS HARBOR, JEFFERSON, KING, KITSAP,
KITTITAS, LEWIS, MASON, PIERCE, SNOHOMISH AND THURSTON COUNTIES

	Rates	Fringes
Elevator Mechanic.....	\$ 35.335	10.765 + A

FOOTNOTE: a. Employer contributes 8% of the basic hourly rate for over 5 year's service and 6% of the basic hourly rate for 6 months to 5 years' of service as vacation paid credit. Seven paid holidays:

New Year's Day; Memorial Day; Independence Day; Labor Day, Thanksgiving Day; Friday after Thanksgiving and Christmas Day

ELEV0023-002 01/01/2004

PACIFIC COUNTY

	Rates	Fringes
Elevator Mechanic.....	\$ 35.505	10.415+a

FOOTNOTE

a: Vacation Pay: 8% with 5 or more years of service, 6% for 6 months to 5 years service. Paid Holidays: Memorial Day, Independence Day, Labor Day, Thanksgiving Day and Friday after, and Christmas Day, and New Years Day.

ENGI0302-001 06/01/2004

CHELAN (WEST OF THE 120TH MERIDIAN), CLALLAM, GRAYS HARBOR,
JEFFERSON, KING, KITSAP, KITTITAS, MASON AND SNOHOMISH COUNTIES

ON PROJECTS DESCRIBED IN FOOTNOTE A BELOW, THE RATE FOR EACH GROUP SHALL BE 95% OF THE BASE RATE PLUS FULL FRINGE BENEFITS.

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ON ALL OTHER WORK, THE FOLLOWING RATES APPLY.

Zone 1 (0-25 radius miles):

	Rates	Fringes
Power equipment operators:		
Group 1A.....	\$ 30.61	10.25
Group 1AA.....	\$ 31.15	10.25
Group 1AAA.....	\$ 31.67	10.25
Group 1.....	\$ 30.09	10.25
Group 2.....	\$ 29.63	10.25
Group 3.....	\$ 29.24	10.25
Group 4.....	\$ 27.01	10.25

Zone Differential (Add to Zone 1 rates):

Zone 2 (26-45 radius miles) - \$.70
Zone 3 (Over 45 radius miles) - \$1.00

BASEPOINTS: Aberdeen, Bellingham, Bremerton, Everett, Kent, Mount Vernon, Port Angeles, Port Townsend, Seattle, Shelton, Wenatchee, Yakima

POWER EQUIPMENT OPERATORS CLASSIFICATIONS

GROUP 1AAA - Cranes-over 300 tons, or 300 ft of boom (including jib with attachments)

GROUP 1AA - Cranes 200 to 300 tons, or 250 ft of boom (including jib with attachments); Tower crane over 175 ft in height, base to boom

GROUP 1A - Cranes, 100 tons thru 199 tons, or 150 ft of boom (including jib with attachments); Crane-overhead, bridge type, 100 tons and over; Tower crane up to 175 ft in height base to boom; Loaders-overhead, 8 yards and over; Shovels, excavator, backhoes-6 yards and over with attachments

GROUP 1 - Cableway; Cranes 45 tons thru 99 tons, under 150 ft of boom (including jib with attachments); Crane-overhead, bridge type, 45 tons thru 99 tons; Derricks on building work; Excavator, shovel, backhoes over 3 yards and under 6 yards; Hard tail end dump articulating off-road equipment 45 yards and over; Loader- overhead 6 yards to, but not including 8 yards; Mucking machine, mole, tunnel, drill and/or shield; Quad 9, HD 41, D-10; Remote control operator on rubber tired earth moving equipment; Rollagon; Scrapers-self propelled 45 yards and over; Slipform pavers; Transporters, all truck or track type

GROUP 2 - Barrier machine (zipper); Batch Plant Operator-Concrete; Bump Cutter; Cranes, 20 tons thru 44 tons with attachments; Crane-overhead, bridge type-20 tons through 44 tons; Chipper; Concrete Pump-truck mount with boom attachment; Crusher; Deck Engineer/Deck Winches (power); Drilling machine; Excavator, shovel, backhoe-3 yards and under; Finishing Machine, Bidwell, Gamaco and similar equipment; Guardrail punch; Horizontal/directional drill operator; Loaders-overhead under 6 yards; Loaders-plant feed; Locomotives-all; Mechanics-all; Mixers-asphalt plant; Motor patrol graders-finishing; Piledriver (other than crane mount); Roto-mill, roto-grinder; Screedman,

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spreader, topside operator-Blaw Knox, Cedar Rapids, Jaeger, Caterpillar, Barbar Green; Scraper-self propelled, hard tail end dump, articulating off-road equipment-under 45 yards; Subgrade trimmer; Tractors, backhoes-over 75 hp; Transfer material service machine-shuttle buggy, blaw knox-roadtec; Truck crane oiler/driver-100 tons and over; Truck Mount portable conveyor; Yo Yo Pay dozer

GROUP 3 - Conveyors; Cranes-thru 19 tons with attachments; A-frame crane over 10 tons; Drill oilers-auger type, truck or crane mount; Dozers-D-9 and under; Forklift-3000 lbs. And over with attachments; Horizontal/directional drill locator; Outside hoists-(elevators and manlifts), air tuggers, strato tower bucket elevators; Hydralifts/boom trucks over 10 tons; Loader-elevating type, belt; Motor patrol grader-nonfinishing; Plant oiler- asphalt, crusher; Pumps-concrete; Roller, plant mix or multi-lift materials; Saws-concrete; Scrpers-concrete and carry-all; Service engineer-equipment; Trenching machines; Truck Crane Oiler/Driver under 100 tons; Tractors, backhoe 75 hp and under

GROUP 4 - Assistant Engineer; Bobcat; Brooms; Compressor; Concrete finish machine-laser screed; Cranes-A frame-10 tons and under; Elevator and Manlift-permanent or shaft type; Gradechecker, Stakehop; Forklifts under 3000 lbs. With attachments; Hydralifts/boom trucks, 10 tons and under; Oil distributors, blower distribution and mulch seeding operator; Pavement breaker; Posthole digger, mechanical; Power plant; Pumps, water; Rigger and Bellman; Roller-other than plant mix; Wheel Tractors, farmall type; Shotcrete/gunite equipment operator

FOOTNOTE A- Reduced rates may be paid on the following:

1. Projects involving work on structures such as buildings and bridges whose total value is less than \$1.5 million excluding mechanical, electrical, and utility portions of the contract.
2. Projects of less than \$1 million where no building is involved. Surfacing and paving including, but utilities excluded.
3. Marine projects (docks, wharfs, etc.) less than \$150,000.

HANDLING OF HAZARDOUS WASTE MATERIALS: Personnel in all craft classifications subject to working inside a federally designed hazardous perimeter shall be eligible for compensation in accordance with the following group schedule relative to the level of hazardous waste as outlined in the specific hazardous waste project site safety plan.

H-1 Base wage rate when on a hazardous waste site when not outfitted with protective clothing.

H-2 Class "C" Suit - Base wage rate plus \$.25 per hour.

H-3 Class "B" Suit - Base wage rate plus \$.50 per hour.

H-4 Class "A" Suit - Base wage rate plus \$.75 per hour.

ENGI0370-008 08/01/2003

CHELAN (EAST OF THE 120TH MERIDIAN) COUNTY

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ZONE 1:

	Rates	Fringes
Power equipment operators:		
GROUP 1.....	\$ 20.99	7.37
GROUP 1A.....	\$ 20.44	7.37
GROUP 2.....	\$ 21.31	7.37
GROUP 3.....	\$ 21.92	7.37
GROUP 4.....	\$ 22.08	7.37
GROUP 5.....	\$ 22.24	7.37
GROUP 6.....	\$ 22.52	7.37
GROUP 7.....	\$ 22.79	7.37
GROUP 8.....	\$ 23.89	7.37

ZONE DIFFERENTIAL (Add to Zone 1 rate):
 Zone 2 - \$2.00

Zone 1: Within 45 mile radius of Spokane, Moses Lake, Pasco, Washington;
 Lewiston, Idaho

Zone 2: Outside 45 mile radius of Spokane, Moses Lake, Pasco, Washington;
 Lewiston, Idaho

POWER EQUIPMENT OPERATORS CLASSIFICATIONS

GROUP 1A: Boat Operator; Crush Feeder; Oiler; Steam Cleaner

GROUP 1: Bit Grinders; Bolt Threading Machine; Compressors (under 2000 CFM, gas, diesel, or electric power); Deck Hand; Drillers Helper (assist driller in making drill rod connections, service drill engine and air compressor, repair drill rig and drill tools; drive drill support truck to and on the job site, remove drill cuttings from around bore hole and inspect drill rig while in operation); Fireman & Heat Tender; Grade Checker; Hydro-seeder, Mulcher, Nozzleman; Oiler Driver, & Cable Tender, Mucking Machine; Pumpman; Rollers, all types on subgrade, including seal and chip coatings (farm type, Case, John Deere & similar, or Compacting Vibrator), except when pulled by Dozer with operable blade; Welding Machine

GROUP 2: A-frame Truck (single drum); Assistant Refrigeration Plant (under 1000 ton); Assistant Plant Operator, Fireman or Pugmixer (asphalt); Bagley or Stationary Scraper; Belt Finishing Machine; Blower Operator (cement); Cement Hog; Compressor (2000 CFM or over, 2 or more, gas diesel or electric power); Concrete Saw (multiple cut); Distributor Leverman; Ditch Witch or similar; Elevator Hoisting Materials; Dope Pots (power agitated); Fork Lift or Lumber Stacker, hydra-lift & similar; Gin Trucks (pipeline); Hoist, single drum; Loaders (bucket elevators and conveyors); Longitudinal Float; Mixer (portable-concrete); Pavement Breaker, Hydra-Hammer & similar; Power Broom; Railroad Ballast Regulation Operator (self-propelled); Railroad Power Tamper Operator (self-propelled); Railroad Tamper Jack Operator (self-propelled); Spray Curing Machine (concrete); Spreader Box (self-propelled); Straddle Buggy (Ross & similar on construction job only); Tractor (Farm type R/T with attachment, except Backhoe); Tugger Operator

GROUP 3: A-frame Truck (2 or more drums); Assistant Refrigeration Plant & Chiller Operator (over 1000 ton); Backfillers (Cleveland & similar); Batch

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Plant & Wet Mix Operator, single unit (concrete); Belt-Crete Conveyors with power pack or similar; Belt Loader (Kocal or similar); Bending Machine; Bob Cat; Boring Machine (earth); Boring Machine (rock under 8 inch bit) (Quarry Master, Joy or similar); Bump Cutter (Wayne, Saginaw or similar); Canal Lining Machine (concrete); Chipper (without crane); Cleaning & Doping Machine (pipeline); Deck Engineer; Elevating Belt-type Loader (Euclid, Barber Green & similar); Elevating Grader-type Loader (Dumora, Adams or similar); Generator Plant Engineers (diesel or electric); Gunnite Combination Mixer & Compressor; Locomotive Engineer; Mixermobile; Mucking Machine; Posthole Auger or Punch; Pump (grout or jet); Soil Stabilizer (P & H or similar); Spreader Machine; Tractor (to D-6 or equivalent) and Traxcavator; Traverse Finish Machine; Turnhead Operator

GROUP 4: Concrete Pumps (squeeze-crete, flow-crete, pump-crete, Whitman & similar); Curb Extruder (asphalt or concrete); Drills (churn, core, calyx or diamond) (Operate drilling machine, drive or transport drill rig to and on job site and weld well casing); Equipment Serviceman, Greaser & Oiler; Hoist (2 or more drums or Tower Hoist); Loaders (overhead & front-end, under 4 yds. R/T); Refrigeration Plant Engineer (under 1000 ton); Rubber-tired Skidders (R/T with or without attachments); Surface Heater & Planer Machine; Trenching Machines (under 7 ft. depth capacity); Turnhead (with re-screening); Vacuum Drill (reverse circulation drill under 8 inch bit)

GROUP 5: Backhoe (under 45,000 gw); Backhoe and Hoe Ram (under 3/4 yd.); Carrydeck & boom truck (under 25 tons); Cranes (25 tons & under), all attachments including clamshell, dragline); Derricks & Stifflegs (under 65 tons); Drilling Equipment (8 inch bit & over) (Robbins, reverse circulation & similar) (operates drill machine, drive or transport drill rig to and on job site and weld well casing); Hoe Ram; Piledriving Engineers; Paving (dual drum); Railroad Track Liner Operator (self-propelled); Refrigeration Plant Engineer (1000 tons & over); Signalman (Whirleys, Highline Hammerheads or similar)

GROUP 6: Asphalt Plant Operator; Automatic Subgrader (Ditches & Trimmers) (Autograde, ABC, R.A. Hansen & similar on grade wire); Backhoe (45,000 gw and over to 110,000 gw); Backhoes & Hoe Ram (3/4 yd. to 3 yd.); Batch Plant (over 4 units); Batch & Wet Mix Operator (multiple units, 2 & incl. 4); Blade Operator (Motor Patrol & Attachments, Athey & Huber); Boom Cats (side); Cableway Controller (dispatcher); Clamshell Operator (under 3 yds.); Compactor (self-propelled with blade); Concrete Pump Boom Truck; Concrete Slip Form Paver; Cranes (over 25 tons including 45 tons), all attachments including clamshell, dragline; Crusher, Grizzle & Screening Plant Operator; Dozer, 834 R/T & similar; Draglines (under 3 yds.); Drill Doctor; H.D.Mechanic; H.D. Welder; Loader Operator (front-end & overhead, 4 yds. incl. 8 yds.), Multiple Dozer Units with single blade; Paving Machine (asphalt and concrete); Quad-Track or similar equipment; Roller (finishing asphalt pavement); Roto Mill (pavement grinder); Scrapers, all rubber-tired; Screed Operator; Shovel (under 3 yds.); Tractors (D-6 & equivalent & over); Trenching Machines (7 ft. depth & over); Tug Boat Operator; Vector Guzzler, super sucker

GROUP 7: Backhoe (over 110,000 gw); Backhoes & Hoe Ram (3 yds. & over); Blade (finish & bluetop), Automatic, CMI, ABC, Finish Athey & Huber & similar when used as automatic; Cableway Operators; Clamshell Operator (3 yds. &

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over); Cranes (over 45 tons to but not including 85 tons), all attachments including clamshell and dragline; Derricks & Stifflegs (65 tons & over); Draglines (3 yds. & over); Elevating Belt (Holland type); Heavy Equipment Robotics Operator; Loader (360 degrees revolving Koehring Scooper or similar); Loaders (overhead & front-end, over 8 yds. to 10 yds.); Rubber-tired Scrapers (multiple engine with three or more scrapers); Shovels (3 yds. & over); Ultra High Pressure Waterjet Cutting Tool System Operator (30,000 psi); Vacuum Blasting Machine Operator; Whirleys & Hammerheads, ALL

GROUP 8: Cranes (85 tons and over, and all climbing, overhead, rail and tower); Loaders (overhead and front-end, 10 yards and over); Helicopter Pilot

BOOM PAY: (All Cranes, Including Tower
180 ft to 250 ft \$.30 over scale
Over 250 ft \$.60 over scale

NOTE:

In computing the length of the boom on Tower Cranes, they shall be measured from the base of the tower to the point of the boom.

HAZMAT: Anyone working on HAZMAT jobs, working with supplied air shall receive \$1.00 an hour above classification.

ENGI0612-002 06/01/2004

LEWIS, PIERCE, PACIFIC (portion lying north of a parallel line extending west from the northern boundary of Wahkaikum County to the sea) AND THURSTON COUNTIES

ON PROJECTS DESCRIBED IN FOOTNOTE A BELOW, THE RATE FOR EACH GROUP SHALL BE 90% OF THE BASE RATE PLUS FULL FRINGE BENEFITS. ON ALL OTHER WORK, THE FOLLOWING RATES APPLY.

Zone 1 (0-25 radius miles):

	Rates	Fringes
Power equipment operators:		
GROUP 1A.....	\$ 30.61	10.25
GROUP 1AA.....	\$ 31.15	10.25
GROUP 1AAA.....	\$ 31.67	10.25
GROUP 1.....	\$ 30.09	10.25
GROUP 2.....	\$ 29.63	10.25
GROUP 3.....	\$ 29.24	10.25
GROUP 4.....	\$ 27.01	10.25

Zone Differential (Add to Zone 1 rates):

Zone 2 (26-45 radius miles) = \$.70
Zone 3 (Over 45 radius miles) - \$1.00

BASEPOINTS: CENTRALIA, OLYMPIA, TACOMA

POWER EQUIPMENT OPERATORS CLASSIFICATIONS

SECTION 00101
INSTRUCTIONS, CONDITIONS, AND NOTICES TO OFFERORS

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GROUP 1 AAA - Cranes-over 300 tons or 300 ft of boom (including jib with attachments)

GROUP 1AA - Cranes- 200 tons to 300 tons, or 250 ft of boom (including jib with attachments; Tower crane over 175 ft in height, base to boom

GROUP 1A - Cranes, 100 tons thru 199 tons, or 150 ft of boom (including jib with attachments); Crane-overhead, bridge type, 100 tons and over; Tower crane up to 175 ft in height base to boom; Loaders-overhead, 8 yards and over; Shovels, excavator, backhoes-6 yards and over with attachments

GROUP 1 - Cableway; Cranes 45 tons thru 99 tons under 150 ft of boom (including jib with attachments); Crane-overhead, bridge type, 45 tons thru 99 tons; Derricks on building work; Excavator, shovel, backhoes over 3 yards and under 6 yards; Hard tail end dump articulating off-road equipment 45 yards and over; Loader- overhead, 6 yards to, but not including, 8 yards; Mucking machine, mole, tunnel, drill and/or shield; Quad 9 HD 41, D-10; Remote control operator on rubber tired earth moving equipment; Rollagon; Scrapers-self-propelled 45 yards and over; Slipform pavers; Transporters, all track or truck type

GROUP 2 - Barrier machine (zipper); Batch Plant Operator-concrete; Bump Cutter; Cranes, 20 tons thru 44 tons with attachments; Crane-Overhead, bridge type, 20 tons through 44 tons; Chipper; Concrete pump-truck mount with boom attachment; Crusher; Deck engineer/deck winches (power); Drilling machine; Excavator, shovel, backhoe-3 yards and under; Finishing machine, Bidwell, Gamaco and similar equipment; Guardrail punch; Loaders, overhead under 6 yards; Loaders-plant feed; Locomotives-all; Mechanics- all; Mixers, asphalt plant; Motor patrol graders, finishing; Piledriver (other than crane mount); Roto-mill, roto- grinder; Screedman, spreader, topside operator-Blaw Knox, Cedar Rapids, Jaeger, Caterpillar, Barbar Green; Scraper-self- propelled, hard tail end dump, articulating off-road equipment- under 45 yards; Subgrader trimmer; Tractors, backhoe over 75 hp; Transfer material service machine-shuttle buggy, Blaw Knox- Roadtec; Truck Crane oiler/driver-100 tons and over; Truck Mount Portable Conveyor; Yo Yo pay

GROUP 3 - Conveyors; Cranes through 19 tons with attachments; Crane-A-frame over 10 tons; Drill oilers-auger type, truck or crane mount; Dozer-D-9 and under; Forklift-3000 lbs. And over with attachments; Horizontal/directional drill locator; Outside Hoists-(elevators and manlifts), air tuggers, strato tower bucket elevators; Hydralifts/boom trucks over 10 tons; Loaders-elevating type, belt; Motor patrol grader-nonfinishing; Plant oiler- asphalt, crusher; Pump-Concrete; Roller, plant mix or multi-lfit materials; Saws-concrete; Scrapers, concrete and carry all; Service engineers-equipment; Trenching machines; Truck crane oiler/driver under 100 tons; Tractors, backhoe under 75 hp

GROUP 4 - Assistant Engineer; Bobcat; Brooms; Compressor; Concrete Finish Machine-laser screed; Cranes A-frame 10 tons and under; Elevator and manlift (permanent and shaft type); Forklifts-under 3000 lbs. with attachments; Gradechecker, stakehop; Hydralifts/boom trucks, 10 tons and under; Oil distributors, blower distribution and mulch seeding operator; Pavement breaker; Posthole digger-mechanical; Power plant; Pumps-water; Rigger and Bellman; Roller-other than plant mix; Wheel Tractors, farmall type; Shotcrete/gunite equipment operator

SECTION 00101
INSTRUCTIONS, CONDITIONS, AND NOTICES TO OFFERORS

FOOTNOTE A- Reduced rates may be paid on the following:

1. Projects involving work on structures such as buildings and bridges whose total value is less than \$1.5 million excluding mechanical, electrical, and utility portions of the contract.
2. Projects of less than \$1 million where no building is involved. Surfacing and paving included, but utilities excluded.
3. Marine projects (docks, wharfs, etc.) less than \$150,000.

HANDLING OF HAZARDOUS WASTE MATERIALS: Personnel in all craft classifications subject to working inside a federally designated hazardous perimeter shall be eligible for compensation in accordance with the following group schedule relative to the level of hazardous waste as outlined in the specific hazardous waste project site safety plan.

H-1 Base wage rate when on a hazardous waste site when not outfitted with protective clothing

- H-2 Class "C" Suit - Base wage rate plus \$.25 per hour.
- H-3 Class "B" Suit - Base wage rate plus \$.50 per hour.
- H-4 Class "A" Suit - Base wage rate plus \$.75 per hour.

 ENGI0701-008 01/01/2004

PACIFIC (remaining portion) COUNTY

	Rates	Fringes
Power equipment operators:		
(See Footnote A)		
ZONE 1:		
GROUP 1A.....	\$ 30.99	9.70
GROUP 1B.....	\$ 32.46	9.70
GROUP 1.....	\$ 29.51	9.70
GROUP 2.....	\$ 28.25	9.70
GROUP 3.....	\$ 27.47	9.70
GROUP 4.....	\$ 26.93	9.70
GROUP 5.....	\$ 26.32	9.70
GROUP 6.....	\$ 23.91	9.70

Zone Differential (add to Zone 1 rates):
 Zone 2 - \$1.50
 Zone 3 - 3.00

For the following metropolitan counties: MULTNOMAH; CLACKAMAS; MARION; WASHINGTON; YAMHILL; AND COLUMBIA; CLARK; AND COWLITZ COUNTY, WASHINGTON WITH MODIFICATIONS AS INDICATED:

All jobs or projects located in Multnomah, Clackamas and Marion Counties, West of the western boundary of Mt. Hood National Forest and West of Mile Post 30 on Interstate 84 and West of Mile Post 30 on State Highway 26 and West of Mile Post 30 on Highway 22 and all jobs or projects located in Yamhill County, Washington County and Columbia County and all jobs or projects located in Clark & Cowlitz County, Washington except that portion of

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Cowlitz County in the Mt. St. Helens "Blast Zone" shall receive Zone I pay for all classifications.

All jobs or projects located in the area outside the identified boundary above, but less than 50 miles from the Portland City Hall shall receive Zone II pay for all classifications.

All jobs or projects located more than 50 miles from the Portland City Hall, but outside the identified border above, shall receive Zone III pay for all classifications.

For the following cities: ALBANY; BEND; COOS BAY; EUGENE;
GRANTS PASS; KLAMATH FALLS; MEDFORD; ROSEBURG

All jobs or projects located within 30 miles of the respective city hall of the above mentioned cities shall receive Zone I pay for all classifications.

All jobs or projects located more than 30 miles and less than 50 miles from the respective city hall of the above mentioned cities shall receive Zone II pay for all classifications.

All jobs or projects located more than 50 miles from the respective city hall of the above mentioned cities shall receive Zone III pay for all classifications.

POWER EQUIPMENT OPERATORS CLASSIFICATIONS

GROUP 1: CONCRETE: Batch Plant and/or Wet Mix Operator, three units or more; CRANE: Helicopter Operator, when used in erecting work; Whirley Operator, 90 ton and over; LATTICE BOOM CRANE: Operator 200 tons through 299 tons, and/or over 200 feet boom; HYDRAULIC CRANE: Hydraulic Crane Operator 90 tons through 199 tons with luffing or tower attachments; FLOATING EQUIPMENT: Floating Crane, 150 ton but less than 250 ton

GROUP 1A: HYDRAULIC CRANE: Hydraulic Operator, 200 tons and over (with luffing or tower attachment); LATTICE BOOM CRANE: Operator, 200 tons through 299 tons, with over 200 feet boom; FLOATING EQUIPMENT: Floating Crane 250 ton and over

GROUP 1B: LATTICE BOOM CRANE: Operator, 300 tons through 399 tons with over 200 feet boom; Operator 400 tons and over; FLOATING EQUIPMENT: Floating Crane 350 ton and over

GROUP 2: ASPHALT: Asphalt Plant Operator (any type); Roto Mill, pavement profiler, operator, 6 foot lateral cut and over; BLADE: Auto Grader or "Trimmer" (Grade Checker required); Blade Operator, Robotic; BULLDOZERS: Bulldozer operator over 120,000 lbs and above; Bulldozer operator, twin engine; Bulldozer Operator, tandem, quadnine, D10, D11, and similar type; Bulldozer Robotic Equipment (any type); CONCRETE: Batch Plant and/or Wet Mix Operator, one and two drum; Automatic Concrete Slip Form Paver Operator; Concrete Canal Line Operator; Concrete Profiler, Diamond Head; CRANE: Cableway Operator, 25 tons and over; HYDRAULIC CRANE: Hydraulic crane operator 90 tons through 199 tons (with luffing or tower attachment);

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TOWER/WHIRLEY OPERATOR: Tower Crane Operator; Whirley Operator, under 90 tons; LATTICE BOOM CRANE: 90 through 199 tons and/or 150 to 200 feet boom; CRUSHER: Crusher Plant Operator; FLOATING EQUIPMENT: Floating Clamshell, etc. operator, 3 cu. yds. and over; Floating Crane (derrick barge) Operator, 30 tons but less than 150 tons; LOADERS: Loader operator, 120,000 lbs. and above; REMOTE CONTROL: Remote controlled earth-moving equipment; RUBBER-TIRED SCRAPERS: Rubber-tired scraper operator, with tandem scrapers, multi-engine; SHOVEL, DRAGLINE, CLAMSHELL, SKOOPER OPERATOR: Shovel, Dragline, Clamshell, operator 5 cu. yds and over; TRENCHING MACHINE: Wheel Excavator, under 750 cu. yds. per hour (Grade Oiler required); Canal Trimmer (Grade Oiler required); Wheel Excavator, over 750 cu. yds. per hour; Band Wagon (in conjunction with wheel excavator); UNDERWATER EQUIPMENT: Underwater Equipment Operator, remote or otherwise; HYDRAULIC HOES-EXCAVATOR: Excavator over 130,000 lbs.

GROUP 3: BULLDOZERS: Bulldozer operator, over 70,000 lbs. up to and including 120,000 lbs.; HYDRAULIC CRANE: Hydraulic crane operator, 50 tons through 89 tons (with luffing or tower attachment); LATTICE BOOM CRANES: Lattice Boom Crane-50 through 89 tons (and less than 150 feet boom); FORKLIFT: Rock Hound Operator; HYDRAULIC HOES-EXCAVATOR: excavator over 80,000 lbs. through 130,000 lbs.; LOADERS: Loader operator 60,000 and less than 120,000; RUBBER-TIRED SCRAPERS: Scraper Operator, with tandem scrapers; Self-loading, paddle wheel, auger type, finish and/or 2 or more units; SHOVEL, DRAGLINE, CLAMSHELL, SKOOPER OPERATOR: Shovel, Dragline, Clamshell operators 3 cu. yds. but less than 5 cu yds.

GROUP 4: ASPHALT: Screed Operator; Asphalt Paver operator (screeman required); BLADE: Blade operator; Blade operator, finish; Blade operator, externally controlled by electronic, mechanical hydraulic means; Blade operator, multi-engine; BULLDOZERS: Bulldozer Operator over 20,000 lbs and more than 100 horse up to 70,000 lbs; Drill Cat Operator; Side-boom Operator; Cable-Plow Operator (any type); CLEARING: Log Skidders; Chippers; Incinerator; Stump Splitter (loader mounted or similar type); Stump Grinder (loader mounted or similar type; Tub Grinder; Land Clearing Machine (Track mounted forestry mowing & grinding machine); Hydro Axe (loader mounted or similar type); COMPACTORS SELF-PROPELLED: Compactor Operator, with blade; Compactor Operator, multi-engine; Compactor Operator, robotic; CONCRETE: Mixer Mobile Operator; Screed Operator; Concrete Cooling Machine Operator; Concrete Paving Road Mixer; Concrete Breaker; Reinforced Tank Banding Machine (K-17 or similar types); Laser Screed; CRANE: Chicago boom and similar types; Lift Slab Machine Operator; Boom type lifting device, 5 ton capacity or less; Hoist Operator, two (2) drum; Hoist Operator, three (3) or more drums; Derrick Operator, under 100 ton; Hoist Operator, stiff leg, guy derrick or similar type, 50 ton and over; Cableway Operator up to twenty (25) ton; Bridge Crane Operator, Locomotive, Gantry, Overhead; Cherry Picker or similar type crane; Carry Deck Operator; Hydraulic Crane Operator, under 50 tons; LATTICE BOOM CRANE OPERATOR: Lattice Boom Crane Operator, under 50 tons; CRUSHER: Generator Operator; Diesel-Electric Engineer; Grizzley Operator; Drill Doctor; Boring Machine Operator; Driller-Percussion, Diamond, Core, Cable, Rotary and similar type; Cat Drill (John Henry); Directional Drill Operator over 20,000 lbs pullback; FLOATING EQUIPMENT: Diesel-electric Engineer; Jack Operator, elevating barges, Barge Operator, self-unloading; Piledriver Operator (not crane type) (Deckhand required); Floating Clamshell, etc. Operator, under 3 cu. yds. (Fireman or Diesel-Electric

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Engineer required); Floating Crane (derrick barge) Operator, less than 30 tons; GENERATORS: Generator Operator; Diesel-electric Engineer; GUARDRAIL EQUIPMENT: Guardrail Punch Operator (all types); Guardrail Auger Operator (all types); Combination Guardrail machines, i.e., punch auger, etc.; HEATING PLANT: Surface Heater and Planer Operator; HYDRAULIC HOES EXCAVATOR: Robotic Hydraulic backhoe operator, track and wheel type up to and including 20,000 lbs. with any or all attachments; Excavator Operator over 20,000 lbs through 80,000 lbs.; LOADERS: Belt Loaders, Kolman and Ko Cal types; Loaders Operator, front end and overhead, 25,000 lbs and less than 60,000 lbs; Elevating Grader Operator by Tractor operator, Sierra, Euclid or similar types; PILEDRIEVERS: Hammer Operator; Piledriver Operator (not crane type); PIPELINE, SEWER WATER: Pipe Cleaning Machine Operator; Pipe Doping Machine Operator; Pipe Bending Machine Operator; Pipe Wrapping Machine Operator; Boring Machine Operator; Back Filling Machine Operator; REMOTE CONTROL: Concrete Cleaning Decontamination Machine Operator; Ultra High Pressure Water Jet Cutting Tool System Operator/Mechanic; Vacuum Blasting Machine Operator/mechanic; REPAIRMEN, HEAVY DUTY: Diesel Electric Engineer (Plant or Floating; Bolt Threading Machine operator; Drill Doctor (Bit Grinder); H.D. Mechanic; Machine Tool Operator; RUBBER-TIRED SCRAPERS: Rubber-tired Scraper Operator, single engine, single scraper; Self-loading, paddle wheel, auger type under 15 cu. yds.; Rubber-tired Scraper Operator, twin engine; Rubber-tired Scraper Operator, with push-ull attachments; Self Loading, paddle wheel, auger type 15 cu. yds. And over, single engine; Water pulls, water wagons; SHOVEL, DRAGLINE, CLAMSHELL, SKOOPER OPERATOR: Diesel Electric Engineer; Stationary Drag Scraper Operator; Shovel, Dragline, Clamshell, Operator under 3 cy yds.; Grade-all Operator; SURFACE (BASE) MATERIAL: Blade mounted spreaders, Ulrich and similar types; TRACTOR-RUBBERED TIRED: Tractor operator, rubber-tired, over 50 hp flywheel; Tractor operator, with boom attachment; Rubber-tired dozers and pushers (Michigan, Cat, Hough type); Skip Loader, Drag Box; TRENCHING MACHINE: Trenching Machine operator, digging capacity over 3 ft depth; Back filling machine operator; TUNNEL: Mucking machine operator

GROUP 5: ASPHALT: Extrusion Machine Operator; Roller Operator (any asphalt mix); Asphalt Burner and Reconditioner Operator (any type); Roto-Mill, pavement profiler, ground man; BULLDOZERS: Bulldozer operator, 20,000 lbs. or less or 100 horse or less; COMPRESSORS: Compressor Operator (any power), over 1,250 cu. ft. total capacity; COMPACTORS: Compactor Operator, including vibratory; Wagner Pactor Operator or similar type (without blade); CONCRETE: Combination mixer and Compressor Operator, gunite work; Concrete Batch Plant Quality Control Operator; Belcrete Operator; Pumpcrete Operator (any type); Pavement Grinder and/or Grooving Machine Operator (riding type); Cement Pump Operator, Fuller-Kenyon and similar; Concrete Pump Operator; Grouting Machine Operator; Concrete mixer operator, single drum, under (5) bag capacity; Cast in place pipe laying machine; maginnisInternal Full slab vibrator operator; Concrete finishing machine operator, Clary, Johnson, Bidwell, Burgess Bridge deck or similar type; Curb Machine Operator, mechanical Berm, Curb and/or Curb and Gutter; Concrete Joint Machine Operator; Concrete Planer Operator; Tower Mobile Operator; Power Jumbo Operator setting slip forms in tunnels; Slip Form Pumps, power driven hydraulic lifting device for concrete forms; Concrete Paving Machine Operator; Concrete Finishing Machine Operator; Concrete Spreader Operator; CRANE: Helicopter Hoist Operator; Hoist Operator, single drum; Elevator Operator; A-frame Truck Operator, Double drum; Boom Truck Operator; HYDRAULIC

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CRANE OPERATOR: Hydraulic Boom Truck, Pittman; DRILLING: Churm Drill and Earth Boring Machine Operator; Vacuum Truck; Directional Drill Operator over 20,000 lbs pullback; FLOATING EQUIPMENT: Fireman; FORKLIFT: Fork Lift, over 10 ton and/or robotic; HYDRAULIC HOES EXCAVATORS: Hydraulic Backhoe Operator, wheel type (Ford, John Deere, Case type); Hydraulic Backhoe Operator track type up to and including 20,000 lbs.; LOADERS: Loaders, rubber-tired type, less than 25,000 lbs; Elevating Grader Operator, Tractor Towed requiring Operator or Grader; Elevating loader operator, Athey and similar types; OILERS: Service oiler (Greaser); PIPELINE-SEWER WATER: Hydra hammer or similar types; Pavement Breaker Operator; PUMPS: Pump Operator, more than 5 (any size); Pot Rammer Operator; RAILROAD EQUIPMENT: Locomotive Operator, under 40 tons; Ballast Regulator Operator; Ballast Tamper Multi-Purpose Operator; Track Liner Operator; Tie Spacer Operator; Shuttle Car Operator; Locomotive Operator, 40 tons and over; MATERIAL HAULERS: Cat wagon DJBs Volvo similar types; Conveyored material hauler; SURFACING (BASE) MATERIAL: Rock Spreaders, self-propelled; Pulva-mixer or similar types; Chiip Spreading machine operator; Lime spreading operator, construction job siter; SWEEPERS: Sweeper operator (Wayne type) self-propelled construction job site; TRACTOR-RUBBER TIRED: Tractor operator, rubber-tired, 50 hp flywheel and under; Trenching machine operator, maximum digging capacity 3 ft depth; TUNNEL: Dinkey

GROUP 6: ASPHALT: Plant Oiler; Plant Fireman; Pugmill Operator (any type); Truck mounted asphalt spreader, with screed; COMPRESSORS: Compressor Operator (any power), under 1,250 cu. ft. total capacity; CONCRETE: Plant Oiler, Assistant Conveyor Operator; Conveyor Operator; Mixer Box Operator (C.T.B., dry batch, etc.); Cement Hog Operator; Concrete Saw Operator; Concrete Curing Machine Operator (riding type); Wire Mat or Brooming Machine Operator; CRANE: Oiler; Fireman, all equipment; Truck Crane Oiler Driver; A-frame Truck Operator, single drum; Tugger or Coffin Type Hoist Operator; CRUSHER: Crusher Oiler; Crusher Feeder; CRUSHER: Crusher oiler; Crusher feeder; DRILLING: Drill Tender; Auger Oiler; FLOATING EQUIPMENT: Deckhand; Boatman; FORKLIFT: Self-propelled Scaffolding Operator, construction job site (excluding working platform); Fork Lift or Lumber Stacker Operator, construction job site; Ross Carrier Operator, construction job site; Lull Hi-Lift Operator or Similar Type; GUARDRAIL EQUIPMENT: Oiler; Auger Oiler; Oiler, combination guardrail machines; Guardrail Punch Oiler; HEATING PLANT: Temporary Heating Plant Operator; LOADERS: Bobcat, skid steer (less than 1 cu yd.); Bucket Elevator Loader Operator, BarberGreene and similar types; OILERS: Oiler; Guardrail Punch Oiler; Truck Crane Oiler-Driver; Auger Oiler; Grade Oiler, required to check grade; Grade Checker; Rigger; PIPELINE-SEWER WATER: Tar Pot Fireman; Tar Pot Fireman (power agitated); PUMPS: Pump Operator (any power); Hydrostatic Pump Operator; RAILROAD EQUIPMENT: Brakeman; Oiler; Switchman; Motorman; Ballast Jack Tamper Operator; SHOVEL, DRAGLINE, CLAMSHELL, SKOOPER, ETC. OPERATOR: Oiler, Grade Oiler (required to check grade); Grade Checker; Fireman; SWEEPER: Broom operator, self propelled, construction job site; SURFACING (BASE) MATERIAL: Roller Operator, grading of base rock (not asphalt); Tamping Machine operator, mechanical, self-propelled; Hydrographic Seeder Machine Operator; TRENCHING MACHINE: Oiler; Grade Oiler; TUNNEL: Conveyor operator; Air filtration equipment operator

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CHELAN AND KITTITAS COUNTIES

	Rates	Fringes
Ironworker.....	\$ 28.02	13.30

IRON0086-003 07/01/2004		

CALLAM, GRAYS HARBOR, JEFFERSON, KING, KITSAP, LEWIS, MASON, PACIFIC, PIERCE, SNOHOMISH AND THURSTON COUNTIES

	Rates	Fringes
Ironworker.....	\$ 29.82	13.30

LABO0001-003 06/01/2004		

	Rates	Fringes
Laborers:		
CHELAN AND KITTITAS		
COUNTIES ZONE 1:		
GROUP 1.....	\$ 14.70	7.70
GROUP 2.....	\$ 17.02	7.70
GROUP 3.....	\$ 18.74	7.70
GROUP 4.....	\$ 19.22	7.70
GROUP 5.....	\$ 19.58	7.70
CLALLAM, GRAYS HARBOR, JEFFERSON, KING, KITSAP, LEWIS, MASON, PACIFIC		
(North of a straight line made by extending the north boundary of		
Wahkiakum County west to the Pacific Ocean), PIERCE, SNOHOMISH AND THURSTON		
COUNTIES ZONE 1:		
GROUP 1.....	\$ 19.96	7.70
GROUP 2.....	\$ 20.28	7.70
GROUP 3.....	\$ 24.96	7.70
GROUP 4.....	\$ 25.44	7.70
GROUP 5.....	\$ 25.80	7.70

ZONE DIFFERENTIAL (ADD TO ZONE 1 RATES):
 ZONE 2 - \$.70
 ZONE 3 - \$1.00

BASE POINTS: CHELAN, SUNNYSIDE, WENATCHEE, AND YAKIMA

- ZONE 1 - Projects within 25 radius miles of the respective city hall
- ZONE 2 - More than 25 but less than 45 radius miles from the respective city hall
- ZONE 3 - More than 45 radius miles from the respective city hall

BASE POINTS: BELLINGHAM, MT. VERNON, EVERETT, SEATTLE, KENT, TACOMA, OLYMPIA, CENTRALIA, ABERDEEN, SHELTON, PT. TOWNSEND, PT. ANGELES, AND BREMERTON

ZONE 1 - Projects within 25 radius miles of the respective city hall

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ZONE 2 - More than 25 but less than 45 radius miles from the respective city hall

ZONE 3 - More than 45 radius miles from the respective city hall

LABORERS CLASSIFICATIONS

GROUP 1: Landscaping and Planting; Watchman; Window Washer/Cleaner (detail clean-up, such as but not limited to cleaning floors, ceilings, walls, windows, etc., prior to final acceptance by the owner)

GROUP 2: Batch Weighman; Crusher Feeder; Fence Laborer; Flagman; Pilot Car

GROUP 3: General Laborer; Air, Gas, or Electric Vibrating Screed; Asbestos Abatement Laborer; Ballast Regulator Machine; Brush Cutter; Brush Hog Feeder; Burner; Carpenter Tender; Cement Finisher Tender; Change House or Dry Shack; Chipping Gun (under 30 lbs.); Choker Setter; Chuck Tender; Clean-up Laborer; Concrete Form Stripper; Curing Laborer; Demolition (wrecking and moving including charred material); Ditch Digger; Dump Person; Fine Graders; Firewatch; Form Setter; Gabian Basket Builders; Grout Machine Tender; Grinders; Guardrail Erector; Hazardous Waste Worker (Level C); Maintenance Person; Material Yard Person; Pot Tender; Rip Rap Person; Riggers; Scale Person; Sloper Sprayer; Signal Person; Stock Piler; Stake Hopper; Toolroom Man (at job site); Topper-Tailer; Track Laborer; Truck Spotter; Vinyl Seamer

GROUP 4: Cement Dumper-Paving; Chipping Gun (over 30 lbs.); Clary Power Spreader; Concrete Dumper/Chute Operator; Concrete Saw Operator; Drill Operator (hydraulic, diamond, aiartrac); Faller and Bucker Chain Saw; Grade Checker and Transit Person; Groutmen (pressure) including post tension beams; Hazardous Waste Worker (Level B); High Scaler; Jackhammer; Laserbeam Operator; Manhole Builder-Mudman; Mortarman and Hodcarrier; Nozzleman (concrete pump, green cutter when using combination of high pressure air and water on concrete and rock, sandblast, gunite, shotcrete, water blaster, vacuum blaster); Pavement Breaker; Pipe Layer and Caulker; Pipe Pot Tender; Pipe Reliner (not insert type); Pipe Wrapper; Power Jacks; Railroad Spike Puller-Power; Raker-Asphalt; Rivet Buster; Rodder; Sloper (over 20 ft); Spreader (concrete); Tamper and Similar electric, air and glass operated tool; Timber Person-sewer (lagger shorer and cribber); Track Liner Power; Tugger Operator; Vibrator; Well Point Laborer

GROUP 5: Caisson Worker; Miner; Powderman; Re-Timberman; Hazardous Waste Worker (Level A).

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CHELAN COUNTY

	Rates	Fringes
Hod Carrier.....	\$ 21.05	6.80

LABO0335-003 06/01/2004

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PACIFIC (South of a straight line made by extending the north Boundary line of Wahkiakum County west to the Pacific Ocean)
 COUNTY

	Rates	Fringes
Laborers:		
ZONE 1:		
GROUP 1.....	\$ 23.73	7.50
GROUP 2.....	\$ 24.27	7.50
GROUP 3.....	\$ 24.68	7.50
GROUP 4.....	\$ 25.03	7.50
GROUP 5.....	\$ 21.44	7.50
GROUP 6.....	\$ 19.22	7.50
GROUP 7.....	\$ 16.30	7.50

LABORERS CLASSIFICATIONS

GROUP 1: Asphalt Plant Laborers; Asphalt Spreaders; Batch Weighman; Broomers; Brush Burners and Cutters; Car and Truck Loaders; Carpenter Tender; Change-House Man or Dry Shack Man; Choker Setter; Clean-up Laborers; Curing-concrete; Demolition, Wrecking, and Moving Laborers; Dumpers, road oiling crew; Dumpmen (for grading crew); Elevator Feeders; Guard Rail, Median Rail, Reference Post, Guide Post, Right-of-way Marker; Fine Graders; Fire Watch; Form Strippers (not swinging stages); General Laborers; Hazardous Waste Worker; Leverman or Aggregate Spreader (Flaherty and similar types); Loading Spotters; Material Yard Man (including electrical); Pittsburgh Chipper Operator or similar types; Railroad Track Laborers; Ribbon Setters (including steel forms); Rip Rap Man (hand placed); Road Pump Tender; Sewer Laborer; Signalman; Skipman; Slopers; Spraymen; Stake Chaser; Stockpiler; Tie Back Shoring; Timber Faller and Bucker (hand labor); Toolroom Man (at job site); Tunnel Bullgang (above ground); Weight-Man-Crusher (aggregate when used)

GROUP 2: Applicator (including pot power tender for same), applying protective material by hand or nozzle on utility lines or storage tanks on project; Brush (power saw); Burners; Choker Splicer; Clary Power Spreader and similar types; Clean up-nozzleman-Green cutter (concrete, rock, etc.); Concrete Laborer; Concrete Power Buggyman; Crusher Feeder; Demolition and Wrecking Charred Materials; Gunite Nozzleman Tender; Gunite or Sand Blasting Pot Tender; Handlers or Mixers of all Materials of an irritating nature (including cement and lime); Pipe Doping & Wrapping; Tool Operators (includes but not limited to: Dry pack machine, Jackhammer, Chipping guns, Paving breakers); Post Hole Digger, air, gas or electric; Vibrating Screed; Tampers; Sand Blasting (wet); Stake-Setter; Tunnel-Muckers, Brakemen, Concrete Crew, Bull gang (Underground)

GROUP 3: Asbestos Removal (structural removal only); Bit Grinder; Drill Doctor; Drill Operators, air tracks cat drills, wagon drills, rubber-mounted drills, and other similar types; Concrete Saw Operator; Gunite Nozzleman; High scalers, strippers and drillers (covers work in swinging stages, chairs or belts, under extreme conditions unusual to normal drilling, blasting, barring-down, or sloping and stripping); Manhole Builder; Powdermen; Power Saw Operators (Bucking and Falling); Pumpcrete Nozzlemen;

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Sand Blasting (dry); Sewer Timberman; Track Liners; Anchor Machines; Ballast Regulators; Multiple Tampers; Power Jacks; Tugger Operator; Tunnel-Chuck Tenders, Nippers and Timbermen; Vibrator; Water Blaster

GROUP 4: Asphalt Raker; Concrete Saw Operator (walls); Concrete Nozzelman; Grade Checker; Pipelayer; Laser Beam (Tunnel) applicable when assigned to move, set up, align laser beam; Miner-Tunnel; Motorman-dinky Locomotive-Tunnel; Powderman-Tunnel; Shield Operator-Tunnel

GROUP 5: Traffic Flaggers

GROUP 6: Fence Builders

GROUP 7: Landscaping and Planting Laborers

ZONE DIFFERENTIAL (ADD TO ZONE 1 RATES):

ZONE 2 - \$0.65
ZONE 3 - 1.15
ZONE 4 - 1.70
ZONE 5 - 2.75

ZONE DEFINITIONS

BASE POINTS: GOLDENDALE, LONGVIEW, AND VANCOUVER

ZONE 1: Projects within 30 miles of the respective city hall
ZONE 2: More than 30 miles but less than 40 miles from the respective city hall.
ZONE 3: More than 40 miles but less than 50 miles from the respective city hall.
ZONE 4: More than 50 miles but less than 80 miles from the respective city hall.
ZONE 5: More than 80 miles from the respective city hall.

LABO0335-009 06/01/2004

PACIFIC(south of a straight line made by extending the north boundary of Wahkiakum County west to the Pacific Ocean)

	Rates	Fringes
Hod Carrier.....	\$ 25.49	7.50

PAIN0005-001 03/01/2004

CLALLAM, GRAYS HARBOR, JEFFERSON, KING, KITSAP, LEWIS, MASON, PIERCE, SNOHOMISH AND THURSTON COUNTIES

	Rates	Fringes
Painter.....	\$ 24.36	6.41

* PAIN0005-003 06/10/2004

CLALLAM, GRAYS HARBOR, JEFFERSON, KING, KITSAP, LEWIS, MASON,

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PIERCE, SNOHOMISH AND THURSTON COUNTIES

	Rates	Fringes
Drywall Finisher.....	\$ 27.33	12.11

 PAIN0005-007 07/01/2004

CHELAN AND KITTITAS COUNTIES

	Rates	Fringes
Painters:		
BRUSH, PAPERHANGER, STEAM- CLEANING, STRIPING and SPRAY	\$ 18.89	6.43
TV, RADIO, ELECTRICAL TRANSMISSION TOWERS.....	\$ 20.64	6.43

 PAIN0005-013 07/01/2004

CALLAM, GRAYS HARBOR, JEFFERSON, LEWIS, MASON, PACIFIC (NORTHERN PORTION),
 PIERCE AND THURSTON COUNTIES

	Rates	Fringes
Soft Floor Layer.....	\$ 21.70	9.18

 PAIN0054-003 07/01/2004

CHELAN AND KITTITAS COUNTIES

	Rates	Fringes
Drywall Finisher (TAPER).....	\$ 20.69	7.15

 PAIN0054-008 09/01/2003

CHELAN AND KITTITAS COUNTIES

	Rates	Fringes
Glazier.....	\$ 18.00	5.26

 PAIN0055-008 07/01/2004

PACIFIC COUNTY

	Rates	Fringes
Drywall Finisher.....	\$ 27.28	10.38

 PAIN0055-009 07/01/2003

PACIFIC COUNTY

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	Rates	Fringes
Painters:		
Brush & Roller.....	\$ 17.61	6.12
High work - All work 60 ft. or higher.....	\$ 18.36	6.12
Spray and Sandblasting.....	\$ 18.21	6.12

 PAIN0188-001 07/01/2004

CLALLAM, JEFFERSON, KING, KITSAP, LEWIS, MASON, PIERCE, SNOHOMISH, THURSTON
 COUNTIES

	Rates	Fringes
Glazier.....	\$ 28.87	11.09

 PAIN0188-002 07/01/2004

GRAYS HARBOR AND PACIFIC COUNTIES

	Rates	Fringes
Glazier.....	\$ 12.65	8.87

 * PAIN1238-001 07/01/2004

KING, KITSAP AND SNOHOMISH COUNTIES

	Rates	Fringes
Soft Floor Layer.....	\$ 23.02	9.32

 PLAS0072-002 06/01/2004

CHELAN AND KITTITAS COUNTIES

Zone 1:

	Rates	Fringes
Cement Mason.....	\$ 21.66	7.28

Zone Differential (Add to Zone 1 rates): Zone 2 - \$2.00

BASE POINTS: Spokane, Pasco, Moses Lake, and Lewiston

Zone 1: 0 - 45 radius miles from the main post office

Zone 2: 45 radius miles from the main post office

 PLAS0082-003 06/01/2004

PACIFIC (South of a straight line made by extending the north boundary line
 of Wahkiakum County west to the Pacific Ocean)
 COUNTY

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	Rates	Fringes
Plasterer.....	\$ 26.49	8.28

 PLAS0528-002 06/01/2004

CLALLAM, GRAYS HARBOR, JEFFERSON, KING, KITSAP, LEWIS, MASON, PACIFIC (North of a straight line made by extending the north boundary line of Wahkiakum Count, west to the Pacific Ocean), PIERCE, SNOHOMISH AND THURSTON COUNTIES

	Rates	Fringes
Cement Mason.....	\$ 29.14	10.87

 PLUM0032-001 01/01/2004

CHELAN AND KITTITAS (NORTHERN TIP) COUNTIES

	Rates	Fringes
Plumbers and Pipefitters.....	\$ 26.38	11.68

 PLUM0032-002 01/01/2004

CLALLAM, KING AND JEFFERSON COUNTIES

	Rates	Fringes
Plumbers and Pipefitters.....	\$ 34.43	14.33

 PLUM0082-004 01/01/2004

GRAYS HARBOR, LEWIS, MASON (EXCLUDING NE SECTION), PACIFIC, PIERCE AND THURSTON COUNTIES

	Rates	Fringes
Plumbers and Pipefitters.....	\$ 30.40	13.17

 PLUM0265-001 01/01/2004

SNOHOMISH COUNTY

	Rates	Fringes
Plumbers and Pipefitters.....	\$ 30.20	13.17

 PLUM0598-002 06/01/2004

KITTITAS (ALL BUT NORTHERN TIP)

Rates	Fringes
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Plumbers and Pipefitters.....	\$ 31.57	15.25
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PLUM0631-001 01/01/2004

MASON (NE SECTION), AND KITSAP COUNTIES

	Rates	Fringes
Plumbers and Pipefitters All new construction, additions, and remodeling of commercial building projects such as: cocktail lounges and taverns, professional buildings, medical clinics, retail stores, hotels and motels, restaurants and fast food types, gasoline service stations, and car washes where the plumbing and mechanical cost of the project is less than \$100,000.....	\$ 20.85	4.58
All other work where the plumbing and mechanical cost of the project is \$100,000 and over.....	\$ 29.29	13.17

ROOF0054-001 06/01/2003

CLALLAM, JEFFERSON, KING, KITSAP, MASON AND SNOHOMISH COUNTIES

	Rates	Fringes
Roofer.....	\$ 25.62	8.91

* ROOF0153-001 04/01/2004

GRAYS HARBOR, LEWIS, PACIFIC, PIERCE AND THURSTON COUNTIES

	Rates	Fringes
Roofer.....	\$ 25.25	7.29

ROOF0189-001 07/01/2004

CHELAN COUNTY

	Rates	Fringes
Roofer.....	\$ 20.36	6.95

ROOF0189-004 07/01/2004

KITTITAS COUNTY

	Rates	Fringes
Roofer.....	\$ 21.30	6.20

SFWA0699-001 04/01/2004

KING, KITSAP, PIERCE, SNOHOMISH AND THURSTON COUNTIES

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	Rates	Fringes
Sprinkler Fitter.....	\$ 33.34	13.90

 SHEE0066-003 07/01/2004

CHELAN COUNTY

	Rates	Fringes
Sheet Metal Worker.....	\$ 23.62	10.05

 SHEE0066-004 07/01/2004

CLALLAM, GRAYS HARBOR, JEFFERSON, KING, KITSAP, LEWIS, MASON,
 PACIFIC, PIERCE, SNOHOMISH AND THURSTON COUNTIES

	Rates	Fringes
Sheet Metal Worker.....	\$ 32.35	14.29

 SHEE0066-010 07/01/2004

KITTITAS COUNTY

	Rates	Fringes
Sheet Metal Worker.....	\$ 25.26	11.83

 TEAM0174-002 06/01/2004

CLALLAM, GRAYS HARBOR, JEFFERSON, KING, KITSAP, LEWIS, MASON, PACIFIC (North
 of a straight line made by extending the north boundary line of Wahkiakum
 County west to the Pacific Ocean), PIERCE, SNOHOMISH AND THURSTON COUNTIES

	Rates	Fringes
Truck drivers:		
ZONE A:		
GROUP 1:.....	\$ 26.39	11.08
GROUP 2:.....	\$ 25.81	11.08
GROUP 3:.....	\$ 23.41	11.08
GROUP 4:.....	\$ 19.16	11.08
GROUP 5:.....	\$ 26.15	11.08

ZONE B (25-45 miles from center of listed cities*): Add \$.70 per hour to
 Zone A rates. ZONE C (over 45 miles from center of listed cities*): Add \$1.00
 per hour to Zone A rates.

*Zone pay will be calculated from the city center of the following listed
 cities:

BELLINGHAM	CENTRALIA	RAYMOND	OLYMPIA
EVERETT	SHELTON	ANACORTES	BELLEVUE
SEATTLE	PORT ANGELES	MT. VERNON	KENT
TACOMA	PORT TOWNSEND	ABERDEEN	BREMERTON

SECTION 00101
 INSTRUCTIONS, CONDITIONS, AND NOTICES TO OFFERORS

TRUCK DRIVERS CLASSIFICATIONS

GROUP 1 -"A-frame or Hydralift" trucks and Boom trucks or similar equipment when "A" frame or "Hydralift" and Boom truck or similar equipment is used; Buggymobile; Bulk Cement Tanker; Dumpsters and similar equipment, Tournorockers, Tournowagon, Turnotrailer, Cat DW series, Terra Cobra, Le Tourneau, Westinghouse, Athye Wagon, Euclid Two and Four-Wheeled power tractor with trailer and similar top-loaded equipment transporting material: Dump Trucks, side, end and bottom dump, including semi-trucks and trains or combinations thereof with 16 yards to 30 yards capacity: Over 30 yards \$.15 per hour additional for each 10 yard increment; Explosive Truck (field mix) and similar equipment; Hyster Operators (handling bulk loose aggregates); Lowbed and Heavy Duty Trailer; Road Oil Distributor Driver; Spreader, Flaherty Transit mix used exclusively in heavy construction; Water Wagon and Tank Truck-3,000 gallons and over capacity

GROUP 2 - Bulllifts, or similar equipment used in loading or unloading trucks, transporting materials on job site; Dumpsters, and similar equipment, Tournorockers, Tournowagon, Turnotrailer, Cat. D.W. Series, Terra Cobra, Le Tourneau, Westinghouse, Athye wagon, Euclid two and four-wheeled power tractor with trailer and similar top-loaded equipment transporting material, Dump trucks, side, end and bottom dump, including semi-trucks and trains or combinations thereof with less than 16 yards capacity; Flatbed: (Dual Rear Axle); Grease Truck, Fuel Truck, Greaser, Battery Service Man and/or Tire Service Man; Leverman and loader at bunkers and batch plants; Oil tank transport; Scissor, Slurry Truck; Sno-Go and similar equipment; Swampers; Straddler Carrier (Ross, Hyster) and similar equipment; Team Driver; Tractor (small rubber-tired (when used within Teamster jurisdiction); Vacuum truck; Water Wagon and Tank trucks-less than 3,000 gallons capacity; Winch truck; Wrecker, tow truck and similar equipment

GROUP 3 - Flatbed: single rear axle; Pickup sweeper, Pickup Truck (Adjust upward by \$2.00 per hour for onsite work)

GROUP 4 - Escort or pilot driver

GROUP 5 - Mechanic

HAZMAT PROJECTS

Anyone working on a HAZMAT job, where HAZMAT certification is required, shall be compensated as a premium, in addition to the classification working in as follows:

LEVEL C: +\$.25 per hour - This level uses an air purifying respirator or additional protective clothing.

LEVEL B: +\$.50 per hour - Uses same respirator protection as Level A. Supplied air line is provided in conjunction with a chemical "splash suit."

LEVEL A: +\$.75 per hour - This level utilizes a fully-encapsulated suit with a self-contained breathing apparatus or a supplied air line.

TEAM0760-004 06/01/2004

CHELAN AND KITTITAS COUNTIES

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(ANYONE WORKING ON HAZMAT JOBS SEE FOOTNOTE A BELOW)

	Rates	Fringes
Truck drivers:		
GROUP 1.....	\$ 19.43	9.50
GROUP 2.....	\$ 22.07	9.50
GROUP 3.....	\$ 22.18	9.50
GROUP 4.....	\$ 22.51	9.50
GROUP 5.....	\$ 22.62	9.50
GROUP 6.....	\$ 22.78	9.50
GROUP 7.....	\$ 23.32	9.50
GROUP 8.....	\$ 23.64	9.50

TRUCK DRIVERS CLASSIFICATIONS

GROUP 1: Escort Driver or Pilot Car; Employee Haul; Power Boat Hauling Employees or Material

GROUP 2: Fish Truck; Flat Bed Truck; Fork Lift (3000 lbs. And under); Trailer Mounted Hydro Seeder and Mulcher; Leverperson (loading trucks at bunkers); Seeder & Mulcher; Stationary Fuel Operator; Tractor (small, rubber-tired,pulling trailer or similar equipment)

GROUP 3: Auto Crane (2000 lbs. capacity); Buggy Mobile & Similar; Bulk Cement Tanks & Spreader; Dumptor (6 yds. & under); Flat Bed Truck with Hydraulic System; Fork Lift (3001-16,000 lbs.); Fuel Truck Driver; Steamcleaner & Washer; Power Operated Sweeper; Rubber-tired Tunnel Jumbo; Scissors Truck; Slurry Truck Driver; Straddle Carrier (Ross, Hyster, & similar); Tireperson; Transit Mixers & Truck Hauling Concrete (3 yd. to & including 6 yds.); Trucks, side, end, bottom and articulated end dump (3 yards to and including 6 yds.); Warehouseperson (to include shipping & receiving); Wrecker & Tow Truck

GROUP 4: A-Frame; Burner, Cutter, & Welder; Service Greaser; Trucks, side, end, bottom and articulated end dump (over 6 yds. to & including 12 yds.); Truck Mounted Hydro Seeder; Warehouseperson; Water Tank truck (0-8000 gallons)

GROUP 5: Dumpster (over 6 yds.); Lowboy (50 tons & under); Self- Loading Roll Off; Semi-Truck & Trailer; Tractor with Steer Trailer; Transit Mixers and Trucks Hauling Concrete (over 6 yds. to and including 10 yds.); Trucks, side, end, bottom and articulated end dump (over 12 yds. to & including 20 yds.); Truck-Mounted Crane (with load bearing surface either mounted or pulled)(up to 14 ton); Vacuum Truck (super sucker, guzzler, etc.)

GROUP 6: Flaherty Spreader Box Driver; Flowboys; Fork Lift (over 16,000 lbs.); Dumps (Semi-end); Lowboy (over 50 tons); Mechanic (Field); Transfer Truck and Trailer; Transit Mixers & Trucks Hauling Concrete (over 10 yds. to & including 20 yds.); Trucks, side, end, bottom and end dump (over 20 yds. to & including 40 yds.); Truck and Pup; Tournarocker, DWs & similar with 2 or more 4 wheel-power tractor with trailer, gallonage or yardage scale, whichever is greater; Water Tank Truck (8,001- 14,000 gallons)

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GROUP 7: Oil Distributor Driver; Stringer Truck (cable operated trailer); Transit Mixers & Hauling Concrete (over 20 yds.); Truck, side, end, bottom and articulated end dump (over 40 yds. to & including 100 yds.); Truck Mounted Crane (with load bearing surface either mounted or pulled (16 through 25 tons)

GROUP 8: Prime Movers and Stinger Truck; Trucks, side, end, bottom and articulated end dump (over 100 yds.); Helicopter Pilot Hauling Employees or Materials

Footnote A- Anyone working on a HAZMAT job, where HAZMAT certification is required, shall be compensated as a premium, in addition to the classification working in as follows:

LEVEL D: - \$.25 PER HOUR (This is the lowest level of protection. No respirator is used and skin protection is minimal.

LEVEL C: - \$.50 PER HOUR (This level uses an air purifying respirator or additional protective clothing.

LEVEL B: - \$.75 PER HOUR (Uses same respirator protection as Level A. Supplied air line is provided in conjunction with a chemical "spash suit."

LEVEL A: - \$1.00 PER HOUR (this level utilizes a fully encapsulated suit with a self-contained breathing apparatus or a supplied air line.

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.
=====

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

In the listing above, the "SU" designation means that rates listed under the identifier do not reflect collectively bargained wage and fringe benefit rates. Other designations indicate unions whose rates have been determined to be prevailing.

WAGE DETERMINATION APPEALS PROCESS

- 1.) Has there been an initial decision in the matter? This can be:
- * an existing published wage determination
 - * a survey underlying a wage determination
 - * a Wage and Hour Division letter setting forth a position on a wage determination matter
 - * a conformance (additional classification and rate) ruling

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On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted

because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator

(See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board

U.S. Department of Labor

200 Constitution Avenue, N.W.

Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

=====

END OF GENERAL DECISION

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**SECTION 00851
LIST OF DRAWINGS**

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[1.19 NOTICE OF BUY AMERICAN ACT/BALANCE OF PAYMENTS PROGRAM REQUIREMENT--CONSTRUCTION MATERIALS \(FAR 52.225-10\) \(MAY 2002\)](#)..... ERROR! BOOKMARK NOT DEFINED.

[1.20 BUY AMERICAN ACT-CONSTRUCTION MATERIALS UNDER TRADE AGREEMENTS \(FAR 52.225-11\) \(JAN 2004\)](#)..... ERROR! BOOKMARK NOT DEFINED.

[1.21 NOTICE OF BUY AMERICAN ACT REQUIREMENT--CONSTRUCTION MATERIALS UNDER TRADE AGREEMENTS \(FAR 52.225-12\) \(JAN 2004\)](#) ERROR! BOOKMARK NOT DEFINED.

[1.22 PERFORMANCE AND PAYMENT BONDS-- CONSTRUCTION \(FAR 52.228-15\) \(JULY 2000\)](#)
..... ERROR! BOOKMARK NOT DEFINED.

[1.23 ADDITIONAL BOND SECURITY \(FAR 52.228-2\) \(OCT 1997\)](#) .. ERROR! BOOKMARK NOT DEFINED.

[1.24 BOND PREMIUM ADJUSTMENT \(VAAR 852.228-70\) \(APR 1984\)](#) ERROR! BOOKMARK NOT DEFINED.

[1.25 PLEDGES OF ASSETS \(FAR 52.228-11\) \(FEB 1992\)](#) ERROR! BOOKMARK NOT DEFINED.

[1.26 INSURANCE - WORK ON A GOVERNMENT INSTALLATION \(FAR 52.228-5\) \(JAN 1997\)](#)
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[1.27 SUPPLEMENTAL INSURANCE REQUIREMENTS](#) ERROR! BOOKMARK NOT DEFINED.
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[1.29 FEDERAL, STATE, AND LOCAL TAXES \(FAR 52.229-3\) \(APR 2003\)](#) ERROR! BOOKMARK NOT DEFINED.
 [1.30 FEDERAL, STATE, AND LOCAL TAXES \(STATE AND LOCAL ADJUSTMENTS\) \(FAR 52.229-4\) \(APR 2003\)](#) ERROR! BOOKMARK NOT DEFINED.

[1.31 PAYMENTS UNDER FIXED-PRICE CONSTRUCTION CONTRACTS \(FAR 52.232-5\) \(SEPTEMBER 2002\)](#) ERROR! BOOKMARK NOT DEFINED.

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[1.35 PAYMENT BY ELECTRONIC FUNDS TRANSFER--OTHER THAN CENTRAL CONTRACTOR REGISTRATION \(FAR 52.232-34\) \(MAY 1999\)](#) ERROR! BOOKMARK NOT DEFINED.

[1.36 ASSIGNMENT OF CLAIMS \(FAR 52.232-23\) \(JAN 1986\)](#) ERROR! BOOKMARK NOT DEFINED.

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[1.39 PERFORMANCE OF WORK BY THE CONTRACTOR \(VAAR 852.236-72\) \(APR 1984\)](#) ERROR! BOOKMARK NOT DEFINED.

[1.40 LIMITATIONS ON SUBCONTRACTING \(FAR 52.219-14\) \(DEC 1996\)](#) ERROR! BOOKMARK NOT DEFINED.

[1.41 DIFFERING SITE CONDITIONS \(FAR 52.236-2\) \(APR 1984\)](#) . ERROR! BOOKMARK NOT DEFINED.

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[1.43 CHANGES - SUPPLEMENT \(FOR CHANGES OVER \\$500,000\) \(VAAR 852.236-88 \(A\)\) \(JUN 1987\)](#) ERROR! BOOKMARK NOT DEFINED.

[1.44 CHANGES - SUPPLEMENT \(FOR CHANGES COSTING \\$500,000 OR LESS\) \(VAAR 852.236-88 \(B\)\) \(JUN 1987\)](#) ERROR! BOOKMARK NOT DEFINED.

[1.45 SITE INVESTIGATION AND CONDITIONS AFFECTING THE WORK \(FAR 52.236-3\) \(APR 1984\)](#) ERROR! BOOKMARK NOT DEFINED.

[1.46 MATERIAL AND WORKMANSHIP \(FAR 52.236-5\) \(APR 1984\)](#) .. ERROR! BOOKMARK NOT DEFINED.

[1.47 SUPERINTENDENCE BY THE CONTRACTOR \(FAR 52.236-6\) \(APR 1984\)](#) ERROR! BOOKMARK NOT DEFINED.

[1.48 PERMITS AND RESPONSIBILITIES \(FAR 52.236-7\) \(NOV 1991\)](#) .. ERROR! BOOKMARK NOT DEFINED.

[1.49 OTHER CONTRACTS \(FAR 52.236-8\) \(APR 1984\)](#) .. ERROR! BOOKMARK NOT DEFINED.

[1.50 USE AND POSSESSION PRIOR TO COMPLETION \(FAR 52.236-11\) \(APR 1984\)](#) ERROR! BOOKMARK NOT DEFINED.

[1.51 CLEANING UP \(FAR 52.236-12\) \(APR 1984\)](#) ERROR! BOOKMARK NOT DEFINED.

[1.52 ACCIDENT PREVENTION \(FAR 52.236-13\) \(NOV 1991\)](#) ERROR! BOOKMARK NOT DEFINED.

[1.53 ACCIDENT PREVENTION \(VAAR 852.236-87\) \(SEP 1993\)](#) ERROR! BOOKMARK NOT DEFINED.

[1.54 SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION \(FAR 52.236-21\) \(FEB 1997\)](#) ERROR! BOOKMARK NOT DEFINED.

[1.55 SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION \(VAAR 852.236-71\) \(APR 1984\)](#) ERROR! BOOKMARK NOT DEFINED.

[1.56 INSPECTION OF CONSTRUCTION \(FAR 52.246-12\) \(AUG 1996\)](#) ERROR! BOOKMARK NOT DEFINED.

1.57 INSPECTION OF CONSTRUCTION (VAAR 852.236-74) (APR 1984) . ERROR! BOOKMARK NOT DEFINED.

1.58 VALUE ENGINEERING - CONSTRUCTION (FAR 52.248-3) (FEB 2000) ERROR! BOOKMARK NOT DEFINED.

1.59 DEFAULT (FIXED-PRICE CONSTRUCTION) (FAR 52.249-10) (APR 1984) ERROR! BOOKMARK NOT DEFINED.

1.60 GUARANTY (VAAR 852.236-75) (APR 1984) ERROR! BOOKMARK NOT DEFINED.

1.61 CORRESPONDENCE (VAAR 852.236-76) (APR 1984) ERROR! BOOKMARK NOT DEFINED.

1.62 REFERENCE TO "STANDARDS" (VAAR 852.236-77) (APR 1984) ERROR! BOOKMARK NOT DEFINED.

1.63 GOVERNMENT SUPERVISION (VAAR 852-236-78) (APR 1984) . ERROR! BOOKMARK NOT DEFINED.

1.64 DAILY REPORT OF WORKERS AND MATERIALS (VAAR 852.236-79) (APR 1984) ERROR! BOOKMARK NOT DEFINED.

1.65 SUBCONTRACTS AND WORK COORDINATION (VAAR 852.236-80) (//AND 852.236 - 81//) (APR 1984) ERROR! BOOKMARK NOT DEFINED.

1.66 SCHEDULE OF WORK PROGRESS (VAAR 852.236-84) (NOV 1984) .. ERROR! BOOKMARK NOT DEFINED.

1.67 WORKMEN'S COMPENSATION (VAAR 852.236-86) (APR 1984) . ERROR! BOOKMARK NOT DEFINED.

1.68 GENDER ERROR! BOOKMARK NOT DEFINED.

1.69 CONTRACTOR'S COST BREAKDOWN ERROR! BOOKMARK NOT DEFINED.

1.70 COMMERCIAL ADVERTISING (VAAR 852.270-4) (NOV 1984) .. ERROR! BOOKMARK NOT DEFINED.

1.71 SCHEDULE OF PAYMENTS FOR DESIGN SERVICES ... ERROR! BOOKMARK NOT DEFINED.

1.72 OWNERSHIP OF ORIGINAL DOCUMENTS ERROR! BOOKMARK NOT DEFINED.

1.73 RETENTION OF REVIEW DOCUMENTS ERROR! BOOKMARK NOT DEFINED.

1.74 CONTRACT DRAWINGS AND SPECIFICATIONS GOVERNMENT FURNISHED PLANNING INFORMATION ERROR! BOOKMARK NOT DEFINED.

1.75 COORDINATION WITH MEDICAL CENTER ERROR! BOOKMARK NOT DEFINED.

1.76 RESPONSIBILITY OF THE DESIGN-BUILD CONTRACTOR ERROR! BOOKMARK NOT DEFINED.

1.77 AWARD FEE EVALUATION ERROR! BOOKMARK NOT DEFINED.

1.78 CLAUSES INCORPORATED BY REFERENCE (FAR 52.252-2) (FEB 1998) ERROR! BOOKMARK NOT DEFINED.

SECTION 01001
GENERAL CONDITIONS

**01001.1 52.203-10 PRICE OR FEE ADJUSTMENT FOR ILLEGAL OR IMPROPER
ACTIVITY (JAN 1997)**

(a) The Government, at its election, may reduce the price of a fixed-price type contract and the total cost and fee under a cost- type contract by the amount of profit or fee determined as set forth in paragraph (b) of this clause if the head of the contracting activity or designee determines that there was a violation of subsection 27 (a) , (b) , or (c) of the Office of Federal Procurement Policy Act, as amended (41 U.S.C. 423), as implemented in section 3.104 of the Federal Acquisition Regulation.

(b) The price or fee reduction referred to in paragraph (a) of this clause shall be-

(1) For cost-plus-fixed-fee contracts, the amount of the fee specified in the contract at the time of award;

(2) For cost-plus-incentive-fee contracts, the target fee specified in the contract at the time of award, notwithstanding any minimum fee or "fee floor" specified in the contract.

(3) For cost-plus-award-fee contracts

(i) The base fee established in the contract at the time of contract award;

(ii) If no base fee is specified in the contract, 30 percent of the amount of each award fee otherwise payable to the Contractor for each award fee evaluation period or at each award fee determination point.

(4) For fixed-price-incentive contracts, the Government may-

(i) Reduce the contract target price and contract target profit both by an amount equal to the initial target profit specified in the contract at the time of contract award; or

(ii) If an immediate adjustment to the contract target price and contract target profit would have a significant adverse impact on the incentive price revision relationship under the contract, or adversely affect the contract financing provisions, the Contracting Officer may defer such adjustment until establishment of the total final price of the contract. The total final price established in accordance with the incentive price revision

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provisions of the contract shall be reduced by an amount equal to the initial target profit specified in the contract at the time of contract award and such reduced price shall be the total final contract price.

(5) For firm-fixed-price contracts, by 10 percent of the initial contract price or a profit amount determined by the Contracting Officer from records or documents in existence prior to the date of the contract award.

(c) The Government may, at its election, reduce a prime contractor's price or fee in accordance with the procedures of paragraph (b) of this clause for violations of the Act by its subcontractors by an amount not to exceed the amount of profit or fee reflected in the subcontract at the time the subcontract was first definitively priced.

(d) In addition to the remedies in paragraphs (a) and (c) of this clause, the Government may terminate this contract for default. The rights and remedies of the Government specified herein are not exclusive, and are in addition to any other rights and remedies provided by law or under this contract.

(End of Clause)

**01001.2 52.203-12 LIMITATION ON PAYMENTS TO INFLUENCE CERTAIN
FEDERAL TRANSACTIONS (JUNE 2003)**

(a) Definitions.

"Agency," as used in this clause, means executive agency as defined in 2.101.

"Covered Federal action," as used in this clause, means any of the following Federal actions:

- (1) The awarding of any Federal contract.
- (2) The making of any Federal grant.
- (3) The making of any Federal loan.
- (4) The entering into of any cooperative agreement.

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(5) The extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

"Indian tribe" and "tribal organization," as used in this clause, have the meaning provided in section 4 of the "Indian Self-Determination and Education Assistance Act (25 U.S.C. 450B) and include Alaskan Natives.

"Influencing or attempting to influence," as used in this clause, means making, with the intent to influence, any communication to or appearance before an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with any covered Federal action.

"Local government," as used in this clause, means a unit of government in a State and, if chartered, established, or otherwise recognized by a State for the performance of a governmental duty, including a local public authority, a special district, an intrastate district, a council of governments, a sponsor group representative organization, and any other instrumentality of a local government.

"Officer or employee of an agency," as used in this clause, includes the following individuals who are employed by an agency:

(1) An individual who is appointed to a position in the Government under title 5, United States Code, including a position under a temporary appointment.

(2) A member of the uniformed services, as defined in subsection 101(3), title 37, United States Code.

(3) A special Government employee, as defined in section 202, title 18, United States Code.

(4) An individual who is a member of a Federal advisory committee, as defined by the Federal Advisory Committee Act, title 5, United States Code, appendix 2.

"Person," as used in this clause, means an individual corporation, company, association, authority, firm, partnership, society, State, and local government, regardless of whether such entity is operated for profit, or not for profit. This term excludes an Indian tribe, tribal organization, or any other Indian organization with respect to expenditures specifically permitted by other Federal law.

"Reasonable compensation," as used in this clause, means with respect to a regularly employed officer or employee of any person, compensation that is consistent with the normal compensation for such officer or employee for work that is not furnished to, not funded by, or not furnished in cooperation with the Federal Government.

"Reasonable payment," as used in this clause, means, with respect to professional and other technical services, a payment in an amount that is consistent with the amount normally paid for such services in the private sector.

"Recipient," as used in this clause, includes the Contractor and all subcontractors. This term excludes an Indian tribe, tribal organization, or any other Indian organization with respect to expenditures specifically permitted by other Federal law.

"Regularly employed," as used in this clause, means, with respect to an officer or employee of a person requesting or receiving a Federal contract, an officer or employee who is employed by such person for at least 130 working days within 1 year immediately preceding the date of the submission that initiates agency consideration of such person for receipt of such contract. An officer or employee who is employed by such person for less than 130 working days within 1 year immediately preceding the date of the submission that initiates agency consideration of such person shall be considered to be regularly employed as soon as he or she is employed by such person for 130 working days.

"State," as used in this clause, means a State of the United States, the District of Columbia, or an outlying area of the United States, an agency or instrumentality of a State, and multi-State, regional, or interstate entity having governmental duties and powers.

(b) Prohibitions.

(1) Section 1352 of title 31, United States Code, among other things, prohibits a recipient of a Federal contract, grant, loan, or cooperative agreement from using appropriated funds to pay any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with any of the following covered Federal actions: the awarding of any Federal contract; the making of any Federal grant; the making of any Federal loan; the entering into of any cooperative agreement; or the modification of any Federal contract, grant, loan, or cooperative agreement.

(2) The Act also requires Contractors to furnish a disclosure if any funds other than Federal appropriated funds (including profit or fee received under a covered Federal transaction) have been paid, or will be paid, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with a Federal contract, grant, loan, or cooperative agreement.

(3) The prohibitions of the Act do not apply under the following conditions:

(i) Agency and legislative liaison by own employees.

(A) The prohibition on the use of appropriated funds, in subparagraph (b) (1) of this clause, does not apply in the case of a payment of reasonable compensation made to an officer or employee of a person requesting or receiving a covered Federal action if the payment is for agency and legislative liaison activities not directly related to a covered Federal action.

(B) For purposes of subdivision (b) (3) (i) (A) of this clause, providing any information specifically requested by an agency or Congress is permitted at any time.

(C) The following agency and legislative liaison activities are permitted at any time where they are not related to a specific solicitation for any covered Federal action:

(1) Discussing with an agency the qualities and characteristics (including individual demonstrations) of the person's products or services, conditions or terms of sale, and service capabilities.

(2) Technical discussions and other activities regarding the application or adaptation of the person's products or services for an agency's use.

(D) The following agency and legislative liaison activities are permitted where they are prior to formal solicitation of any covered Federal action -

(1) Providing any information not specifically requested but necessary for an agency to make an informed decision about initiation of a covered Federal action;

(2) Technical discussions regarding the preparation of an unsolicited proposal prior to its official submission; and

(3) Capability presentations by persons seeking awards from an agency pursuant to the provisions of the Small Business Act, as amended by Pub. L. 95-507, and subsequent amendments.

(E) Only those services expressly authorized by subdivision (b) (3) (i) (A) of this clause are permitted under this clause.

(ii) Professional and technical services.

(A) The prohibition on the use of appropriated funds, in subparagraph (b) (1) of this clause, does not apply in the case of -

(1) A payment of reasonable compensation made to an officer or employee of a person requesting or receiving a covered Federal action or an extension, continuation, renewal, amendment, or modification of a covered Federal action, if payment is for professional or technical services rendered directly in the preparation, submission, or negotiation of any bid, proposal, or application for that Federal action or for meeting requirements imposed by or pursuant to law as a condition for receiving that Federal action.

(2) Any reasonable payment to a person, other than an officer or employee of a person requesting or receiving a covered Federal action or an extension, continuation, renewal, amendment, or modification of a covered Federal action if the payment is for professional or technical services rendered directly in the preparation, submission, or negotiation of any bid, proposal, or application for that Federal action or for meeting requirements imposed by or pursuant to law as a condition for receiving that Federal action. Persons other than officers or employees of a person requesting or receiving a covered Federal action include consultants and trade associations.

(B) For purposes of subdivision (b) (3) (ii) (A) of this clause, "professional and technical services" shall be limited to advice and analysis directly applying any professional or technical discipline. For example, drafting of a legal document accompanying a bid or proposal by a lawyer is allowable. Similarly, technical advice provided by an engineer on the performance or operational capability of a piece of equipment rendered directly in the negotiation of a contract is allowable. However, communications with the intent to influence made by a professional (such as a licensed lawyer) or a technical person (such as a licensed accountant) are not allowable under this section unless they provide advice and analysis directly applying their professional or technical expertise and unless the advice or analysis is rendered directly or solely in the preparation, submission or negotiation of a covered Federal action. Thus, for example, communications with the intent to influence made by a lawyer that do not

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provide legal advice or analysis directly and solely related to the legal aspects of his or her client's proposal, but generally advocate one proposal over another are not allowable under this section because the lawyer is not providing professional legal services. Similarly, communications with the intent to influence made by an engineer providing an engineering analysis prior to the preparation or submission of a bid or proposal are not allowable under this section since the engineer is providing technical services but not directly in the preparation, submission or negotiation of a covered Federal action.

(C) Requirements imposed by or pursuant to law as a condition for receiving a covered Federal award include those required by law or regulation and any other requirements in the actual award documents.

(D) Only those services expressly authorized by subdivisions (b) (3) (ii) (A) (1) and (2) of this clause are permitted under this clause.

(E) The reporting requirements of FAR 3.803(a) shall not apply with respect to payments of reasonable compensation made to regularly employed officers or employees of a person.

(c) Disclosure.

(1) The Contractor who requests or receives from an agency a Federal contract shall file with that agency a disclosure form, OMB standard form LLL, Disclosure of Lobbying Activities, if such person has made or has agreed to make any payment using nonappropriated funds (to include profits from any covered Federal action), which would be prohibited under subparagraph (b) (1) of this clause, if paid for with appropriated funds.

(2) The Contractor shall file a disclosure form at the end of each calendar quarter in which there occurs any event that materially affects the accuracy of the information contained in any disclosure form previously filed by such person under subparagraph (c) (1) of this clause. An event that materially affects the accuracy of the information reported includes -

(i) A cumulative increase of \$25,000 or more in the amount paid or expected to be paid for influencing or attempting to influence a covered Federal action; or

(ii) A change in the person(s) or individual(s) influencing or attempting to influence a covered Federal action; or

(iii) A change in the officer(s), employee(s), or Member(s) contacted to influence or attempt to influence a covered Federal action.

(3) The Contractor shall require the submittal of a certification, and if required, a disclosure form by any person who requests or received any subcontract exceeding \$100,000 under the Federal contract.

(4) All subcontractor disclosure forms (but not certifications) shall be forwarded from tier to tier until received by the prime Contractor. The prime Contractor shall submit all disclosures to the Contracting Officer at the end of the calendar quarter in which the disclosure form is submitted by the subcontractor. Each subcontractor certification shall be retained in the subcontractor file of the awarding Contractor.

(d) Agreement. The Contractor agrees not to make any payment prohibited by this clause.

(e) Penalties.

(1) Any person who makes an expenditure prohibited under paragraph (a) of this clause or who fails to file or amend the disclosure form to be filed or amended by paragraph (b) of this clause shall be subject to civil penalties as provided for by 31 U.S.C. 1352. An imposition of a civil penalty does not prevent the Government from seeking any other remedy that may be applicable.

(2) Contractors may rely without liability on the representation made by their subcontractors in the certification and disclosure form.

(f) Cost allowability. Nothing in this clause makes allowable or reasonable any costs which would otherwise be unallowable or unreasonable. Conversely costs made specifically unallowable by the requirements in this clause will not be made allowable under any other provision.

(End of Clause)

**01001.3 52.209-6 PROTECTING THE GOVERNMENT'S INTEREST WHEN
SUBCONTRACTING WITH CONTRACTORS DEBARRED, SUSPENDED,
OR PROPOSED FOR DEBARMENT (JUL 1995)**

(a) The Government suspends or debars Contractors to protect the Government's interests. The Contractor shall not enter into any subcontract in excess of \$25,000 with a Contractor that is debarred, suspended, or proposed for debarment unless there is a compelling reason to do so.

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(b) The Contractor shall require each proposed first-tier subcontractor, whose subcontract will exceed \$25,000, to disclose to the Contractor, in writing, whether as of the time of award of the subcontract, the subcontractor, or its principals, is or is not debarred, suspended, or proposed for debarment by the Federal Government.

(c) A corporate officer or a designee of the Contractor shall notify the Contracting Officer, in writing, before entering into a subcontract with a party that is debarred, suspended, or proposed for debarment (see FAR 9.404 for information on the List of Parties Excluded from Federal Procurement and Nonprocurement Programs). The notice must include the following:

(1) The name of the subcontractor.

(2) The Contractor's knowledge of the reasons for the subcontractor being on the List of Parties Excluded from Procurement Programs.

(3) The compelling reason(s) for doing business with the subcontractor notwithstanding its inclusion on the List of Parties Excluded From Federal Procurement and Nonprocurement Programs.

(4) The systems and procedures the Contractor has established to ensure that it is fully protecting the Government's interests when dealing with such subcontractor in view of the specific basis for the party's debarment, suspension, or proposed debarment.

(End of Clause)

01001.4 52.211-6 BRAND NAME OR EQUAL (AUG 1999).

(a) If an item in this solicitation is identified as "brand name or equal," the purchase description reflects the characteristics and level of quality that will satisfy the Government's needs. The salient physical, functional, or performance characteristics that "equal" products must meet are specified in the solicitation.

(b) To be considered for award, offers of "equal" products, including "equal" products of the brand name manufacturer, must--

(1) Meet the salient physical, functional, or performance characteristic specified in this solicitation;

(2) Clearly identify the item by--

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(i) Brand name, if any; and

(ii) Make or model number;

(3) Include descriptive literature such as illustrations, drawings, or a clear reference to previously furnished descriptive data or information available to the Contracting Officer; and

(4) Clearly describe any modifications the offeror plans to make in a product to make it conform to the solicitation requirements. Mark any descriptive material to clearly show the modifications.

(c) The Contracting Officer will evaluate "equal" products on the basis of information furnished by the offeror or identified in the offer and reasonably available to the Contracting Officer. The Contracting Officer is not responsible for locating or obtaining any information not identified in the offer.

(d) Unless the offeror clearly indicates in its offer that the product being offered is an "equal" product, the offeror shall provide the brand name product referenced in the solicitation.

(End of Provision)

**01001.5 52.211-10 COMMENCEMENT, PROSECUTION, AND COMPLETION
OF WORK (APR 1984)**

The Contractor shall be required to (a) commence work under this contract within calendar days after the date the Contractor receives the notice to proceed, (b) prosecute the work diligently, and (c) complete the entire work ready for use not later than 270 calendar days after receipt of notice to proceed. The time stated for completion shall include final cleanup of the premises.

(End of Clause)

**01001.6 52.214-27 PRICE REDUCTION FOR DEFECTIVE COST OR PRICING
DATA--MODIFICATIONS--SEALED BIDDING (OCT 1997)**

(a) This clause shall become operative only for any modification to this contract involving aggregate increases and/or decreases in costs, plus applicable profits, expected to exceed the threshold for the submission of cost or pricing data at FAR 15.804-2(a)(1), except that this clause does not apply to a modification if an exception under FAR 15.804-1 applies.

(1) Based on adequate price competition;

(2) Based on established catalog or market prices of commercial items sold in substantial quantities to the general public; or

(3) Set by law or regulation.

(b) If any price, including profit, negotiated in connection with any modification under this clause, was increased by any significant amount because (1) the Contractor or subcontractor furnished cost or pricing data that were not complete, accurate, and current as certified in its Certificate of Current Cost or Pricing Data, (2) a subcontractor or prospective subcontractor furnished the Contractor cost or pricing data that were not complete, accurate, and current as certified in Contractor's Certificate of Current Cost or Pricing Data, or (3) any of these parties furnished data of any description that were not accurate, the price shall be reduced accordingly and the contract shall be modified to reflect the reduction. This right to a price reduction is limited to that resulting from defects in data relating to modifications for which this clause becomes operative under paragraph (a) above.

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(c) Any reduction in the contract price under paragraph (b) above due to defective data from a prospective subcontractor that was not subsequently awarded the subcontract shall be limited to the amount, plus the applicable overhead and profit markup, by which (1) the actual subcontract or (2) the actual cost to the Contractor, if there was no subcontract, was less than the prospective subcontract cost estimate submitted by the Contractor; provided, that the actual subcontract price was not itself affected by defective cost or pricing data.

(d) (1) If the Contracting Officer determines under paragraph (b) of this clause that a price or cost reduction should be made, the Contractor agrees not to raise the following matters as a defense --

(i) The Contractor or subcontractor was a sole source supplier or otherwise was in a superior bargaining position and thus the price of the contract would not have been modified even if accurate, complete, and current cost or pricing data had been submitted.

(ii) The Contracting Officer should have known that the cost or pricing data in issue were defective even though the Contractor or subcontractor took no affirmative action to bring the character of the data to the attention of the Contracting Officer.

(iii) The contract was based on an agreement about the total cost of the contract and there was no agreement about the cost of each item procured under the contract; or

(iv) The Contractor or subcontractor did not submit a Certificate of Current Cost or Pricing Data.

(2) (i) Except as prohibited by subdivision (d) (2) (ii) of this clause, an offset in an amount determined appropriate by the Contracting Officer based upon the facts shall be allowed against the amount of a contract price reduction if --

(A) The Contractor certifies to the Contracting Officer that, to the best of the Contractor's knowledge and belief, the Contractor is entitled to the offset in the amount requested; and

(B) The Contractor proves that the cost or pricing data were available before the date of agreement on the price of the contract (or price of the modification) and that the data were not submitted before such date.

(ii) An offset shall not be allowed if --

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(A) The understated data was known by the Contractor to be understated when the Certificate of Current Cost or Pricing Data was signed; or

(B) The Government proves that the facts demonstrate that the contract price would not have increased in the amount to be offset even if the available data had been submitted before the date of agreement on price.

(e) If any reduction in the contract price under this clause reduces the price of items for which payment was made prior to the date of the modification reflecting the price reduction, the Contractor shall be liable to and shall pay the United States at the time such overpayment is repaid --

(1) Simple interest on the amount of such overpayment to be computed from the date(s) of overpayment to the Contractor to the date the Government is repaid by the Contractor at the applicable underpayment rate effective for each quarter prescribed by the Secretary of the Treasury under 26 U.S.C. 6621(a)(2); and

(2) A penalty equal to the amount of the overpayment, if the Contractor or subcontractor knowingly submitted cost or pricing data which were incomplete, inaccurate, or noncurrent.

(End of Clause)

**01001.7 52.214-28 SUBCONTRACTOR COST OR PRICING DATA--
MODIFICATIONS--SEALED BIDDING (OCT 1997)**

(a) The requirements of paragraphs (b) and (c) of this clause shall (1) become operative only for any modification to this contract involving aggregate increases and/or decreases in costs, plus applicable profits, expected to exceed the threshold for submission of cost or pricing data at (FAR) 48 CFR 15.804-2(a)(1), and (2) be limited to such modifications.

(b) Before awarding any subcontract expected to exceed the threshold for submission of cost or pricing data at FAR 15.804- 2(a)(1), on the date of agreement on price or the date of award, whichever is later; or before pricing any subcontract modifications involving aggregate increases and/or decreases in costs, plus applicable profits, expected to exceed the threshold for submission of cost or pricing data at FAR 15.804-2(a)(1), the Contractor shall require the subcontractor to submit cost or pricing data (actually or by specific identification in writing), unless an exception under FAR 15.804-1 applies.

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(1) Based on adequate price competition;

(2) Based on established catalog or market prices of commercial items sold in substantial quantities to the general public; or

(3) Set by law or regulation.

(c) The Contractor shall require the subcontractor to certify in substantially the form prescribed in subsection 15.804-4 of the Federal Acquisition Regulation that, to the best of its knowledge and belief, the data submitted under paragraph (b) above were accurate, complete, and current as of the date of agreement on the negotiated price of the subcontract or subcontract modification.

(d) The Contractor shall insert the substance of this clause, including this paragraph (d), in each subcontract that, when entered into, exceeds the threshold for submission of cost or pricing data at FAR 15.804-2(a)(1).

(End of Clause)

01001.8 52.216-1 TYPE OF CONTRACT (APR 1984)

The Government contemplates award of a Fixed Price contract resulting from this solicitation.

(End of Provision)

01001.9 52.219-18 NOTIFICATION OF COMPETITION LIMITED TO ELIGIBLE 8(A) CONCERNS (JUNE 2003)

(a) Offers are solicited only from small business concerns expressly certified by the Small Business Administration (SBA) for participation in the SBA's 8(a) Program and which meet the following criteria at the time of submission of offer -

(1) The Offeror is in conformance with the 8(a) support limitation set forth in its approved business plan; and

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(2) The Offeror is in conformance with the Business Activity Targets set forth in its approved business plan or any remedial action directed by the SBA.

(b) By submission of its offer, the Offeror represents that it meets all of the criteria set forth in paragraph (a) of this clause.

(c) Any award resulting from this solicitation will be made to the Small Business Administration, which will subcontract performance to the successful 8(a) offeror selected through the evaluation criteria set forth in this solicitation.

(d) (1) Agreement. A small business concern submitting an offer in its own name shall furnish, in performing the contract, only end items manufactured or produced by small business concerns in the United States or its outlying areas. If this procurement is processed under simplified acquisition procedures and the total amount of this contract does not exceed \$25,000, a small business concern may furnish the product of any domestic firm. This paragraph does not apply to construction or service contracts.

(2) The will notify the Department of Veterans Affairs Contracting Officer in writing immediately upon entering an agreement (either oral or written) to transfer all or part of its stock or other ownership interest to any other party.

(End of Clause)

**01001.10 52.222-4 CONTRACT WORK HOURS AND SAFETY STANDARDS
ACT--OVERTIME COMPENSATION (SEPT 2000)**

(a) Overtime requirements. No Contractor or subcontractor employing laborers or mechanics (see Federal Acquisition Regulation 22.300) shall require or permit them to work over 40 hours in any workweek unless they are paid at least 1 and 1/2 times the basic rate of pay for each hour worked over 40 hours.

(b) Violation; liability for unpaid wages; liquidated damages. The responsible Contractor and subcontractor are liable for unpaid wages if they violate the terms in paragraph (a) of this clause. In addition, the Contractor and subcontractor are liable for liquidated damages payable to the

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Government. The Contracting Officer will assess liquidated damages at the rate of \$10 per affected employee for each calendar day on which the employer required or permitted the employee to work in excess of the standard workweek of 40 hours without paying overtime wages required by the Contract Work Hours and Safety Standards Act.

(c) Withholding for unpaid wages and liquidated damages. The Contracting Officer will withhold from payments due under the contract sufficient funds required to satisfy any Contractor or subcontractor liabilities for unpaid wages and liquidated damages. If amounts withheld under the contract are insufficient to satisfy Contractor or subcontractor liabilities, the Contracting Officer will withhold payments from other Federal or Federally assisted contracts held by the same Contractor that are subject to the Contract Work Hours and Safety Standards Act.

(d) Payrolls and basic records.

(1) The Contractor and its subcontractors shall maintain payrolls and basic payroll records for all laborers and mechanics working on the contract during the contract and shall make them available to the Government until 3 years after contract completion. The records shall contain the name and address of each employee, social security number, labor classifications, hourly rates of wages paid, daily and weekly number of hours worked, deductions made, and actual wages paid. The records need not duplicate those required for construction work by Department of Labor regulations at 29 CFR 5.5(a)(3) implementing the Davis-Bacon Act.

(2) The Contractor and its subcontractors shall allow authorized representatives of the Contracting Officer or the Department of Labor to inspect, copy, or transcribe records maintained under paragraph (d)(1) of this clause. The Contractor or subcontractor also shall allow authorized representatives of the Contracting Officer or Department of Labor to interview employees in the workplace during working hours.

(e) Subcontracts. The Contractor shall insert the provisions set forth in paragraphs (a) through (d) of this clause in subcontracts exceeding \$100,000 and require subcontractors to include these provisions in any lower tier subcontracts. The Contractor shall be responsible for compliance by any subcontractor or lower-tier subcontractor with the provisions set forth in paragraphs (a) through (d) of this clause.

(End of Clause)

(a) All laborers and mechanics employed or working upon the site of the work will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR Part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the Contractor and such laborers and mechanics. Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph (d) of this clause; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such period. Such laborers and mechanics shall be paid not less than the appropriate wage rate and fringe benefits in the wage determination for the classification of work actually performed, without regard to skill, except as provided in the clause entitled Apprentices and Trainees. Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein; provided, that the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classifications and wage rates conformed under paragraph (b) of this clause) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the Contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

(b)(1) The Contracting Officer shall require that any class of laborers or mechanics which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The Contracting Officer shall approve an additional classification and wage rate and fringe benefits therefore only when all the following criteria have been met:

(i) The work to be performed by the classification requested is not performed by a classification in the wage determination.

(ii) The classification is utilized in the area by the construction industry.

(iii) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(2) If the Contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the Contracting Officer agree on the classification and wage rate (including the amount

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designated for fringe benefits, where appropriate), a report of the action taken shall be sent by the Contracting Officer to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, DC 20210. The administrator or an authorized representative will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the Contracting Officer or will notify the Contracting Officer within the 30-day period that additional time is necessary.

(3) In the event the contractor, the laborers or mechanics to be employed in the classification, or their representatives, and the Contracting Officer do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the Contracting Officer shall refer the questions, including the views of all interested parties and the recommendation of the Contracting Officer, to the Administrator of the Wage and Hour Division for Determination. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the Contracting Officer or will notify the Contracting Officer within the 30-day period that additional time is necessary.

(4) The wage rate (including fringe benefits, where appropriate) determined pursuant to subparagraphs (b) (2) and (b) (3) of this clause shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

(c) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the Contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(d) If the Contractor does not make payments to a trustee or other third person, the contractor may consider a part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program: provided, that the Secretary of Labor has found, upon the written request of the Contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor any require the Contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

(End of Clause)

01001.12 52.222-7 WITHHOLDING OF FUNDS (FEB 1988)

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The Contracting Officer shall, upon his or her own action or upon written request of an authorized representative of the Department of Labor, withhold or cause to be withheld from the Contractor under this contract or any other Federal contract with the same Prime Contractor, or any other Federally assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same Prime Contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work, all or part of the wages required by the contract, the Contracting Officer may, after written notice to the Contractor, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

(End of Clause)

01001.13 52.222-8 PAYROLLS AND BASIC RECORDS (FEB 1988)

(a) Payrolls and basic records relating thereto shall be maintained by the Contractor during the course of the work and preserved for a period of 3 years thereafter for all laborers and mechanics working at the site of the work. Such records shall contain the name, address, and social security number of each such work, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made, and actual wages paid. Whenever the Secretary of Labor has found, under paragraph (d) of the clause entitled Davis-Bacon Act, that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the Contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

(b)(1) the Contractor shall submit weekly for each week in which any contract work is performed a copy of all payrolls to the Contracting Officer. The payrolls submitted shall set out accurately and completely all of the information required to be maintained under paragraph (a) of this clause. This information may be submitted in any form desired. Optional Form WH-347 (Federal Stock Number 029-005-00014-1) is available for this purpose and may

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be purchased from the Superintendent of Documents, U.S. government Printing Office, Washington, DC 20402. the Prime Contractor is responsible for the submission of copies of payrolls by all subcontractors.

(2) Each payroll submitted shall be accompanied by a "Statement of Compliance." signed by the Contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify -

(i) that the payroll for the payroll period contains the information required to be maintained under paragraph (a) of this clause and that such information is correct and complete:

(ii) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in the Regulations, 29 CFR Part 3; and

(iii) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(3) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WHs-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by subparagraph (b)(2) of this clause.

(4) The falsification of any of the certifications in this clause may subject the Contractor or subcontractor to civil or criminal prosecution under Section 1001 of Title 18 and Section 3729 of title 31 of the United States Code.

(c) the Contractor or subcontractor shall make the records required under paragraph (a) of this clause available for inspection, copying, or transcription by the Contracting Officer or authorized representatives of the Contracting Officer or the Department of Labor. The Contractor or subcontractor shall permit the Contracting Officer or representatives of the Contracting Officer or the Department of Labor to interview employees during working hours on the job. If the Contractor or subcontractor fails to submit required records or to make them available, the Contracting Officer may, after written notice to the Contractor, take such action as may be necessary to cause the suspension of any further payment. furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

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(End of Clause)

01001.14 52.222-9 APPRENTICES AND TRAINEES (FEB 1988)

(a) Apprentices. Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Bureau of Apprenticeship and Training, or with a State Apprenticeship Agency recognized by the Bureau, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Bureau of Apprenticeship and Training or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the Contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated in this paragraph, shall be paid not less than the applicable wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the Contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the bureau of Apprenticeship and Training, or a State apprenticeship Agency recognized by the Bureau, withdraws approval of an apprenticeship program, the Contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(b) Trainees. Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the

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U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainees shall be paid the full amount of fringe benefits listed in the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate in the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate in the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate in the wage determination for the work actually performed. In the event the employment and Training Administration withdraws approval of a training program, the Contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(c) Equal employment opportunity. The utilization of apprentices, trainees, and journeymen under this clause shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, and 29 CFR Part 30.

(End of Clause)

**01001.15 52.222-10 COMPLIANCE WITH COPELAND ACT REQUIREMENTS
(FEB 1988)**

The Contractor shall comply with the requirements of 29 CFR Part 3, which are hereby incorporated by reference in this contract.

(End of Clause)

01001.16 52.222-11 SUBCONTRACTS (LABOR STANDARDS) (FEB 1988)

(a) The Contractor or subcontractor shall insert in any subcontracts the clauses entitled Davis-Bacon Act, contract Work Hours and Safety Standards Act - Overtime Compensation, Apprentices and Trainees, Payrolls and Basic

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Records, Compliance with Copeland Act Requirements, Withholding of Funds, Subcontracts (Labor Standards), Contract Termination - Debarment. Disputes concerning Labor Standards. Compliance with Davis-Bacon and Related Act Regulations, and Certification of Eligibility, and such other clauses as the Contracting Officer may, by appropriate instructions, require, and also a clause requiring subcontractors to include these clauses in any lower tier subcontracts. The Prime Contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with all the contract clauses cited in this paragraph.

(b) (1) Within 14 days after award of the contract, the Contractor shall deliver to the Contracting Officer shall deliver to the Contracting Officer a completed Statement and Acknowledgment Form (SF 1413) for each subcontract, including the subcontractor's signed and dated acknowledgement that the clauses set forth in paragraph (a) of this clause have been included in the subcontract.

(2) Within 14 days after the award of any subsequently awarded subcontract the Contractor shall deliver to the Contracting Officer an updated completed SF 1413 for such additional subcontract.

(End of Clause)

01001.17 52.222-12 CONTRACT TERMINATION - DEBARMENT (FEB 1988)

A breach of the contract clauses entitled Davis-Bacon act, Contract work Hours and Safety Standards act - Overtime Compensation, Apprentices and Trainees. Payrolls and Basic Records, Compliance with Copeland Act Requirements. Subcontracts (Labor Standards), Compliance With Davis-Bacon and Related Act Regulations, or Certification of Eligibility may be grounds for termination of the contract, and for debarment as a Contractor and subcontractor as provided in 29 CFR 5.12.

(End of Clause)

01001.18 52.222-13 COMPLIANCE WITH DAVIS-BACON AND RELATED ACT REGULATIONS (FEB 1988)

All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR Parts 1, 3, and, 5 are hereby incorporated by reference in this contract.

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(End of Clause)

**01001.19 52.222-14 DISPUTES CONCERNING LABOR STANDARDS
(FEB 1988)**

The United States Department of Labor has set forth in 29 CFR Parts 5, 6, and 7 procedures for resolving disputes concerning labor standards requirements. Such disputes shall be resolved in accordance with those procedures and not the disputes clause of this contract. disputes within the meaning of this clause include disputes between the Contractor (or any of its subcontractors) and the contracting agency, the U.S. Department of Labor, or the employees or their representatives.

(End of Clause)

01001.20 52.222-15 CERTIFICATION OF ELIGIBILITY (FEB 1988)

(a) By entering into this contract, the Contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the Contractor's firm is a person or firm ineligible to be awarded government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(b) No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(c) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001.

(End of Clause)

**01001.21 52.222-23 NOTICE OF REQUIREMENT FOR AFFIRMATIVE ACTION
 TO ENSURE EQUAL EMPLOYMENT OPPORTUNITY FOR CONSTRUCTION
 (FEB 1999)**

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

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

Goals for minority participation for each trade	Goals for female participation for each trade
Trade 6.2% of Contractor Aggregate Work Force	Trade 6.9% of Contractor Aggregate Work Force

(Goals are attached at the end of this provision)

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

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

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from Contractor to Contractor, or from project to project, for the sole purpose of meeting the Contractor's goals shall be a violation of the contract, Executive Order 11246, as amended, and the regulations in 41 CFR 60-4. Compliance with the goals will be measured against the total work hours performed.

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

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

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

(3) Estimated dollar amount of the subcontract;

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

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

(e) As used in this Notice, and in any contract resulting from this solicitation, the "covered area" is:

(End of Provision)

01001.22 52.223-6 DRUG-FREE WORKPLACE (MAY 2001)

(a) Definitions. As used in this clause,

"Controlled substances" means a controlled substance in schedules I through V of section 202 of the Controlled Substances Act (21 U.S.C. 812) and as further defined in regulation at 21 CFR 1308.11-1308.15.

"Conviction" means a finding of guilt (including a plea of nolo contendere) or imposition of sentence, or both, by any judicial body charged

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with the responsibility to determine violations of the Federal or State criminal drug statutes.

"Criminal drug statute" means a Federal or non-Federal criminal statute involving the manufacture, distribution, dispensing, possession or use of any controlled substance.

"Drug-free workplace" means the site(s) for the performance of work done by the Contractor in connection with a specific contract where employees of the Contractor are prohibited from engaging in the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance.

"Employee" means an employee of a Contractor directly engaged in the performance of work under a Government contract. "Directly engaged" is defined to include all direct cost employees and any other Contractor employee who has other than a minimal impact or involvement in contract performance.

"Individual" means an offeror/contractor that has no more than one employee including the offeror/contractor.

(b) The Contractor, if other than an individual, shall--within 30 days after award (unless a longer period is agreed to in writing for contracts of 30 days or more performance duration); or as soon as possible for contracts of less than 30 days performance duration--

(1) Publish a statement notifying its employees that the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance is prohibited in the contractor's workplace and specifying the actions that will be taken against employees for violations of such prohibition;

(2) Establish an ongoing drug-free awareness program to inform such employees about--

(i) The dangers of drug abuse in the workplace;

(ii) The contractor's policy of maintaining a drug-free workplace;

(iii) Any available drug counseling, rehabilitation, and employee assistance programs; and

(iv) The penalties that may be imposed upon employees for drug abuse violations occurring in the workplace.

(3) Provide all employees engaged in performance of the contract with a copy of the statement required by subparagraph (b) (1) of this clause;

(4) Notify such employees in writing in the statement required by subparagraph (b) (1) of this clause, that as a condition of continued employment on this contract, the employee will-

(i) Abide by the terms of the statement; and

(ii) Notify the employer in writing of the employee's conviction under a criminal drug statute for a violation occurring in the workplace no later than 5 days after such conviction;

(5) Notify the Contracting Officer in writing within 10 calendar days after receiving notice under subdivision (a) (4) (ii) of this clause, from an employee or otherwise receiving actual notice of such conviction. The notice shall include the position title of the employee;

(6) Within 30 days after receiving notice under subparagraph (b) (4) (ii) of this provision of a conviction, take one of the following actions with respect to any employee who is convicted of a drug abuse violation occurring in the workplace:

(i) Taking appropriate personnel action against such employee, up to and including termination; or

(ii) Require such employee to satisfactorily participate in a drug abuse assistance or rehabilitation program approved for such purposes by a Federal, State, or local health, law enforcement, or other appropriate agency; and

(7) Make a good faith effort to maintain a drug-free workplace through implementation of subparagraphs (b) (1) through (b) (6) of this clause.

(c) The Contractor, if an individual, agrees by award of the contract or acceptance of a purchase order, not to engage in the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance while performing this contract.

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(d) In addition to other remedies available to the Government, the Contractor's failure to comply with the requirements of paragraph (b) and (c) of this clause may, pursuant to FAR 23.506, render the contractor subject to suspension of contract payments, termination of the contract for default, and suspension or debarment.

(End of Clause)

01001.23 52.223-14 TOXIC CHEMICAL RELEASE REPORTING (AUG 2003)

(a) Unless otherwise exempt, the Contractor, as owner or operator of a facility used in the performance of this contract, shall file by July 1 for the prior calendar year an annual Toxic Chemical Release Inventory Form (Form R) as described in sections 313(a) and (g) of the Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA) (42 U.S.C. 11023(a) and (g)), and section 6607 of the Pollution Prevention Act of 1990 (PPA) (42 U.S.C. 13106). The Contractor shall file, for each facility subject to the Form R filing and reporting requirements, the annual Form R throughout the life of the contract.-

(b) A Contractor-owned or -operated facility used in the performance of this contract is exempt from the requirement to file an annual Form R if--

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

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

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

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

(i) Major group code 10 (except 1011, 1081, and 1094).

(ii) Major group code 12 (except 1241).

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(iii) Major group codes 20 through 39.

(iv) Industry code 4911, 4931, or 4939 (limited to facilities that combust coal and/or oil for the purpose of generating power for distribution in commerce).

(v) Industry code 4953 (limited to facilities regulated under the Resource Conservation and Recovery Act, Subtitle C (42 U.S.C. 6921, et seq.)), 5169, 5171, or 7389 (limited to facilities primarily engaged in solvent recovery services on a contract or fee basis); or

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

(c) If the Contractor has certified to an exemption in accordance with one or more of the criteria in paragraph (b) of this clause, and after award of the contract circumstances change so that any of its owned or operated facilities used in the performance of this contract is no longer exempt--

(1) The Contractor shall notify the Contracting Officer; and-

(2) The Contractor, as owner or operator of a facility used in the performance of this contract that is no longer exempt, shall (i) submit a Toxic Chemical Release Inventory Form (Form R) on or before July 1 for the prior calendar year during which the facility becomes eligible; and (ii) continue to file the annual Form R for the life of the contract for such facility.-

(d) The Contracting Officer may terminate this contract or take other action as appropriate, if the Contractor fails to comply accurately and fully with the EPCRA and PPA toxic chemical release filing and reporting requirements.

(e) Except for acquisitions of commercial items as defined in FAR Part 2, the Contractor shall--

(1) For competitive subcontracts expected to exceed \$100,000 (including all options), include a solicitation provision substantially the same as the provision at FAR 52.223-13, Certification of Toxic Chemical Release Reporting; and

(2) Include in any resultant subcontract exceeding \$100,000 (including all options), the substance of this clause, except this paragraph (e).

(End of Clause)

**01001.24 52.225-9 BUY AMERICAN ACT--CONSTRUCTION MATERIALS
(JUNE 2003)**

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

Component means any article, material, or supply incorporated directly into construction materials.

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

Cost of components means--

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

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

Domestic construction material means--

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

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

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

United States means the 50 States, the District of Columbia, and outlying areas.

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

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

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

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

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

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

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

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

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

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

(B) Unit of measure;

(C) Quantity;

(D) Price;

(E) Time of delivery or availability;

(F) Location of the construction project;

(G) Name and address of the proposed supplier; and

(H) A detailed justification of the reason for use of foreign construction materials cited in accordance with paragraph (b) (3) of this clause.

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

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

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

satisfactory explanation, the Contracting Officer need not make a determination.

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

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

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

Construction material description	Unit of Measure (dollars) /1/	Unit of Quantity	Price

--			
Item 1:			
Foreign construction material	
		
Domestic construction material	
		
Item 2:			
Foreign construction material	
		
Domestic constructionmaterial	
		

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

(End of Clause)

01001.25 825.108 EXCEPTED ARTICLES, MATERIALS AND SUPPLIES

The following items are added to the list of exceptions contained in FAR 25.108(d):

Glass, Wire

Glass, Lead

Insulin, Human

01001.26 52.227-1 AUTHORIZATION AND CONSENT (JUL 1995)

(a) The Government authorizes and consents to all use and manufacture, in performing this contract or any subcontract at any tier, of any invention described in and covered by a United States patent (1) embodied in the structure or composition of any article the delivery of which is accepted by the Government under this contract or (2) used in machinery, tools, or methods whose use necessarily results from compliance by the Contractor or a subcontractor with (i) specifications or written provisions forming a part of this contract or (ii) specific written instructions given by the Contracting Officer directing the manner of performance. The entire liability to the Government for infringement of a patent of the United States shall be determined solely by the provisions of the indemnity clause, if any, included in this contract or any subcontract hereunder (including any lower-tier subcontract), and the Government assumes liability for all other infringement to the extent of the authorization and consent hereinabove granted.

(b) The Contractor agrees to include, and require inclusion of, this clause, suitably modified to identify the parties, in all subcontracts at any tier for supplies or services (including construction, architect-engineer services, and materials, supplies, models, samples, and design or testing services expected to exceed the simplified acquisition threshold; however, omission of this clause from any subcontract, including those at or below the simplified acquisition threshold, does not affect this authorization and consent.

(End of Clause)

**01001.27 52.227-2 NOTICE AND ASSISTANCE REGARDING PATENT
COPYRIGHT INFRINGEMENT (AUG 1996)**

(a) The Contractor shall report to the Contracting Officer, promptly and in reasonable written detail, each notice or claim of patent or copyright infringement based on the performance of this contract of which the Contractor has knowledge.

(b) In the event of any claim or suit against the Government on account of any alleged patent or copyright infringement arising out of the performance of this contract or out of the use of any supplies furnished or work or services performed under this contract, the Contractor shall furnish to the Government, when requested by the Contracting Officer, all evidence and information in possession of the Contractor pertaining to such suit or claim. Such evidence and information shall be furnished at the expense of the Government except where the Contractor has agreed to indemnify the Government.

(c) The Contractor agrees to include, and require inclusion of, this clause in all subcontracts at any tier for supplies or services (including construction and architect-engineer subcontracts and those for material, supplies, models, samples, or design or testing services) expected to exceed the simplified acquisition threshold at FAR 2.101.

(End of Clause)

01001.28 52.228-1 BID GUARANTEE (SEP 1996)

(a) Failure to furnish a bid guarantee in the proper form and amount, by the time set for opening of bids, may be cause for rejection of the bid.

(b) The bidder shall furnish a bid guarantee in the form of a firm commitment, e.g., bid bond supported by good and sufficient surety or sureties acceptable to the Government, postal money order, certified check, cashier's check, irrevocable letter of credit, or, under Treasury Department regulations, certain bonds or notes of the United States. The Contracting Officer will return bid guarantees, other than bid bonds, (1) to unsuccessful bidders as soon as practicable after the opening of bids, and (2) to the successful bidder upon execution of contractual documents and bonds (including any necessary coinsurance or reinsurance agreements), as required by the bid as accepted.-

(c) The amount of the bid guarantee shall be percent of the bid price or , whichever is less.-

(d) If the successful bidder, upon acceptance of its bid by the Government within the period specified for acceptance, fails to execute all contractual documents or furnish executed bond(s) within 10 days after receipt of the forms by the bidder, the Contracting Officer may terminate the contract for default.

(e) In the event the contract is terminated for default, the bidder is liable for any cost of acquiring the work that exceeds the amount of its bid, and the bid guarantee is available to offset the difference.

(End of Clause)

**01001.29 52.228-5 INSURANCE - WORK ON A GOVERNMENT INSTALLATION
(JAN 1997)**

(a) The Contractor shall, at its own expense, provide and maintain during the entire performance of this contract, at least the kinds and minimum amounts of insurance required in the schedule or elsewhere in the contract.

(b) Before commencing work under this contract, the Contractor shall notify the Contracting Officer in writing that the required insurance has been obtained. The policies evidencing required insurance shall contain an endorsement to the effect that any cancellation or any material change adversely affecting the Government's interest shall not be effective (1) for such period as the laws of the State in which this contract is to be performed prescribe or (2) until 30 days after the insurer or the Contractor gives written notice to the Contracting Officer, whichever period is longer.

(c) The Contractor shall insert the substance of this clause, including this paragraph (c), in subcontracts under this contract that require work on a Government installation and shall require subcontractors to provide and

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maintain the insurance required in the Schedule or elsewhere in the contract. The Contractor shall maintain a copy of all subcontractors' proofs of required insurance, and shall make copies available to the Contracting Officer upon request.

(End of Clause)

01001.30 SUPPLEMENTAL INSURANCE REQUIREMENTS

In accordance with FAR 28.307-2 and the previous clause, the following minimum coverage shall apply to this contract:

(a) Workers' compensation and employers liability: Contractors are required to comply with applicable Federal and State workers' compensation and occupational disease statutes. If occupational diseases are not compensable under those statutes, they shall be covered under the employer's liability section of the insurance policy, except when contract operations are so commingled with a Contractor's commercial operations that it would not be practical to require this coverage. Employer's liability coverage of at least \$100,000 is required, except in States with exclusive or monopolistic funds that do not permit workers' compensation to be written by private carriers.

(b) General Liability: \$500,000 per occurrences.

(c) Automobile liability: \$250,000 per person; \$500,000 per occurrence and \$100,000 property damage.

(d) The successful bidder must present to the Contracting Officer, prior to award, evidence of general liability insurance without any exclusionary clauses for asbestos that would void the general liability coverage.

(End of Clause)

01001.31 52.228-14 IRREVOCABLE LETTER OF CREDIT (DEC 1999)

(a) "Irrevocable letter of credit" (ILC), as used in this clause, means a written commitment by a federally insured financial institution to pay all or part of a stated amount of money, until the expiration date of the letter, upon presentation by the Government (the beneficiary) of a written demand

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therefor. Neither the financial institution nor the offeror/Contractor can revoke or condition the letter of credit.

(b) If the offeror intends to use an ILC in lieu of a bid bond, or to secure other types of bonds such as performance and payment bonds, the letter of credit and letter of confirmation formats in paragraphs (e) and (f) of this clause shall be used.

(c) The letter of credit shall be irrevocable, shall require presentation of no document other than a written demand and the ILC (including confirming letter, if any), shall be issued/confirmed by an acceptable federally insured financial institution as provided in paragraph (d) of this clause, and--

(1) If used as a bid guarantee, the ILC shall expire no earlier than 60 days after the close of the bid acceptance period;

(2) If used as an alternative to corporate or individual sureties as security for a performance or payment bond, the offeror/ Contractor may submit an ILC with an initial expiration date estimated to cover the entire period for which financial security is required or may submit an ILC with an initial expiration date that is a minimum period of one year from the date of issuance. The ILC shall provide that, unless the issuer provides the beneficiary written notice of non-renewal at least 60 days in advance of the current expiration date, the ILC is automatically extended without amendment for one year from the expiration date, or any future expiration date, until the period of required coverage is completed and the Contracting Officer provides the financial institution with a written statement waiving the right to payment. The period of required coverage shall be:

(i) For contracts subject to the Miller Act, the later of--

(A) One year following the expected date of final payment;

(B) For performance bonds only, until completion of any warranty period.

(d) Only federally insured financial institutions rated investment grade or higher shall issue or confirm the ILC. The offeror/Contractor shall provide the Contracting Officer a credit rating that indicates the financial institution has the required rating(s) as of the date of issuance of the ILC. Unless the financial institution issuing the ILC had letter of credit business of at least \$25 million in the past year, ILCs over \$5 million must be confirmed by another acceptable financial institution that had letter of credit business of at least \$25 million in the past year.

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(e) The following format shall be used by the issuing financial institution to create an ILC:

[Issuing Financial Institution's Letterhead or Name and Address]

Issue Date-----

Irrevocable Letter of Credit No.-----
Account party's name-----
Account party's address----- For
Solicitation No.----- (For
reference only)

TO:

[U.S. Government agency] [U.S. Government agency's address]

1. We hereby establish this irrevocable and transferable Letter of Credit in your favor for one or more drawings up to United States \$_____. This Letter of Credit is payable at [issuing financial institution's and, if any, confirming financial institution's] office at [issuing financial institution's address and, if any, confirming financial institution's address] and expires with our close of business on _____, or any automatically extended expiration date.

2. We hereby undertake to honor your or the transferee's sight draft(s) drawn on the issuing or, if any, the confirming financial institution, for all or any part of this credit if presented with this Letter of Credit and confirmation, if any, at the office specified in paragraph 1 of this Letter of Credit on or before the expiration date or any automatically extended expiration date.

3. [This paragraph is omitted if used as a bid guarantee, and subsequent paragraphs are renumbered.] It is a condition of this Letter of Credit that it is deemed to be automatically extended without amendment for one year from the expiration date hereof, or any future expiration date, unless at least 60 days prior to any expiration date, we notify you or the transferee by registered mail, or other receipted means of delivery, that we elect not to consider this Letter of Credit renewed for any such additional period. At the

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time we notify you, we also agree to notify the account party (and confirming financial institution, if any) by the same means of delivery.

4. This Letter of Credit is transferable. Transfers and assignments of proceeds are to be effected without charge to either the beneficiary or the transferee/assignee of proceeds. Such transfer or assignment shall be only at the written direction of the Government (the beneficiary) in a form satisfactory to the issuing financial institution and the confirming financial institution, if any.

5. This Letter of Credit is subject to the Uniform Customs and Practice (UCP) for Documentary Credits, 1993 Revision, International Chamber of Commerce Publication No. 500, and to the extent not inconsistent therewith, to the laws of _____ [state of confirming financial institution, if any, otherwise state of issuing financial institution].

6. If this credit expires during an interruption of business of this financial institution as described in Article 17 of the UCP, the financial institution specifically agrees to effect payment if this credit is drawn against within 30 days after the resumption of our business.

Sincerely,

[Issuing financial institution]

(f) The following format shall be used by the financial institution to confirm an ILC:

.[Confirming Financial Institution's Letterhead or Name and Address]---

(Date) _____

Our Letter of Credit Advice Number-----
----- Beneficiary:-----
----- [U.S. Government agency] Issuing Financial Institution:-----
----- Issuing Financial Institution's LC No.:-----
----- Gentlemen:

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1. We hereby confirm the above indicated Letter of Credit, the original of which is attached, issued by _____ [name of issuing financial institution] for drawings of up to United States dollars _____/U.S. \$ _____ and expiring with our close of business on _____ [the expiration date], or any automatically extended expiration date.

2. Draft(s) drawn under the Letter of Credit and this Confirmation are payable at our office located at _____.

3. We hereby undertake to honor sight draft(s) drawn under and presented with the Letter of Credit and this Confirmation at our offices as specified herein.

4. [This paragraph is omitted if used as a bid guarantee, and subsequent paragraphs are renumbered.] It is a condition of this confirmation that it be deemed automatically extended without amendment for one year from the expiration date hereof, or any automatically extended expiration date, unless:

(a) At least 60 days prior to any such expiration date, we shall notify the Contracting Officer, or the transferee and the issuing financial institution, by registered mail or other receipted means of delivery, that we elect not to consider this confirmation extended for any such additional period; or

(b) The issuing financial institution shall have exercised its right to notify you or the transferee, the account party, and ourselves, of its election not to extend the expiration date of the Letter of Credit.

5. This confirmation is subject to the Uniform Customs and Practice (UCP) for Documentary Credits, 1993 Revision, International Chamber of Commerce Publication No. 500, and to the extent not inconsistent therewith, to the laws of _____ [state of confirming financial institution].

6. If this confirmation expires during an interruption of business of this financial institution as described in Article 17 of the UCP, we specifically agree to effect payment if this credit is drawn against within 30 days after the resumption of our business.

Sincerely, .-----
----- [Confirming financial institution]

(g) The following format shall be used by the Contracting Officer for a sight draft to draw on the Letter of Credit: SIGHT DRAFT

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[City, State] (Date) _____ [Name and address of financial
institution] Pay to the order of-----
----- [Beneficiary Agency] _____

the sum of United States \$ _____ This draft is drawn under-----
----- Irrevocable Letter of Credit No.-----

----- [Beneficiary Agency] By: _____

(End of Clause)

**01001.32 52.228-15 PERFORMANCE AND PAYMENT BONDS--CONSTRUCTION
(JULY 2000)**

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

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

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

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

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

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

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

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

(d) Surety or other security for bonds. The bonds shall be in the form of firm commitment, supported by corporate sureties whose names appear on the list contained in Treasury Department Circular 570, individual sureties, or by other acceptable security such as postal money order, certified check, cashier's check, irrevocable letter of credit, or, in accordance with Treasury Department regulations, certain bonds or notes of the United States. Treasury Circular 570 is published in the Federal Register or may be obtained from the U.S. Department of Treasury, Financial Management Service, Surety Bond Branch, 401 14th Street, NW, 2nd Floor, West Wing, Washington, DC 20227.

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

(End of Clause)

01001.33 52.232-17 INTEREST (JUN 1996)

(a) Except as otherwise provided in this contract under a Price Reduction for Defective Cost or Pricing Data clause or a Cost Accounting Standards clause, all amounts that become payable by the Contractor to the Government under this contract (net of any applicable tax credit under the Internal Revenue Code (26 U.S.C. 1481)) shall bear simple interest from the date due until paid unless paid within 30 days of becoming due. The interest rate shall be the interest rate established by the Secretary of the Treasury as provided in Section 12 of the Contract Disputes Act of 1978 (Public Law 95-563), which is applicable to the period in which the amount becomes due, as provided in paragraph (b) of this clause, and then at the rate applicable for each six-month period as fixed by the Secretary until the amount is paid.

(b) Amounts shall be due at the earliest of the following dates:

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(1) The date fixed under this contract.

(2) The date of the first written demand for payment consistent with this contract, including any demand resulting from a default termination.

(3) The date the Government transmits to the Contractor a proposed supplemental agreement to confirm completed negotiations establishing the amount of debt.

(4) If this contract provides for revision of prices, the date of written notice to the Contractor stating the amount of refund payable in connection with a pricing proposal or a negotiated pricing agreement not confirmed by contract modification.

(c) The interest charge made under this clause may be reduced under the procedures prescribed in 32.614-2 of the Federal Acquisition Regulation in effect on the date of this contract.

(End of Clause)

01001.34 52.233-2 SERVICE OF PROTEST (AUG 1996)

(a) Protests, as defined in section 33.101 of the Federal Acquisition Regulation, that are filed directly with an agency, and copies of any protests that are filed with the General Accounting Office (GAO), shall be served on the Contracting Officer (addressed as follows) by obtaining written and dated acknowledgment of receipt from:

Hand-Carried Address:

Contracting Officer (S138P&C)
VA Puget Sound HCS
1660 S. Columbian Way
Bldg. 18, Room 106
Seattle WA 98108

Mailing Address:

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Contracting Officer (S138P&C)
VA Puget Sound HCS
1660 S. Columbian Way
Seattle WA 98108

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

(End of Provision)

01001.35 52.236-1 PERFORMANCE OF WORK BY THE CONTRACTOR (APR 1984)

The Contractor shall perform on the site, and with its own organization, work equivalent to at least 25% percent of the total amount of work to be performed under the contract. This percentage may be reduced by a supplemental agreement to this contract if, during performing the work, the Contractor requests a reduction and the Contracting Officer determines that the reduction would be to the advantage of the Government.

(End of Clause)

01001.36 52.236-4 PHYSICAL DATA (APR 1984)

Data and information furnished or referred to below is for the Contractor's information. The Government shall not be responsible for any interpretation of or conclusion drawn from the data or information by the Contractor.

(a) The indications of physical conditions on the drawings and in the specifications are the result of site investigations by:

(b) Weather Conditions:

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(c) Transportation Facilities

(d) Other Physical Data

(End of Clause)

01001.37 52.236-5 MATERIAL AND WORKMANSHIP (APR 1984)

(a) All equipment, material, and articles incorporated into the work covered by this contract shall be new and of the most suitable grade for the purpose intended, unless otherwise specifically provided in this contract. References in the specifications to equipment, material, articles, or patented processes by trade name, make, or catalog number, shall be regarded as establishing a standard of quality and shall not be construed as limiting competition. The Contractor may, at its option, use any equipment, material, article, or process that, in the judgment of the Contracting Officer, is equal to that named in the specifications, unless otherwise specifically provided in this contract.

(b) The Contractor shall obtain the Contracting Officer's approval of the machinery and mechanical and other equipment to be incorporated into the work. When requesting approval, the Contractor shall furnish to the Contracting Officer the name of the manufacturer, the model number, and other information concerning the performance, capacity, nature, and rating of the machinery and mechanical and other equipment. When required by this contract or by the Contracting Officer, the Contractor shall also obtain the Contracting Officer's approval of the material or articles which the Contractor contemplates incorporating into the work. When requesting approval, the Contractor shall provide full information concerning the material or articles. When directed to do so, the Contractor shall submit samples for approval at the Contractor's expense, with all shipping charges prepaid. Machinery, equipment, material, and articles that do not have the required approval shall be installed or used at the risk of subsequent rejection.

(c) All work under this contract shall be performed in a skillful and workmanlike manner. The Contracting Officer may require, in writing, that the Contractor remove from the work any employee the Contracting Officer deems incompetent, careless, or otherwise objectionable.

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(End of Clause)

**01001.38 52.236-14 AVAILABILITY AND USE OF UTILITY SERVICES
(APR 1984)**

(a) The Government shall make all reasonably required amounts of utilities available to the Contractor from existing outlets and supplies, as specified in the contract. Unless otherwise provided in the contract, the amount of each utility service consumed shall be charged to or paid for by the Contractor at prevailing rates charged to the Government or, where the utility is produced by the Government, at reasonable rates determined by the Contracting Officer. The Contractor shall carefully conserve any utilities furnished without charge.

(b) The Contractor, at its expense and in a workmanlike manner satisfactory to the Contracting Officer, shall install and maintain all necessary temporary connections and distribution lines, and all meters required to measure the amount of each utility used for the purpose of determining charges. Before final acceptance of the work by the Government, the Contractor shall remove all the temporary connections, distribution lines, meters, and associated paraphernalia.

(End of Clause)

01001.39 52.236-27 SITE VISIT (CONSTRUCTION) (FEB 1995)

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

(b) Site visits may be arranged during normal duty hours by contacting:

Name: Gloria Cahill

Address: 1660 S. Columbian Way
Bldg. 18, Room 107
Seattle, WA 98108

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Telephone: 206 764-2206

(End of Provision)

01001.40 52.242-13 BANKRUPTCY (JUL 1995)

In the event the Contractor enters into proceedings relating to bankruptcy, whether voluntary or involuntary, the Contractor agrees to furnish, by certified mail or electronic commerce method authorized by the contract, written notification of the bankruptcy to the Contracting Officer responsible for administering the contract. This notification shall be furnished within five days of the initiation of the proceedings relating to bankruptcy filing. This notification shall include the date on which the bankruptcy petition was filed, the identity of the court in which the bankruptcy petition was filed, and a listing of Government contract numbers and contracting offices for all Government contracts against which final payment has not been made. This obligation remains in effect until final payment under this contract.

(End of Clause)

01001.41 52.243-6 CHANGE ORDER ACCOUNTING (APR 1984)

The Contracting Officer may require change order accounting whenever the estimated cost of a change or series of related changes exceeds \$100,000. The Contractor, for each change or series of related changes, shall maintain separate accounts, by job order or other suitable accounting procedure, of all incurred segregable, direct costs (less allocable credits) of work, both changed and not changed, allocable to the change. The Contractor shall maintain such accounts until the parties agree to an equitable adjustment for the changes ordered by the Contracting Officer or the matter is conclusively disposed of in accordance with the Disputes clause.

(End of Clause)

01001.42 52.248-3 VALUE ENGINEERING--CONSTRUCTION (FEB 2000)

(a) General. The Contractor is encouraged to develop, prepare, and submit value engineering change proposals (VECPs) voluntarily. The Contractor shall

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share in any instant contract savings realized from accepted VECPs, in accordance with paragraph (f) below.

(b) Definitions. "Collateral costs," as used in this clause, means agency costs of operation, maintenance, logistic support, or Government- furnished property.

"Collateral savings," as used in this clause, means those measurable net reductions resulting from a VECP in the agency's overall projected collateral costs, exclusive of acquisition savings, whether or not the acquisition cost changes.

"Contractor's development and implementation costs," as used in this clause, means those costs the Contractor incurs on a VECP specifically in developing, testing, preparing, and submitting the VECP, as well as those costs the Contractor incurs to make the contractual changes required by Government acceptance of a VECP.

"Government costs," as used in this clause, means those agency costs that result directly from developing and implementing the VECP, such as any net increases in the cost of testing, operations, maintenance, and logistic support. The term does not include the normal administrative costs of processing the VECP.

"Instant contract savings," as used in this clause, 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 (H) below).

"Value engineering change proposal (VECP)" means a proposal that--

- (1) Requires a change to this, the instant contract, to implement; and
- (2) Results in reducing the contract price or estimated cost without impairing essential functions or characteristics; provided, that it does not involve a change--
 - (i) In deliverable end item quantities only; or
 - (ii) To the contract type only.

(c) VECP preparation. As a minimum, the Contractor shall include in each VECP the information described in subparagraphs (1) through (7) below. If the proposed change is affected by contractually required configuration management or similar procedures, the instructions in those 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 and analysis 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 (i) the affected portions of the existing contract requirement and (ii) 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 (h) below.

(4) A description and estimate of costs the Government may incur in implementing the VECP, such as test and evaluation and operating and support costs.

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

(6) A statement of the time by which a contract modification 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.

(7) 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) Submission. The Contractor shall submit VECPs to the Resident Engineer at the worksite, with a copy to the Contracting Officer.

(e) Government action. (1) The Contracting Officer will notify the Contractor of the status of the VECP within 45 calendar days after the contracting office receives it. If additional time is required, the Contracting Officer will notify the Contractor within the 45-day period and provide the reason for the delay and the expected date of the decision. The

Government will process VECPs expeditiously; however, it will not be liable for any delay in acting upon a VECP.

(2) If the VECP is not accepted, the Contracting Officer will notify the Contractor in writing, explaining the reasons for rejection. The Contractor may withdraw any VECP, in whole or in part, at any time before it is accepted by the Government. The Contracting Officer may require that the Contractor provide written notification before undertaking significant expenditures for VECP effort.

(3) 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 decision to accept or reject all or part of any VECP is a unilateral decision made solely at the discretion of the Contracting Officer.

(f) Sharing. (1) Rates. The Government's share of savings is determined by subtracting Government costs from instant contract savings and multiplying the result by (i) 45 percent for fixed-price contracts or (ii) 75 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 to the contract price or fee.

(g) Collateral savings. If a VECP is accepted, the Contracting Officer will increase the instant contract amount by 20 percent of any projected collateral savings determined to be realized in a typical year of use after subtracting any Government costs not previously offset. However, the Contractor's share of collateral savings will not exceed the contract's firm-fixed-price or estimated cost, at the time the VECP is accepted, or \$100,000, whichever is greater. The Contracting Officer is the sole determiner of the amount of collateral savings.

(h) Subcontracts. The Contractor shall include an appropriate value engineering clause in any subcontract of \$50,000 or more and may include one in subcontracts of lesser value. In computing any adjustment in this contract's price under paragraph (f) above, the Contractor's allowable development and implementation costs shall include any subcontractor's allowable development and implementation costs clearly resulting from a VECP accepted by the Government under this contract, but shall exclude any value engineering incentive payments to a subcontractor. The Contractor may choose any arrangement for subcontractor value engineering incentive payments; provided, that these payments shall not reduce the Government's share of the savings resulting from the VECP.

(i) Data. The Contractor may restrict the Government'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--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 value engineering change proposal 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. (The terms "unlimited rights" and "limited rights" are defined in Part 27 of the Federal Acquisition Regulation.)

(End of Clause)

01001.43 VAAR 852.203-71 DISPLAY OF VA HOTLINE POSTER

(a) Except as provided in paragraph (c) below, the Contractor shall display prominently in common work areas within business segments performing work under VA contracts, VA Hotline posters prepared by the VA Office of the Inspector General.

(b) VA Hotline posters may be obtained from the VA Office of Inspector General (53E), P.O. Box 34647, Washington, DC 20043- 4647.

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(c) The Contractor need not comply with paragraph (a) above, if the Contractor has established a mechanism, such as a hotline, by which employees may report suspected instances of improper conduct, and instructions that encourage employees to make such reports.

(End of Clause)

01001.44 852.211-75 TECHNICAL INDUSTRY STANDARDS (APR 1984)

The supplies or equipment required by this invitation for bid or request for proposal must conform to the standards of the and as to . The successful bidder or offeror will be required to submit proof that the item(s) he furnishes conforms to this requirement. This proof may be in the form of a label or seal affixed to the equipment or supplies, warranting that they have been tested in accordance with and conform to the specified standards. The seal or label of any nationally recognized laboratory such as those listed by the National Fire Protection Association, Boston, Massachusetts, in the current edition of their publication "Research on Fire," is acceptable. Proof may also be furnished in the form of a certificate from one of these laboratories certifying that the item(s) furnished have been tested in accordance with and conform to the specified standards.

(End of Provision)

01001.45 VAAR 852.211-77 BRAND NAME OR EQUAL (NOV 1984)

(Note: As used in this clause, the term "brand name" includes identification of products by make and model.)

(a) If items called for by this invitation for bids have been identified in the schedule by a "brand name or equal" description, such identification is intended to be descriptive, but not restrictive, and is to indicate the quality and characteristics of products that will be satisfactory. Bids offering "equal" products (including products of the brand name manufacturer other than the one described by brand name) will be considered for award if such products are clearly identified in the bids and are determined by the Government to meet fully the salient characteristics requirements listed in the invitation.

(b) Unless the bidder clearly indicates in his bid that he is offering an "equal" product, his bid shall be considered as offering a brand name product referenced in the invitation for bids.

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(c) (1) If the bidder proposes to furnish an "equal" product, the brand name, if any, of the product to be furnished shall be inserted in the space provided in the Invitation for Bids, or such product shall be otherwise clearly identified in the bid. The evaluation of bids and the determination as to equality of the product offered shall be the responsibility of the Government and will be based on information furnished by the bidder or identified in his/her bid as well as other information reasonably available to the purchasing activity. CAUTION TO BIDDERS. The purchasing activity is not responsible for locating or securing any information which is not identified in the bid and reasonably available to the purchasing activity. Accordingly, to insure that sufficient information is available, the bidder must furnish as a part of his/her bid all descriptive material (such as cuts, illustration, drawings or other information) necessary for the purchasing activity to: (i) Determine whether the product offered meets the salient characteristics requirement of the Invitation for Bids, and (ii) establish exactly what the bidder proposes to furnish and what the Government would be binding itself to purchase by making an award. The information furnished may include specific references to information previously furnished or to information otherwise available to the purchasing activity.

(2) If the bidder proposes to modify a product so as to make it conform to the requirements of the Invitation for Bids, he/she shall: (i) Include in his/her bid a clear description of such proposed modifications, and (ii) clearly mark any descriptive material to show the proposed modifications.

(3) Modifications proposed after bid opening to make a product conform to a brand name product referenced in the Invitation for Bids will not be considered.

(End of Clause)

01001.46 VAAR 852.233-70 PROTEST CONTENT (JAN 1998)

(a) Any protest filed by an interested party shall:

(1) Include the name, address, fax number, and telephone number of the protester;

(2) Identify the solicitation and/or contract number;

(3) Include an original signed by the protester or the protester's representative, and at least one copy;

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(4) Set forth a detailed statement of the legal and factual grounds of the protest, including a description of resulting prejudice to the protester, and provide copies of relevant documents;

(5) Specifically request a ruling of the individual upon whom the protest is served;

(6) State the form of relief requested; and

(7) Provide all information establishing the timeliness of the protest.

(b) Failure to comply with the above may result in dismissal of the protest without further consideration.

(End of Provision)

01001.47 VAAR 852.233-71 ALTERNATE PROTEST PROCEDURE (JAN 1998)

As an alternative to filing a protest with the contracting officer, an interested party may file a protest with the Deputy Assistant Secretary for Acquisition and Materiel Management, Acquisition Administration Team, Department of Veterans Affairs, 810 Vermont Avenue, NW, Washington, DC, 20420, or, for solicitations issued by the Office of Facilities Management, the Chief Facilities Management Officer, Office of Facilities Management, 810 Vermont Avenue, NW, Washington, DC 20420. The protest will not be considered if the interested party has a protest on the same or similar issues pending with the contracting officer.

(End of Provision)

01001.48 VAAR 852.236-78 GOVERNMENT SUPERVISION (APR 1984)

(a) The work will be under the direction of the Department of Veterans Affairs contracting officer, who may designate another VA employee to act as resident engineer at the construction site.

(b) Except as provided below, the resident engineer's directions will not conflict with or change contract requirements.

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(c) Within the limits of any specific authority delegated by the contracting officer, the resident engineer may by written direction make changes in the work. The contractor shall be advised of the extent of such authority prior to execution of any work under the contract.

(End of Clause)

**01001.49 VAAR 852.236-80 SUBCONTRACTS AND WORK COORDINATION
(APR 1984)**

(a) Nothing contained in this contract shall be construed as creating any contractual relationship between any subcontractor and the Government. Divisions or sections of specifications are not intended to control the contractor in dividing work among subcontractors, or to limit work performed by any trade.

(b) The contractor shall be responsible to the Government for acts and omissions of his/her own employees, and of the subcontractors and their employees. The contractor shall also be responsible for coordination of the work of the trades, subcontractors, and material suppliers.

(c) The Government or its representatives will not undertake to settle any differences between the contractor and subcontractors or between subcontractors.

(d) The Government reserves the right to refuse to permit employment on the work or require dismissal from the work of any subcontractor who, by reason of previous unsatisfactory work on Department of Veterans Affairs projects or for any other reason, is considered by the contracting officer to be incompetent or otherwise objectionable.

(End of Clause)

**01001.50 VAAR 852.236-83 PAYMENTS UNDER FIXED-PRICE CONSTRUCTION
CONTRACTS (JUL 2002)**

The clause entitled "Payments under Fixed-Price Construction Contracts" in FAR 52.232-5 is implemented as follows:

(a) Retainage:

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(1) The contracting officer may retain funds:

(i) Where the performance under the contract has been determined to be deficient or the contractor has performed in an unsatisfactory manner in the past; or

(ii) As the contract nears completion, to ensure that deficiencies will be corrected and that completion is timely.

(2) Examples of deficient performance justifying a retention of funds include, but are not restricted to, the following:

(i) Unsatisfactory progress as determined by the contracting officer;

(ii) Failure either to meet schedules in Section Network Analysis System (NAS), or to process the Interim Arrow Diagram/Complete Project Arrow Diagram;

(iii) Failure to present submittals in a timely manner; or

(iv) Failure to comply in good faith with approved subcontracting plans, certifications or contract requirements.

(3) Any level of retention shall not exceed 10 percent either where there is determined to be unsatisfactory performance, or when the retainage is to ensure satisfactory completion. Retained amounts shall be paid promptly upon completion of all contract requirements, but nothing contained in this subparagraph shall be construed as limiting the contracting officer's right to withhold funds under other provisions of the contract or in accordance with the general law and regulations regarding the administration of Government contracts.

(b) The contractor shall submit a schedule of costs in accordance with the requirements of Section Network Analysis System (NAS) to the contracting officer for approval within 90 calendar days after date of receipt of notice to proceed. The approved cost schedule will be one of the bases for determining progress payments to the contractor for work completed.

(1) Costs as shown on this schedule must be true costs and, should the resident engineer so desire, he/she may require the contractor to submit his/her original estimate sheets or other information to substantiate the detailed makeup of the cost schedule.

(2) The total costs of all activities shall equal the contract price.

(3) Insurance and similar items shall be prorated and included in each activity cost of the critical path method (CPM) network.

(4) The CPM network shall include a separate cost loaded activity for adjusting and testing of the systems listed below. The percentages listed below will be used to determine the cost of adjust and test activities and identify, for payment purposes, the value of the work to adjust, correct and test systems after the material has been installed.

(5) Payment for adjust and test activities will be made only after the contractor has demonstrated that each of the systems is substantially complete and operates as required by the contract.

VALUE OF ADJUSTING, CORRECTING, AND TESTING SYSTEM

System	Percent
Pneumatic tube system.....	10
Incinerators (medical waste and trash).....	5
Sewage treatment plant equipment.....	5
Water treatment plant equipment.....	5
Washers (dish, cage, glass, etc.).....	5
Sterilizing equipment.....	5
Water distilling equipment.....	5
Prefab temperature rooms (cold, constant temperature).....	5
Entire air-conditioning system (Specified under 600 Sections)	5

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Entire boiler plant system (specified under 700 Sections)	5
General supply conveyors	10
Food service conveyors	10
Pneumatic soiled linen and trash system	10
Elevators and dumbwaiters	10
Materials transport system	10
Engine-generator system	5
Primary switchgear	5
Secondary switchgear	5
Fire alarm system	5
Nurse call system	5
Intercom system	5
Radio system	5
TV (entertainment) system	5

(c) In addition to this cost schedule, the contractor shall submit such unit costs as may be specifically requested. The unit costs shall be those used by the contractor in preparing his/her bid and will not be binding as pertaining to any contract changes.

(d) The contracting officer will consider for monthly progress payments material and/or equipment procured by the contractor and stored on the construction site as space is available, or at a local approved location off the site, under such terms and conditions as such officer approves, including but not limited to the following:

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(1) The material or equipment is in accordance with the contract requirements and/or approved samples and shop drawings.

(2) Only those materials and/or equipment as are approved by the resident engineer for storage will be included.

(3) Such materials and/or equipment will be protected against weather, theft and other hazards and will not be subjected to deterioration.

(5) All of the other terms, provisions, conditions and covenants contained in the contract shall be and remain in full force and effect as therein provided.

(6) A supplemental agreement will be executed between the Government and the contractor with the consent of the contractor's surety for off-site storage.

(e) The contractor, prior to receiving a progress or final payment under this contract, shall submit to the contracting officer a certification that the contractor has made payment from proceeds of prior payments, or that timely payment will be made from the proceeds of the progress or final payment then due, to subcontractors and suppliers in accordance with the contractual arrangements with them.

(f) The Government reserves the right to withhold payment until samples, shop drawings, engineer's certificates, additional bonds, payrolls, weekly statements of compliance, proof of title, nondiscrimination compliance reports, or any other things required by this contract, have been submitted to the satisfaction of the contracting officer.

(End of Clause)

01001.51 VAAR 852.236-84 SCHEDULE OF WORK PROGRESS (NOV 1984)

(a) The contractor shall submit with the schedule of costs, a progress schedule that indicates the anticipated installation of work versus the elapsed contract time, for the approval of the contracting officer. The progress schedule time shall be represented in the form of a bar graph with the contract time plotted along the horizontal axis. The starting date of the schedule shall be the date the contractor receives the "Notice to Proceed." The ending date shall be the original contract completion date. At a minimum, both dates shall be indicated on the progress schedule. The specific item of

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work, i.e., "Excavation", "Floor Tile", "Finish Carpentry", etc., should be plotted along the vertical axis and indicated by a line or bar at which time(s) during the contract this work is scheduled to take place. The schedule shall be submitted in triplicate and signed by the contractor.

(b) The actual percent completion will be based on the value of installed work divided by the current contract amount. The actual completion percentage will be indicated on the monthly progress report.

(c) The progress schedule will be revised when individual or cumulative time extensions of 15 calendar days or more are granted for any reason. The revised schedule should indicate the new contract completion date and should reflect any changes to the installation time(s) of the items of work affected.

(d) The revised progress schedule will be used for reporting future scheduled percentage completion.

(End of Clause)

**01001.52 VAAR 852.236-85 SUPPLEMENTARY LABOR STANDARDS PROVISIONS
(APR 1984)**

(a) The wage determination decision of the Secretary of Labor is set forth in section GR, General Requirements, of this contract. It is the result of a study of wage conditions in the locality and establishes the minimum hourly rates of wages and fringe benefits for the described classes of labor in accordance with applicable law. No increase in the contract price will be allowed or authorized because of payment of wage rates in excess of those listed.

(b) The contractor shall submit the required copies of payrolls to the contracting officer through the resident engineer or engineer officer, when acting in that capacity. Department of Labor Form WH-347, Payroll, available from the Superintendent of Documents, Government Printing Office, Washington, DC 20402, may be used for this purpose. If, however, the contractor or subcontractor elects to use an individually composed payroll form, it shall contain the same information shown on Form WH- 347, and in addition be accompanied by Department of Labor Form WH-348, Statement of Compliance, or any other form containing the exact wording of this form.

(End of Clause)

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01001.53 VAAR 852.236-86 WORKER'S COMPENSATION (JUL 2002)

The Act of June 25, 1936, 49 Stat. 1938 (40 U.S.C. 290) authorizes the constituted authority of States to apply their worker's compensation laws to all lands and premises owned or held by the United States.

(End of Clause)

01001.54 VAAR 852.236-88 CONTRACT CHANGES--SUPPLEMENT (JUL 2002)

(a) Paragraphs (a)(1) through (a)(4) apply to proposed contract changes costing over \$500,000.

(1) When requested by the contracting officer, the contractor shall submit proposals for changes in work to the resident engineer. Proposals, to be submitted as expeditiously as possible but within 30 calendar days after receipt of request, shall be in legible form, original and two copies, with an itemized breakdown that will include material, quantities, unit prices, labor costs (separated into trades), construction equipment, etc. (Labor costs are to be identified with specific material placed or operation performed.) The contractor must obtain and furnish with a proposal an itemized breakdown as described above, signed by each subcontractor participating in the change regardless of tier. When certified cost or pricing data are required under FAR Subpart 15.403, the cost or pricing data shall be submitted in accordance with FAR 15.403-5.

(2) When the necessity to proceed with a change does not allow sufficient time to negotiate a modification or because of failure to reach an agreement, the contracting officer may issue a change order instructing the contractor to proceed on the basis of a tentative price based on the best estimate available at the time, with the firm price to be determined later. Furthermore, when the change order is issued, the contractor shall submit a proposal, which includes the information required by paragraph (a)(1), for cost of changes in work within 30 calendar days.

(3) The contracting officer will consider issuing a settlement by determination to the contract if the contractor's proposal required by paragraphs (a) and (b) of this clause is not received within 30 calendar days or if agreement has not been reached.

(4) Bond premium adjustment, consequent upon changes ordered, will be made as elsewhere specified at the time of final settlement under the contract and will not be included in the individual change.

(b) Paragraphs (b) (1) through (b) (11) apply to proposed contract changes costing \$500,000 or less:

(1) When requested by the contracting officer, the contractor shall submit proposals for changes in work to the resident engineer. Proposals, to be submitted as expeditiously as possible but within 30 calendar days after receipt of request, shall be in legible form, original and two copies, with an itemized breakdown that will include material, quantities, unit prices, labor costs (separated into trades), construction equipment, etc. (Labor costs are to be identified with specific material placed or operation performed.) The contractor must obtain and furnish with a proposal an itemized breakdown as described above, signed by each subcontractor participating in the change regardless of tier. When certified cost or pricing data or information other than cost or pricing data are required under FAR 15.403, the data shall be submitted in accordance with FAR 15.403-5. No itemized breakdown will be required for proposals amounting to less than \$1,000.

(2) When the necessity to proceed with a change does not allow sufficient time to negotiate a modification or because of failure to reach an agreement, the contracting officer may issue a change order instructing the contractor to proceed on the basis of a tentative price based on the best estimate available at the time, with the firm price to be determined later. Furthermore, when the change order is issued, the contractor shall submit within 30 calendar days a proposal, which includes the information required by paragraph (b) (1), for the cost of the changes in work.

(3) The contracting officer will consider issuing a settlement by determination to the contract if the contractor's proposal required by paragraphs (a) and (b) of this clause is not received within 30 calendar days or if agreement has not been reached.

(4) Allowances not to exceed 10 percent each for overhead and profit for the party performing the work will be based on the value of labor, material, and use of construction equipment required to accomplish the change. As the value of the change increases, a declining scale will be used in negotiating the percentage of overhead and profit. Allowable percentages on changes will not exceed the following: 10 percent overhead and 10 percent profit on the first \$20,000; 7-1/2 percent overhead and 7-1/2 percent profit on the next \$30,000; 5 percent overhead and 5 percent profit on balance over \$50,000. Profit shall be computed by multiplying the profit percentage by the sum of the direct costs and computed overhead costs.

(5) The prime contractor's or upper-tier subcontractor's fee on work performed by lower-tier subcontractors will be based on the net increased cost to the prime contractor or upper-tier subcontractor, as applicable. Allowable fee on changes will not exceed the following: 10 percent fee on the first \$20,000; 7-1/2 percent fee on the next \$30,000; and 5 percent fee on balance over \$50,000.

(6) Not more than four percentages, none of which exceed the percentages shown above, will be allowed regardless of the number of tiers of subcontractors.

(7) Where the contractor's or subcontractor's portion of a change involves credit terms, such items must be deducted prior to adding overhead and profit for the party performing the work. The contractor's fee is limited to the net increase to contractor of subcontractors' portions cost computed in accordance herewith.

(8) Where a change involves credit items only, a proper measure of the amount of downward adjustment in the contract price is the reasonable cost to the contractor if he/she had performed the deleted work. A reasonable allowance for overhead and profit are properly includable as part of the downward adjustment for a deductive change. The amount of such allowance is subject to negotiation.

(9) Cost of Federal Old Age Benefit (Social Security) tax and of Worker's Compensation and Public Liability insurance appertaining to changes are allowable. While no percentage will be allowed thereon for overhead or profit, prime contractor's fee will be allowed on such items in subcontractor's proposals.

(10) Overhead and contractor's fee percentages shall be considered to include insurance other than mentioned herein, field and office supervisors and assistants, security police, use of small tools, incidental job burdens, and general home office expenses and no separate allowance will be made therefore. Assistants to office supervisors include all clerical, stenographic and general office help. Incidental job burdens include, but are not necessarily limited to, office equipment and supplies, temporary toilets, telephone and conformance to OSHA requirements. Items such as, but not necessarily limited to, review and coordination, estimating and expediting relative to contract changes are associated with field and office supervision and are considered to be included in the contractor's overhead and/or fee percentage.

(11) Bond premium adjustment, consequent upon changes ordered, will be made as elsewhere specified at the time of final settlement under the contract and will not be included in the individual change.

(End of Clause)

**01001.55 VAAR 852.236-90 RESTRICTION ON SUBMISSION AND USE OF
EQUAL PRODUCTS (NOV 1986)**

This clause applies to the following items:

Schlage (SC) Lockset and cylinder
Best (BE) Permanent Cores
Von Duprin (VO) Exit Devices
Cerberus Prytronics Fire Alarm
Swiss Log Pneumatic Tube
Techworks

Notwithstanding the "Material and Workmanship" clause of this contract, FAR 52.236-5(a), nor any other contractual provision, "equal" products will not be considered by the Department of Veterans Affairs and may not be used.

(End of Clause)

01001.56 VAAR 852.236-91 SPECIAL NOTES (JUL 2002)

(a) Signing of the bid shall be deemed to be a representation by the bidder that:

(1) Bidder is a construction contractor who owns, operates, or maintains a place of business, regularly engaged in construction, alteration or repair of buildings, structures, communications facilities, or other engineering projects, including furnishing and installing of necessary equipment; or

(2) If newly entering into a construction activity, bidder has made all necessary arrangements for personnel, construction equipment, and required licenses to perform construction work; and

(3) Upon request, prior to award, bidder will promptly furnish to the Government a statement of facts in detail as to bidder's previous experience (including recent and current contracts), organization (including company

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officers), technical qualifications, financial resources and facilities available to perform the contemplated work.

(b) Unless otherwise provided in this contract, where the use of optional materials or construction is permitted, the same standard of workmanship, fabrication and installation shall be required irrespective of which option is selected. The contractor shall make any change or adjustment in connecting work or otherwise necessitated by the use of such optional material or construction, without additional cost to the Government.

(c) When approval is given for a system component having functional or physical characteristics different from those indicated or specified, it is the responsibility of the contractor to furnish and install related components with characteristics and capacities compatible with the approved substitute component as required for systems to function as noted on drawings and specifications. There shall be no additional cost to the Government.

(d) In some instances it may have been impracticable to detail all items in specifications or on drawings because of variances in manufacturers methods of achieving specified results. In such instances the contractor will be required to furnish all labor, materials, drawings, services and connections necessary to product systems or equipment which are completely installed, functional, and ready for operation by facility personnel in accordance with their use.

(e) Claims by the contractor for delay attributed to unusually severe weather must be supported by climatological data covering the period and the same period for the 10 preceding years. When the weather in question exceeds in intensity or frequency the 10 year average, the excess experienced shall be considered "unusually severe." Comparison shall be on a monthly basis. Whether or not unusually severe weather in fact delays the work will depend upon the effect of weather on the branches of work being performed during the time under consideration.

(End of Clause)

**01001.57 VAAR 852.236-72 PERFORMANCE OF WORK BY THE CONTRACTOR
(JUL 2002)**

(a) Contract work accomplished on the site by laborers, mechanics, and foreman/forewomen on the contractor's payroll and under his/her direct supervision shall be included in establishing the percent of work to be performed by the contractor. Cost of material and equipment installed by such labor may be included. The work by contractor's executive, supervisory and clerical forces shall be excluded in establishing compliance with the requirements of this clause.

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(b) The contractor shall submit, simultaneously with the schedule of costs required by the Payments under Fixed-Price Construction Contracts clause of the contract, a statement designating the branch or branches of contract work to be performed with his/her forces. The approved schedule of costs will be used in determining the value of a branch or branches, or portions thereof, of the work for the purpose of this article.

(c) If, during the progress of work hereunder, the contractor requests a change in the branch or branches of the work to be performed by his/her forces and the contracting officer determines it to be in the best interests of the Government, the contracting officer may, at his/her discretion, authorize a change in such branch or branches of said work. Nothing contained herein shall permit a reduction in the percentage of work to be performed by the contractor with his/her forces, it being expressly understood that this is a contract requirement without right or privilege of reduction.

(d) In the event the contractor fails or refuses to meet the requirement of the FAR clause at 52.236-1, it is expressly agreed that the contract price will be reduced by 15 percent of the value of that portion of the percentage requirement that is accomplished by others. For the purpose of this clause, it is agreed that 15 percent is an acceptable estimate of the contractor's overhead and profit, or mark-up, on that portion of the work which the contractor fails or refuses to perform, with his/her own forces, in accordance with the FAR clause at 52.236-1.

(End of Clause)

**01001.58 VAAR 852.270-1 REPRESENTATIVES OF CONTRACTING OFFICERS
(APR 1984)**

The contracting officer reserves the right to designate representatives to act for him/her in furnishing technical guidance and advice or generally supervise the work to be performed under this contract. Such designation will be in writing and will define the scope and limitations of the designee's authority. A copy of the designation shall be furnished the contractor.

(End of Provision)

01001.59 52.252-2 CLAUSES INCORPORATED BY REFERENCE (FEB 1998)

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Ambulatory Clinic Expansion

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

<http://arnet.gov/far/>
<http://www.va.gov/oa&mm/vaar/>

2001	52.202-1	DEFINITIONS	DEC
		ALTERNATE I (MAY 2001)	
1984	52.203-3	GRATUITIES	APR
1984	52.203-5	COVENANT AGAINST CONTINGENT FEES	APR
1995	52.203-6	RESTRICTIONS ON SUBCONTRACTOR SALES TO THE GOVERNMENT	JUL
1995	52.203-7	ANTI-KICKBACK PROCEDURES	JUL
1997	52.203-8	CANCELLATION, RESCISSION, AND RECOVERY OF FUNDS FOR ILLEGAL OR IMPROPER ACTIVITY	JAN
2000	52.204-4	PRINTED OR COPIED DOUBLE-SIDED ON RECYCLED PAPER	AUG
2003	52.204-6	DATA UNIVERSAL NUMBERING SYSTEM (DUNS) NUMBER	OCT
1998	52.211-1	AVAILABILITY OF SPECIFICATIONS LISTED IN THE GSA INDEX OF FEDERAL SPECIFICATIONS, STANDARDS AND COMMERCIAL ITEM DESCRIPTIONS, FPMR PART 101-29 (AUG 1998)	AUG
2003	52.211-2	AVAILABILITY OF SPECIFICATIONS LISTED IN THE DOD INDEX OF SPECIFICATIONS & STDS (DODISS) & DESCRIPTIONS LISTED IN THE ACQUISITION MANAGEMENT SYSTEMS & DATA	DEC
1987	52.214-1	SOLICITATION DEFINITIONS--SEALED BIDDING	JUL
1989	52.214-3	AMENDMENTS TO INVITATIONS FOR BIDS	DEC
1984	52.214-4	FALSE STATEMENTS IN BIDS	APR

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	BIDDING--CONSTRUCTION	
52.214-26	AUDIT AND RECORDS--SEALED BIDDING	OCT
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52.222-21	PROHIBITION OF SEGREGATED FACILITIES	FEB
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52.222-26	EQUAL OPPORTUNITY	APR
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52.222-27	AFFIRMATIVE ACTION COMPLIANCE	FEB
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52.222-35	EQUAL OPPORTUNITY FOR SPECIAL DISABLED	DEC
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52.222-36	AFFIRMATIVE ACTION FOR WORKERS WITH	JUN
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52.222-37	EMPLOYMENT REPORTS ON SPECIAL DISABLED	DEC
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52.222-38	COMPLIANCE WITH VETERANS EMPLOYMENT	
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52.223-5	POLLUTION PREVENTION AND RIGHT-TO-KNOW	AUG
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52.225-13	RESTRICTIONS ON CERTAIN FOREIGN	DEC
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52.225-10	NOTICE OF BUY AMERICAN ACT REQUIREMENT	MAY
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1984	52.245-1	PROPERTY RECORDS	APR
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1984	52.245-3	IDENTIFICATION OF GOVERNMENT-FURNISHED PROPERTY	APR
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1984	852.214-70	CAUTION TO BIDDERS-BID ENVELOPES	APR
1984	852.228-70	BOND PREMIUM ADJUSTMENT	APR
2002	852.236-71	SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION	JUL
2002	852.236-74	INSPECTION OF CONSTRUCTION	JUL
1984	852.236-76	CORRESPONDENCE	APR
2002	852.236-77	REFERENCE TO STANDARDS	JUL
1984	852.236-79	DAILY REPORT OF WORKERS AND MATERIAL	APR
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**SECTION 01010
GENERAL REQUIREMENTS**

1.1 GENERAL INTENTION

- A. Contractor shall completely prepare site for building operations and furnish labor and materials and perform work for Department of Veterans Affairs, Seattle Campus, Ambulatory Care Expansion, Building 100, Diagnostic and Treatment Building as required by drawings and specifications.
- B. Visits to the site by Bidders may be made only by appointment with the Medical Center Engineering Officer.
- C. Offices of Anshen+Allen Architects, as Architect-Engineers, will render certain technical services during construction. Such services shall be considered as advisory to the Government and shall not be construed as expressing or implying a contractual act of the Government without affirmations by Contracting Officer or the Contracting Officer's Technical Representative (COTR).
- D. Before placement and installation of work subject to tests by testing laboratory retained by Department of Veterans Affairs, the Contractor shall notify the COTR in sufficient time to enable testing laboratory personnel to be present at the site in time for proper taking and testing of specimens and field inspection. Such prior notice shall be not less than three work days unless otherwise designated by the COTR.
- E. Prior to commencing work, general contractor shall provide proof that an OSHA certified "competent person" (29 CFR 1926.20(b)(2)) will maintain a presence at the work site whenever the general or subcontractors are present.

1.2 STATEMENT OF BID ITEM(S)

ITEM I, GENERAL CONSTRUCTION: Work includes general construction, alterations, selective demolition, temporary fencing, landscape demo and restoration, mechanical and electrical work, and certain other items.

1.3 SPECIFICATIONS AND DRAWINGS FOR CONTRACTOR

After award of contract, the Issuing Office shall provide one set of full-sized black and white prints of the drawings and one set of unbound specifications to the Contractor for reproduction of sets at the Contractor's expense. Such prints shall be returned to the Issuing Office immediately after printing is complete.

1.4 FIRE SAFETY

A. Applicable Publications: Publications listed below form part of this Article to extent referenced. Publications are referenced in text by basic designations only.

1. American Society for Testing and Materials (ASTM)
E84-1998.....Surface Burning Characteristics of Building
Materials
2. National Fire Protection Association (NFPA):
10-1998.....Standard for Portable Fire Extinguishers
FCLCH-30-2000.....Flammable and Combustible Liquids Code
51B-1999.....Standard for Fire Prevention During Welding,
Cutting and Other Hot Work
70-2000.....National Electrical Code
241-2000.....Standard for Safeguarding Construction,
Alteration, and Demolition Operations
3. Occupational Safety and Health Administration (OSHA)
29 CFR 1926.....Safety and Health Regulations for Construction

B. Fire Safety Plan: Establish and maintain a fire protection program in accordance with 29 CFR 1926. Prior to start of work, prepare a plan detailing project-specific fire safety measures, including periodic status reports, and submit to Engineer and Facility Safety Manager for review for compliance with contract requirements in accordance with Section 01340, SAMPLES AND SHOP DRAWINGS. Prior to any worker for the contractor or subcontractors beginning work, they shall undergo a safety briefing provided by the general contractor's competent person per OSHA requirements. This briefing shall include information on the construction limits, VAMC safety guidelines, means of egress, break areas, work hours, locations of restrooms, use of VAMC equipment, etc. Documentation shall be provided to the COTR that individuals have undergone contractor's safety briefing.

C. Site and Building Access: Maintain free and unobstructed access to facility emergency services and for fire, police and other emergency response forces in accordance with NFPA 241.

D. Separate temporary facilities, such as trailers, storage sheds, and dumpsters, from existing buildings and new construction by distances in accordance with NFPA 241. For small facilities with less than 6 m (20 feet) exposing overall length, separate by 3m (10 feet).

E. Temporary Construction Partitions:

1. Install and maintain temporary construction partitions to provide smoke-tight separations between construction areas and adjoining areas. Construct partitions of gypsum board or treated plywood (flame spread rating of 25 or less in accordance with ASTM E84) on both sides of fire retardant treated wood or metal steel studs. Extend the partitions through suspended ceilings to floor slab deck or roof. Seal joints and penetrations. At door openings, install Class C, $\frac{3}{4}$ hour fire/smoke rated doors with self-closing devices.
2. Install two-hour-fire-rated temporary construction partitions as shown on drawings to maintain integrity of existing exit stair enclosures, area enclosures, vertical shafts and openings enclosures.

F. Temporary Heating and Electrical: Install, use and maintain installations in accordance with 29 CFR 1926, NFPA 241 and NFPA 70.

G. Means of Egress: Do not block exiting for occupied buildings, including paths from exits to roads. Minimize disruptions and coordinate with COTR and facility Safety Manager.

H. Egress Routes for Construction Workers: Maintain free and unobstructed egress. Inspect daily. Report findings and corrective actions weekly to COTR and facility Safety Manager.

I. Fire Extinguishers: Provide and maintain extinguishers in construction areas and temporary storage areas in accordance with 29 CFR 1926, NFPA 241 and NFPA 10.

J. Flammable and Combustible Liquids: Store, dispense and use liquids in accordance with 29 CFR 1926, NFPA 241 and NFPA 30.

K. Standpipes: Install and extend standpipes up with each floor in accordance with 29 CFR 1926 and NFPA 241. Do not charge wet standpipes subject to freezing until weather protected.

L. Sprinklers: Install, test and activate new automatic sprinklers prior to removing existing sprinklers.

M. Existing Fire Protection: Do not impair automatic sprinklers, smoke and heat detection, and fire alarm systems, except for portions immediately under construction, and temporarily for connections. Provide fire watch for impairments more than 4 hours in a 24-hour period. Request interruptions in accordance with Article, OPERATIONS AND STORAGE AREAS, and coordinate with COTR and facility Safety Manager. All existing or

temporary fire protection systems (fire alarms, sprinklers) located in construction areas shall be tested as coordinated with the medical center. Parameters for the testing and results of any tests performed shall be recorded by the medical center and copies provided to the COTR.

- N. Smoke Detectors: Prevent accidental operation. Remove temporary covers at end of work operations each day. Coordinate with COTR and facility Safety Manager.
- O. Hot Work: Perform and safeguard hot work operations in accordance with NFPA 241 and NFPA 51B. Coordinate with COTR. Obtain permits from facility Safety Manager at least 24 hours in advance. Designate contractor's responsible project-site fire prevention program manager to permit hot work.
- P. Fire Hazard Prevention and Safety Inspections: Inspect entire construction areas weekly. Coordinate with, and report findings and corrective actions weekly to COTR and facility Safety Manager.
- Q. Smoking: Smoking is prohibited in and adjacent to construction areas inside existing buildings and additions under construction. In separate and detached buildings under construction, smoking is prohibited except in designated smoking rest areas.
- R. Dispose of waste and debris in accordance with NFPA 241. Remove from buildings daily.
- S. Perform other construction, alteration and demolition operations in accordance with 29 CFR 1926.
- T. If required, submit documentation to the COTR that personnel have been trained in the fire safety aspects of working in areas with impaired structural or compartmentalization features.

1.5 SECURITY

All construction workers on the site, including workers for the subcontractor and all subcontractors, shall follow the Department of Veterans Affairs' procedures for obtaining and use of photo IDs.

1.6 OPERATIONS AND STORAGE AREAS

- A. The Contractor shall confine all operations (including storage of materials) on Government premises to areas authorized or approved by the Contracting Officer. The Contractor shall hold and save the Government, its officers and agents, free and harmless from liability of any nature occasioned by the Contractor's performance.

- B. Temporary buildings (e.g., storage sheds, shops, offices) and utilities may be erected by the Contractor only with the approval of the Contracting Officer and shall be built with labor and materials furnished by the Contractor without expense to the Government. The temporary buildings and utilities shall remain the property of the Contractor and shall be removed by the Contractor at its expense upon completion of the work. With the written consent of the Contracting Officer, the buildings and utilities may be abandoned and need not be removed.
- C. The Contractor shall, under regulations prescribed by the Contracting Officer, use only established roadways, or use temporary roadways constructed by the Contractor when and as authorized by the Contracting Officer. When materials are transported in prosecuting the work, vehicles shall not be loaded beyond the loading capacity recommended by the manufacturer of the vehicle or prescribed by any Federal, State, or local law or regulation. When it is necessary to cross curbs or sidewalks, the Contractor shall protect them from damage. The Contractor shall repair or pay for the repair of any damaged curbs, sidewalks, or roads.
- D. Working space and space available for storing materials shall be as determined by the COTR.
- E. Workmen are subject to rules of Medical Center applicable to their conduct.
- F. Execute work so as to interfere as little as possible with normal functioning of Medical Center as a whole, including operations of utility services, fire protection systems and any existing equipment, and with work being done by others. Use of equipment and tools that transmit vibrations and noises through the building structure, are not permitted in buildings that are occupied, during construction, jointly by patients or medical personnel, and Contractor's personnel, except as permitted by COTR where required by limited working space.
1. Do not store materials and equipment in other than assigned areas.
 2. Schedule delivery of materials and equipment to immediate construction working areas within buildings in use by Department of Veterans Affairs in quantities sufficient for not more than two work days. Provide unobstructed access to Medical Center areas required to remain in operation.

3. Where access by Medical Center personnel to vacated portions of buildings is not required, storage of Contractor's materials and equipment will be permitted subject to fire and safety requirements.
- G. Schedules and Areas of Work: To insure such executions, Contractor shall furnish the Contracting Officer with a schedule of approximate dates on which the Contractor intends to accomplish work in each specific area of site, building or portion thereof. In addition, Contractor shall notify the Contracting Officer two weeks in advance of the proposed date of starting work in each specific area of site, building or portion thereof. Arrange such dates to insure accomplishment of this work in successive phases mutually agreeable to Contracting Officer and Contractor, as follows:
- Area of Work 1: Clearing of staging area and installation of construction fence.
- Area of Work 2: Partial demolition of existing building and installation of structural steel.
- Area of Work 3: Work on stair 7 and the associated stair shaft.
- Area of Work 4: Demolition of existing housekeeping closet and associated remodel.
- Area of Work 5: Work on inside of rooms.
- Area of Work 6: Demolition and construction of new door at 3rd Floor, Sheet A4.04.
- H. Building No. 100 will be occupied during performance of work; but immediate areas of alterations will be vacated.
1. Contractor shall take all measures and provide all material necessary for protecting existing equipment and property in affected areas of construction against dust and debris, so that equipment and affected areas to be used in the Medical Centers operations will not be hindered. Contractor shall permit access to Department of Veterans Affairs personnel and patients through other construction areas which serve as routes of access to such affected areas and equipment. Coordinate alteration work in areas occupied by Department of Veterans Affairs so that Medical Center operations will continue during the construction period.
 2. The following immediate areas of alterations will be temporarily vacated for no more than two weeks while alterations are performed: Rooms 2D-178a, 2D-178b, 2D-177, 2D-176, 2D-174, 2D-173, and 2D-172.

3. Installation of the structural steel columns, girders, beams and decking will be scheduled during hours that the first floor West Clinic is not in operation. Clinic operation hours are: Monday through Friday 7:30 a.m. to 5:30 p.m.
 4. Work on Stair 7 shall be coordinated with requirements for exiting and with the COTR. Demolition of the existing roof slab, installation of the new stair and landing, and all work requiring welding or grinding will be scheduled for hours that the West Clinic is not in operation.
 5. Coordinate mechanical work affecting the Dental Clinic to hours that the Dental Clinic is not in operation. Schedule all work so that all mechanical functions are operational when the clinic reopens.
Dental Clinic hours are Monday through Friday 7:30 a.m. to 5:30 p.m.
- I. Staging areas, location of equipment: The contractor must obtain approval from the COTR to locate cranes or other equipment outside the staging area. Such requests shall be submitted at least 21 calendar days prior to the date the equipment will be installed, with a description of the equipment, the proposed location and the proposed duration.
- J. Construction Fence: Before construction operations begin, Contractor shall provide a chain link construction fence, 2100 mm (seven feet) minimum height, around the staging and construction areas indicated on the drawings. Provide gates as required for access with necessary hardware, including hasps and padlocks. Fasten fence fabric to terminal posts with tension bands and to line posts and top and bottom rails with tie wires spaced at maximum 15 inches. Bottom of fences shall extend to one inch above grade. Remove the fence when directed by COTR.
- K. When a building is turned over to Contractor, Contractor shall accept entire responsibility therefor.
1. Contractor shall maintain a minimum temperature of 4 degrees C (40 degrees F) at all times, except as otherwise specified.
 2. Contractor shall maintain in operating condition existing fire protection and alarm equipment. In connection with fire alarm equipment, Contractor shall make arrangements for pre-inspection of site with Fire Department which will be required to respond to an alarm from Contractor's employee or watchman.

- L. Utilities Services: Maintain existing utility services for Medical Center at all times. Provide temporary facilities, labor, materials, equipment, connections, and utilities to assure uninterrupted services. Where necessary to cut existing water, steam, gases, sewer or air pipes, or conduits, wires, cables, etc. of utility services or of fire protection systems and communications systems (including telephone), they shall be cut and capped at suitable places where shown; or, in absence of such indication, where directed by COTR.
1. No utility service such as water, gas, steam, sewers or electricity, or fire protection systems and communications systems may be interrupted without prior approval of COTR. Electrical work shall be accomplished with all affected circuits or equipment deenergized. When an electrical outage cannot be accomplished, work on any energized circuits or equipment shall not commence without the COTR's prior knowledge and written approval. Refer to specification Section 16050 for additional requirements.
 2. Contractor shall submit a request to interrupt any such services to COTR, in writing, 48 hours in advance of proposed interruption. Request shall state reason, date, exact time of, and approximate duration of such interruption.
 3. Contractor will be advised (in writing) of approval of request, or of which other date and/or time such interruption will cause least inconvenience to operations of Medical Center. Interruption time approved by Medical Center may occur at other than Contractor's normal working hours.
 4. Major interruptions of any system must be requested, in writing, at least 15 calendar days prior to the desired time and shall be performed as directed by the COTR.
 5. In case of a contract construction emergency, service will be interrupted on approval of COTR. Such approval will be confirmed in writing as soon as practical.
 6. Whenever it is required that a connection fee be paid to a public utility provider for new permanent service to the construction project, for such items as water, sewer, electricity, gas or steam, payment of such fee shall be the responsibility of the Government and not the Contractor.

- M. Abandoned Lines: All service lines such as wires, cables, conduits, ducts, pipes and the like, and their hangers or supports, which are to be abandoned but are not required to be entirely removed, shall be sealed, capped or plugged. The lines shall not be capped in finished areas, but shall be removed and sealed, capped or plugged in ceilings, within furred spaces, in unfinished areas, or within walls or partitions; so that they are completely behind the finished surfaces.
- N. To minimize interference of construction activities with flow of Medical Center traffic, comply with the following:
 - 1. Keep roads, walks and entrances to grounds, to parking and to occupied areas of buildings clear of construction materials, debris and standing construction equipment and vehicles.
 - 2. Method and scheduling of required cutting, altering and removal of existing roads, walks and entrances must be approved by the COTR.
- O. Coordinate the work for this contract with other construction operations as directed by COTR. This includes the scheduling of traffic and the use of roadways, as specified in Article, USE OF ROADWAYS.

1.6 ALTERATIONS

- A. Survey: Before any work is started, the Contractor shall make a thorough survey with the COTR of areas of buildings in which alterations occur and areas which are anticipated routes of access, and furnish a report, signed by both, to the Contracting Officer. This report shall list by rooms and spaces:
 - 1. Existing condition and types of resilient flooring, doors, windows, walls and other surfaces not required to be altered throughout affected areas of building.
 - 2. Existence and conditions of items such as plumbing fixtures and accessories, electrical fixtures, equipment, venetian blinds, shades, etc., required by drawings to be either reused or relocated, or both.
 - 3. Shall note any discrepancies between drawings and existing conditions at site.
 - 4. Shall designate areas for working space, materials storage and routes of access to areas within buildings where alterations occur and which have been agreed upon by Contractor and COTR.

- B. Any items required by drawings to be either reused or relocated or both, found during this survey to be nonexistent, or in opinion of COTR, to be in such condition that their use is impossible or impractical, shall be furnished and/or replaced by Contractor with new items in accordance with specifications which will be furnished by Government. Provided the contract work is changed by reason of this subparagraph B, the contract will be modified accordingly, under provisions of clause entitled "DIFFERING SITE CONDITIONS" (FAR 52.236-2) and "CHANGES" (FAR 52.243-4 and VAAR 852.236-88) of Section 01001, GENERAL CONDITIONS.
- C. Re-Survey: Thirty days before expected partial or final inspection date, the Contractor and COTR together shall make a thorough re-survey of the areas of buildings involved. They shall furnish a report on conditions then existing, of resilient flooring, doors, windows, walls and other surfaces as compared with conditions of same as noted in first condition survey report.
1. Re-survey report shall also list any damage caused by Contractor to such flooring and other surfaces, despite protection measures; and, will form basis for determining extent of repair work required of Contractor to restore damage caused by Contractor's workmen in executing work of this contract.
- D. Protection: Provide the following protective measures:
1. Wherever existing roof surfaces are disturbed they shall be protected against water infiltration. In case of leaks, they shall be repaired immediately upon discovery.
 2. Temporary protection against damage for portions of existing structures and grounds where work is to be done, materials handled and equipment moved and/or relocated.
 3. Protection of interior of existing structures at all times, from damage, dust and weather inclemency. Wherever work is performed, floor surfaces that are to remain in place shall be adequately protected prior to starting work, and this protection shall be maintained intact until all work in the area is completed.
 4. Dampen debris to keep down dust and provide temporary construction partitions in existing structures where directed by COTR. Blank off ducts and diffusers to prevent circulation of dust into occupied areas during construction.

5. Do not perform any dust producing tasks within occupied areas without the approval of the COTR. For construction in any areas that will remain jointly occupied by the medical Center and Contractor's workers, the Contractor shall:
 - a. Provide dust proof one-hour fire-rated temporary drywall construction barriers to completely separate construction from the operational areas of the hospital in order to contain dirt debris and dust. Barriers shall be sealed and made presentable on hospital occupied side. Install a self-closing rated door in a metal frame, commensurate with the partition, to allow worker access. Maintain negative air at all times. A fire retardant polystyrene, 6-mil thick or greater plastic barrier meeting local fire codes may be used where dust control is the only hazard, and an agreement is reached with the COTR and Medical Center.
 - b. Install HEPA (High Efficiency Particulate Accumulator) filter vacuum system rated at 95% capture of 0.3 microns including pollen, mold spores and dust particles. Insure continuous negative air pressures occurring within the work area. HEPA filtration is required where the exhaust dust may reenter the breathing zone. HEPA filters should have ASHRAE 85 or other prefilter to extend the useful life of the HEPA. Provide both primary and secondary filtrations units. Exhaust hoses shall be heavy duty, flexible steel reinforced and exhausted so that dust is not reintroduced to the medical center.
 - c. Adhesive Walk-off/Carpet Walk-off Mats, minimum 24" x 36", shall be used at all interior transitions from the construction area to occupied medical center area. These mats shall be changed as often as required to maintain clean work areas directly outside construction area.
 - d. Broom clean and wet mop at the end of each workday. Vacuum utilizing HEPA filtration. Maintain surrounding area frequently. Remove debris as they are created. Transport these outside the construction area in containers with tightly fitting lids.
 - e. The contractor shall not haul debris through patient-care areas without prior approval of the COTR and the Medical Center. When approved, debris shall be hauled in enclosed dust proof containers or wrapped in plastic and sealed with duct tape. No

sharp objects should be allowed to cut through the plastic. Wipe down the exterior of the containers with a damp rag to remove dust. All equipment, tools, material, etc. transported through occupied areas shall be made free from dust and moisture by vacuuming and wipe down.

- f. Using a HEPA vacuum, clean inside the barrier and vacuum ceiling tile prior to replacement. Any ceiling access panels opened for investigation beyond sealed areas shall be replaced immediately when unattended.
 - g. There shall be no standing water during construction. This includes water in equipment drip pans and open containers within the construction areas. All accidental spills must be cleaned up and dried within 12 hours. Remove and dispose of porous materials that remain damp for more than 72 hours.
 - h. At completion, remove construction barriers and ceiling protection carefully, outside of normal work hours. Vacuum and clean all surfaces free of dust after the removal.
- E. Disposal and Retention: Materials and equipment accruing from work removed and from demolition of buildings or structures, or parts thereof, shall be disposed of as follows:
- 1. Reserved items which are to remain property of the Government are identified by attached tags or noted on drawings or in specifications as items to be stored. Items which remain property of the Government shall be removed or dislodged from present locations in such a manner as to prevent damage which would be detrimental to re-installation and reuse. Store such items where directed by COTR.
 - 2. Items not reserved shall become property of the Contractor and be removed by Contractor from Medical Center.
 - 3. Items of portable equipment and furnishings located in rooms and spaces in which work is to be done under this contract shall remain the property of the Government. When rooms and spaces are vacated by the Department of Veterans Affairs during the alteration period, such items which are NOT required by drawings and specifications to be either relocated or reused will be removed by the Government in advance of work to avoid interfering with Contractor's operation.
- F. Final Cleanup:

1. Upon completion of project, or as work progresses, remove all construction debris from above ceiling, vertical shafts and utility chases that have been part of the construction.
2. Perform HEPA vacuum cleaning of all surfaces in the construction area. This includes walls, ceilings, cabinets, furniture (built-in or free standing), partitions, flooring, etc.
3. All new air ducts shall be cleaned prior to final inspection.

1.7 PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES, AND IMPROVEMENTS

- A. The Contractor shall preserve and protect all structures, equipment, and vegetation (such as trees, shrubs, and grass) on or adjacent to the work site, which are not to be removed and which do not unreasonably interfere with the work required under this contract. The Contractor shall only remove trees when specifically authorized to do so, and shall avoid damaging vegetation that will remain in place. If any limbs or branches of trees are broken during contract performance, or by the careless operation of equipment, or by workmen, the Contractor shall trim those limbs or branches with a clean cut and paint the cut with a tree-pruning compound as directed by the COTR.
- B. The Contractor shall protect from damage all existing improvements and utilities at or near the work site and on adjacent property of a third party, the locations of which are made known to or should be known by the Contractor. The Contractor shall repair any damage to those facilities, including those that are the property of a third party, resulting from failure to comply with the requirements of this contract or failure to exercise reasonable care in performing the work. If the Contractor fails or refuses to repair the damage promptly, the Contracting Officer may have the necessary work performed and charge the cost to the Contractor.

(FAR 52.236-9)

- C. Refer to Section 01568, ENVIRONMENTAL PROTECTION, for additional requirements on protecting vegetation, soils and the environment. Refer to Articles, "Alterations", "Restoration", and "Operations and Storage Areas" for additional instructions concerning repair of damage to structures and site improvements.

1.8 RESTORATION

- A. Remove, cut, alter, replace, patch and repair existing work as necessary to install new work. Except as otherwise shown or specified, do not cut, alter or remove any structural work, and do not disturb any ducts, plumbing, steam, gas, or electric work without approval of the COTR. Existing work to be altered or extended and that is found to be defective in any way, shall be reported to the COTR before it is disturbed. Materials and workmanship used in restoring work, shall conform in type and quality to that of original existing construction, except as otherwise shown or specified.
- B. Upon completion of contract, deliver work complete and undamaged. Existing work (walls, ceilings, partitions, floors, mechanical and electrical work, lawns, paving, roads, walks, etc.) disturbed or removed as a result of performing required new work, shall be patched, repaired, reinstalled, or replaced with new work, and refinished and left in as good condition as existed before commencing work.
- C. At Contractor's own expense, Contractor shall immediately restore to service and repair any damage caused by Contractor's workmen to existing piping and conduits, wires, cables, etc., of utility services or of fire protection systems and communications systems (including telephone) which are indicated on drawings and which are not scheduled for discontinuance or abandonment.
- D. Expense of repairs to such utilities and systems not shown on drawings or locations of which are unknown will be covered by adjustment to contract time and price in accordance with clause entitled "CHANGES" (FAR 52.243-4 and VAAR 852.236-88) and "DIFFERING SITE CONDITIONS" (FAR 52.236-2) of Section 01001, GENERAL CONDITIONS.

1.9 LAYOUT OF WORK

The Contractor shall lay out the work from Government established base lines and bench marks, indicated on the drawings, and shall be responsible for all measurements in connection with the layout. The Contractor shall furnish, at Contractor's own expense, all stakes, templates, platforms, equipment, tools, materials, and labor required to lay out any part of the work. The Contractor shall be responsible for executing the work to the lines that may be established or indicated by the Contracting Officer. The Contractor shall also be responsible for maintaining and preserving all stakes and other marks

established by the Contracting Officer until authorized to remove them. If such marks are destroyed by the Contractor or through Contractor's negligence before their removal is authorized, the Contracting Officer may replace them and deduct the expense of the replacement from any amounts due or to become due to the Contractor.

(FAR 52.236-17)

1.10 AS-BUILT DRAWINGS

- A. The contractor shall maintain two full size sets of as-built drawings which will be kept current during construction of the project, to include all contract changes, modifications and clarifications.
- B. All variations shall be shown in the same general detail as used in the contract drawings. To insure compliance, as-built drawings shall be made available for the COTR's review, as often as requested.
- C. Contractor shall deliver two approved completed sets of as-built drawings to the COTR within 15 calendar days after each completed phase and after the acceptance of the project by the COTR.
- D. Paragraphs A, B, & C shall also apply to all shop drawings.

1.11 USE OF ROADWAYS

For hauling, use only established public roads and roads on Medical Center property and, when authorized by the COTR, such temporary roads which are necessary in the performance of contract work. Temporary roads shall be constructed by the Contractor at Contractor's expense. When necessary to cross curbing, sidewalks, or similar construction, they must be protected by well-constructed bridges.

1.12 TEMPORARY USE OF MECHANICAL AND ELECTRICAL EQUIPMENT

- A. Use of new installed mechanical and electrical equipment to provide heat, ventilation, plumbing, light and power will be permitted subject to compliance with the following provisions:
 - 1. Permission to use each unit or system must be given by COTR. If the equipment is not installed and maintained in accordance with the following provisions, the COTR will withdraw permission for use of the equipment.
 - 2. Electrical installations used by the equipment shall be completed in accordance with the drawings and specifications to prevent damage to the equipment and the electrical systems, i.e. transformers, relays, circuit breakers, fuses, conductors, motor controllers and their overload elements shall be properly sized, coordinated and adjusted.

- Voltage supplied to each item of equipment shall be verified to be correct and it shall be determined that motors are not overloaded. The electrical equipment shall be thoroughly cleaned before using it and again immediately before final inspection including vacuum cleaning and wiping clean interior and exterior surfaces.
3. Units shall be properly lubricated, balanced, and aligned. Vibrations must be eliminated.
 4. Automatic temperature control systems for preheat coils shall function properly and all safety controls shall function to prevent coil freeze-up damage.
 5. The air filtering system utilized shall be that which is designed for the system when complete, and all filter elements shall be replaced at completion of construction and prior to testing and balancing of system.
 6. All components of heat production and distribution system, metering equipment, condensate returns, and other auxiliary facilities used in temporary service shall be cleaned prior to use; maintained to prevent corrosion internally and externally during use; and cleaned, maintained and inspected prior to acceptance by the Government.
- B. Prior to final inspection, the equipment or parts used which show wear and tear beyond normal, shall be replaced with identical replacements, at no additional cost to the Government.
- C. This paragraph shall not reduce the requirements of the mechanical and electrical specifications sections.

1.13 TEMPORARY USE OF EXISTING ELEVATORS

Contractor will not be allowed the use of existing elevators. Outside type hoist shall be used by Contractor for transporting materials and equipment.

1.14 TEMPORARY TOILETS

Provide where directed, (for use of all Contractor's workmen) ample temporary sanitary toilet accommodations with suitable sewer and water connections; or, when approved by COTR, provide suitable dry closets where directed. Keep such places clean and free from flies, and all connections and appliances connected therewith are to be removed prior to completion of contract, and premises left perfectly clean.

1.15 AVAILABILITY AND USE OF UTILITY SERVICES

- A. The Government shall make all reasonably required amounts of utilities available to the Contractor from existing outlets and supplies, as specified in the contract. The amount to be paid by the Contractor for chargeable electrical services shall be the prevailing rates charged to the Government. The Contractor shall carefully conserve any utilities furnished without charge.
- B. The Contractor, at Contractor's expense and in a workmanlike manner satisfactory to the Contracting Officer, shall install and maintain all necessary temporary connections and distribution lines, and all meters required for temporary electrical service. Confirm points of connection and routing of lines with COTR. Before final acceptance of the work by the Government, the Contractor shall remove all the temporary connections, distribution lines and associated paraphernalia. Contractor shall repair damage to room finishes and shall restore fire-rated walls at penetrations.
- C. Heat: Furnish temporary heat necessary to prevent injury to work and materials through dampness and cold. Use of open salamanders or any temporary heating devices which may be fire hazards or may smoke and damage finished work, will not be permitted. Maintain minimum temperatures as specified for various materials.
Obtain heat by connecting to Medical Center heating distribution system; steam is available at no cost to Contractor.
- D. Electricity (for Construction and Testing): Furnish all temporary electric services.
Obtain electricity by connecting to the Medical Center electrical distribution system. The Contractor shall meter and pay for electricity required for electric cranes and hoisting devices, electrical welding devices and any electrical heating devices providing temporary heat. Electricity for all other uses is available at no cost to the Contractor.
- E. Water (for Construction and Testing): Furnish temporary water service.
1. Obtain water by connecting to the Medical Center water distribution system. Provide reduced pressure backflow preventer at each connection. Water is available at no cost to the Contractor.
 2. Maintain connections, pipe, fittings and fixtures and conserve water-use so none is wasted. Failure to stop leakage or other wastes

will be cause for revocation (at COTR's discretion) of use of water from Medical Center's system.

G. Steam: Furnish steam system for testing required in various sections of specifications.

1. Obtain steam for testing by connecting to the Medical Center steam distribution system. Steam is available at no cost to the Contractor.
2. Maintain connections, pipe, fittings and fixtures and conserve steam-use so none is wasted. Failure to stop leakage or other waste will be cause for revocation (at COTR's discretion), of use of steam from the Medical Center's system.

1.16 NEW TELEPHONE EQUIPMENT

The contractor shall coordinate with the work of installation of telephone equipment by others. This work shall be completed before the building is turned over to VA.

1.17 TESTS

- A. Pre-test mechanical and electrical equipment and systems and make corrections required for proper operation of such systems before requesting final tests. Final test will not be conducted unless pre-tested.
- B. Conduct final tests required in various sections of specifications in presence of an authorized representative of the Contracting Officer. Contractor shall furnish all labor, materials, equipment, instruments, and forms, to conduct and record such tests.
- C. Mechanical and electrical systems shall be balanced, controlled and coordinated. A system is defined as the entire complex which must be coordinated to work together during normal operation to produce results for which the system is designed. For example, air conditioning supply air is only one part of entire system which provides comfort conditions for a building. Other related components are return air, exhaust air, steam, chilled water, refrigerant, hot water, controls and electricity, etc. Another example of a complex which involves several components of different disciplines is a boiler installation. Efficient and acceptable boiler operation depends upon the coordination and proper operation of fuel, combustion air, controls, steam, feedwater, condensate and other related components.

- D. All related components as defined above shall be functioning when any system component is tested. Tests shall be completed within a reasonably short period of time during which operating and environmental conditions remain reasonably constant.
- E. Individual test result of any component, where required, will only be accepted when submitted with the test results of related components and of the entire system.

1.18 INSTRUCTIONS

- A. Contractor shall furnish Maintenance and Operating manuals and verbal instructions when required by the various sections of the specifications and as hereinafter specified.
- B. Manuals: Maintenance and operating manuals (four copies each) for each separate piece of equipment shall be delivered to the COTR coincidental with the delivery of the equipment to the job site. Manuals shall be complete, detailed guides for the maintenance and operation of equipment. They shall include complete information necessary for starting, adjusting, maintaining in continuous operation for long periods of time and dismantling and reassembling of the complete units and sub-assembly components. Manuals shall include an index covering all component parts clearly cross-referenced to diagrams and illustrations. Illustrations shall include "exploded" views showing and identifying each separate item. Emphasis shall be placed on the use of special tools and instruments. The function of each piece of equipment, component, accessory and control shall be clearly and thoroughly explained. All necessary precautions for the operation of the equipment and the reason for each precaution shall be clearly set forth. Manuals must reference the exact model, style and size of the piece of equipment and system being furnished. Manuals referencing equipment similar to but of a different model, style, and size than that furnished will not be accepted.
- C. Instructions: Contractor shall provide qualified, factory-trained manufacturers' representatives to give detailed instructions to assigned Department of Veterans Affairs personnel in the operation and complete maintenance for each piece of equipment. All such training will be at the job site. These requirements are more specifically detailed in the various technical sections. Instructions for different items of equipment that are component parts of a complete system, shall

be given in an integrated, progressive manner. All instructors for every piece of component equipment in a system shall be available until instructions for all items included in the system have been completed. This is to assure proper instruction in the operation of inter-related systems. All instruction periods shall be at such times as scheduled by the COTR and shall be considered concluded only when the COTR is satisfied in regard to complete and thorough coverage. The Department of Veterans Affairs reserves the right to request the removal of, and substitution for, any instructor who, in the opinion of the COTR, does not demonstrate sufficient qualifications in accordance with requirements for instructors above.

1.19 GOVERNMENT-FURNISHED PROPERTY

- A. The Government shall deliver to the Contractor, the Government-furnished property shown on the drawings.
- B. Equipment furnished by Government to be installed by Contractor will be furnished to Contractor at the Medical Center.
- C. Storage space for equipment will be provided by the Government and the Contractor shall be prepared to unload and store such equipment therein upon its receipt at the Medical Center.
- D. Notify Contracting Officer in writing, 60 days in advance, of date on which Contractor will be prepared to receive equipment furnished by Government. Arrangements will then be made by the Government for delivery of equipment.
 - 1. Immediately upon delivery of equipment, Contractor shall arrange for a joint inspection thereof with a representative of the Government. At such time the Contractor shall acknowledge receipt of equipment described, make notations, and immediately furnish the Government representative with a written statement as to its condition or shortages.
 - 2. Contractor thereafter is responsible for such equipment until such time as acceptance of contract work is made by the Government.
- E. Equipment furnished by the Government will be delivered in a partially assembled (knock down) condition in accordance with existing standard commercial practices, complete with all fittings, fastenings, and appliances necessary for connections to respective services installed under contract. All fittings and appliances (i.e., couplings, ells, tees, nipples, piping, conduits, cables, and the like) necessary to

make the connection between the Government furnished equipment item and the utility stub-up shall be furnished and installed by the contractor at no additional cost to the Government.

- F. Completely assemble and install the Government furnished equipment in place ready for proper operation in accordance with specifications and drawings.
- G. Furnish supervision of installation of equipment at construction site by qualified factory trained technicians regularly employed by the equipment manufacturer.

1.20 CONSTRUCTION SIGN

- A. Provide a Construction Sign where directed by the COTR. All wood members shall be of framing lumber. Cover sign frame with 0.7 mm (24 gage) galvanized sheet steel nailed securely around edges and on all bearings. Provide three 100 by 100 mm (4 inch by 4 inch) posts (or equivalent round posts) set 1200 mm (four feet) into ground. Set bottom of sign level at 900 mm (three feet) above ground and secure to posts with through bolts. Make posts full height of sign. Brace posts with 50 x 100 mm (two by four inch) material as directed.
- B. Paint all surfaces of sign and posts two coats of white gloss paint. Border and letters shall be of black gloss paint, except project title which shall be blue gloss paint.
- C. Maintain sign and remove it when directed by the COTR.
- D. Detail Drawing of construction sign showing required legend and other characteristics of sign is shown on the drawings.

1.21 CONSTRUCTION PHOTOGRAPHS

- A. During construction period through completion, furnish Department of Veterans Affairs 50 views of photographs, which include one color print of each view and one Compact Disc (CD) per visit containing those views taken that visit. Photographic views shall be taken of exterior and interior as selected and directed by COTR. Photographs of reinforcing steel shall be taken after all reinforcing steel, sleeves, inserts, etc. are in place but prior to setting of runways.
 - 1. Normally such photographs will be taken at monthly intervals.
However, the COTR may also direct taking of special photographs at any time prior to completion and acceptance of contract.
 - 2. In event a greater or lesser number of photographs than above specified are required by the COTR, adjustment in contract price

- will be made in accordance with clause entitled "CHANGES" (FAR 52.243-4 and VAAR 852.236-88) of Section 01001, GENERAL CONDITIONS.
- B. Photographs shall be taken by a commercial photographer and must show distinctly, at as large a scale as possible, all parts of work embraced in picture. Prints shall be made on 200 x 250 mm (8 by 10 inch) regular-weight matte paper and produced by an Ektacolor or Kodacolor process:
1. Photographs shall have 200 x 200 mm (8 by 8 inch) full picture print with no margin on three sides and masking out of negative 50 mm (2 inches) on the bottom for pretyped self-adhesive identity label to be added by COTR.
- C. Prints must be shipped flat to the COTR:
1. In case any set of prints are not submitted within five days of date established by COTR for taking thereof, the COTR shall have such photographs taken and cost of same will be deducted from any money due to the Contractor.

1.22 FINAL ELEVATION PHOTOGRAPHS

- A. Identifying data shall be carried on label affixed to back of photograph without damage to photograph and shall be similar to that provided for final construction photographs.
- B. Photographs shall be taken upon completion, including landscaping. They shall be taken on a clear sunny day to obtain sufficient detail to show depth and to provide clear, sharp pictures. They shall be 400 mm x 500 mm (16 by 20 inches), on regular weight paper, matte finish, and produced by an Ektacolor or Kodacolor process from not less than 100 by 125 mm (four by five inch) negatives. In addition, provide all final elevation photographs in electronic format on Compact Discs (CD).
- C. Furnish one 400 mm x 500 mm (16 by 20 inch) color print of the following buildings constructed under this project. Photographs shall be artistically composed showing full front elevations. A minimum of three views shall be taken and proofs submitted to the COTR for selection of final photograph. Back of prints to be labeled with Project Title, location and date. Negatives shall become property of the Government and must be forwarded with photographs. Photographs shall be shipped flat and delivered to the COTR.

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**SECTION 01090
REFERENCE STANDARDS**

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies the availability and source of references and standards specified in the project manual under paragraphs APPLICABLE PUBLICATIONS and/or shown on the drawings.

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

- A. The GSA Index of Federal Specifications, Standards and Commercial Item Descriptions, FPMR Part 101-29 and copies of specifications, standards, and commercial item descriptions cited in the solicitation may be obtained for a fee by submitting a request to - GSA Federal Supply Service, Specifications Section, Suite 8100, 470 East L'Enfant Plaza, SW, Washington, DC 20407, Telephone (202) 619-8925, Facsimile (202) 619-8978.
- B. If the General Services Administration, Department of Agriculture, or Department of Veterans Affairs issued this solicitation, a single copy of specifications, standards, and commercial item descriptions cited in this solicitation may be obtained free of charge by submitting a request to the addressee in paragraph (a) of this provision. Additional copies will be issued for a fee.

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

The specifications and standards cited in this solicitation can be examined at the following location:

DEPARTMENT OF VETERANS AFFAIRS
Office of Facilities Management
Facility Quality Service (181A)
811 Vermont Avenue, NW - Room 462
Washington, DC 20420
Telephone Number: (202) 565-6455
Between 9:00 AM - 3:00 PM

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

The specifications cited in this solicitation may be obtained from the associations or organizations listed below.

AA Aluminum Association Inc.

<http://www.aluminum.org>

AABC Associated Air Balance Council

<http://www.aabchg.com>

AAMA American Architectural Manufacturer's Association

<http://www.aamanet.org>

AAN American Nursery and Landscape Association

<http://www.anla.org>

AASHTO American Association of State Highway and Transportation
Officials

<http://www.aashto.org>

AATCC American Association of Textile Chemists and Colorists

<http://www.aatcc.org>

ACGIH American Conference of Governmental Industrial Hygienists

<http://www.acgih.org>

ACI American Concrete Institute

<http://www.aci-int.net>

ACPA American Concrete Pipe Association

<http://www.concrete-pipe.org>

ACPPA American Concrete Pressure Pipe Association

<http://www.acppa.org>

ADC Air Diffusion Council

<http://flexibleduct.org>

AGA American Gas Association

<http://www.aga.org>

AGC Associated General Contractors of America

<http://www.agc.org>

AGMA American Gear Manufacturers Association, Inc.

<http://www.agma.org>

AHAM Association of Home Appliance Manufacturers

<http://www.aham.org>

AISC American Institute of Steel Construction

<http://www.aisc.org>

AISI	American Iron and Steel Institute http://www.steel.org
AITC	American Institute of Timber Construction http://www.aitc_glulam.org
AMCA	Air Movement and Control Association, Inc. http://www.amca.org
ANLA	American Nursery & Landscape Association http://www.anal.org
ANSI	American National Standards Institute, Inc. http://www.ansi.org
APA	The Engineered Wood Association http://www.apawood.org
ARI	Air-Conditioning and Refrigeration Institute http://www.ari.org
ASAE	American Society of Agricultural Engineers http://www.asae.org
ASCE	American Society of Civil Engineers http://www.asce.org
ASHRAE	American Society of Heating, Refrigerating, and Air-Conditioning Engineers http://www.ashrae.org
ASME	American Society of Mechanical Engineers http://www.asme.org
ASSE	American Society of Sanitary Engineering http://www.asse-plumbing.org
ASTM	American Society for Testing and Materials http://www.astm.org
AWI	Architectural Woodwork Institute http://www.awinet.org
AWA	American Welding Society, Inc. http://www.amweld.org
AWWA	American Water Works Association http://www.awwa.org
BHMA	Builders Hardware Manufacturers Association http://www.buildershardware.com
BIA	Brick Institute of America http://www.bia.org

BOCA The Building Officials and Code Administrators International
<http://www.bocai.org>

CAGI Compressed Air and Gas Institute
<http://www.cagi.org>

CGA Compressed Gas Association, Inc.
<http://www.cganet.com>

CI The Chlorine Institute, Inc.
<http://www.cl2.com>

CISCA Ceilings and Interior Systems Construction Association
<http://www.cisca.org>

CISPI Cast Iron Soil Pipe Institute
<http://www.cispi.org>

CLFMI Chain Link Fence Manufacturers Institute
9891 Broken Land Parkway Suite 300
Columbia, MD 21046
(301) 596-2584

CPMB Concrete Plant Manufacturers Bureau
900 Spring Street
Silver Spring, MD 20910
(301) 587-1400

CRA California Redwood Association
<http://www.calredwood.org>

CRSI Concrete Reinforcing Steel Institute
933 N. Plum Grove Road
Schamburg, IL 60173
(708) 517-1200
Publications: P.O. Box 100125
Roswell, GA 30075

CTI Cooling Technology Institute
<http://www.cti.org>

DHI Door and Hardware Institute
<http://www.dhi.org>

EGSA Electrical Generating Systems Association
<http://www.egsa.org>

EEI Edison Electric Institute
<http://www.eei.org>

EPA Environmental Protection Agency
<http://www.epa.gov>

ETL ETL Testing Laboratories, Inc.
Industrial Park, Route 11; P.O. Box 2040
Cortland, NY 13045
(607) 753-6711

FAA Federal Aviation Administration
<http://www.faa.gov>

FCC Federal Communications Commission
<http://www.fcc.gov>

FPS The Forest Products Society
<http://www.forestprod.org>

GANA Glass Association of North America
<http://www.cssinfo.com/info/gana.htm/>

FM Factory Mutual Insurance
<http://www.fmglobal.com>

GA Gypsum Association
<http://www.gypsum.org>

GSA General Services Administration
<http://www.gsa.gov>

HI Hydraulic Institute
<http://www.pumps.org>

HPVA Hardwood Plywood & Veneer Association
<http://www.hpva.org>

ICBO International Conference of Building Officials
<http://www.icbo.org>

ICEA Insulated Cable Engineers Association Inc.
<http://www.icea.net>

\ICAC Institute of Clean Air Companies
<http://www.icac.com>

IEEE Institute of Electrical and Electronics Engineers
<http://www.ieee.org/>

IMSA International Municipal Signal Association
<http://www.imsasafety.org>

IPCEA Insulated Power Cable Engineers Association
See - ICEA

ITS Inchcape Testing Services
 One Tech Drive
 Andover, MA 01810
 (800) 967-5352 / FAX: (800) 813-9442

NBMA Metal Buildings Manufacturers Association
 <http://www.mbma.com>

MSS Manufacturers Standardization Society of the Valve and Fittings
 Industry Inc.
 <http://www.mss-hq.com>

NAAMM National Association of Architectural Metal Manufacturers
 <http://www.naamm.org>

NAPHCC Plumbing-Heating-Cooling Contractors Association
 <http://www.phccweb.org.org>

NBHA National Builders' Hardware Association
 See - DHI

NBS National Bureau of Standards
 See - NIST

NBBPVI National Board of Boiler and Pressure Vessel Inspectors
 <http://www.nationboard.org>

NEC National Electric Code
 See - NFPA National Fire Protection Association

NEMA National Electrical Manufacturers Association
 <http://www.nema.org>

NFPA National Fire Protection Association
 <http://www.nfpa.org>

NHLA National Hardwood Lumber Association
 <http://www.natlhardwood.org>

NIH National Institute of Health
 <http://www.nih.gov>

NIST National Institute of Standards and Technology
 <http://www.nist.gov>

NLMA Northeastern Lumber Manufacturers Association, Inc.
 <http://www.nelma.org>

NPA National Particleboard Association
 18928 Premiere Court
 Gaithersburg, MD 20879
 (301) 670-0604

NSF National Sanitation Foundation
<http://www.nsf.org>

NWWDA Window and Door Manufacturers Association
<http://www.nwwda.org>

OSHA Occupational Safety and Health Administration
Department of Labor
<http://www.osha.gov>

PCA Portland Cement Association
<http://www.portcement.org>

PCI Precast Prestressed Concrete Institute
<http://www.pci.org>

PPI The Plastic Pipe Institute
<http://www.plasticpipe.org>

PEI Porcelain Enamel Institute, Inc.
<http://www.porcelainenamel.com>

PTI Post-Tensioning Institute
<http://www.post-tensioning.org>

RFCI The Resilient Floor Covering Institute
<http://www.rfci.com>

RIS Redwood Inspection Service
See - CRA

RMA Rubber Manufacturers Association, Inc.
<http://www.rma.org>

SCMA Southern Cypress Manufacturers Association
<http://www.cypressinfo.org>

SDI Steel Door Institute
<http://www.steeldoor.org>

SHLMA Southern Hardwood Lumber Manufacturers
2831 Airway Blvd; Suite 205
Memphis, TN 38132
(901) 346-2222

SIGMA Sealed Insulating Glass Manufacturers Association
401 N. Michigan Avenue
Chicago, IL 60611
(312) 644-6610

SJI Steel Joist Institute
<http://www.steeljoist.org>

SOL 663-01-05
VA Seattle Building 100
Ambulatory Clinic Expansion

SMACNA Sheet Metal and Air-Conditioning Contractors
National Association, Inc.
<http://www.smacna.org>

SPIB Southern Pine Inspection Bureau
4709 Scenic Highway
Pensacola, FL 32504
(904) 434-2611

SSPC The Society for Protective Coatings
<http://www.sspc.org>

STI Steel Tank Institute
<http://www.steeltank.com>

SWI Steel Window Institute
<http://www.steelwindows.com>

TCA Tile Council of America, Inc.
<http://www.tileusa.com>

TEMA Tubular Exchange Manufacturers Association
<http://www.tema.org>

TPI Truss Plate Institute, Inc.
583 D'Onofrio Drive; Suite 200
Madison, WI 53719
(608) 833-5900

UBC The Uniform Building Code
See ICBO

UL Underwriters' Laboratories Incorporated
<http://www.ul.com>

ULC Underwriters' Laboratories of Canada
<http://www.ulc.ca>

WCLIB West Coast Lumber Inspection Bureau
6980 SW Varns Road, P.O. Box 23145
Portland, OR 97223
(503) 639-0651

WRCLA Western Red Cedar Lumber Association
P.O. Box 120786
New Brighton, MN 55112
(612) 633-4334

WSTI Welded Steel Tube Institute
522 Westgate Tower

SECTION 01090
REFERENCE STANDARDS

SOL 663-01-05
VA Seattle Building 100
Ambulatory Clinic Expansion

Cleveland, OH 44116

(440) 333-4550

WWPA Western Wood Products Association

<http://www.wwpa.org>

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**SECTION 01310
EXAM ROOM MOCK-UP**

PART 1- GENERAL

1.1 MOCK-UP REQUIREMENTS:

- A. The Contractor shall construct a mock-up of a typical exam room for review by the Medical Center staff.
- B. The mock-up shall be identified on the project schedule and shall be as early in the construction process as is applicable. It shall precede framing of the interior walls, installation of data or electrical boxes and submittal of Section 12302 Wood Casework shop drawings.
- C. The mock-up shall be of Room 2D-A02 or other exam approved by COTR.
- D. The mock-up shall include the following elements:
 1. Section 09100 NON-LOAD BEARING FRAMING SYSTEMS: Walls framed around one room.
 2. Section 092600 GYPSUM BOARD SYSTEM: Inside walls of exam room covered with GWB and finished.
 3. Section 09900 PAINTING: Interior of room painted PT-1. Door frame painted PT-2.
 4. Section 095110 ACOUSTICAL CEILING: 2'x4' ceiling grid and ceiling tiles.
 5. Section 08110 STEEL DORSS AND FRAMES: Install a hollow metal frame for the door.
 6. Section 08210 WOOD DOORS: Installation of a temporary solid-core wood door (use of specified finish not required).
 7. Section 096600 RESILIENT TILE FLOORING; Section 09680 BASE AND ACCESSORIES: Floor prep only required; floor coverings not required.
 8. Section 108000 TOILET ACCESSORIES: Installation of contractor and owner-furnished accessories.
 9. Section 08710 FINISH HARDWARE: Provide one door hardware with latchset..
 10. Section 12302 CASEWORK: A mock-up and installation of the exam table. Install with a KBT.
 11. Division 15000: Installation of a wall-hung lav with faucets. No connection to water or waste lines is required. No HVAC requirements except for temporary mounting of a thermostat, without connection to the HVAC system.

12. Division 16000: Installation of room lighting connected to temporary power, through light switch. Location of power and data outlets with cover plates temporarily attached to the walls. No power or data connections are required.

F. The Department of Veterans Affairs may make adjustments to locations of wall-hung items, backing and other features based on evaluation of the mock-up.

G. Do not proceed with Section 091000 NON-LOAD BEARING FRAMING or Division 16000 electrical work until approval of the mock-up.

H. Where the Contractor is unable to obtain construction materials due to lead time or scheduling, similar materials may be substituted with prior approval of the COTR.

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**SECTION 01312
CRITICAL PATH SCHEDULE**

PART 1 - GENERAL

1.1 DESCRIPTION:

- A. The contractor shall develop a Critical Path Schedule (CPS) plan and schedule demonstrating fulfillment of the contract requirements of this section and shall utilize the plan for scheduling, coordination and monitoring work under this contract (including all activities of subcontractors, equipment vendors and suppliers). Conventional Critical Path Method (CPM) Precedence Diagram Method (PDM) will be utilized to satisfy both time and cost applications.
- B. Use the principles and definitions of the terms in the Associated General Contractors of America (AGC) publication "The use of CPM in Construction, A Manual for General Contractors and The Construction Industry," Copyright 1976, except the provisions specified in this section shall govern.

1.2 CONTRACTOR'S REPRESENTATIVE:

- A. The contractor shall designate an authorized representative who will be responsible for the preparation and updating the project CPS network for review and progress reporting with and to the COTR. The Contractor's Representative shall have a minimum of three (3) years of construction scheduling experience including the basic requirements and elements of this section.

1.3 CONTRACTOR'S SCHEDULES GENERAL REQUIREMENTS:

- A. Contractor shall use the latest version of Primavera Project Planning software or Sure Trak Project Planning Software.
- B. Time of completion of the project and of completion for each milestone shall adhere to the times specified in the Contract unless an earlier (advanced) time of completion is requested by the Contractor and agreed to by the Contracting Officer by issuance of a Supplemental Agreement.
- C. Float time is the amount of time between the earliest start date and the latest start date or between the earliest finish date and the latest finish date of activities of the Contract Schedule. No time extension or delay costs will be allowed for delays caused by the Government on paths of activities containing float time providing such delay does not exceed the float time, per the approved Contract Schedule.

1.4 CONTRACTOR'S SCHEDULE:

A. Interim Contract Schedule

1. Within fourteen (14) calendar days after receiving Notice to Proceed, Contractor shall furnish to the COTR two (2) prints of a Interim(preliminary) Contract Schedule with files on a compact disk (CD).
2. The Interim Contract Schedule shall be a time scaled precedence diagram of the Critical Path Method (CPM) type.
3. The Interim Contract Schedule shall provide the following:
 - a) The general plan of work reflecting all major milestones and the phasing requirements specified in the section GENERAL REQUIREMENTS.
 - b) Details of planned mobilization of plant and equipment.
 - c) Sequence of early operations and procurement of materials and equipment.
 - d) The Interim Schedule shall describe the activities to be accomplished and their interdependencies subject to all requirements specified, where appropriate. All work activities, other than procurement activities, shall be cost loaded as specified and are the basis for partial payment during the beginning months of the contract while the complete working schedule is being developed and approved. The Interim Schedule shall not be used for time extension analysis. All CPM data supporting any time extension request in accordance with article ADJUSTMENT OF CONTRACT COMPLETION will be derived from the approved final schedule from the contractor.
4. The Contracting Officer and COTR will review the Interim Contract Schedule for conformance with the requirements of the contract. The VA will return the Interim Contract Schedule with comments within seven (7) calendar days after receiving it from the contractor. The Contractor shall use the Interim Contract Schedule and comments from COTR as the basis for preparing the Contract Schedule.

B. Contract Schedule

1. Within forty (40) calendar days after receiving Notice to Proceed, Contractor shall furnish to the COTR, two prints and (1) CD of a

detailed schedule presenting an orderly and realistic plan for completion of the work.

2. The Contract Schedule shall provide the following:
 - a) A time scaled cost and manpower loaded CPM diagram in precedence format.
 - b) No activity on the schedule shall have a duration longer than thirty (30) calendar days, with the exception of fabrication, procurement, punch list activities, and submittal reviews, unless otherwise approved by the COTR. Activity durations shall be the total number of actual days required to perform that activity including consideration of weather impact on completion of that activity.
 - c) Procurement of major equipment, through receipt and inspection at the work site, shall be identified as a separate activity. If installation of minor equipment is part of a broader construction activity, procurement of that minor equipment will not imply progress of that activity.
 - d) VAMC (FOIC) furnished materials and equipment shall be identified as separate activities with deliver dates and storage coordination dates.
 - e) Activities of each project phase, if specified, shall show the plan for completion of the work for each phase within the time or milestone specified.
 - f) Dependencies (or relationships) and logic shall be given between all activities.
 - g) Activities that are dependent on submittal approval and/or material delivery shall not be scheduled to start earlier than the expected approval or delivery dates.
 - h) Each activity shall be tied to a cost breakdown entry with the coding on the Contract Schedule of Values to establish the tie. The Construction Specification Institute (CSI) 16 Division format shall be used for cost coding. The sum of all activities in the Contract Schedule shall equal the total Contract Value in accordance with Article ACTIVITY COST DATA.
 - i) A responsibility code for each activity shall be included corresponding to the subcontractor or trade responsible for performing the work.

- j) Activities shall be included with an appropriate number of days for VA inspection, punch list development, completion of punch list items, testing, training and final clean-up for the work or any designated portion thereof.
3. The COTR and Contracting Officer will review the Contract Schedule for conformance with the requirements of the contract. Within fifteen (10) calendar days after receipt, the COTR will approve the Contract Schedule or return it with comments. If the Contract Schedule is not returned approved, the Contractor shall revise the schedule to incorporate comments and resubmit the schedule for approval within seven (7) calendar days after receipt. The approved schedule shall become the Approved Contract Schedule.
4. If the during the course of the contract, the sequence of construction or apparent contract completion date differs significantly, as determined by the COTR, from the Approved Contract Schedule, the Contractor shall, submit within fifteen (15) calendar days of request a revised schedule to the Contracting Officer for approval. The revised schedule shall indicate the current sequence of construction activities.
5. When a Proposed Change Order or Supplemental Agreement is issued which has the potential to impact specific completion dates, a Network Window shall be prepared by Contractor to reflect the impact of such changes. After the Network Window has been approved and the Contractor is ordered to proceed with the Proposed Change Order, it shall be incorporated into the Approved Contract Schedule.

1.5 SHORT INTERVAL SCHEDULE:

- A. A Short Interval Schedule (SIS) shall be submitted weekly for review by the COTR.
- B. Short Interval Scheduling shall be used throughout on site construction activity.
- C. The interval shall be a three week schedule and shall include the past week, the week submitted and the week thereafter.
- D. The Short Interval Schedule shall contain sufficient detail to evaluate daily milestones and manpower/equipment loading and shall identify/tie into the Approved Contract Schedule.
- E. A weekly meeting will be scheduled at the VA Engineering Office, by the Contracting Officer, to review and discuss the Short Interval Schedule.

F. The weekly Short Interval Schedule shall be approved by the COTR.

1.6 DAILY ACTIVITY REPORTS:

- A. The Contractor shall submit by noon of the following day a Daily Activity Report to COTR for each work day including weekends and Holidays when worked.
- B. The COTR will furnish report forms, however, Contractor may use his own report provided it contains the same information included in the standard form furnished by department.
- C. The report will include equipment, manpower, deliveries, weather conditions, construction activities and issues affecting possible delays or additional costs.

1.7 PROCUREMENT LOG

- A. Within fourteen (14) days after receiving Notice to Proceed, Contractor shall furnish to the COTR three (3) prints of a Procurement Log with files on a CD.
- B. The Procurement Log shall include the following information for each type of material and equipment to be provided:
 - 1. Material or equipment description.
 - 2. Technical specification reference.
 - 3. Duration in days required for preparation and review of submittals.
 - 4. Duration in days required for fabrication and delivery.
 - 5. Cross reference to activities which will be affected by the delivery date of the material or equipment item.
 - 6. Scheduled delivery dates.

1.8 COMPUTER PRODUCED REPORTS AND DIAGRAMS:

- A. Contractor shall submit to the COTR each month concurrent with the submission of progress payment request, two (2) copies of updated computer generated reports and diagrams for the Approved Contract. B.

The following shall be submitted:

- 1. A schedule logic report listing the activities, their early/late and actual start and finish dates, duration, float and the logic relationship of activities sorted by early start.
- 2. A cost report listing each activity and its associated cost, percentage of work accomplished, earned value to date, previous payment amounts earned for the update period.
- 3. A bar chart showing status of activities including percent complete, duration and float.

1.9 ACTIVITY COST DATA:

- A. The contractor shall cost load all work activities except procurement activities. Separate costs shall be included for material and labor in cost loaded activities. The cumulative amount of all cost loaded work activities (including alternates) shall equal the total contract price. Prorate overhead, profit and general conditions on all activities for the entire project length.
- B. In accordance with Article PERFORMANCE OF WORK BY THE CONTRACTOR in the section, GENERAL CONDITIONS, the Contractor shall submit, simultaneously with the cost per activity of the construction schedule required by this section, a responsibility code for all activities of the network for which the Contractor's forces will perform the work.

2.0 PAYMENT TO THE CONTRACTOR:

- A. The Contractor submission of a "Progress Update Report" showing updated activities and cost data in accordance with the provisions of the following Payment and Progress Reporting is the basis upon which progress payments will be made pursuant to Article, PAYMENT UNDER FIXED-PRICE CONSTRUCTION CONTRACTS of Section GENERAL CONDITIONS and Section 01340 SAMPLES AND SHOP DRAWINGS. The Contractor is entitled to a progress payment upon approval of estimates as determined from the currently approved updated computer-produced calendar-dated schedule unless, in special situation, the Contracting Officer permits an exception to this requirement.
- B. When the contractor fails or refuses to furnish the information and CPM Data, which, in the sole judgment of the COTR, is necessary for processing the computer-produced calendar-dated schedules, the Contractor shall not be deemed to have provided an estimate upon which progress payment may be made.

2.1 PAYMENT AND PROGRESS REPORTING:

- A. The Contractor shall complete their copy of the "Progress Payment Report" and all other data required by this section shall be accurately filled in and completed prior to the weekly progress meeting. The Contractor shall provide three (3) copies of this information to the COTR in completed form on or within 5 days prior to the end of each month. Job progress will be reviewed to verify:
 - 1. Actual start dates for activities in progress and finish dates for completed activities.

2. Remaining duration, required to complete each activity started, or scheduled to start, but not completed.
3. Logic, time and cost data for change orders and supplemental agreements that are to be incorporated into schedule. Changes in activity sequence and durations which have been made pursuant to the provisions of following Article, ADJUSTMENT OF CONTRACT COMPLETION.
4. Percentage for completed and partially completed activities.
5. Stored materials

2.2 RESPONSIBILITY FOR COMPLETION:

- A. Whenever it becomes apparent from the weekly meetings or the monthly computer-produced calendar-dated schedule that phasing or contract completion dates will not be met, the Contractor shall execute some or all of the following remedial actions:
 1. Increase construction manpower in such quantities and crafts as necessary to eliminate the backlog of work.
 2. Increase the number of working hours per shift, shifts per working day, working days per week, the amount of construction equipment, or any combination of the foregoing to eliminate the backlog of work.
 3. Reschedule the work in conformance with the specification requirements.
 4. Implementation of the above remedial actions, if required, shall be completed at no additional cost to the government.
- B. Prior to proceeding with any of the above actions, the Contractor shall notify and obtain approval from the Contracting Officer and COTR for the proposed schedule changes. If such actions are approved, the CPM revisions shall be incorporated by the Contractor into the schedule before the next monthly update, at no additional cost to the Government.

2.3 CHANGES TO SCHEDULE

- A. The Contractor shall make changes to the Contract Schedule for any of the following reasons:
 1. Delay in completion of any activity or group of activities indicating an extension of the project completion. Such delays which may be involved with contract changes, strikes, unusual weather, and other delays will not relieve the Contractor from the requirements specified unless the conditions are shown on the CPM as

the direct cause for delaying the project beyond the acceptable limits.

2. Delays in submittals, or deliveries, or work stoppage encountered which make re-planning or re-scheduling of the work necessary.
 3. The schedule does not represent the actual prosecution and progress of the project.
- B. CPM revisions made under this paragraph which affect the previously approved schedules for Government furnished equipment, vacating of areas of the Department of Veterans Affairs Medical Center, contract phase(s) and sub-phase(s), utilities furnished by Government to the Contractor, or any other previously contracted item, must be furnished in writing to the COTR for approval.
- C. The COTR's approval of the revised schedule and all relevant data is contingent upon compliance with all other paragraphs of this section and any other previous agreements with the COTR.

2.4 ADJUSTMENT OF CONTRACT COMPLETION:

- A. The contract completion time will be adjusted only for causes specified in this contract. Request for an extension of the contract completion date by the Contractor shall be supported with a justification, and supporting evidence as the Contracting Officer may deem necessary for determination as to whether or not the Contractor is entitled to an extension of time under the provisions of the contract. The Contracting Officer's determination as to the total number of days of contract extension will be based upon the current computer-produced calendar-dated schedule for the time period in question and all other relevant information.
- B. If the time period(s) in question occurred during the preliminary diagram update(s), such update(s) must be converted to the approved schedule, which will then be used as the basis for the time extension request(s). Actual delays in activities which, according to the calendar-dated schedule, do not affect the extended and predicted contract completion dates shown by the critical path in the network will not be the basis for a change to the contract completion date. The Contracting Officer will, within a reasonable time after receipt of such justification and supporting evidence, review the facts and advise the Contractor in writing of the Contracting Officer's decision.

C. The Contractor shall submit each request for a change in the contract completion date to the COTR in accordance with the provisions specified under Article, CHANGES, in the Section, GENERAL CONDITIONS. The Contractor shall include as a part of each change order proposal, a sketch showing all CPM logic revision, duration changes, and cost changes, for work in question and its relationship to other activities on the approved schedule.

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**SECTION 01320
COORDINATION DRAWINGS**

1.1 COORDINATION DRAWINGS INCLUSIONS

Within 30 days of Award of Contract, the Contractor shall submit coordination drawings showing, at a minimum, the following elements in the above ceiling space and the first and second floor interstitial spaces:

1. Architectural elements such as doors, walls, ceilings, hatches, etc.
2. Structural elements such as beams, columns, hanger bars, floors, etc.
3. Location and layout of HVAAC ducts, VAV boxes, diffusers and other elements.
4. Location and layout of plumbing and piping systems.
5. Location and layout of electrical raceways, cable trays, conduits and lighting.
6. The addition to the pneumatic tube system.

1.2 REVISIONS TO COORDINATION DRAWINGS

The Contractor shall coordinate revisions to the designs of the various trades to resolve conflicts. Revisions shall be made within the scope of the Contract Documents.

1.3 CONFLICTS

The Contractor shall notify the COTR of instances where they cannot resolve the conflict of various traces.

1.4 SUBMISSION

The Coordination Drawings shall be submitted as part of the shop drawing process.

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SECTION 01340
SAMPLES AND SHOP DRAWINGS

- 1-1. Refer to Articles titled SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION (FAR 52.236-21) and, SPECIAL NOTES (VAAR 852.236-91), in Section, GENERAL CONDITIONS.
- 1-2. For the purposes of this contract, samples, test reports, certificates, and manufacturers' literature and data shall also be subject to the previously referenced requirements. The following text refers to all items collectively as SUBMITTALS.
- 1-3. Submit for approval, all of the items specifically mentioned under the separate sections of the specification, with information sufficient to evidence full compliance with contract requirements. Materials, fabricated articles and the like to be installed in permanent work shall equal those of approved submittals. After an item has been approved, no change in brand or make will be permitted unless:
 - A. Satisfactory written evidence is presented to, and approved by Contracting Officer, that manufacturer cannot make scheduled delivery of approved item or;
 - B. Item delivered has been rejected and substitution of a suitable item is an urgent necessity or;
 - C. Other conditions become apparent which indicates approval of such substitute item to be in best interest of the Government.
- 1-4. Forward submittals in sufficient time to permit proper consideration and approval action by Government. Time submission to assure adequate lead time for procurement of contract - required items. Delays attributable to untimely and rejected submittals will not serve as a basis for extending contract time for completion.
- 1-5. Submittals will be reviewed for compliance with contract requirements by Architect-Engineer, and action thereon will be taken by COTR on behalf of the Contracting Officer.
- 1-6. Upon receipt of submittals, Architect-Engineer will assign a file number thereto. Contractor, in any subsequent correspondence, shall refer to this file and identification number to expedite replies relative to previously approved or disapproved submittals.
- 1-7. The Government reserves the right to require additional submittals, whether or not particularly mentioned in this contract. If additional submittals beyond those required by the contract are furnished pursuant to request therefor by Contracting Officer, adjustment in contract price and time will be made in accordance with Articles titled CHANGES (FAR 52.243-4) and
- 1-8. CHANGES - SUPPLEMENT (VAAR 852.236-88) of the GENERAL CONDITIONS.

- 1-8. Schedules called for in specifications and shown on shop drawings shall be submitted for use and information of Department of Veterans Affairs and Architect-Engineer. However, the Contractor shall assume responsibility for coordinating and verifying schedules. The Contracting Officer and Architect-Engineer assumes no responsibility for checking schedules or layout drawings for exact sizes, exact numbers and detailed positioning of items.
- 1-9. Submittals must be submitted by Contractor only and shipped prepaid. Contracting Officer assumes no responsibility for checking quantities or exact numbers included in such submittals.
- 1-10. Samples, except laboratory samples, shop drawings, test reports, certificates and manufacturers' literature and data, shall be submitted for approval to the COTR:
Tom Martin, P.E.
VA Medical Center (138)
1660 South Columbian Way
Seattle, WA 98108
- 1-11. Submit samples required by Section 09050, INTERIOR/EXTERIOR FINISHES, MATERIALS, AND FINISH SCHEDULE, in quadruplicate. Submit other samples in single units unless otherwise specified. Submit shop drawings, schedules, manufacturers' literature and data, and certificates in quadruplicate, except where a greater number is specified.
- 1-12. Submittals will receive consideration only when covered by a transmittal letter signed by Contractor. Letter shall be sent via first class mail or delivered and shall contain the list of items, name of Medical Center, name of Contractor, contract number, applicable specification paragraph numbers, applicable drawing numbers (and other information required for exact identification of location for each item), manufacturer and brand, ASTM or Federal Specification Number (if any) and such additional information as may be required by specifications for particular item being furnished. In addition, catalogs shall be marked to indicate specific items submitted for approval.
 - A. A copy of letter must be enclosed with items, and any items received without identification letter will be considered "unclaimed goods" and held for a limited time only.
 - B. Each sample, certificate, manufacturers' literature and data shall be labeled to indicate the name and location of the Medical Center name of

Contractor, manufacturer, brand, contract number and ASTM or Federal Specification Number as applicable and location(s) on project.

- C. Required certificates shall be signed by an authorized representative of manufacturer or supplier of material, and by Contractor.
- 1.13. If submittal samples have been disapproved, resubmit new samples as soon as possible after notification of disapproval. Such new samples shall be marked "Resubmitted Sample" in addition to containing other previously specified information required on label and in transmittal letter.
- 1-14. Approved samples will be kept on file by the COTR at the site until completion of contract, at which time such samples will be delivered to Contractor as Contractor's property. Where noted in technical sections of specifications, approved samples in good condition may be used in their proper locations in contract work. At completion of contract, samples that are not approved will be returned to Contractor only upon request and at Contractor's expense. Such request should be made prior to completion of the contract. Disapproved samples that are not requested for return by Contractor will be discarded after completion of contract.
- 1.15. Submittal drawings (shop, erection or setting drawings) and schedules, required for work of various trades, shall be checked before submission by technically qualified employees of Contractor for accuracy, completeness and compliance with contract requirements. These drawings and schedules shall be stamped and signed by Contractor certifying to such check.
 - A. For each drawing required, submit one legible photographic paper or vellum reproducible.
 - B. Reproducible shall be full size.
 - C. Each drawing shall have marked thereon, proper descriptive title, including Medical Center location, project number, manufacturer's number, reference to contract drawing number, detail Section Number, and Specification Section Number.
 - C. A space 120 mm by 125 mm (4-3/4 by 5 inches) shall be reserved on each drawing to accommodate approval or disapproval stamp.
 - E. Submit drawings, ROLLED WITHIN A MAILING TUBE, fully protected for shipment.
 - F. One reproducible print of approved or disapproved shop drawings will be forwarded to Contractor.
 - G. When work is directly related and involves more than one trade, shop drawings shall be submitted to Architect-Engineer under one cover.

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SECTION 01340
SAMPLES AND SHOP DRAWINGS

SOL 663-01-05
VA Seattle Building 100
Ambulatory Clinic Expansion

SECTION 01340
SAMPLES AND SHOP DRAWINGS

SECTION 01410
TESTING LABORATORY SERVICES

PART 1 - GENERAL

1.1 DESCRIPTION:

This section specifies materials testing activities and inspection services required during project construction to be provided by a Testing Laboratory retained by Department of Veterans Affairs.

1.2 APPLICABLE PUBLICATIONS:

- A. 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.
- B. American Association of State Highway and Transportation Officials (AASHTO):
 - T27-97.....Standard Specification for Sieve Analysis of Fine and Coarse Aggregates
 - T96-94.....Standard Specification for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
 - T104-97.....Standard Specification for Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate
- C. American Society for Testing and Materials (ASTM):
 - A325-97.....Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
 - A370-97.....Standard Test Methods and Definitions for Mechanical Testing of Steel Products
 - A880-95.....Standard Practice for Criteria for Use in Evaluation of Testing Laboratories and Organizations for Examination and Inspection of Steel, Stainless Steel, and Related Alloys
 - C31/C31M-98.....Standard Practice for Making and Curing Concrete Test Specimens in the Field
 - C33-99.....Standard Specification for Concrete Aggregates
 - C39/C39M-99.....Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens

- C138-92.....Standard Test Method for Unit Weight, Yield,
and Air Content (Gravimetric) of Concrete
- C143/C143M-98.....Standard Test Method for Slump of Hydraulic
Cement Concrete
- C172-99.....Standard Practice for Sampling Freshly Mixed
Concrete
- C173-94.....Standard Test Method for Air Content of freshly
Mixed Concrete by the Volumetric Method
- C330-99.....Standard Specification for Lightweight
Aggregates for Structural Concrete
- C567-99.....Standard Test Method for Density Structural
Lightweight Concrete
- C1019-99.....Standard Test Method for Sampling and Testing
Grout
- C1064/C1064M-99.....Standard Test Method for Temperature of Freshly
Mixed Portland Cement Concrete
- C1077-77.....Standard Practice for Laboratories Testing
Concrete and Concrete Aggregates for Use in
Construction and Criteria for Laboratory
Evaluation
- E94-93.....Standard Guide for Radiographic Testing
- E142-92.....Standard Method for Controlling Quality of
Radiographic Testing
- E164-97.....Standard Practice for Ultrasonic Contact
Examination of Weldments
- E329-00.....Standard Specification for Agencies Engaged in
the Testing and/or Inspection of Materials Used
on Construction
- E543-99.....Standard Practice for Agencies Performing Non-
Destructive Testing
- E605-93.....Standard Test Methods for Thickness and Density
of Sprayed Fire-Resistive Material (SFRM)
Applied to Structural Members
- E709-95.....Standard Guide for Magnetic Particle
Examination
- E1155-96.....Standard Test Method for Determining FF

D. American Welding Society (AWS):

D1.1-00.....Structural Welding Code-Steel

1.3 REQUIREMENTS:

A. Accreditation Requirements: Testing Laboratory retained by Department of Veterans Affairs, must be accredited by one or more of the National Voluntary Laboratory Accreditation Program (NVLAP) programs acceptable in the geographic region for the project. Furnish to the Contracting Officer a copy of the Certificate of Accreditation and Scope of Accreditation. For testing laboratories that have not yet obtained accreditation by a NVLAP program, submit an acknowledgement letter from one of the laboratory accreditation authorities indicating that the application for accreditation has been received and the accreditation process has started, and submit to the Contracting for approval, certified statements, signed by an official of the testing laboratory attesting that the proposed laboratory, meets or conforms to the ASTM standards listed below as appropriate to the testing field.

1. Laboratories engaged in testing of construction materials shall meet the requirements of ASTM E329.
2. Laboratories engaged in testing of concrete and concrete aggregates shall meet the requirements of ASTM C1077.
3. Laboratories engaged in inspection and testing of steel, stainless steel, and related alloys will be evaluated according to ASTM A880.
4. Laboratories engaged in non-destructive testing (NDT) shall meet the requirements of ASTM E543.
5. Laboratories engaged in Hazardous Materials Testing shall meet the requirements of OSHA and EPA.

B. Inspection and Testing: Testing laboratory shall inspect materials and workmanship and perform tests described herein and additional tests requested by COTR. When it appears materials furnished, or work performed by Contractor fail to meet construction contract requirements, Testing Laboratory shall direct attention of COTR to such failure.

C. Written Reports: Testing laboratory shall submit test reports to COTR, Contractor, and Local Building Authority within 24 hours after each test is completed unless other arrangements are agreed to in writing by the COTR. Submit reports of tests that fail to meet construction contract requirements on colored paper.

- D. Verbal Reports: Give verbal notification to COTR immediately of any irregularity.
- E. Test Standards: The Testing Laboratory shall include a lump sum allowance of \$5000 for furnishing published standards (ASTM, AASHTO, ACI, ANSI, AWS, ASHRAE, UL, etc.) referred to or specifically referenced which are pertinent to any Sections of these specifications. Furnish one set of standards in single copies or bound volumes to the COTR within 60 days. Photocopies are not acceptable. Billings for the standards furnished shall be at the net cost to Testing Laboratory. A preliminary list of test standards, with the estimated costs, shall be submitted to the COTR for review before any publications of reference standards are ordered.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 CONCRETE:

- A. Batch Plant Inspection and Materials Testing:
 - 1. Perform continuous batch plant inspection until concrete quality is established to satisfaction of COTR with concurrence of Contracting Officer and perform periodic inspections thereafter as determined by COTR.
 - 2. Periodically inspect and test batch proportioning equipment for accuracy and report deficiencies to COTR.
 - 3. Sample and test mix ingredients as necessary to insure compliance with specifications.
 - 4. Sample and test aggregates daily and as necessary for moisture content. Test the dry rodded weight of the coarse aggregate whenever a sieve analysis is made, and when it appears there has been a change in the aggregate.
 - 5. Certify, in duplicate, ingredients and proportions and amounts of ingredients in concrete conform to approved trial mixes. When concrete is batched or mixed off immediate building site, certify (by signing, initialing or stamping thereon) on delivery slips (duplicate) that ingredients in truck-load mixes conform to proportions of aggregate weight, cement factor, and water-cement ratio of approved trial mixes.
- B. Field Inspection and Materials Testing:

1. Provide a technician at site of placement at all times to perform concrete sampling and testing.
2. Review the delivery tickets of the ready-mix concrete trucks arriving on-site. Notify the Contractor if the concrete cannot be placed within the specified time limits or if the type of concrete delivered is incorrect. Reject any loads that do not comply with the Specification requirements. Rejected loads are to be removed from the site at the Contractor's expense. Any rejected concrete that is placed will be subject to removal.
3. Take concrete samples at point of placement in accordance with ASTM C172. Mold and cure compression test cylinders in accordance with ASTM C31. Make at least three cylinders for each 40 m³ (50 cubic yards) or less of each concrete type, and at least three cylinders for any one day's pour for each concrete type. Label each cylinder with an identification number. COTR may require additional cylinders to be molded and cured under job conditions.
4. Perform slump tests in accordance with ASTM C143. Test the first truck each day, and every time test cylinders are made. Test pumped concrete at the hopper and at the discharge end of the hose at the beginning of each day's pumping operations to determine change in slump.
5. Determine the air content of concrete per ASTM C173. For concrete required to be air-entrained, test the first truck and every 20 m³ (25 cubic yards) thereafter each day. For concrete not required to be air-entrained, test every 80 m³ (100 cubic yards) at random. For pumped concrete, initially test concrete at both the hopper and the discharge end of the hose to determine change in air content.
6. If slump or air content fall outside specified limits, make another test immediately from another portion of same batch.
7. Perform unit weight tests in compliance with ASTM C138 for normal weight concrete and ASTM C567 for lightweight concrete. Test the first truck and each time cylinders are made.
8. Notify laboratory technician at batch plant of mix irregularities and request materials and proportioning check.
9. Verify that specified mixing has been accomplished.

10. Environmental Conditions: Determine the temperature per ASTM C1064 for each truckload of concrete during hot weather and cold weather concreting operations.
 - a. When ambient air temperature falls below 4.4 degrees C (40 degrees F), record maximum and minimum air temperatures in each 24 hour period; record air temperature inside protective enclosure; record minimum temperature of surface of hardened concrete.
 - b. When ambient air temperature rises above 29.4 degrees C (85 degrees F), record maximum and minimum air temperature in each 24 hour period; record minimum relative humidity; record maximum wind velocity; record maximum temperature of surface of hardened concrete.
11. Inspect the reinforcing steel placement, including bar size, bar spacing, top and bottom concrete cover, proper tie into the chairs, and grade of steel prior to concrete placement. Submit detailed report of observations.
12. Observe conveying, placement, and consolidation of concrete for conformance to specifications.
13. Observe condition of formed surfaces upon removal of formwork prior to repair of surface defects and observe repair of surface defects.
14. Observe curing procedures for conformance with specifications, record dates of concrete placement, start of preliminary curing, start of final curing, end of curing period.
15. Observe preparations for placement of concrete:
 - a. Inspect handling, conveying, and placing equipment, inspect vibrating and compaction equipment.
 - b. Inspect preparation of construction, expansion, and isolation joints.
16. Observe preparations for protection from hot weather, cold weather, sun, and rain, and preparations for curing.
17. Observe concrete mixing:
 - a. Monitor and record amount of water added at project site.
 - b. Observe minimum and maximum mixing times.
18. Measure concrete flatwork for levelness and flatness as follows:

- a. Perform Floor Tolerance Measurements F_F and F_L in accordance with ASTM E1155. Calculate the actual overall F- numbers using the inferior/superior area method.
 - b. Perform all floor tolerance measurements within 48 hours after slab installation and prior to removal of shoring and formwork.
 - c. Provide the Contractor and the COTR with the results of all profile tests, including a running tabulation of the overall F_F and F_L values for all slabs installed to date, within 72 hours after each slab installation.
19. Other inspections:
- a. Grouting under base plates.
 - b. Grouting anchor bolts and reinforcing steel in hardened concrete.
- C. Laboratory Tests of Field Samples:
1. Test compression test cylinders for strength in accordance with ASTM C39. For each test series, test one cylinder at 7 days and one cylinder at 28 days. Use remaining cylinder as a spare tested as directed by COTR. Compile laboratory test reports as follows:
Compressive strength test shall be result of one cylinder, except when one cylinder shows evidence of improper sampling, molding or testing, in which case it shall be discarded and strength of spare cylinder shall be used.
 2. Make weight tests of hardened lightweight structural concrete in accordance with ASTM C567.
 3. Furnish certified compression test reports (duplicate) to COTR. In test report, indicate the following information:
 - a. Cylinder identification number and date cast.
 - b. Specific location at which test samples were taken.
 - c. Type of concrete, slump, and percent air.
 - d. Compressive strength of concrete in MPa (psi).
 - e. Weight of lightweight structural concrete in kg/m^3 (pounds per cubic feet).
 - f. Weather conditions during placing.
 - g. Temperature of concrete in each test cylinder when test cylinder was molded.
 - h. Maximum and minimum ambient temperature during placing.
 - i. Ambient temperature when concrete sample in test cylinder was taken.

j. Date delivered to laboratory and date tested.

3.2 REINFORCEMENT:

- A. Review mill test reports furnished by Contractor.
- B. Make one tensile and one bend test in accordance with ASTM A370 from each pair of samples obtained.
- C. Written report shall include, in addition to test results, heat number, manufacturer, type and grade of steel, and bar size.
- D. Perform tension tests of mechanical and welded splices in accordance with ASTM A370.

3.3 STRUCTURAL STEEL:

- A. General: Provide shop and field inspection and testing services to certify structural steel work is done in accordance with contract documents. Welding shall conform to AWS D1.1 Structural Welding Code.
- B. Prefabrication Inspection:
 - 1. Review design and shop detail drawings for size, length, type and location of all welds to be made.
 - 2. Approve welding procedure qualifications either by pre-qualification or by witnessing qualifications tests.
 - 3. Approve welder qualifications by certification or retesting.
 - 4. Approve procedure for control of distortion and shrinkage stresses.
 - 5. Approve procedures for welding in accordance with applicable sections of AWS D1.1.
- C. Fabrication and Erection:
 - 1. Weld Inspection:
 - a. Inspect welding equipment for capacity, maintenance and working condition.
 - b. Verify specified electrodes and handling and storage of electrodes in accordance with AWS D1.1.
 - c. Inspect preparation and assembly of materials to be welded for conformance with AWS D1.1.
 - d. Inspect preheating and interpass temperatures for conformance with AWS D1.1.
 - e. Measure 25 percent of fillet welds.
 - f. Welding Magnetic Particle Testing: Test in accordance with ASTM E709 for a minimum of:
 - 1) 20 percent of all shear plate fillet welds at random, final pass only.

- 2) 20 percent of all continuity plate and bracing gusset plate fillet welds, at random, final pass only.
 - 3) 100 percent of tension member fillet welds (i.e., hanger connection plates and other similar connections) for root and final passes.
 - 4) 20 percent of length of built-up column member partial penetration and fillet welds at random for root and final passes.
 - 5) 100 percent of length of built-up girder member partial penetration and fillet welds for root and final passes.
- g. Welding Ultrasonic Testing: Test in accordance with ASTM E164 and AWS D1.1 for 100 percent of all full penetration welds, braced and moment frame column splices, and a minimum of 20 percent of all other partial penetration column splices, at random.
- h. Verify that correction of rejected welds are made in accordance with AWS D1.1.
- i. Testing and inspection do not relieve the Contractor of the responsibility for providing materials and fabrication procedures in compliance with the specified requirements.
2. Bolt Inspection:
- a. Inspect high-strength bolted connections in accordance AISC Specifications for Structural Joints Using ASTM A325 or A490 Bolts.
 - b. Slip-Critical Connections: Inspect 10 percent of bolts, but not less than 2 bolts, selected at random in each connection in accordance with AISC Specifications for Structural Joints Using ASTM A325 or A490 Bolts. Inspect all bolts in connection when one or more are rejected.
 - c. Fully Pre-tensioned Connections: Inspect 10 percent of bolts, but not less than 2 bolts, selected at random in 25 percent of connections in accordance with AISC Specification for Structural Joints Using ASTM A325 or A490 Bolts. Inspect all bolts in connection when one or more are rejected.
 - d. Bolts installed by turn-of-nut tightening may be inspected with calibrated wrench when visual inspection was not performed during tightening.

- e. Snug Tight Connections: Inspect 10 percent of connections verifying that plies of connected elements have been brought into snug contact.
 - f. Inspect field erected assemblies; verify locations of structural steel for plumbness, level, and alignment.
- D. Submit inspection reports, record of welders and their certification, and identification, and instances of noncompliance to COTR.

3.4 STEEL DECKING:

- A. Provide field inspection of welds of metal deck to the supporting steel, and testing services to insure steel decking has been installed in accordance with contract documents and manufacturer's requirements.
- B. Qualification of Field Welding: Qualify welding processes and welding operators in accordance with "Welder Qualification" procedures of AWS D1.1. Refer to the "Plug Weld Qualification Procedure" in Part 3 "Field Quality Control."
- C. Submit inspection reports, certification, and instances of noncompliance to COTR.

3.5 SHEAR CONNECTOR STUDS:

- A. Provide field inspection and testing services required by AWS D.1 to insure shear connector studs have been installed in accordance with contract documents.
- B. Tests: Test 20 percent of headed studs for fastening strength in accordance with AWS D1.1.
- C. Submit inspection reports, certification, and instances of noncompliance to COTR.

3.6 SPRAYED-ON FIREPROOFING:

- A. Provide field inspection and testing services to certify sprayed-on fireproofing has been applied in accordance with contract documents.
- B. Obtain a copy of approved submittals from COTR.
- C. Use approved installation in test areas as criteria for inspection of work.
- D. Test sprayed-on fireproofing for thickness and density in accordance with ASTM E605.
 - 1. Thickness gauge specified in ASTM E605 may be modified for pole extension so that overhead sprayed material can be reached from floor.
- E. Location of test areas for field tests as follows:

1. Thickness: Select one bay per floor, or one bay for each 930 m² (10,000 square feet) of floor area, whichever provides for greater number of tests. Take thickness determinations from each of following locations: Metal deck, beam, and column.
2. Density: Take density determinations from each floor, or one test from each 930 m² (10,000 square feet) of floor area, whichever provides for greater number of tests, from each of the following areas: Underside of metal deck, beam flanges, and beam web.
- F. Submit inspection reports, certification, and instances of noncompliance to COTR.

3.7 TYPE OF TEST:

(Number of tests required is to be determined.)

A. Concrete:

Making and Curing Concrete Test Cylinders (ASTM C31)

Compressive Strength, Test Cylinders (ASTM C39)

Concrete Slump Test (ASTM C143)

Concrete Air Content Test (ASTM C173)

Unit Weight, Lightweight Concrete (ASTM C567)

Aggregate, Normal Weight:

Gradation (ASTM C33)

Deleterious Substances (ASTM C33)

Soundness (ASTM C33)

Abrasion (ASTM C33)

Aggregate, Lightweight

Gradation (ASTM C330)

Deleterious Substances (ASTM C330)

Unit Weight (ASTM C330)

Flatness and Levelness Readings (ASTM E1155) (number of days)

B. Reinforcing Steel:

Tensile Test (ASTM A370)

Bend Test (ASTM A370)

Mechanical Splice (ASTM A370)

Welded Splice Test (ASTM A370)

C. Structural Steel:

Ultrasonic Testing of Welds (ASTM E164)

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Radiographic Testing of Welds (ASTM E94, E142)

D. Sprayed-On Fireproofing:

Thickness and Density Tests (ASTM E605)

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**SECTION 01510
INFECTION CONTROL AND INTERIM LIFE SAFETY REQUIREMENTS**

PART 1 - GENERAL

1.1 SECTION INCLUDES

- 1.3 Infection Control
- 1.4 Life Safety

1.2 DESCRIPTION OF REQUIREMENTS

- A. Specific minimum administrative and procedural actions are specified in this section, as extensions of provisions in the drawings and general provisions of the contract, including General and Supplementary Conditions and other Division 1 Specification Sections with special attention given to Section 01010. These requirements have been included for specific purposes as indicated.
- B. A written plan outlining the contractors methods of meeting the Infection Control/Interim Life Safety specification must be submitted to owner for approval within 15 days after issuance of notice to proceed. The plan shall include, but not be limited to, construction barrier locations, exit path routing, temporary signage design and locations, proposed materials, negative air routing, proposed cleaning equipment.

1.3 INFECTION CONTROL

A. BARRIERS

- 1. The contractor shall provide appropriate barriers to isolate the construction area from any patient care or other occupied areas. Barriers must enclose entire work area to completely isolate it from all surrounding areas. The barriers shall be constructed as follows:
 - a. To be tightly sealed from wall to wall and floor to ~~structureslab~~ above. This includes areas above suspended ceilings, unless ceilings are not to be disturbed dd, in which case, seal will occur at ceiling level.-
 - b. Out of the following materials:
 - 1. For projects of short durations and with ~~an expected duration of 4 weeks or less~~ little anticipated noise and no hot work, 6-mil fire-retardant (Rexam StarTex or approved equal) visqueen with zipper ~~or overlapping flap openings with~~

- ~~weighted bottom~~. Use of appropriate mini-enclosure for all ceiling work outside of contained workspace is required.
2. For all other projects ~~with an expected duration greater than 4 weeks~~, barriers below suspended ceilings shall be minimum ¼" thick, plastic coated, low VOC, fire treated melamine panels (unless otherwise shown on the drawings). Sealed with smooth surface vinyl tape at all joints and other connection points. All construction barriers must be constructed to be smoke tight and of non-combustible or limited-combustible materials. In locations where solid barriers are not required to extend above the ceiling, above ceiling barriers shall be minimum 6-mil fire-retardant visqueen.
 3. Where barriers are provided in place of a fire rated wall (corridor, smoke barrier, fire wall) barriers shall be minimum ¼" thick, plastic coated, low VOC, fire treated melamine panels (unless otherwise shown on the drawings). Sealed with tape at all joints and other connection points. All construction barriers must be constructed to be smoke tight and of non-combustible or limited-combustible materials. Solid barriers shall be provided above the suspended ceiling to the structure above unless previously approved by the owner.†
 4. Any opening into occupied portions of the building will be made using self-closing doors fitted with gasketing or other material to restrict closing noise and airflow.
- c. All barriers and openings must be maintained on a daily basis to ensure proper airflow, appearance, and workplace security. Barrier failure requires immediate intervention.
1. Elevator openings (where applicable), if not for a dedicated construction elevator, must be sealed air tight to the work area.
 2. All work area entrances must have tacky mats present at all times. Mats must be clean, ~~and~~ intact and maintained on a constant basis.†
 3. Adjacent floor ~~areass~~ directly outside the work area must be vacuumed or wet mopped at appropriate intervals to eliminate tracking and dust migration. Contractor to provide vacuum cleaners and all cleaning equipment.

4. Prior to removal of any barriers, all debris must be removed, the work area wet mopped, ~~or~~ vacuumed, and all surfaces wiped down.
5. All vacuums used in or around the work area must be equipped with HEPA filtration.

B. AIR DISTRIBUTION

1. The contractor shall provide all necessary equipment, including appropriate replacement filters for negative air machines and temporary ductwork to maintain a negative air pressure relationship, for all areas under construction or contained within the construction barriers, to surrounding areas. Negative pressurization of the workspace is required at all times.
 - a. Appropriate equipment, gauge manometers at minimum, shall be provided to constantly monitor the negative pressure relationship. A minimum negative pressure relationship of .01" water column must be maintained between areas under construction and surrounding areas. The contractor is responsible to verify manometer reading at the beginning and end of each day and maintain a log of readings and corrective action taken..
 - b. Work area ventilation must be 100% exhausted to the exterior of the building unless provided written permission by owner to tie into building ventilation exhaust-air.
 - c. All negative air machines must have HEPA filtration in place. Pre-filters must be maintained to prevent airflow restriction and dust accumulation.
 - d. Discharge hoses, vented to an approved location, must be in place and intact at all times.
2. Supply and exhaust air grills serving the building HVAC systems must be covered and sealed to prevent airflow at all times.
3. Penetrations or openings to barrier enclosing the negative pressure area must be tightly sealed at the end of each day.

C. MATERIALS AND MATERIAL HANDLING

1. Prior to start of construction, contractor must submit a 3-ring binder with Material Safety Data Sheets on all paints, glues, mastics, epoxies, adhesives, cleaning products, etc. prior to start of construction for review by Department of Veterans Affairs staff.
2. Contractor shall maintain work area at or below "comfort range" for Office Workers as recognized by Washington State regulatory agency

- guidelines for volatile organic compounds (VOC) during installation and curing time of material.
3. All dirty materials including new materials, debris, and tools must be covered or wrapped when transported through the hospital.
 4. Debris removal must occur in an exterior chute or through ~~predetermined~~ approved routes. After each period of debris removal, the traffic and material corridor (when in occupied portions of the building) shall be cleaned and wet mopped from entrance to work area to disposal area as necessary. Conveyances used for debris removal must be clean and covered.
 5. At the end of each workday, work area must have all debris removed and floors cleaned.
 6. Any material capable of absorbing moisture must be fully dried within 48 hours of becoming wet. If material, either new or existing, inside or out of the work area, becomes wet as a result of the contractors actions and is unable to be dried to an "as-new" condition within 48 hours, the contractor shall remove the material within the same 48 hour period. Materials removed from the work area for this reason must be replaced with new material at contractor expense ~~(specific enough?)~~.

1.4 LIFE SAFETY

A. EXITING AND EGRESS

1. All exits within the work area must be kept clear and unobstructed. Contractors and subcontractors must be aware of appropriate exit paths at all times.
2. All temporary doors and barriers must have appropriate contractor supplied signage outside the work area clearly indicating exit path and direction. Signage design and locations must be approved by the VA prior to installation.
3. All exit paths from occupied areas through or around the work area must be kept clear and unobstructed. Temporary barriers that obstruct usual paths of egress from occupied areas are not to be installed prior to approval of barrier locations and temporary signage plans by the ~~UWMC construction coordinator~~ owner.
4. Temporary barriers created for exiting and egress shall conform to the barrier guidelines of Section 1.03A. Fire detection and

suppression shall remain operational in temporary exit paths unless previously accepted by the VA Safety Office.

B. EMERGENCY ACCESS

1. Access to emergency services and for emergency vehicles and personnel must be kept free and unobstructed at all times.
2. Temporary obstruction of emergency access is allowed for special cases (ex. crane hoists, etc.) on a short-term basis. A written plan must be submitted to the VA for approval at least two weeks prior to the scheduled date of obstruction.

C. FIRE ALARM, DETECTION, AND SUPPRESSION

1. The contractor is responsible to ensure that fire alarm, detection, and suppression systems are not impaired unless disabled by the VA.
2. In the event one or more of these systems is impaired, the contractor is responsible to provide a temporary, equivalent system. A written plan must be submitted to the VA Safety Office for approval at least ~~xxx~~two weeks prior to installation of any temporary systems.
3. The contractor is responsible to comply with all VA smoking policies, emergency response protocol, and hot work permit and fire watch requirements as outlined in section 01010.

PART 2 - PRODUCTS

(Not Applicable)

PART 3 - EXECUTION

(Not Applicable)

- - - E N D - - -

SECTION 01568
ENVIRONMENTAL PROTECTION

EP-1. DESCRIPTION

- A. This section specifies the control of environmental pollution and damage that the Contractor must consider for air, water, and land resources. It includes management of visual aesthetics, noise, solid waste, radiant energy, and radioactive materials, as well as other pollutants and resources encountered or generated by the Contractor. The Contractor is obligated to consider specified control measures with the costs included within the various contract items of work.
- B. Environmental pollution and damage is defined as the presence of chemical, physical, or biological elements or agents which:
1. Adversely effect human health or welfare,
 2. Unfavorably alter ecological balances of importance to human life,
 3. Effect other species of importance to humankind, or;
 4. Degrade the utility of the environment for aesthetic, cultural, and historical purposes.
- C. Definitions of Pollutants:
1. Chemical Waste: Petroleum products, bituminous materials, salts, acids, alkalis, herbicides, pesticides, organic chemicals, and inorganic wastes.
 2. Debris: Combustible and noncombustible wastes, such as leaves, tree trimmings, ashes, and waste materials resulting from construction or maintenance and repair work.
 3. Sediment: Soil and other debris that has been eroded and transported by runoff water.
 4. Solid Waste: Rubbish, debris, garbage, and other discarded solid materials resulting from industrial, commercial, and agricultural operations and from community activities.
 5. Surface Discharge: The term "Surface Discharge" implies that the water is discharged with possible sheeting action and subsequent soil erosion may occur. Waters that are surface discharged may terminate in drainage ditches, storm sewers, creeks, and/or "water of the United States" and would require a permit to discharge water from the governing agency.
 6. Rubbish: Combustible and noncombustible wastes such as paper, boxes, glass and crockery, metal and lumber scrap, tin cans, and bones.

7. Sanitary Wastes:

- a. Sewage: Domestic sanitary sewage and human and animal waste.
- b. Garbage: Refuse and scraps resulting from preparation, cooking, dispensing, and consumption of food.

EP-2. QUALITY CONTROL

- A. Establish and maintain quality control for the environmental protection of all items set forth herein.
- B. Record on daily reports any problems in complying with laws, regulations, and ordinances. Note any corrective action taken.

EP-3. REFERENCES

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.
- B. U.S. National Archives and Records Administration (NARA):
33 CFR 328.....Definitions

EP-4. SUBMITTALS

- A. In accordance with Section, 01340, SAMPLES AND SHOP DRAWINGS, furnish the following:
 - 1. Environmental Protection Plan: After the contract is awarded and prior to the commencement of the work, the Contractor shall meet with the COTR to discuss the proposed Environmental Protection Plan and to develop mutual understanding relative to details of environmental protection. Not more than 20 days after the meeting, the Contractor shall prepare and submit to the COTR for approval, a written and/or graphic Environmental Protection Plan including, but not limited to, the following:
 - a. Name(s) of person(s) within the Contractor's organization who is (are) responsible for ensuring adherence to the Environmental Protection Plan.
 - b. Name(s) and qualifications of person(s) responsible for manifesting hazardous waste to be removed from the site.
 - c. Name(s) and qualifications of person(s) responsible for training the Contractor's environmental protection personnel.
 - d. Description of the Contractor's environmental protection personnel training program.
 - e. A list of Federal, State, and local laws, regulations, and permits concerning environmental protection, pollution control,

noise control and abatement that are applicable to the Contractor's proposed operations and the requirements imposed by those laws, regulations, and permits.

- f. Methods for protection of features to be preserved within authorized work areas including trees, shrubs, vines, grasses, ground cover, landscape features, air and water quality, and soil.
 - g. Procedures to provide the environmental protection that comply with the applicable laws and regulations. Describe the procedures to correct pollution of the environment due to accident, natural causes, or failure to follow the procedures as described in the Environmental Protection Plan.
 - h. Permits, licenses, and the location of the solid waste disposal facility.
 - i. Environmental Monitoring Plans for the job site including land, water, air, and noise.
 - j. Work Area Plan showing the proposed activity in each portion of the area and identifying the areas of limited use or nonuse. Plan should include measures for marking the limits of use areas. This plan may be incorporated within the Erosion Control Plan.
- B. Approval of the Contractor's Environmental Protection Plan will not relieve the Contractor of responsibility for adequate and continued control of pollutants and other environmental protection measures.

EP-5. PROTECTION OF ENVIRONMENTAL RESOURCES

- A. Protect environmental resources within the project boundaries and those affected outside the limits of permanent work during the entire period of this contract. Confine activities to areas defined by the specifications and drawings.
- B. Protection of Land Resources: Prior to construction, identify all land resources to be preserved within the work area. Do not remove, cut, deface, injure, or destroy land resources including trees, shrubs, vines, grasses, top soil, and land forms without permission from the COTR. Do not fasten or attach ropes, cables, or guys to trees for anchorage unless specifically authorized, or where special emergency use is permitted.
 - 1. Protection of Landscape: Protect trees, shrubs, vines, grasses, land forms, and other landscape features shown on the drawings to be

- preserved by marking, fencing, or using any other approved techniques.
- a. Box and protect from damage existing trees and shrubs to remain on the construction site.
 - b. Immediately repair all damage to existing trees and shrubs by trimming, cleaning, and painting with antiseptic tree paint.
 - c. Do not store building materials or perform construction activities closer to existing trees or shrubs than the farthest extension of their limbs.
2. Reduction of Exposure of Unprotected Erodible Soils: Plan and conduct earthwork to minimize the duration of exposure of unprotected soils. Clear areas in reasonably sized increments only as needed to use. Form earthwork to final grade as shown. Immediately protect side slopes and back slopes upon completion of rough grading.
 3. Temporary Protection of Disturbed Areas: Construct diversion ditches, benches, and berms to retard and divert runoff from the staging area to protected drainage areas approved under paragraph 208 of the Clean Water Act.
 - a. Reuse or conserve the collected topsoil sediment as directed by the COTR. Topsoil use and requirements are specified in Section, EARTHWORK.
 - b. Institute effluent quality monitoring programs as required by Federal, State, and local environmental agencies.
 4. Erosion and Sedimentation Control Devices: The erosion and sediment controls selected and maintained by the Contractor shall be such that water quality standards are not violated as a result of the Contractor's activities. Construct or install all temporary and permanent erosion and sedimentation control features on the Environmental Protection Plan. Maintain temporary erosion and sediment control measures such as berms, dikes, drains, sedimentation basins, grassing, and mulching, until permanent drainage and erosion control facilities are completed and operative.
 5. Handle and dispose of solid wastes in such a manner that will prevent contamination of the environment. Place solid wastes (excluding clearing debris) in containers that are emptied on a regular schedule. Transport all solid waste off Government property

and dispose of waste in compliance with Federal, State, and local requirements.

6. Store chemical waste away from the work areas in corrosion resistant containers and dispose of waste in accordance with Federal, State, and local regulations.

7. Handle discarded materials other than those included in the solid waste category as directed by the COTR.

C. Protection of Water Resources: Keep construction activities under surveillance, management, and control to avoid pollution of surface and ground waters and sewer systems. Implement management techniques to control water pollution by the listed construction activities that are included in this contract.

Washing and Curing Water: Do not allow wastewater directly derived from construction activities to enter water areas.

D. Protection of Air Resources: Keep construction activities under surveillance, management, and control to minimize pollution of air resources. Burning is not permitted on the job site. Keep activities, equipment, processes, and work operated or performed, in strict accordance with the State of Washington and Puget Sound Air Pollution Control Agency and Federal emission and performance laws and standards. Maintain ambient air quality standards set by the Environmental Protection Agency, for those construction operations and activities specified.

1. Particulates: Control dust particles, aerosols, and gaseous by-products from all construction activities, processing, and preparation of materials (such as from asphaltic batch plants) at all times, including weekends, holidays, and hours when work is not in progress.

2. Particulates Control: Maintain all excavations, stockpiles, haul roads, permanent and temporary access roads, plant sites, spoil areas, borrow areas, and all other work areas within or outside the project boundaries free from particulates which would cause a hazard or a nuisance. Sprinklering, chemical treatment of an approved type, light bituminous treatment, baghouse, scrubbers, electrostatic precipitators, or other methods are permitted to control particulates in the work area.

- 3. Hydrocarbons and Carbon Monoxide: Control monoxide emissions from equipment to Federal and State allowable limits.
 - 4. Odors: Control odors of construction activities and prevent obnoxious odors from occurring.
- F. Reduction of Noise: Minimize noise using every action possible. Perform noise-producing work in less sensitive hours of the day or week as directed by the COTR. Maintain noise-produced work at or below the decibel levels and within the time periods specified.
- 1. Perform construction activities involving repetitive, high-level impact noise only between 7:00 a.m. and 6:00 p.m unless otherwise permitted by local ordinance or the COTR. Repetitive impact noise on the property shall not exceed the following dB limitations:

Time Duration of Impact Noise	Sound Level in dB
More than 12 minutes in any hour	70
Less than 30 seconds of any hour	85
Less than three minutes of any hour	80
Less than 12 minutes of any hour	75

- 2. Provide sound-deadening devices on equipment and take noise abatement measures that are necessary to comply with the requirements of this contract, consisting of, but not limited to, the following:
 - a. Maintain maximum permissible construction equipment noise levels at 15 m (50 feet) (dBA):

EARTHMOVING		MATERIALS HANDLING	
FRONT LOADERS	75	CONCRETE MIXERS	75
BACKHOES	75	CONCRETE PUMPS	75
DOZERS	75	CRANES	75
TRACTORS	75	DERRICKS IMPACT	75
SCAPERS	80	PILE DRIVERS	95
GRADERS	75	JACK HAMMERS	75
TRUCKS	75	ROCK DRILLS	80
PAVERS, STATIONARY	80	PNEUMATIC TOOLS	80
PUMPS	75	BLASTING	not allowed
GENERATORS	75	SAWS	75

COMPRESSORS

75

VIBRATORS

75

- b. Use shields or other physical barriers to restrict noise transmission.
 - c. Provide soundproof housings or enclosures for noise-producing machinery.
 - d. Use efficient silencers on equipment air intakes.
 - e. Use efficient intake and exhaust mufflers on internal combustion engines that are maintained so equipment performs below noise levels specified.
 - f. Line hoppers and storage bins with sound deadening material.
 - g. Conduct truck loading, unloading, and hauling operations so that noise is kept to a minimum.
3. Measure sound level for noise exposure due to the construction at least once every five successive working days while work is being performed above 55 dB(A) noise level. Measure noise exposure at the property line or 15 m (50 feet) from the noise source, whichever is greater. Measure the sound levels on the A weighing network of a General Purpose sound level meter at slow response. To minimize the effect of reflective sound waves at buildings, take measurements at 900 to 1800 mm (three to six feet) in front of any building face. Submit the recorded information to the COTR noting any problems and the alternatives for mitigating actions.
- G. Restoration of Damaged Property: If any direct or indirect damage is done to public or private property resulting from any act, omission, neglect, or misconduct, the Contractor shall restore the damaged property to a condition equal to that existing before the damage at no additional cost to the Government. Repair, rebuild, or restore property as directed or make good such damage in an acceptable manner.
- H. Final Clean-up: On completion of project and after removal of all debris, rubbish, and temporary construction, Contractor shall leave the construction area in a clean condition satisfactory to the COTR. Cleaning shall include off the station disposal of all items and materials not required to be salvaged, as well as all debris and rubbish resulting from demolition and new work operations.

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**SECTION 01581
TEMPORARY INTERIOR SIGNS**

PART 1 GENERAL

DESCRIPTION

This section specifies temporary interior signs.

PART 2 PRODUCTS

2.1 TEMPORARY SIGNS

- A. Fabricate from 50 Kg (110 pound) mat finish white paper.
- B. Cut to 100 mm (4-inch) wide by 300 mm (12 inch) long size tag.
- C. Punch 3 mm (1/8-inch) diameter hole centered on 100 mm (4-inch) dimension of tag. Edge of Hole spaced approximately 13 mm (1/2-inch) from one end on tag.
- D. Reinforce hole on both sides with gummed cloth washer or other suitable material capable of preventing tie pulling through paper edge.
- E. Ties: Steel wire 0.3 mm (0.0120-inch) thick, attach to tag with twist tie, leaving 150 mm (6-inch) long free ends.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install temporary signs attached to room door frame or room door knob, lever, or pull for doors on corridor openings.
- B. Mark on signs with felt tip marker having approximately 3 mm (1/8-inch) wide stroke for clearly legible numbers or letters.
- C. Identify room with numbers as designated on floor plans.

3.2 LOCATION

- A. Install on doors that have room, corridor, and space numbers shown.
- B. Doors that do not require signs are as follows:
 - 1. Corridor barrier doors (cross-corridor) in corridor with same number.
 - 2. Folding doors or partitions.
 - 3. Toilet or bathroom doors within and between rooms.
 - 4. Communicating doors in partitions between rooms with corridor entrance doors.
 - 5. Closet doors within rooms.
- C. Replace missing, damaged, or illegible signs.

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**SECTION 02201
EARTHWORK**

PART 1 - GENERAL

1.1 DESCRIPTION:

This section specifies the requirements for furnishing all equipment, materials, labor and techniques for earthwork including removal of existing plantings and grading at staging area. Protection of existing site elements and irrigation.

1.2 DEFINITIONS:

Unsuitable Materials:

Fills: Topsoil, frozen materials; construction materials and materials subject to decomposition; clods of clay and stones larger than 75 mm (3 inches); organic materials, including silts, which are unstable; and inorganic materials, including silts, too wet to be stable.

1.3 RELATED WORK:

- A. Materials testing and inspection during construction: Section 01410, TESTING LABORATORY SERVICES.
- B. Safety Requirements: Section 01001, GENERAL CONDITIONS, Article, ACCIDENT PREVENTION.
- C. Protection of existing utilities, fire protection services, existing equipment, roads, and pavements: Section 01010, GENERAL REQUIREMENTS.
- D. Landscape Restoration: Section 02480, LANDSCAPE RESTORATION.

1.4 SUBMITTALS:

- A. Submit in accordance with Section 01340, SAMPLES AND SHOP DRAWINGS.
- B. Furnish to COTR, soil samples, suitable for laboratory tests, of proposed off site or on site fill material.

1.7 APPLICABLE PUBLICATIONS:

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
D1557-91.....Test Method for Laboratory Compaction

PART 2 - PRODUCTS

2.1 MATERIALS:

- A. Fills: Materials approved from on site and off site sources having a minimum dry density of 1760 kg/m³ (110 pcf), a maximum Plasticity Index of 6, and a maximum Liquid Limit of 30.
- B. Granular Fill:
Crushed stone or gravel graded from 13 mm (1/2 inch) to 4.75 mm (No. 4).
- C. Topsoil:
Shall be a well-graded soil of good uniform quality. It shall be a natural, friable soil representative of productive soils in the vicinity. Topsoil shall be free of admixture of subsoil, foreign matter, objects larger than 25 mm (one inch) in any dimension, toxic substances, weeds and any material or substances that may be harmful to plant growth and shall have a pH value of not less than 5.0 nor more than 7.5. At least 10 days prior to topsoil delivery, notify the COTR of the source(s) from which topsoil is to be furnished. Obtain topsoil from well-drained areas. Amend topsoil not meeting the pH range specified by the addition of pH adjusters.

PART 3 - EXECUTION

3.1 SITE PREPARATION:

- A. Protect the existing irrigation system, lighting and other elements on the site in the designated area.
- B. Clearing: Clearing within the limits of staging area as indicated on the drawings Sheet A1.01. Work includes removal of shrubs, debris, and trash. Remove materials from the Medical Center.
- B. Grubbing: Remove stumps and roots 75 mm (3 inches) and larger diameter. Undisturbed sound stumps, roots up to 75 mm (3 inches) diameter, and nonperishable solid objects which will be a minimum of 900 mm (3 feet) below subgrade or finished embankment may be left.
- C. Stripping Topsoil: The limits of earthwork operations shall be within the staging area. Remove the topsoil from the site.
- D. Disposal: All materials removed from the property shall be disposed of at a legally approved site, for the specific materials, and all removals shall be in accordance with all applicable Federal, State and local regulations. No burning of materials is permitted onsite.
- E. Grading: Level the staging area.

F. Granular Fill: Spread minimum of 1" depth of granular fill in the staging area, more if required for dust control.

3.2 REGRADING

- A. Granular fill removal: Near completion of the project, or as instructed by the COTR, remove the granular fill and dispose off site.
- B. Regrading: Spread imported topsoil on disturbed area and regrade to previous contours.

3.3 REPAIR

Repair damage to the irrigation system, curbs, pavement, walks, signage, lighting and underground utilities.

3.4 CLEAN-UP:

Upon completion of earthwork operations, clean areas affected by the work, remove tools, and equipment. Provide site clear, clean, free of debris, and suitable for subsequent landscape restoration. Remove debris, rubbish, and excess material from the Medical Center Property.

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**SECTION 02480
LANDSCAPING**

PART 1 - GENERAL

1.1 DESCRIPTION

This work consists of grass and seeding of area used for construction staging.

1.2 EQUIPMENT

Maintain all equipment, tools and machinery while on the project in sufficient quantities and capacity for proper execution of the work.

1.3 RELATED WORK

- A. Section 02201, EARTHWORK.
- B. Section 01568, ENVIRONMENTAL PROTECTION.

1.4 SUBMITTALS

Certificates of Conformance or Compliance: Before delivery, notarized certificates attesting that the following materials meet the requirements specified shall be submitted to the COTR for approval:

- 1. Fertilizers.
- 2. Lime
- 3. Peat
- 4. Seed

1.5 DELIVERY AND STORAGE

A. Delivery:

- 1. Notify the COTR of the delivery schedule in advance so the plant material may be inspected upon arrival at the job site. Remove unacceptable plant material from the job site immediately.
- 2. Deliver fertilizer to the site in the original, unopened containers bearing the manufacturer's guaranteed chemical analysis, name, trade name or trademark, and in conformance to state and federal law. In lieu of containers, fertilizer may be furnished in bulk and a certificate indicating the above information shall accompany each delivery.

B. Storage:

Keep seed, lime, and fertilizer in dry storage away from contaminants.

1.6 PLANTING AND TURF INSTALLATION SEASONS AND CONDITIONS

No work shall be done when the ground is frozen, snow covered, too wet or in an otherwise unsuitable condition for planting. Special

conditions may exist that warrants a variance in the specified planting dates or conditions. Submit a written request to the COTR stating the special conditions and proposal variance.

1.7 TURF ESTABLISHMENT PERIOD

- A. The Establishment Period for plants and turf shall begin immediately after installation, with the approval of the COTR, and continue until the date that the Government performs a final inspection. During the Turf Establishment Period the Contractor shall:
 - 1. Water all turf to maintain an adequate supply of moisture within the root zone. An adequate supply of moisture is the equivalent of 25 mm (1 inch) of absorbed water per week either through natural rainfall or augmented by periodic watering. Apply water at a moderate rate so as not to displace the mulch or flood the plants and turf.
 - 2. Provide the following turf establishment:
 - a. Eradicate all weeds. Water, fertilize, overseed, and perform any other operation necessary to promote the growth of grass.
 - b. Replant areas void of turf 0.1 m² (one square foot) and larger in area.

1.8 TURF GUARANTEE

- A. All work shall be in accordance with the terms of the Paragraph, "Guaranty" of Section GENERAL CONDITIONS, including the following supplements:
- B. A One Year Turf Guarantee will begin on the date that the Government performs the final inspection. The Contractor shall have completed, located, and installed all turf according to the plans and specifications. All turf is expected to be living and in a healthy condition at the time of final inspection.
- C. The Contractor will replace any areas void of turf immediately. A one year guarantee for the turf that was replaced will begin on the day the work is completed.
- D. The Government will reinspect all turf at the end of the One Year Guarantee. The Contractor will replace any dead, missing, or defective turf immediately. The Guarantee will end on the date of this inspection provided the Contractor has complied with the work required by this specification.

1.9 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation only.
- B. Turf Producers International:
Guideline Specifications to Turfgrass Sodding 1995 ed.
- C. U. S. Department of Agriculture Federal Seed Act of August 9, 1939:
53 Stat. 1275.....Rules and Regulations

PART 2 - PRODUCTS

2.1 GENERAL

All turf material will match the damaged varieties. If said varieties are unavailable, substitution will be made with approval of the VA.

2.2 LIME

Lime shall be agricultural limestone containing not less than 90 percent calcium and magnesium carbonates. Lime must be ground to such a fineness that not less than 90% must pass No. 8 mesh and not less than 25% must pass No. 100 mesh. Moisture is not to exceed 10%.

2.3 SOIL CONDITIONERS

- A. Peat shall be a natural product of sphagnum moss peat, peat moss or hypnum moss derived from a fresh-water site conforming to Fed. Spec. Q-P-166, except as otherwise specified. Peat shall be shredded and granulated to pass through a ½-inch mesh screen and conditioned in storage piles for at least six months after excavation.
- B. Sand shall be clean and free of toxic materials.
- C. Perlite shall conform to ASTM C549.
- D. Vermiculite shall be horticultural grade and free of any toxic materials and conform to ASTM C516.

2.4 PLANTING SOIL MIXTURE

The planting soil mixture shall be composed of 2 parts topsoil and 1 part organic matter.

2.5 TURF FERTILIZER

Provide turf fertilizer that is commercial grade, free flowing, uniform in composition, and conforms to applicable state and federal regulations. Granular fertilizer shall bear the manufacturer's guaranteed statement of analysis. Fifty percent of nitrogen shall be derived from sulfur-coated urea, methylene urea and ureaform. The

balance of nitrogen to be free from ammoniated phosphate, ammonium sulfate and gypsum.

Seeded: 15 lbs. Per 1000 sq. ft.

2.6 WATER

Water shall be obtained as specified in GENERAL REQUIREMENTS, Temporary Services at no cost to the Contractor.

2.7 SEED

Seed shall be state-certified seed of the latest season's crop and shall be delivered in original sealed packages bearing the producer's guaranteed analysis for percentages of mixtures, purity, germination, weed seed content, and inert material. Seed shall be labeled in conformance with U. S. Department of Agriculture rules and regulations under the Federal Seed Act and applicable state seed laws. Seed that has become wet, moldy, or otherwise damaged will not be acceptable. Seed mixtures shall be a NW blend, 3-way rye.

PART 3 - EXECUTION

3.1 TILLAGE FOR TURF AREAS

All areas of grass damaged by the construction shall be restored as follows:

- A. After the grass areas have been brought to previous grades, thoroughly till the soil to a depth of at least 100 mm (4 inches) by scarifying, disking, harrowing, or other approved methods. This is particularly important in areas where heavy equipment has been used, and especially under wet soil conditions. Remove all debris and stones larger than 25 mm (one inch) remaining on the surface after tillage in preparation for finish grading. To minimize erosion, do not till areas of 3:1 slope ratio or greater. Scarify these areas to a 50 mm (one inch) depth and remove debris and stones.
- B. FINISH GRADING: After tilling the soil for bonding of topsoil with the subsoil, spread the topsoil evenly to a minimum depth of 3 inches. Incorporate topsoil at least 2 to 3 inches into the subsoil to avoid soil layering. 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. Complete lawn work only after areas is brought to finished grade.

- C. APPLICATION OF FERTILIZER AND LIME FOR TURF AREAS: Apply turf fertilizer at the rate of 15 pounds per 1,000 square feet. Incorporate fertilizers into the soil to a depth of at least 50 mm (2 inches) as part of the finish grading operation. Immediately restore the soil to an even condition before any turf work
- D. MECHANICAL SEEDING: Broadcast seed by approved sowing equipment at the rate of 5 pounds per 1,000 square feet. Sow one half of the seed in one direction, and the remainder sown at right angles to the first sowing. Cover seed to an average depth of 6 mm (1/4 inch) by means of spike-tooth harrow, cultipacker, or other approved device. Immediately after seeding, firm up the entire area with a roller not exceeding 225 kg/m (150 pounds per foot) of roller width. Where seeding is performed with a cultipacker-type seeder or where seed is applied in combination with hydro-mulching, no rolling is required. Immediately after preparing the seeded area, evenly spread an organic mulch of straw by hand or by approved mechanical blowers at the rate of 0.5 kg/m² (2 tons per acre). Application shall allow some sunlight to penetrate and air to circulate but also reduce soil and seed erosion and conserve soil moisture. Hydroseeding may be approved by the VA at the contractor's request.
- E. WATERING: Apply water to the turf areas immediately following installation at a rate sufficient to ensure thorough wetting of the soil to a depth of at least 100 mm (4 inches). Supervise watering operation to prevent run-off. Supply all pumps, hoses, pipelines, and sprinkling equipment. Repair all areas damaged by water operations.
- F. PROTECTION OF TURF AREAS: Immediately after installation of the turf areas, protect against traffic or other use by erecting barricades, as required, and placing approved signs at appropriate intervals until final acceptance.

3.22 ENVIRONMENTAL PROTECTION

All work and Contractor operations shall comply with the requirements of Section, ENVIRONMENTAL PROTECTION.

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**SECTION 03300
CAST-IN-PLACE CONCRETE**

PART 1 - GENERAL

1.1 DESCRIPTION:

This section specifies cast-in-place structural concrete and materials and mixes for other concrete.

1.2 RELATED WORK:

- A. Materials testing and inspection during construction: Section 01410, TESTING LABORATORY SERVICES.

1.3 TESTING AGENCY FOR CONCRETE MIX DESIGN:

- A. Testing agency retained and reimbursed by the Contractor and approved by Contracting Officer's Technical Representative.
- B. Testing agency maintaining active participation in Program of Cement and Concrete Reference Laboratory (CCRL) of National Institute of Standards and Technology.
- C. Testing agency shall furnish equipment and qualified technicians to establish proportions of ingredients for concrete mixes.

1.4 TOLERANCES:

- A. Formwork: ACI 117, except the elevation tolerance of formed surfaces before removal of shores is +0 mm (+0 inch) and -20 mm (-3/4 inch).
- B. Reinforcement Fabricating and Placing: ACI 117, except that fabrication tolerance for bar sizes Nos. 10, 13, and 16 (Nos. 3, 4, and 5) (Tolerance Symbol 1 in Fig. 2.1(a), ACI, 117) used as column ties or stirrups is +0 mm (+0 inch) and -13 mm (-1/2 inch) where gross bar length is less than 3600 mm (12 feet), or +0 mm (+0 inch) and -20 mm (-3/4 inch) where gross bar length is 3600 mm (12 feet) or more.
- C. Cross-Sectional Dimension: ACI 117, except tolerance for thickness of slabs 12 inches or less is +20 mm (+3/4 inch) and -6 mm (-1/4 inch). Tolerance of thickness of beams more than 300 mm (12 inch) but less than 900 mm (3 feet) is +20 mm (+3/4 inch) and -10 mm (-3/8 inch).
- D. Slab Finishes: ACI 117, Section 4.5.6, F-number method in accordance with ASTM E1155, except as follows:
 - 1. Test entire slab surface, including those areas within 600 mm (2 feet) of construction joints and vertical elements that project through slab surface.
 - 2. Maximum elevation change which may occur within 600 mm (2 feet) of any column or wall element is 6 mm (0.25 inches).

3. Allow sample measurement lines that are perpendicular to construction joints to extend past joint into previous placement no further than 1500 mm (5 feet).

1.5 REGULATORY REQUIREMENTS:

- A. ACI 315 - Details and Detailing of Concrete Reinforcement.
- B. ACI 318 - Building Code Requirements for Reinforced Concrete.
- C. ACI 301 - Standard Specifications for Structural Concrete.

1.6 SUBMITTALS:

- A. Submit in accordance with Section 01340, SAMPLES AND SHOP DRAWINGS.
- B. Shop Drawings:
Reinforcing steel: Complete shop drawings
- C. Mill Test Reports:
Reinforcing steel.
Cement.
- D. Manufacturer's Certificates:
Lightweight aggregate for structural concrete.
Air-entraining admixture.
Chemical admixtures, including chloride ion content.
Waterproof paper for curing concrete.
Liquid membrane-forming compounds for curing concrete.
Non-shrinking grout.
- D. Testing Agency for Concrete Mix Design: Approval request including qualifications of principals and technicians and evidence of active participation in program of Cement and Concrete Reference Laboratory (CCRL) of National Institute of Standards and Technology.
- E. Test Report for Concrete Mix Designs: Trial mixes including water-cement ratio curves, concrete mix ingredients, and admixtures.

1.7 DELIVERY, STORAGE, AND HANDLING:

- A. Conform to ACI 304. Store aggregate separately for each kind or grade, to prevent segregation of sizes and avoid inclusion of dirt and other materials.
- B. Deliver cement in original sealed containers bearing name of brand and manufacturer, and marked with net weight of contents. Store in suitable watertight building in which floor is raised at least 300 mm (1 foot) above ground. Store bulk cement in separate suitable bins.

- C. Deliver other packaged materials for use in concrete in original sealed containers, plainly marked with manufacturer's name and brand, and protect from damage until used.

1.8 PRE-CONCRETE CONFERENCE:

- A. General: At least 15 days prior to submittal of design mixes, conduct a meeting to review proposed methods of concrete construction to achieve the required results.
- B. Agenda: Includes but is not limited to:
 - 1. Submittals.
 - 2. Coordination of work.
 - 3. Availability of material.
 - 4. Concrete mix design including admixtures.
 - 5. Methods of placing, finishing, and curing.
 - 6. Finish criteria required to obtain required flatness and levelness.
 - 7. Material inspection and testing.
- C. Attendees: Include but not limited to representatives of Contractor; subcontractors involved in supplying, conveying, placing, finishing, and curing concrete; lightweight aggregate manufacturer; admixture manufacturers; Contracting Officer's Technical Representative; Consulting Engineer; Department of Veterans Affairs retained testing laboratories for concrete testing and finish (F-number) verification.
- D. Minutes of the meeting: Contractor shall take minutes and type and distribute the minutes to attendees within five days of the meeting.

1.09 APPLICABLE PUBLICATIONS:

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. Federal Specifications (Fed. Spec.):
 - MM-L-751H.....Lumber Softwood
- C. American Concrete Institute (ACI):
 - 117-90.....Standard Specifications for Tolerances for Concrete Construction and Materials
 - 117R-90.....Commentary on Standard Specifications for Tolerances for Concrete Construction and Materials
 - 211.1-91.....Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete

- 211.2-98.....Standard Practice for Selecting Proportions for
Structural Lightweight Concrete
- 214-77.....Recommended Practice for Evaluation of Strength
Test Results of Concrete
- 301-96.....Standard Specifications for Structural Concrete
- 304R-89.....Guide for Measuring, Mixing, Transporting, and
Placing Concrete
- 305R-91.....Hot Weather Concreting
- 306R-88.....Cold Weather Concreting
- 308-92.....Standard Practice for Curing Concrete
- 309R-96.....Guide for Consolidation of Concrete
- 315-92.....Details and Detailing of Concrete Reinforcement
- 318/318R-99.....Building Code Requirements for Reinforced
Concrete and Commentary
- 347R-94.....Guide to Formwork for Concrete
- D. American National Standards Institute and American Hardboard
Association (ANSI/AHA):
 - A135.4-95.....Basic Hardboard
- E. American Society for Testing and Materials (ASTM):
 - A82-97.....Standard Specification for Steel Wire, Plain,
for Concrete Reinforcement
 - A185-97.....Standard Specification for Steel Welded Wire
Fabric, Plain, for Concrete Reinforcement
 - A615/A615M-00.....Standard Specification for Deformed and Plain
Billet-Steel Bars for Concrete Reinforcement
 - A653/A653M-99.....Standard Specification for Steel Sheet, Zinc-
Coated (Galvanized) or Zinc-Iron Alloy-Coated
(Galvannealed) by the Hot-Dip Process
 - A706/A706M-98.....Standard Specification for Low-Alloy Steel
Deformed and Plain Bars for Concrete
Reinforcement
 - A767/A767M-97.....Standard Specification for Zinc-Coated
(Galvanized) Steel Bars for Concrete
Reinforcement
 - A775/A775M-97.....Standard Specification for Epoxy-Coated
Reinforcing Steel Bars
 - A820-96.....Standard Specification for Steel Fibers for
Fiber-Reinforced Concrete

A996/A996M-00.....Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement
C31/C31M-98.....Standard Practice for Making and Curing Concrete Test Specimens in the field
C33-99.....Standard Specification for Concrete Aggregates
C39/C39M-99.....Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
C94/C94M-00.....Standard Specification for Ready-Mixed Concrete
C143/C143M-98.....Standard Test Method for Slump of Hydraulic Cement Concrete
C150-99.....Standard Specification for Portland Cement
C171-97.....Standard Specification for Sheet Materials for Curing Concrete
C172-99.....Standard Specification for Sampling Freshly Mixed Concrete
C173-94.....Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
C192/C192M-98.....Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory
C231-97.....Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
C260-00.....Standard Specification for Air-Entraining Admixtures for Concrete
C309-98.....Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
C330-99.....Standard Specification for Lightweight Aggregates for Structural Concrete
C494/C494M-99.....Standard Specification for Chemical Admixtures for Concrete
C496-96.....Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens
C567-99.....Standard Test Method for Density of Structural Lightweight Concrete
C618-99.....Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete
C666-97.....Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing

- C881-99.....Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete
- C1107-99.....Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-shrink)
- D6-95.....Standard Test Method for Loss on Heating of Oil and Asphaltic Compounds
- D297-93.....Standard Test Methods for Rubber Products-Chemical Analysis
- D1751-99.....Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types)
- D4397-96.....Standard Specification for Polyethylene Sheeting for Construction, Industrial and Agricultural Applications
- E1155-96.....Standard Test Method for Determining FF
- F. American Welding Society (AWS):
 - D1.4-98.....Structural Welding Code - Reinforcing Steel
- G. Concrete Reinforcing Steel Institute (CRSI):
 - DA4-90.....Manual of Standard Practice
- H. National Cooperative Highway Research Program (NCHRP):
 - Report No. 244-81.....Concrete Sealers for the Protection of Bridge Structures
- I. U. S. Department of Commerce Product Standard (PS):
 - PS 1-83.....Construction and Industrial Plywood
- J. U. S. Army Corps of Engineers Handbook for Concrete and Cement:
 - CRD C513-74.....Rubber Waterstops
 - CRD C572-74.....Polyvinyl chloride Waterstops

PART 2 - PRODUCTS:

2.1 FORMS:

- A. Wood: Fed Spec MM-L-751H, free from loose knots and suitable to facilitate finishing concrete surface specified; tongue and grooved.
- B. Plywood: PS-1 Exterior Grade B-B (concrete-form) 16 mm (5/8 inch), or 20 mm (3/4 inch) thick for unlined contact form. B-B High Density Concrete Form Overlay optional.

- C. Permanent Steel Form for Concrete Slabs: Corrugated, ASTM A653, Grade E, and Galvanized, ASTM A653, G90. Provide venting where insulating concrete fill is used.
- D. Form Ties: Develop a minimum working strength of 13.35 kN (3000 pounds) when fully assembled. Ties shall be adjustable in length to permit tightening of forms and not have any lugs, cones, washers to act as spreader within form, nor leave a hole larger than 20 mm (3/4 inch) diameter, or a depression in exposed concrete surface, or leave metal closer than 40 mm (1 1/2 inches) to concrete surface. Wire ties not permitted. Cutting ties back from concrete face not permitted.

2.2 MATERIALS:

- A. Portland Cement: ASTM C150 Type I or II.
- B. Coarse Aggregate: ASTM C33.
 - 1. Size 67. Size 467 may be used for footings and walls over 300 mm (12 inches) thick.
 - 2. Coarse aggregate for applied topping, encasement of steel columns, and metal pan stair fill shall be Size 7.
 - 3. Maximum size of coarse aggregates not more than one-fifth of narrowest dimension between sides of forms, one-third of depth of slabs, nor three-fourth of minimum clear spacing between reinforcing bars.
- C. Lightweight Aggregates for Structural Concrete: ASTM C330, Table 1. Maximum size of aggregate not larger than one-fifth of narrowest dimension between forms, nor three-fourth of minimum clear distance between reinforcing bars. Contractor to furnish certified report to verify that aggregate is sound and durable, and has a durability factor of not less than 80 based on 300 cycles of freezing and thawing when tested in accordance with ASTM C666.
- D. Fine Aggregate: ASTM C33. Fine aggregate for applied concrete floor topping shall pass a 4.75 mm (No. 4) sieve, 10 percent maximum shall pass a 150 μ m (No. 100) sieve.
- E. Mixing Water: Fresh, clean, and potable.
- F. Admixtures:
 - 1. Water Reducing Admixture: ASTM C494, Type A and not contain more chloride ions than are present in municipal drinking water.

2. Water Reducing, Retarding Admixture: ASTM C494, Type D and not contain more chloride ions than are present in municipal drinking water.
3. High-Range Water-Reducing Admixture (Superplasticizer): ASTM C494, Type F or G, and not contain more chloride ions than are present in municipal drinking water.
4. Non-Corrosive, Non-Chloride Accelerator: ASTM C494, Type C or E, and not contain more chloride ions than are present in municipal drinking water. Admixture manufacturer must have long-term non-corrosive test data from an independent testing laboratory of at least one year duration using an acceptable accelerated corrosion test method such as that using electrical potential measures.
5. Air Entraining Admixture: ASTM C260.
6. Prohibited Admixtures: Calcium chloride, thiocyanate or admixtures containing more than 0.05 percent chloride ions are not permitted.
7. Certification: Written conformance to the requirements above and the chloride ion content of the admixture prior to mix design review.
- G. Vapor Barrier: ASTM D4397, 0.25 mm (10 mil).
- H. Reinforcing Steel: ASTM A615, or ASTM A996, deformed, grade as shown.
- I. Welded Wire Fabric: ASTM A185.
- J. Reinforcing Bars to be Welded: ASTM A706.
- K. Supports, Spacers, and Chairs: Types which will hold reinforcement in position shown in accordance with requirements of ACI 318 except as specified.
- L. Expansion Joint Filler: ASTM D1751.
- M. Sheet Materials for Curing Concrete: ASTM C171.
- N. Liquid Membrane-forming Compounds for Curing Concrete: ASTM C309, Type I, with fugitive dye. Compound shall be compatible with scheduled surface treatment, such as paint and resilient tile, and shall not discolor concrete surface.
- O. Non-Shrink Grout:
 1. ASTM C1107, pre-mixed, produce a compressive strength of at least 35 MPa (5000 psi) at three days. Furnish test data from an independent laboratory indicating that the grout when placed at a fluid consistency shall achieve 95 percent bearing under a 1200 mm x 1200 mm (4 foot by 4 foot) base plate.
 2. Where high fluidity or increased placing time is required, furnish test data from an independent laboratory indicating that the grout

when placed at a fluid consistency shall achieve 95 percent under an 450 mm x 900 mm (18 inch by 36 inch) base plate.

2.3 CONCRETE MIXES:

- A. Mix Designs: Proportioned in accordance with Section 5.3, "Proportioning on the Basis of Field Experience and/or Trial Mixtures" of ACI 318.
 - 1. If trial mixes are used, make a set of at least 6 cylinders in accordance with ASTM C192 for test purposes from each trial mix; test three for compressive strength at 7 days and three at 28 days.
 - 2. Submit a report of results of each test series, include a detailed listing of the proportions of trial mix or mixes, including cement, admixtures, weight of fine and coarse aggregate per m³ (cubic yard) measured dry rodded and damp loose, specific gravity, fineness modulus, percentage of moisture, air content, water-cement ratio, and consistency of each cylinder in terms of slump. Include dry unit weight of lightweight structural concrete.
 - 3. Prepare a curve showing relationship between water-cement ratio at 7-day and 28-day compressive strengths. Plot each curve using at least three specimens.
 - 4. If the field experience method is used, submit complete standard deviation analysis.
- B. After approval of mixes no substitution in material or change in proportions of approval mixes may be made without additional tests and approval of Contracting Officer's Technical Representative or as specified. Making and testing of preliminary test cylinders may be carried on pending approval of cement, providing Contractor and manufacturer certify that ingredients used in making test cylinders are the same. Contracting Officer's Technical Representative may allow Contractor to proceed with depositing concrete for certain portions of work, pending final approval of cement and approval of design mix.
- C. Cement Factor: Maintain minimum cement factors in Table I regardless of compressive strength developed above minimums.

TABLE I - CEMENT AND WATER FACTORS FOR CONCRETE

Concrete Strength	Non-Air-Entrained	Air-Entrained
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Min. 28 Day Comp. Str. MPa (psi)	Min. Cement kg/m ³ (lbs/c. yd)	Max. Water Cement Ratio	Min. Cement kg/m ³ (lbs/c. yd)	Max. Water Cement Ratio
30 (4000) ^{1,3}	325 (550)	0.55	340 (570)	0.50
25 (3000) ^{1,3}	280 (470)	0.65	290 (490)	0.55

1. If trial mixes are used, the proposed mix design shall achieve a compressive strength 8.3 MPa (1200 psi) in excess of f'c. For concrete strengths above 35 Mpa (5000 psi), the proposed mix design shall achieve a compressive strength 9.7 MPa (1400 psi) in excess of f'c.

2. Lightweight Structural Concrete. Pump mixes may require higher cement values.

3. For concrete exposed to high sulfate content soils maximum water cement ratio is 0.44.

* Determined by Laboratory in accordance with ACI 211.1 for normal concrete or ACI 211.2 for lightweight structural concrete.

D. Maximum Slump: Maximum slump, as determined by ASTM C143 with tolerances as established by ASTM C94, for concrete to be vibrated shall be as shown in Table II.

TABLE II - MAXIMUM SLUMP, mm (INCHES)*

Type of Construction	Normal Weight Concrete	Lightweight Structural Concrete
Slabs, Beams, Reinforced Walls, and Building Columns	100 mm (4 inches)	100 mm (4 inches)

* Slump may be increased by the use of the approved high-range water-reducing admixture (superplasticizer). Tolerances as established by ASTM C94. Concrete containing the high-range-water-reducing admixture may have a maximum slump of 225 mm (9 inches). The concrete shall arrive at the job site at a slump of 50 mm to 75 mm (2 inches to 3 inches), and 75 mm to 100 mm (3 inches to 4 inches) for lightweight concrete. This should be verified, and then the high-range-water-reducing admixture added to increase the slump to the approved level.

E. Air-Entrainment: Air-entrainment of normal weight concrete shall conform with Table III. Air-entrainment of lightweight structural

concrete shall conform with Table IV. Determine air content by either ASTM C173 or ASTM C231.

**TABLE III - TOTAL AIR CONTENT
 FOR VARIOUS SIZES OF COARSE AGGREGATES (NORMAL CONCRETE)**

Nominal Maximum Size of Coarse Aggregate, mm (Inches)	
Total Air Content	Percentage by Volume
10 mm (3/8 in).6 to 10	13 mm (1/2 in).5 to 9
20 mm (3/4 in).4 to 8	25 mm (1 in).3-1/2 to 6-1/2
40 mm (1 1/2 in).3 to 6	

**TABLE IV
 AIR CONTENT OF LIGHTWEIGHT STRUCTURAL CONCRETE**

Nominal Maximum size of Coarse Aggregate, mm's (Inches)	
Total Air Content	Percentage by Volume
Greater than 10 mm (3/8 in) 4 to 8	10 mm (3/8 in) or less 5 to 9

- F. Lightweight structural concrete shall not weigh more than air-dry unit weight shown. Air-dry unit weight determined on 150 mm by 300 mm (6 inch by 12 inch) test cylinders after seven days standard moist curing followed by 21 days drying at 23 degrees C \pm 1.7 degrees C (73.4 \pm 3 degrees Fahrenheit), and 50 (plus or minus 7) percent relative humidity. Use wet unit weight of fresh concrete as basis of control in field.
- G. Concrete slabs placed at air temperatures below 10 degrees C (50 degrees Fahrenheit) use non-corrosive, non-chloride accelerator. Concrete required to be air entrained use approved air entraining admixture. Pumped concrete, synthetic fiber concrete, architectural concrete, concrete required to be watertight, and concrete with a water/cement ratio below 0.50 use high-range water-reducing admixture (superplasticizer).
- H. Durability: Use air entrainment for exterior exposed concrete subjected to freezing and thawing and other concrete shown or specified. Air content as shown in Table III or Table IV.
- I. Enforcing Strength Requirements: Test as specified in Section, TESTING LABORATORY SERVICES, during the progress of the work. Seven-day tests may be used as indicators of 28-day strength. Average of any three 28-day consecutive strength tests of laboratory-cured specimens

representing each type of concrete shall be equal to or greater than specified strength. No single test shall be more than 3.5 MPa (500 psi) below specified strength. Interpret field test results in accordance with ACI 214. Should strengths shown by test specimens fall below required values, Contracting Officer's Technical Representative (COTR) may require any one or any combination of the following corrective actions, at no additional cost to the Government:

1. Require changes in mix proportions by selecting one of the other appropriate trial mixes or changing proportions, including cement content, of approved trial mix.
2. Require additional curing and protection.
3. If five consecutive tests fall below 95 percent of minimum values given in Table I or if test results are so low as to raise a question as to the safety of the structure, COTR may direct Contractor to take cores from portions of the structure. Use results from cores tested by the Contractor retained testing agency to analyze structure.
4. If strength of core drilled specimens falls below 85 percent of minimum value given in Table I, COTR may order load tests, made by Contractor retained testing agency, on portions of building so affected. Load tests in accordance with ACI 318 and criteria of acceptability of concrete under test as given therein.
5. Concrete work, judged inadequate by structural analysis, by results of load test, or for any reason, shall be reinforced with additional construction or replaced, if directed by the COTR.

2.4 BATCHING AND MIXING:

- A. General: Concrete shall be "Ready-Mixed" and comply with ACI 318 and ASTM C94, except as specified. Batch mixing at the site is permitted. Mixing process and equipment must be approved by COTR. With each batch of concrete, furnish certified delivery tickets listing information in Paragraph 16.1 and 16.2 of ASTM C94. Maximum delivery temperature of concrete is 38⁰C (100 degrees Fahrenheit). Minimum delivery temperature as follows:

Atmospheric Temperature	Minimum Concrete Temperature
-1. degrees to 4.4 degrees C (30 degrees to 40 degrees F)	15.6 degrees C (60 degrees F.)

-17 degrees C to -1.1 degrees C (0 degrees to 30 degrees F.)	21 degrees C (70 degrees F.)
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PART 3 - EXECUTION

3.1 FORMWORK:

- A. General: Design in accordance with ACI 347 is the responsibility of the Contractor. The Contractor shall retain a registered Professional Engineer to design the formwork, shores, and reshores.
 - 1. Form boards and plywood forms may be reused for contact surfaces of exposed concrete only if thoroughly cleaned, patched, and repaired and COTR approves their reuse.
 - 2. Corrugated fiberboard forms: Place forms on a smooth firm bed, set tight, with no buckled cartons to prevent horizontal displacement, and in a dry condition when concrete is placed.
- B. Treating and Wetting: Treat or wet contact forms as follows:
 - 1. Coat plywood and board forms with non-staining form sealer. In hot weather, cool forms by wetting with cool water just before concrete is placed.
 - 2. Clean and coat removable metal forms with light form oil before reinforcement is placed. In hot weather, cool metal forms by thoroughly wetting with water just before placing concrete.
 - 3. Use sealer on reused plywood forms as specified for new material.
- C. Size and Spacing of Studs: Size and space studs, wales and other framing members for wall forms so as not to exceed safe working stress of kind of lumber used nor to develop deflection greater than 1/270 of free span of member.
- D. Unlined Forms: Use plywood forms to obtain a smooth finish for concrete surfaces. Tightly butt edges of sheets to prevent leakage. Back up all vertical joints solidly and nail edges of adjacent sheets to same stud with 6d box nails spaced not over 150 mm (6 inches) apart.
- E. Lined Forms: May be used in lieu of unlined plywood forms. Back up form lining solidly with square edge board lumber securely nailed to studs with all edges in close contact to prevent bulging of lining. No joints in lining and backing may coincide. Nail abutted edges of sheets to same backing board. Nail lining at not over 200 mm (8 inches) on center along edges and with at least one nail to each square foot of surface

area; nails to be 3d blued shingle or similar nails with thin flatheads.

F. Inserts, Sleeves, and Similar Items: Flashing reglets, steel strips, masonry ties, anchors, wood blocks, nailing strips, grounds, inserts, wire hangers, sleeves, drains, guard angles, forms for floor hinge boxes, inserts or bond blocks for elevator guide rails and supports, and other items specified as furnished under this and other sections of specifications and required to be in their final position at time concrete is placed shall be properly located, accurately positioned, and built into construction, and maintained securely in place.

1. Locate inserts or hanger wires for furred and suspended ceilings only in bottom of concrete joists, or similar concrete member of overhead concrete joist construction.
2. Install sleeves, inserts and similar items for mechanical services in accordance with drawings prepared specially for mechanical services. Contractor is responsible for accuracy and completeness of drawings and shall coordinate requirements for mechanical services and equipment.
3. Do not install sleeves in beams, joists or columns except where shown or permitted by COTR. Install sleeves in beams, joists, or columns that are not shown, but are permitted by the COTR, and require no structural changes, at no additional cost to the Government.
4. Minimum clear distance of embedded items such as conduit and pipe is at least three times diameter of conduit or pipe, except at stub-ups and other similar locations.
5. Provide recesses and blockouts in floor slabs for door closers and other hardware as necessary in accordance with manufacturer's instructions.

G. Construction Tolerances:

1. Set and maintain concrete formwork to assure erection of completed work within tolerances specified and to accommodate installation of other rough and finish materials. Accomplish remedial work necessary for correcting excessive tolerances. Erected work that exceeds specified tolerance limits shall be remedied or removed and replaced, at no additional cost to the Government.

2. Permissible surface irregularities for various classes of materials are defined as "finishes" in specification sections covering individual materials. They are to be distinguished from tolerances specified which are applicable to surface irregularities of structural elements.

3.2 PLACING REINFORCEMENT:

- A. General: Details of concrete reinforcement in accordance with ACI 318 and ACI 315, unless otherwise shown.
- B. Placing: Place reinforcement conforming to CRSI DA4, unless otherwise shown.
 1. Place reinforcing bars accurately and tie securely at intersections and splices with 1.6 mm (16 gauge) black annealed wire. Secure reinforcing bars against displacement during the placing of concrete by spacers, chairs, or other similar supports. Portions of supports, spacers, and chairs in contact with formwork shall be made of plastic in areas that will be exposed when building is occupied. Type, number, and spacing of supports conform to ACI 315. Where concrete slabs are placed on ground, use concrete blocks or other non-corrodible material of proper height, for support of reinforcement. Use of brick or stone supports will not be permitted.
 2. Lap welded wire fabric at least 1 1/2 mesh panels plus end extension of wires not less than 300 mm (12 inches) in structural slabs. Lap welded wire fabric at least 1/2 mesh panels plus end extension of wires not less than 150 mm (6 inches) in slabs on grade.
 3. Splice column steel at no points other than at footings and floor levels unless otherwise shown.
- C. Spacing: Minimum clear distances between parallel bars, except in columns and multiple layers of bars in beams shall be equal to nominal diameter of bars. Minimum clear spacing is 25 mm (1 inch) or 1-1/3 times maximum size of coarse aggregate.
- D. Splicing: Splices of reinforcement made only as required or shown or specified. Accomplish splicing as follows:
 1. Lap splices: Do not use lap splices for bars larger than Number 36 (Number 11). Minimum lengths of lap as shown.
 2. Welded splices: Splicing by butt-welding of reinforcement permitted providing the weld develops in tension at least 125 percent of the yield strength (fy) for the bars. Welding conform to the

- requirements of AWS D1.4. Welded reinforcing steel conform to the chemical analysis requirements of AWS D1.4.
- a. Submit test reports indicating the chemical analysis to establish weldability of reinforcing steel.
 - b. Submit a field quality control procedure to insure proper inspection, materials and welding procedure for welded splices.
 - c. Department of Veterans Affairs retained testing agency shall test a minimum of three splices, for compliance, locations selected by COTR.
3. Mechanical Splices: Develop in tension and compression at least 125 percent of the yield strength (fy) of the bars. Stresses of transition splices between two reinforcing bar sizes based on area of smaller bar. Provide mechanical splices at locations indicated. Use approved exothermic, tapered threaded coupling, or swaged and threaded sleeve. Exposed threads and swaging in the field not permitted.
- a. Initial qualification: In the presence of COTR, make three test mechanical splices of each bar size proposed to be spliced. Department of Veterans Affairs retained testing laboratory will perform load test.
 - b. During installation: Furnish, at no additional cost to the Government, one companion (sister) splice for every 50 splices for load testing. Department of Veterans Affairs retained testing laboratory will perform the load test.
- E. Bending: Bend bars cold, unless otherwise approved. Do not field bend bars partially embedded in concrete, except when approved by COTR.
- F. Cleaning: Metal reinforcement, at time concrete is placed, shall be free from loose flaky rust, mud, oil, or similar coatings that will reduce bond.
- G. Future Bonding: Protect exposed reinforcement bars intended for bonding with future work by wrapping with felt and coating felt with a bituminous compound unless otherwise shown.

3.3 CONSTRUCTION JOINTS:

- A. Unless otherwise shown, location of construction joints to limit individual placement shall not exceed 24,000 mm (80 feet) in any horizontal direction, except slabs on grade which shall have

construction joints shown. Allow 48 hours to elapse between pouring adjacent sections unless this requirement is waived by COTR.

- B. Locate construction joints in suspended floors near the quarter-point of spans for slabs, beams or girders, unless a beam intersects a girder at center, in which case joint in girder shall be offset a distance equal to twice width of beam. Provide keys and inclined dowels as shown. Provide longitudinal keys as shown.

3.4 EXPANSION JOINTS:

- A. Clean expansion joint surfaces before installing premolded filler and placing adjacent concrete.

3.5 PLACING CONCRETE:

- A. Preparation:

1. Remove hardened concrete, wood chips, shavings and other debris from forms.
2. Remove hardened concrete and foreign materials from interior surfaces of mixing and conveying equipment.
3. Have forms and reinforcement inspected and approved by COTR before depositing concrete.
4. Provide runways for wheeling equipment to convey concrete to point of deposit. Keep equipment on runways which are not supported by or bear on reinforcement. Provide similar runways for protection of vapor barrier on coarse fill.

- B. Bonding: Before depositing new concrete on or against concrete which has been set, thoroughly roughen and clean existing surfaces of laitance, foreign matter, and loose particles.

1. Preparing surface for applied topping:

- a. Remove laitance, mortar, oil, grease, paint, or other foreign material by sand blasting. Clean with vacuum type equipment to remove sand and other loose material.
- b. Broom clean and keep base slab wet for at least four hours before topping is applied.
- c. Use a thin coat of one part Portland cement, 1.5 parts fine sand, bonding admixture; and water at a 50: 50 ratio and mix to achieve the consistency of thick paint. Apply to a damp base slab by scrubbing with a stiff fiber brush. New concrete shall be placed while the bonding grout is still tacky.

- C. Conveying Concrete: Convey concrete from mixer to final place of deposit by a method which will prevent segregation. Method of conveying concrete subject to approval of COTR.
- D. Placing: For special requirements see Paragraphs, HOT WEATHER and COLD WEATHER.
1. Do not place concrete when weather conditions prevent proper placement and consolidation, or when concrete has attained its initial set, or has contained its water or cement content more than 1 1/2 hours.
 2. Deposit concrete in forms as near as practicable in its final position. Prevent splashing of forms or reinforcement with concrete in advance of placing concrete.
 3. Do not drop concrete freely more than 3000 mm (10 feet) for concrete containing the high-range water-reducing admixture (superplasticizer) or 1500 mm (5 feet) for conventional concrete. Where greater drops are required, use a tremie or flexible spout (canvas elephant trunk), attached to a suitable hopper.
 4. Discharge contents of tremies or flexible spouts in horizontal layers not exceeding 500 mm (20 inches) in thickness, and space tremies such as to provide a minimum of lateral movement of concrete.
 5. Continuously place concrete until an entire unit between construction joints is placed. Rate and method of placing concrete shall be such that no concrete between construction joints will be deposited upon or against partly set concrete, after it's initial set has taken place, or after 45 minutes of elapsed time during concrete placement.
 6. On bottom of members with severe congestion of reinforcement, deposit 25 mm (1 inch) layer of flowing concrete containing the specified high-range water-reducing admixture (superplasticizer). Successive concrete lifts may be a continuation of this concrete or concrete with a conventional slump.
 7. Concrete on metal deck:
 - a. Concrete on metal deck shall be minimum thickness shown. Allow for deflection of steel beams and metal deck under the weight of wet concrete in calculating concrete quantities for slab.

- 1) The Contractor shall become familiar with deflection characteristics of structural frame to include proper amount of additional concrete due to beam/deck deflection.

E. Consolidation: Conform to ACI 309. Immediately after depositing, spade concrete next to forms, work around reinforcement and into angles of forms, tamp lightly by hand, and compact with mechanical vibrator applied directly into concrete at approximately 450 mm (18 inch) intervals. Mechanical vibrator shall be power driven, hand operated type with minimum frequency of 5000 cycles per minute having an intensity sufficient to cause flow or settlement of concrete into place. Vibrate concrete to produce thorough compaction, complete embedment of reinforcement and concrete of uniform and maximum density without segregation of mix. Do not transport concrete in forms by vibration.

1. Use of form vibration shall be approved only when concrete sections are too thin or too inaccessible for use of internal vibration.
2. Carry on vibration continuously with placing of concrete. Do not insert vibrator into concrete that has begun to set.

3.6 HOT WEATHER:

Follow the recommendations of ACI 305 or as specified to prevent problems in the manufacturing, placing, and curing of concrete that can adversely affect the properties and serviceability of the hardened concrete. Methods proposed for cooling materials and arrangements for protecting concrete shall be made in advance of concrete placement and approved by COTR.

3.7 COLD WEATHER:

Follow the recommendations of ACI 306 or as specified to prevent freezing of concrete and to permit concrete to gain strength properly. Use only the specified non-corrosive, non-chloride accelerator. Do not use calcium chloride, thiocyanates or admixtures containing more than 0.05 percent chloride ions. Methods proposed for heating materials and arrangements for protecting concrete shall be made in advance of concrete placement and approved by COTR.

3.8 PROTECTION AND CURING:

A. Conform to ACI 308: Initial curing shall immediately follow the finishing operation. Protect exposed surfaces of concrete from premature drying, wash by rain and running water, wind, mechanical

injury, and excessively hot or cold temperatures. Keep concrete not covered with membrane or other curing material continuously wet for at least 7 days after placing, except wet curing period for high-early-strength concrete shall be not less than 3 days. Keep wood forms continuously wet to prevent moisture loss until forms are removed. Cure exposed concrete surfaces as described below. Other curing methods may be used if approved by COTR.

1. Liquid curing and sealing compounds: Apply by power-driven spray or roller in accordance with the manufacturer's instructions. Apply immediately after finishing. Maximum coverage 10m²/L (400 square feet per gallon) on steel troweled surfaces and 7.5m²/L (300 square feet per gallon) on floated or broomed surfaces for the curing/sealing compound.
2. Plastic sheets: Apply as soon as concrete has hardened sufficiently to prevent surface damage. Utilize widest practical width sheet and overlap adjacent sheets 50 mm (2 inches). Tightly seal joints with tape.
3. Paper: Utilize widest practical width paper and overlap adjacent sheets 50 mm (2 inches). Tightly seal joints with sand, wood planks, pressure-sensitive tape, mastic or glue.

3.9 REMOVAL OF FORMS:

- A. Remove in a manner to assure complete safety of structure after the following conditions have been met.
 1. Where structure as a whole is supported on shores, forms for beams and girder sides, columns, and similar vertical structural members may be removed after 24 hours, provided concrete has hardened sufficiently to prevent surface damage and curing is continued without any lapse in time as specified for exposed surfaces.
 2. Take particular care in removing forms of architectural exposed concrete to insure surfaces are not marred or gouged, and that corners and arises are true, sharp and unbroken.
- B. Control Test: Use to determine if the concrete has attained sufficient strength and curing to permit removal of supporting forms. Cylinders required for control tests taken in accordance with ASTM C172, molded in accordance with ASTM C31, and tested in accordance with ASTM C39. Control cylinders cured and protected in the same manner as the structure they represent. Supporting forms or shoring not removed until

strength of control test cylinders have attained at least 70 percent of minimum 28-day compressive strength specified.

3.10 CONCRETE SURFACE PREPARATION:

- A. Metal Removal: Unnecessary metal items cut back flush with face of concrete members.
- B. Patching: Maintain curing and start patching as soon as forms are removed. Do not apply curing compounds to concrete surfaces requiring patching until patching is completed. Use cement mortar for patching of same composition as that used in concrete. Use white or gray Portland cement as necessary to obtain finish color matching surrounding concrete. Thoroughly clean areas to be patched. Cut out honeycombed or otherwise defective areas to solid concrete to a depth of not less than 25 mm (1 inch). Cut edge perpendicular to surface of concrete. Saturate with water area to be patched, and at least 150 mm (6 inches) surrounding before placing patching mortar. Give area to be patched a brush coat of cement grout followed immediately by patching mortar. Cement grout composed of one part Portland cement, 1.5 parts fine sand, bonding admixture, and water at a 50:50 ratio, mix to achieve consistency of thick paint. Mix patching mortar approximately 1 hour before placing and remix occasionally during this period without addition of water. Compact mortar into place and screed slightly higher than surrounding surface. After initial shrinkage has occurred, finish to match color and texture of adjoining surfaces. Cure patches as specified for other concrete. Fill form tie holes which extend entirely through walls from unexposed face by means of a pressure gun or other suitable device to force mortar through wall. Wipe excess mortar off exposed face with a cloth.
- C. Upon removal of forms, clean vertical concrete surface that is to receive bonded applied cementitious application with wire brushes or by sand blasting to remove unset material, laitance, and loose particles to expose aggregates to provide a clean, firm, granular surface for bond of applied finish.

3.11 CONCRETE FINISHES:

- A. Slab Finishes:
 - 1. Monitoring and Adjustment: Provide continuous cycle of placement, measurement, evaluation and adjustment of procedures to produce slabs within specified tolerances. Monitor elevations of structural

- steel in key locations before and after concrete placement to establish typical deflection patterns for the structural steel. Determine elevations of cast-in-place slab soffits prior to removal of shores. Provide information to COTR and floor consultant for evaluation and recommendations for subsequent placements.
2. Set perimeter forms to serve as screed using either optical or laser instruments. For slabs on grade, wet screeds may be used to establish initial grade during strike-off, unless COTR determines that the method is proving insufficient to meet required finish tolerances and directs use of rigid screed guides. Where wet screeds are allowed, they shall be placed using grade stakes set by optical or laser instruments. Use rigid screed guides, as opposed to wet screeds, to control strike-off elevation for all types of elevated (non slab-on-grade) slabs. Divide bays into halves or thirds by hard screeds. Adjust as necessary where monitoring of previous placements indicates unshored structural steel deflections to other than a level profile.
 3. Place slabs monolithically. Once slab placement commences, complete finishing operations within same day. Slope finished slab to floor drains where they occur, whether shown or not.
 4. Use straightedges specifically made for screeding, such as hollow magnesium straightedges or power strike-offs. Do not use pieces of dimensioned lumber. Strike off and screed slab to a true surface at required elevations. Use optical or laser instruments to check concrete finished surface grade after strike-off. Repeat strike-off as necessary. Complete screeding before any excess moisture or bleeding water is present on surface. Do not sprinkle dry cement on the surface.
 5. Immediately following screeding, and before any bleed water appears, use a 3000 mm (10 foot) wide highway straightedge in a cutting and filling operation to achieve surface flatness. Do not use bull floats or darbys, except that darbying may be allowed for narrow slabs and restricted spaces.
 6. Wait until water sheen disappears and surface stiffens before proceeding further. Do not perform subsequent operations until concrete will sustain foot pressure with maximum of 6 mm (1/4 inch) indentation.

7. Scratch Finish: Finish base slab to receive a bonded applied cementitious application as indicated above, except that bull floats and darbys may be used. Thoroughly coarse wire broom within two hours after placing to roughen slab surface to insure a permanent bond between base slab and applied materials.
8. Float Finish: Slabs to receive unbonded toppings, steel trowel finish, fill, mortar setting beds, or a built-up roof, and ramps, stair treads, platforms (interior and exterior), and equipment pads shall be floated to a smooth, dense uniform, sandy textured finish. During floating, while surface is still soft, check surface for flatness using a 3000 mm (10 foot) highway straightedge. Correct high spots by cutting down and correct low spots by filling in with material of same composition as floor finish. Remove any surface projections and re-float to a uniform texture.
9. Steel Trowel Finish: Concrete surfaces to receive resilient floor covering or carpet, monolithic floor slabs to be exposed to view in finished work, future floor roof slabs, applied toppings, and other interior surfaces for which no other finish is indicated. Steel trowel immediately following floating. During final troweling, tilt steel trowel at a slight angle and exert heavy pressure to compact cement paste and form a dense, smooth surface. Finished surface shall be smooth, free of trowel marks, and uniform in texture and appearance.
10. Broom Finish: Finish exterior slabs, ramps, and stair treads with a bristle brush moistened with clear water after surfaces have been floated. Brush in a direction transverse to main traffic. Match texture approved by COTR from sample panel.
11. Finished slab flatness (FF) and levelness (FL) values comply with the following minimum requirements:
 - a. Areas covered with carpeting, or not specified otherwise in b. below:

Slab on Grade:	
Specified overall value	F _F 25/F _L 20
Minimum local value	F _F 17/F _L 15
Level suspended slabs (shored until after testing) and topping slabs:	
Specified overall value	FF 25/FL 20

Minimum local value FF 17/FL 15

Unshored suspended slabs:

Specified overall value FF 25

Minimum local value FF 17

Level tolerance such that 80 percent of all points fall within a 20 mm (3/4 inch) envelope +10 mm, -10 mm (+3/8 inch, -3/8 inch) from the design elevation.

- b. Areas that will be exposed, receive thin-set tile or resilient flooring, or roof areas designed as future floors:

Slab on grade:

Specified overall value FF 36/FL 20

Minimum local value FF 24/FL 15

Level suspended slabs (shored until after testing) and topping slabs

Specified overall value FF 30/FL 20

Minimum local value FF 24/FL 15

Unshored suspended slabs:

Specified overall value FF 30

Minimum local value FF 24

Level tolerance such that 80 percent of all points fall within a 20 mm (3/4 inch) envelope +10 mm, -10 mm (+3/8 inch, -3/8 inch) from the design elevation.

- c. "Specified overall value" is based on the composite of all measured values in a placement derived in accordance with ASTM E1155.
- d. "Minimum local value" (MLV) describes the flatness or levelness below which repair or replacement is required. MLV is based on the results of an individual placement and applies to a minimum local area. Minimum local area boundaries may not cross a construction joint or expansion joint. A minimum local area will be bounded by construction and/or control joints, or by column lines and/or half-column lines, whichever is smaller.

12. Measurements

- a. Department of Veterans Affairs retained testing laboratory will take measurements as directed by COTR, to verify compliance with F_F , F_L , and other finish requirements. Measurements will occur within 48 hours after completion of concrete placement (weekends

and holidays excluded). Make measurements before shores or forms are removed to insure the "as-built" levelness is accurately assessed. Profile data for above characteristics may be collected using a laser level or any Type II apparatus (ASTM E1155, "profileograph" or "dipstick"). Contractor's surveyor shall establish reference elevations to be used by Department of Veterans Affairs retained testing laboratory.

- b. Contractor not experienced in using F_F and F_L criteria is encouraged to retain the services of a floor consultant to assist with recommendations concerning adjustments to slab thicknesses, finishing techniques, and procedures on measurements of the finish as it progresses in order to achieve the specific flatness and levelness numbers.
13. Acceptance/ Rejection:
- a. If individual slab section measures less than either of specified minimum local F_F/F_L numbers, that section shall be rejected and remedial measures shall be required. Sectional boundaries may be set at construction and contraction (control) joints, and not smaller than one-half bay.
 - b. If composite value of entire slab installation, combination of all local results, measures less than either of specified overall F_F/F_L numbers, then whole slab shall be rejected and remedial measures shall be required.
14. Remedial Measures for Rejected Slabs: Correct rejected slab areas by grinding, planing, surface repair with underlayment compound or repair topping, retopping, or removal and replacement of entire rejected slab areas, as directed by COTR, until a slab finish constructed within specified tolerances is accepted.

3.12 SURFACE TREATMENTS:

- A. Use on exposed concrete floors and concrete floors to receive carpeting
- B. Liquid Densifier/Sealer: Apply in accordance with manufacturer's directions just prior to completion of construction.
- C. Non-Slip Finish: Except where safety nosing and tread coverings are shown, apply non-slip abrasive aggregate to treads and platforms of concrete steps and stairs, and to surfaces of exterior concrete ramps and platforms. Broadcast aggregate uniformly over concrete surface at rate of application of 8% per 1/10th m^2 (7.5 percent per square foot) of

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area. Trowel concrete surface to smooth dense finish. After curing, rub treated surface with abrasive brick and water to slightly expose abrasive aggregate.

- - - E N D - - -

SECTION 03300
CAST-IN-PLACE CONCRETE

**SECTION 05120
STRUCTURAL STEEL**

PART 1 GENERAL

1.1 DESCRIPTION:

This section specifies structural steel shown and classified by Section 2, Code of Standard Practice for Steel Building and Bridges. This section also applies, in addition to structural steel shown in the construction documents, to exterior metal panels backup structural steel members to be designed and supplied by contractor and/or metal panel supplier.

1.2 RELATED DOCUMENTS:

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.3 RELATED WORK:

- ~~1.~~A. Materials testing and inspection during construction: Section 01410, TESTING LABORATORY SERVICES.
- B. Painting: Section 09900, PAINTING.
- C. Steel Decking: Section 05311, STEEL DECKING.
- D. Composite Steel Deck: Section 05321, STEEL DECKING COMPOSITE.
- E. Fireproofing: Section 07253, SPRAYED-ON FIREPROOFING.

1.4 APPLICABLE PUBLICATIONS:

- A. Publications listed below form part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Institute of Steel Construction (AISC):
 - 1. Load and Resistance Factor Design Specifications for Structural Steel Buildings (third edition, 2001)
 - 2. Seismic Provisions for Structural Steel Buildings (May 2002)
 - 3. Code of Standard Practice for Steel Buildings and Bridges (March,2000), modified as follows
 - a. Section 3. Design Drawings and Specifications, Paragraph 3.3 Discrepancies,: Delete the second paragraph : "When discrepancies exist between the Design Drawings and Specifications, the Design Drawings shall govern...".
 - b. Section 4 - Approval, Paragraph 4.4.1; Delete subparagraph (b) " Confirmation that the Contracting Officer's Technical

Representative for Design has reviewed and approved the
Connection details shown on the Shop and Erection Drawings..."

C. American National Standards (ANSI):

1. B18.22.1-98 Plain Washers
2. B18.23.1-98 Beveled Washers
3. B18.22M-00 Metric Plain Washers

D. American Society for Testing and Materials (ASTM):

1. A6/A6M-02 Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling
2. A36/A36M-01 Standard Specification for Carbon Structural Steel
3. A53/A53M-01 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
4. A123/A123-97e1 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
5. A153-01a Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
6. A307-00 Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
7. A325-02 Standard Specification for High-Strength Bolts for Structural Steel Joints
8. A435/A435M-90 Straight Beam Ultrasonic Examination of Steel Plates
8. A500-01 Standard Specification for Cold-formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
10. A563 Standard Specification for Carbon and Alloy Steel Nuts
11. A572/A572-01 Standard Specification for High-Strength Columbium - Vanadium Steels of Structural Quality
12. A780 Standard Specification for Repair of Damaged Hot-Dip Galvanized Coatings
13. A898 Standard Specification for Straight Beam Ultrasonic Examination of Rolled Steel Structural Shapes
14. A992 Standard Specification for Steel for Structural Shapes For Use in Building Framing
15. F436 Standard Specification for Hardened Steel Washers
16. F844 Standard Specification for Washers, Steel, Plain (Flat), Unhardened for General Use
17. F959 Standard Specification for Compressible-Washer Type Direct Tension Indicators for Use with Structural Fasteners

- E. American Welding Society (AWS):
1. D1.1-02 Structural Welding Code - Steel
 2. D1.3-98 Structural Welding Code - Sheet Steel
 3. D1.4-98 Structural Welding Code - Reinforcing Steel
 4. D2.4 Symbols for Welding, Brazing, and Nondestructive Examination
 5. A3.0 Standard Welding Terms and Definitions
 6. A4.3 Standard Methods for Determination of the Diffusible Hydrogen Content of Martensitic, Bainitic, and Ferritic Steel Weld Metal Produced by Arc Welding.
 7. C4.1-G Oxygen Cutting Surface Roughness Gauge
 8. C4.1-WC Criteria for Describing Oxygen-Cut Surfaces
 9. QC-1 Standard and Guide for Qualification and Certification of Welding Inspectors
- F. FEMA 353 (2000) - Recommended Specifications and Quality Assurance Guidelines for Steel Moment-Frame Construction for Seismic Applications:
1. Appendix A - Weld Metal/Welding Procedure Specification Toughness Verification Test
 2. Appendix B - Supplemental Welder Qualification Testing Procedure
 3. Appendix C - Supplemental Charpy V-Notch Toughness Testing for Combinations of Filler Metals
 4. Appendix D - Supplemental Testing for Extended Exposure Limits for Flux-Cored Arc Welding Filler Metals.
 5. Appendix E - Supplementary Ultrasonic Technician Testing
- G. International Code Council (ICC)
International Building Code (2003)
- H. Military Specifications (Mil. Spec.):
MIL-P-21035 Paint, High Zinc Dust Content, Galvanizing, Repair
- I. Occupational Safety and Health Administration (OSHA):
29 CFR Part 1926-2001 Safety Standards for Steel Erection
- J. Research Council on Structural Connections (RCSC) of the Engineering Foundation:
Specification for Structural Joints Using ASTM A325 or A490 Bolts
- K. Steel Structures Painting Council (SSPC):
1. "Systems and Specifications"
 2. "Steel Structures Painting Manual"

1.5 DEFINITIONS:

- ~~A~~-A. Structural Steel: Elements of structural-steel frame, as classified by AISC's "Code of Standard Practice for Steel Buildings and Bridges," that support design loads.
- B. Architecturally Exposed Structural Steel: Structural steel designated as architecturally exposed structural steel in the Contract Documents.
- C. Heavy Structural Sections
 - 1. ASTM A6 Group 3 shapes with flanges thicker than 1.5 inches
 - 2. ASTM A6 Group 4 and Group 5 shapes
 - 3. Welded built-up members with web or flange plates exceeding 2 inches in thickness
- D. Nondestructive Testing:
 - 1. Magnetic particle testing (MT)
 - 2. Penetrant testing (PT)
 - 3. Radiographic testing (RT)
 - 4. Ultrasonic testing (UT)
- E. Seismic Force Resisting System (SFERS) - assembly of structural elements that resist seismic forces including columns, beams, braces, collectors, shear walls, and the interconnections between the elements. The SFERS does not include elements that provide out-of-plane bracing to components of the SFERS nor components designed to resist gravity loads only.
- F. Special Inspector - qualified person or firm, hired by the Owner, with demonstrated competence for inspection of the particular type of construction or operation requiring special inspection.
- G. Structural Weld Demand - All welds that are part of the Seismic Force Resisting System are Category A-H (as defined by FEMA 353) welds unless specifically indicated otherwise.

1.6 SYSTEM DESCRIPTION:

The Seismic Force Resisting System (SFERS) is composed of concrete diaphragms on metal deck, special steel moment resisting frames (SMRF's) including columns and beams, and special concentrically braced frames. The SFERS is essentially complete when the concrete floor slabs and all elements of the SMRF's have been installed and connections are complete. Connections shall be considered complete only after inspection and acceptance by the Owner's Testing Agency.

1.7 SUBMITTALS:

- A. Product Data: manufacturer's specifications and installation instructions: Include laboratory test reports and data to show compliance with Contract Documents.
1. Structural steel primer paint.
 2. Welding Electrodes.
 - a. Filler metal manufacturer's technical data sheet for each electrode. Include Charpy V-Notch (CVN) properties of electrodes where applicable.
 - b. Manufacturer's Certificate of Conformance is acceptable for proof of conformance to this requirement
 3. Fastener products including bolts, nuts, washers and direct tension indicators when used in the Seismic Force Resisting System:
 - a. Heat analysis, heat number.
 - b. Hardness, tensile and proof load tests.
 - c. Lot number and purchase order number.
 - d. Statement of compliance with dimensional and thread fit requirements.
- B. Shop Drawings and Erection Drawings:
1. Include complete details, schedules, procedures and diagrams for fabrication and assembly of structural steel members.
 2. Include all dimensional and geometric information, grade of steel, shop surface treatments and shop connections in the shop and erection drawings.
 3. Include details of cuts, connections, camber, holes, and other pertinent data.
 4. Indicate welds by standard AWS symbols, and show size, length, and type of each weld. Clearly distinguish between shop and field welds.
 5. Provide setting drawings, templates, and directions for installation of anchor bolts and other anchorage.
 6. Reproductions of the Contract Drawings are not allowed for shop drawings.
 7. Indicate profiles, sizes, spacing, lengths and locations of structural members, indicating stiffener and continuity plates, bolts, fasteners, welds and attachments.

8. Indicate weld electrode type and electrode toughness for welds part of the SFRS.

C. Procedures and Control Plans:

1. Written Welding Procedure Specification (WPS) for each weld used on the project before the start of work.
 - a. Include all information required by AWS D1.1 and the Sample Welding Form given in the Annex to AWS D1.1.
 - b. Record the name of the individuals responsible for the suitability of the WPS on the WPS.
 - e. Written procedure for back gouging, grinding, re-welding and the application of the reinforcing fillets as required for the completed weld.
2. Procedure Qualification Records (PQR) for WPS's that are not pre-qualified per AWS D1.1 prior to the start of work. Submit a PQR for each weld made up of a combination of different welds and/or filler metals, even if those welds are individually qualified or prequalified.
3. Fastener Installation Procedures

Procedures for pre-installation testing, installation, snugging, pretensioning, and post-installation of high strength bolted connections in accordance with Section 8 - RCSC Specification for Structural Joints Using ASTM A325 or A490 Bolts, indicating type of connection as defined by AISC.

D. Certificates of Compliance, Test Reports, and data on type of tests conducted and test results:

1. Provide all Certificates of Compliance written in English.
2. Structural Steel

Steel mill test reports: include chemical and physical properties for all structural steel members including but not limited to: rolled structural steel bars, plates, shapes, and sheet piling, pipe, tubes, bar
3. Fastening material

Manufacturer's Certifications for all fastener components, including bolts, nuts and washers, used in the Seismic Force Resisting System including heat analysis, heat number, results of hardness, tensile and proof load tests.
4. Welding material

Weld metal: Certificate of Compliance, including Charpy V-Notch values for all welding electrodes, fluxes and shielding gasses used in complete joint penetration and partial joint penetration welds or where required as indicated on the drawings.

5. Shear Connectors:
 - a. Certified Test Reports for in-plant quality control mechanical tests for diameter supplied that indicate minimum requirements for physical properties, inspection, marking and tests for structural steel as defined by ASTM, including, but not limited to ASTM A6.
 - b. Manufacturer's Certification that shear connectors meet AWS D.1, Sections 7.2 and 7.3. requirements.
 - c. Certified material test reports indicating diameter, chemical properties and grade on each heat number supplied.
 6. Current valid certificates issued by an independent testing agency for all welders, welding operators, and tack welders. Submit re-certification data for each welder required to rectify.
 7. Contractor's Fabrication/Erection Inspector qualifications.
 8. Contractor's inspection reports on all shop and field welds, including preheat and cooldown reports.
- E. Written frame distortion control program
1. Indicate sequence of erection and intended sequence of flange and web welding and bolting to maintain alignment of structural steel elements.
 2. Include interior bracing and erection sequencing for vertical framing systems as well as lateral force resisting framing systems.

1.8 QUALITY CONTROL:

- A. Contractor is solely responsible for the quality of the Work
- B. Steel fabricator:
 1. Minimum five years experience in fabrication of structural steel and able to furnish evidence of ability, facilities, proficiency of personnel, and completed projects, of similar size and type.
 2. Fabrication plant AISC certified for "Complex Steel Structures" with facilities and personnel qualified to conduct the work and required testing and inspection.
 3. Fabricate structural steel in one location by one fabricator, unless specifically requested otherwise in writing at the time of bidding

and specifically accepted by the Owner in writing. If more than one location is used, pay the additional inspection costs due to inspection time, mileage, subsistence and engineering at all other sites.

4. Fabrication occurring more than 100 miles away from the project site is not permitted unless specifically requested in writing at the time of bidding and is subject to Owner acceptance. If the Owner accepts the location, pay additional inspection costs for travel, mileage and subsistence.

- C. Steel erector: minimum five years experience in structural steel erection and able to furnish evidence of ability, facilities, proficiency of personnel, and completed projects, of similar size and type. AISC erector certification satisfies this requirement.

Before authorizing the commencement of steel erection, the controlling contractor shall ensure that the steel erector is provided with the written notification required by 29 CFR 1926.752. Provide a copy of this notification to the Contracting Officer's Technical Representative.

- D. Welding Personnel: Provide Welding Performance Qualification Records (WPQRs) as evidence that welding personnel in the fabrication shop and in the field have completed the appropriate welding personnel qualification test in accordance with AWS D1.1.
1. If evidence cannot be provided, test personnel per AWS D1.1. Upon successful completion of qualification testing, provide the Welding Performance Qualification Record with appropriate identification and description to show conformance with AWS D1.1.
 2. Include name of the welder, name and title of person conducting the examination, the position of welds, the results of tests and the date of examination. An independent testing agency will perform testing.
 3. Submit identifying stenciled test coupons made by any welder whose workmanship is subject to question. Re-qualify any welder when, in the opinion of the Contracting Officer's Technical Representative, the work of the welder created a reasonable doubt as to the proficiency of the welder. Tests, when required, will be conducted at the sole expense of the Contractor.

- E. The Contracting Officer's Technical Representative may require coupons to be cut from any location in any joint for testing. Repair the members cut in a neat and workmanlike manner with joints of proper type to develop the full strength of the members and joints cut, with peening or stress relief heat treatment as necessary. Chip out or cut to base metal all sections of welds found defective and reweld properly before proceeding with the work.
- F. Verify, to the satisfaction of the Special Inspector, that electrical meters are being used, and those in use accurately reflect voltage and amperage at the welding site for the length of cable in use.
- G. Welding Inspection by the Contractor: Inspect all shop and field welding by the Contractor's "Fabrication/Erection Inspector" as defined by AWS D1.1. Governing Building Code regulations do not alleviate either the Fabrication/Erection Inspector or the "Special Inspector", supplied by the Testing Agency, from the welding inspection requirements of AWS D1.1. The Fabrication/Erection Inspector shall be present during all shop and field welding operations, shall inspect the work as required by AWS D1.1 and shall possess and be familiar with all approved WPS, and shall cooperate with the Special Inspector.
- H. All erection of structural steel shall be inspected by the Contractor's Fabrication/Erection Inspector.

1.9 QUALITY ASSURANCE:

- A. Quality assurance is testing and inspection by the Owner's Testing Agency and Special Inspectors to aid the Owner in evaluating the Contractor's performance. It is not a substitute for the testing and inspection which is required as part of the Contractor's quality control system.
- B. Testing and inspection: Section 01410, TESTING LABORATORY SERVICES and this Section.
- C. Review welding procedures, welders' qualifications, and welding operations in accordance with the governing building code and AWS D1.1.
- D. Verify the work is performed in accordance with AWS D1.1 and the following:
 - 1. Verify that all welders on the project understand and follow the requirements of the written WPS.

2. Verify that all welders have the applicable WPS document and drawings for each connection or weld, joint and assembly at their station.
- E. Pre-Fabrication / Pre-Erection Conference: Prior to fabrication and following WPS approvals, convene a pre-construction meeting, or series of meetings to review fabrication and erection methods, submittals, sequencing, and testing and inspection as required.
1. Include the Contractor's production personnel, the Contractor's Fabrication/Erection Inspector, Inspector of Record, the Owner's Testing Agency and the Contracting Officer's Technical Representative.
 2. Conduct meetings at the Project Site to facilitate verification of site conditions, methods and sequencing.
- F. The Contracting Officer's Technical Representative may require samples to be cut from any location in any joint for testing.
- G. Owner reserves the right to remove welders from performing welding when adequate quality is not met as required by this specification.

1.10 DELIVERY, STORAGE, AND HANDLING:

- A. Delivery: Unload all structural steel promptly upon arrival and store in an area designated and approved by the Contracting Officer's Technical Representative at the site of the work.
- B. Steel Storage: Keep structural steel properly drained. Provide adequate shoring and protection to prevent distortion and other damage. Store on timber; do not lay on mud, directly on ground or cinders, or otherwise handle so as to damage finishes. Ensure that all sections are readily accessible for inspection.
- C. Weld filler metals storage: Store in accordance with the requirements set forth in AWS D1.1 and any supplemental storage requirements specified for weld materials used in the Seismic Force Resisting System.
- D. Damaged materials: Replace damaged material with new material or repair damaged material in an approved manner.

1.11 SEQUENCING AND SCHEDULING:

- A. Refer to Section 01110 for project construction phases/bid packages.
- B. Notify the Contracting Officer's Technical Representative in sufficient time prior to shop or field fabrication or erection to permit testing and inspection without delaying work.

- C. Ensure timely delivery of items to be embedded in work of other sections so that work is not delayed.
- D. Coordinate work with the Owner's Testing Agency to assure that all test and inspection procedures required by the Contract Documents and Public Agencies are properly provided. Cooperate fully with all testing and inspection agencies in the performance of their work and provide the following:
 - 1. Information as to starting time and place of Shop fabrication.
 - 2. A complete set of Contract Documents and reviewed shop and erection drawings.
 - 3. Cutting lists, order sheets, material bills and shipping bills.
 - 4. Representative sample pieces requested by the inspection agency for testing, if necessary.
 - 5. Full and ample means of assistance for testing and inspection of material.
 - 6. Proper facilities, including scaffolding, temporary work platforms, etc., for inspection of the work in shop and field.
 - 7. Schedule of anticipated shop and site welding, including the anticipated numbers of welders and their tasks. Provide change to schedule to inspector in such a timely manner as to not add costs to the inspector, inspection agency or Owner.

PART 2 PRODUCTS

2.1 MATERIALS:

- A. Work exposed to view: Use only materials that are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled trade names and roughness. Remove such blemishes by grinding, in accordance with AWS D1.1 or AISC as applicable, prior to cleaning, treating and application of surface finishes.
- B. Shapes, Plates and Tubing:
 - 1. Structural Steel Wide Flange sections: ASTM A992.
 - 2. Structural steel Wide Flange sections part of the SFRS shall have a steel toughness of CVN = 20 ft-lbs @ 70 degrees Fahrenheit.
 - 3. Structural Steel Channels, Angles: ASTM A36.
 - 4. Structural Plates and Bars: ASTM A36 and ASTM A572, as indicated on the construction drawings.
 - 5. Plates part of the SFRS shall be A572, Grade 50.
 - 6. Cold-Formed Steel Tubing: ASTM A500, Grade B.

7. Steel Pipe: ASTM A53, Grade B.
8. Stainless Steel Shapes, Plates and Bars: ASTM A276.

C. Fasteners:

1. High-strength Steel Bolts: A325, Type 1, and ASTM A449, as indicated on the construction documents.
2. Machine Bolts: ASTM A307
3. Threaded Rod: ASTM A572.
4. Nuts for High Strength Bolts: ASTM A563 Heavy Hex Nut Grade
5. Washers for High Strength Bolts: ASTM F436.
6. Compressible-Washer-Type Direct Tension Indicators: ASTM F959.
7. Twist Off Type Tension Control Structural Bolts: ASTM F1852.
8. Circular Washers for Common Bolts: ANSI B18.22.1 and ASTM F844.
9. Beveled Washers for Common Bolts: ANSI B18.23.1.
10. Anchor Rods (cast in concrete): ASTM F1554.
11. Nuts for Anchor Bolts or Rods: ASTM A563 heavy hex.
12. Threaded Studs: Threaded stud type, ASTM A108, Grade 1015 through 1020, cold finished low-carbon steel, minimum tensile strength of 60,000 psi; sizes and numbers as indicated, threads are UNC-2A unless otherwise indicated. Nelson/TRW or approved equivalent.
13. Headed Studs: Nelson, flux filled, type H4L or H3L, welded to steel. Studs shall be made from cold drawn steel Grades 1010 through 1020 per ASTM A108, minimum tensile strength of 60,000 psi and shall be welded per the manufacturer's recommendations.
14. Shear Connectors (Automatic End Welded Studs): Headed stud type, ASTM A108, Grade 1015 or 1020, cold finished low-carbon steel, minimum tensile strength of 60,000 psi; "Nelson/TRW" or approved equal.
15. Concrete anchors (deformed bar anchors): Nelson, flux filled deformed bar anchors, type 2DL, welded to steel. Bars shall be made from ASTM A108 cold worked, deformed wire per ASTM A496 and shall be welded per the manufacturer's recommendations.

D. Arc-welding electrodes/filler metals: AWS D1.1, low-hydrogen.

E7XTX, E7XTXX or E70XXX electrodes minimum:

- a. Welding electrodes used as part of the SFRS: E71T-8 with minimum CVN = 20 ft-lbs @ 0 degrees Fahrenheit and minimum CVN = 40 ft-lbs @ 70 degrees Fahrenheit.

- b. Welding electrodes that meet one of the following: AWS A5.20, AWS A5.29, AWS A5.1, AWS A5.5, AWS A5.17, AWS A5.23.
- c. Maximum FCAW wire diameter values specified in AWS D1.1.
- E. Structural steel primer paint: Modified Alkyd. Tnemec Co., Inc., "Series FD88 Azeron"; International Protective Coatings, "Interprime 298" or approved equivalent. Do not exceed applicable local limits for Volatile Organic Compounds (V.O.C.) set by air quality regulations for the conditions of application in the subject area.
- F. Galvanize in accordance with ASTM A123 and/or ASTM A153 with no appreciable flaking or mill scale present upon completion of process.
- G. Grout beneath baseplates: See Section 03300 - Cast-in-Place Concrete

2.2 SUPPLEMENTAL REQUIREMENTS FOR SEISMIC FORCE RESISTING SYSTEM ELEMENTS:

- A. Wide Flange Shapes:
 - 1. Structural Steel Wide Flange sections: ASTM A992.
Charpy V-Notch requirements: minimum average absorbed energy value of 20 ft-lbs at 70 degrees F when tested in accordance with ASTM A6, Supplementary Requirement S5.
 - 2. Heavy Structural Sections:
 - a. Charpy V-Notch requirements: minimum average absorbed energy value of 20 ft-lbs at 70 degrees F when tested in accordance with ASTM A6, Supplementary Requirement S5.
 - b. Columns - ultrasonically examine, prior to welding, all heavy structural section columns for evidence of laminations, inclusions or other discontinuities in accordance with ASTM A435 or ASTM A898, Level 1 criteria, in zones 3 inches above and below beam flange connection locations.
- B. Steel Plates: ASTM A572, Grade 50.
- C. Welding Material
 - 1. Filler minimum mechanical properties for welded joints that are part of the Seismic Force Resisting System: Charpy V-Notch (CVN) test values;
 - a. 20 ft-lbs at 0 degrees Fahrenheit using AWS A5 classification methods
 - b. 40 ft-lbs at 70 degrees Fahrenheit for welds designated as Seismic Demand Category A-H , tested in accordance FEMA 353, Appendix A. Each lot of filler metal shall be tested.

- c. Minimum yield strength: 58 ksi, for welds designated as Seismic Demand Category A-H , using AWS A5 classification tests and test procedures in FEMA 353, Appendix A.
 - d. Minimum tensile strength: 70 ksi, using AWS A5 classification tests and test procedures in FEMA 353, Appendix A.
 - e. Minimum elongation: 22 percent using AWS A5 classification tests and test procedures in FEMA 353, Appendix A.
2. Hydrogen Level - for welded joints designated as Seismic Weld Category A-H
- a. Electrode diffusible hydrogen less than or equal to 16.0mL/100g of deposited metal as tested using AWS A4.3.
 - b. Certificates of Conformance shall be considered adequate proof that electrodes meet this requirement.
3. Packaging Requirements: Moisture-resistant, undamaged packages. Maintain effectively sealed until the electrode is required for use.

2.3 FABRICATION:

- A. Fabricate and assemble structural assemblies in shop to greatest extent possible. Fabricate items of structural steel in accordance with AISC Specifications.
1. Properly mark and match-mark materials for field assembly.
 2. Fabricate members for delivery that expedites field erection operations.
 3. Where finishing is required, complete assembly, including welding of units, before start of finishing operations. Provide finish surfaces of members exposed in final structure free of markings, burrs, and other defects.
 4. Fabricate columns and members of frames supporting vertical loads so as to compensate for building deformations due to dead loads.
 5. Provide minimum 4 anchor bolts at column base plates.
- B. Drawings indicate intent of connection details. Where connection detail is not shown, pattern details after a connection of similar condition. Connections not shown on the Drawings but proposed by the Contractor require approval by the Contracting Officer's Technical Representative.
- D. Provide standard holes for bolts 1/16 inch larger than the nominal bolt diameter unless otherwise noted. If the material thickness is not greater than the nominal diameter of the bolt plus 1/8 inch, the holes

may be punched. Drill holes in material thicker than 1 inch from the solid or sub-punch and ream.

1. Holes for high-strength bolts: Assemble high strength bolts in accordance with AISC Specifications for Structural Joints Using ASTM A325 or A490 Bolts for shear/bearing fully-tensioned joints, unless other AISC termed methods are specifically indicated. Use standard holes unless otherwise indicated.
 2. Remove burrs that prohibit solid seating by grinding.
- E. Provide holes for concrete reinforcement to pass through wide flange sections at concrete walls. Shop flame-cut holes are permitted for holes greater than 1.5 inch diameter in flanges of Group 4 and 5 wide flange sections. Provide hole diameters in accordance with AISC recommendations for anchor rod holes in column base plates. Grind flame-cut hole smooth to roughness no greater than 1000 microinches.
- F. Camber all beams and girders as indicated on the Drawings. Where no camber is specified, place natural camber of the member up, opposite for cantilevers.
- G. Assemble common threaded fasteners (ASTM A307)
1. Draw up tight
 2. Check threads with chisel or provide approved locking nuts.
 3. Provide beveled washers under bolt heads or nuts resting on surfaces exceeding five percent slope with respect to head or nut.
- H. Comply with AWS D1.1 for procedures, appearance and quality of welds, and methods used in welding work unless otherwise indicated.
1. Calibrate equipment for electric welding with meters for voltage and amperage that accurately indicate voltage and amperage quantities at the welding site for the length of cable to be used.
 2. Demonstrate to the satisfaction of the Owner's Testing Agency the accuracy of the meters, using external meters attached to extension cables of a length that reflects actual project conditions.
 3. If equipment meters do not accurately reflect electrical properties at the welding site, use external meters at the welding site, provided by the Contractor at the Contractor's expense.
 4. Assemble and weld built-up sections by methods that produce true alignment of axes without warp.

- I. Provide shop welding by welders qualified with AWS D1.1, Section 4, Part A - General Requirements, and Part C - Performance Qualification, to perform the type of welds required.
- J. Complete joint penetration welded construction: comply with AWS D1.1 for procedures, appearance and quality of welds, and methods. Comply with the following additional requirements:
 1. Field welding processes: Shielded Metal Arc Welding (SMAW) and Flux Core Arc Welding (FCAW).
 2. Shop welding processes: Shielded Metal Arc Welding (SMAW), Flux Core Arc Welding (FCAW), or Submerged Arc Welding (SAW). FCAW filler metal wire is limited to 7/64-inch diameter maximum. SMAW welding electrodes are limited to 5/32-inch diameter maximum.
 3. Use only electrodes capable of depositing notch-tough weld metal with a minimum Charpy V-Notch impact test value of 20 ft-lbs at -20 degrees F and with a minimum strength of 70 ksi.
 4. Terminate welds in such a manner that will ensure sound welds.
 - a. Use weld tabs where necessary. Length of weld run-off tabs: 1.5 times the beam or column flange thickness with no sharp corners or edges.
 - b. Start and complete welds on the run-off tabs where possible.
 - c. Remove weld run-off tabs at the face of the beam or column flange. Do not remove base material.
 - d. Grind the surface of the removed tab and weld metal to a surface roughness of less than 500 microinches. Supply a ground radius between two faces of base metal where they meet at any angle less than 180 degrees.
 - e. No weld "dams" are allowed. Continue back-up bars to the ends of the weld tabs.
 - f. Where indicated on the drawings, remove back-up bars after the completion of the weld. Grind the weld smooth, back gouge the weld root pass to sound material, and reweld with a 1/4 inch cover fillet weld, unless otherwise noted.
 5. Provide weld access holes of adequate size with minimum dimensions specified by AWS D1.1 to ensure adequate access for welding and inspection. Grind smooth the cut edges of weld access holes to a surface roughness not exceeding 500 microinches.

6. Remove tack-welds not incorporated into the final weld assembly. Grind the areas smooth to a surface roughness not exceeding 500 microinches.
7. Clean groove penetration thermal cuts by grinding.
8. Lay weld passes in horizontal layers without excessive weaving.
9. Thoroughly de-slag each pass and clean by wire brushing.
10. Do not peen the root pass or surface layers. Peening may be used on intermediate layers for control of shrinkage stresses to prevent cracking or distortion or both.
11. The use of Post Weld Heat Treatment (PWHT) is permitted at the Contractor's option, but is not required. The use of PWHT shall meet the Stress-Relief Heat Treatment limitations of AWS D1.1, Section 5.8, and shall be used as needed to produce quality welds.

K. Stud Connector Welding: AWS D1.1

1. Do not shop weld studs to top flanges of floor beams. Field install studs after metal decking surface has been installed.
2. Weld studs with automatically timed stud welding equipment connected to suitable source of direct current electrode negative power. Calibrate voltage, current, time, and gun settings for optimal welding based on manufacturer's recommendations.

2.4 FINISHES:

- A. Shop prime structural steel except;
 1. Fireproofed portions of members
 2. Concrete- embedded portions of members. Prime embedded steel, which is partially exposed, on exposed portions and initial 2 inches of embedded areas only.
 3. Surfaces that are welded
 4. Faying surfaces at slip critical bolted connections.
- B. Slip-critical high-strength bolted connections: prepare faying surfaces in accordance with "Class A" or better requirements as defined by AISC unless otherwise indicated.
- C. Clean steel to be primed or painted after inspection and before shipping. Remove loose rust, loose mill scale, dirt, grease, and spatter, slag or flux deposits. Clean steel in accordance with Steel Structures Painting Council (SSPC) and as required by the primer or

paint manufacturer's recommendations. Prepare the surface in accordance with:

- D. SP-1 "Solvent Cleaning."
- E. SP-2 "Hand Tool Cleaning" or SP-3 "Power Tool Cleaning."
- F. Primer paint: Apply one coat of immediately after surface preparation in accordance with manufacturer's instructions and at a rate to provide dry film thickness of not less than 2.0 mils. Use methods that result in full coverage of joints, corners, edges and exposed surfaces. Permit thorough drying before shipment.
- G. AESS members: Refer to Division 9 to ensure primer is compatible with specified finish paint.
- H. Galvanize steel members as indicated in the Drawings.

2.5 SOURCE QUALITY CONTROL:

- A. Tests and Inspections: Perform testing and Inspection of work in accordance with Section 01450, QUALITY CONTROL and Section 05120, STRUCTURAL STEEL, Article 3.5 Field Quality Control.
- B. Verification of Performance: Owner's Testing Agency: Review the following to ensure source quality:
 - 1. Certificates of Compliance and Mill Test Reports obtained from the mills producing the steel. Verify that the steel meets the minimum specified chemical and physical properties.
 - 2. Certificates of verification from the supplier of Structural Steel if different than the Structural Steel production mill.
 - 3. Certificates of compliance for weld metal used in the work.
 - 4. Test reports as required to verify compliance with the project specifications.
- C. Inspect structural steel at plant before shipment; however, Contracting Officer's Technical Representative reserves right, at any time before final acceptance, to reject material not complying with requirements.
- D. Any steel not properly identified shall be tested to meet the requirements of the appropriate ASTM standard.
- E. Enforcement agency may require additional testing to determine quality of steel if there is doubt as to acceptability.

PART 3 EXECUTION

3.1 FABRICATION:

Fabrication in accordance with Chapter M, Specification for Steel Buildings - Load and Resistance Factor Design.

3.2 SHOP PAINTING:

- A. General: Shop paint steel with primer in accordance with Section 6, Code of Standard Practice for Steel Buildings and Bridges.
- B. Shop paint for steel surfaces is specified in Section 09900, PAINTING.
- C. Do not apply paint to following:
 - 1. Surfaces within 50 mm (2 inches) of joints to be welded in field.
 - 2. Surfaces which will be encased in concrete.
 - 3. Surfaces which will receive sprayed on fireproofing.
 - 4. Top flange of members which will have shear connector studs applied.
- D. Structural steel in the interstitial space that does not receive sprayed on fireproofing shall be painted with primer in accordance with general requirement of shop painting.
- D. Zinc Coated (Hot Dip Galvanized) per ASTM A123 (after fabrication):
Touch-up after erection: Clean and wire brush any abraded and other spots worn through zinc coating, including threaded portions of bolts and welds and touch-up with galvanizing repair paint.

3.3 ERECTION:

- A. Conform to the IBC and the AISC Specifications for Design, Fabrication and Erection of Structural Steel for Buildings for the workmanship and details of structural steel work, unless otherwise specified. Conform to AWS D1.1 for the quality of materials and the fabrication of all welded connections, unless otherwise specified.
- B. Secure all field measurements necessary for the completion of this work. Correct all errors of detailing, fabrication, and fitting of the structural members to each other and their supports.
 - 1. Survey the base structure before proceeding with erection to verify all dimensions and determine required compensating adjustments. Should column locations vary beyond the allowable tolerances, take necessary corrective measures and modify details or methods as approved by the Contracting Officer's Technical Representative.
 - 2. Check elevations of concrete bearing surfaces, and locations of bolts and similar devices, before erection work proceeds. Report discrepancies to Contracting Officer's Technical Representative. Do not proceed with erection until corrections have been made, or until compensating adjustments to structural steel work have been agreed upon with Contracting Officer's Technical Representative.

3. Survey the final erected structural steel frame prior to the application of any other work, reporting any discrepancies from Contract Documents to the Contracting Officer's Technical Representative.
- C. Provide column anchor bolts, rods, nuts, plate washers, and setting templates for setting anchor bolts as required by work of other Sections. Provide 1/8" minimum steel plate setting templates for all anchor bolts.
- D. Protect all materials, both before and after fabrication, from rust corrosion and keep free of dirt, grease and other foreign matter.
- E. Provide temporary shoring and bracing members with connections of sufficient strength and stiffness to bear imposed loads. Remove temporary members and connections when permanent members are in place and final connections are made. Provide temporary guy lines to achieve proper alignment of structures as erection proceeds. Structural frame is not considered self-supporting until completion of structural work, including casting of concrete floor slabs.
- F. Field Assembly: Control all erection procedures and sequences including but not limited to temperature differentials and weld shrinkage.
 1. Erect frames in accordance with reviewed frame distortion control programs.
 2. Install beams with camber up.
 3. Set structural frames accurately to lines and elevations. Align and adjust various members forming part of complete frame or structure before permanently fastening. Clean bearing surfaces and other surfaces that will be in permanent contact before assembly. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 4. Level and plumb individual members of structure within required tolerances
 - a. Establish leveling and plumbing measurements on mean operating temperature of structure. Make allowances for difference between temperature at time of erection and mean temperature at which structure will be when completed and in service.
 - b. Promptly grout beneath column base plates after the structural steel frame or portion has been plumbed and before casting of any slab concrete on metal decks.

- 5. Splice members only where indicated on structural drawings.
- G. Comply with AISC Specifications for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
- H. Automatically end-weld steel shear connectors in accordance with the manufacturer's recommendations.
 - 1. Provide complete fusion between the end of the connector and the plate with no evidence of excessive porosity or evidence of lack of fusion between the welded end of the stud and the plate.
 - 2. Perform welding only by qualified welders approved by the testing agency.
 - 3. For connectors installed using fillet welding, ensure proper mating of connector to base metal by removing material which may keep the connector at any height off the base metal.
- I. Touch-Up Painting:
 - 1. Immediately after steel erection, clean field welds, bolted connections, and abraded areas of shop paint. Apply paint to exposed areas using same material as used for shop painting.
 - 2. Apply by brush or spray to provide minimum dry film thickness of 1.5 mils.
- J. Touch-Up Galvanizing:

Repair galvanized steel in accordance with ASTM A780.

3.4 WELDING:

- A. Welded structural joints: conform to AISC and AWS D1.1 for the details of all joints, the technique of welding employed, the appearance and quality of welds made, and the methods used in correcting defective work.
- B. Perform all welding in accordance with the approved, written WPS whether the WPS is prequalified or is qualified by test. Provide welders and inspectors with the approved WPS for the joint being welded.
- C. Conform to the following requirements for all welding:
 - 1. Use equipment that supplies proper current, voltage, etc., as recommended by the manufacturer of electrodes, adjusted to suit arrangement and thickness of base metal. Provide suitable meters and means of adjustment for current and voltage.

2. Clean all surfaces of rust, paint and foreign matter of any kind. Remove scale by wire brush, chipping or hammering as required. Before welding thermal cut edges, chip clean and grind to bright metal. Clamp members as required, space and alternate welds, as may be necessary to prevent warping or misalignment.
3. For weld joint profiles, meet dimensional requirements and maximum tolerances specified by AWS D1.1 or as specified in approved PQRs. Correct joint fit-up that does not comply using approved procedures and obtain approval by the inspector before welding proceeds.
4. Provide minimum preheat and interpass temperatures and Post-heat/Cool Down procedures as required by AWS D1.1, unless otherwise specified herein. Control deposition rates to ensure that interpass temperatures are within the range required in the WPS.
5. Ensure welds present a uniform surface, free of defects as defined by AWS, and without undercutting or over-lapping and free of excessive oxides, gas pockets and non-metallic inclusions. Make welds with the proper number of beads or passes to secure sound, thoroughly fused joints. Do not exceed maximum layer height and bead width specified in AWS D1.1. Clean each pass by chipping and wire brushing to remove scale and slag, before placing any additional weld metal.
6. For highly restrained connection and/or weldments, design the sequence of welding to minimize distortion of the members and to minimize the buildup of internal stresses. Follow the sequence of welding established in the reviewed contractor's Distortion Control Program, monitored by the contractor's welding inspector and monitored by the Owner's Testing Agency.
7. Thoroughly fuse weld metal with the base metal along all surfaces and edges of the union.

**3.5 SUPPLEMENTAL WELDING REQUIREMENTS -SEISMIC FORCE RESISTING SYSTEM (SFRS)
- SEISMIC WELD CATEGORIES A-H:**

- A. Separate Welding Procedures Specifications (WPSs) shall be prepared for each electrode brand and electrode diameter that is to be used for seismic welding. The WPS shall be based on FEMA 353, Appendix A lot tests. WPS shall show specific amperage, voltage and travel speed ranges which will not exceed lot test minimum and maximum heat input

values. Fabricator and Erector QC personnel shall verify and document actual production welding variables on a daily basis.

- B. Welders and welding operators: Pass supplemental Welder qualification Testing per FEMA 353, Appendix B, on special test joint mock-ups.
 - 1. Perform testing using WPS at set at highest deposition rate to be used in work.
 - 2. Provide separate welder personnel qualification tests for FCAW-S and FCAW-G.
 - 3. Testing required for all personnel performing welds of beam flange to column flange through a weld access hole.
- C. Intermix of Filler Metals: Provide supplemental toughness testing when FCAW-S filler metals are used in conjunction with filler metals for other processes including FCAW-G.
- D. Electrode Storage;
 - 1. Do not use FCAW electrodes where manufacturer's packaging has been damaged.
 - 2. o not modify or lubricate electrodes after opening of packaging. Drying as specified by the manufacturer is permitted.
- E. Exposure Limits
 - 1. Limit exposure of FCAW electrodes based upon the results of exposure tests prescribed in FEMA 353, Appendix D. These tests may be conducted by the electrode manufacturer, supplier, the Contractor, or by an independent testing agency or laboratory with suitable equipment.
 - 2. In lieu of testing, when welding is to be suspended for more than 8 hours, remove electrodes from the machines and store in an electrode wire oven maintained at a temperature between 250 degrees and 550degrees F, or as recommended by the manufacturer.
 - 3. Unless testing per FEMA 353, Appendix D, demonstrates longer exposure limits, do not use electrodes not consumed within 24 hours of accumulated exposure outside closed or heated storage for welds in Seismic Weld Demand Category A or B.
 - 4. Identify electrode spools to facilitate monitoring of total atmospheric exposure time.
 - 5. FCAW electrodes exposed for periods exceeding an accumulated 24 hours may be dried if manufacturer's testing and recommendations

show that drying is effective at removing moisture and restoring electrodes to their designated diffusible hydrogen level.

F. Minimum Preheat and Interpass Temperature

1. Provide minimum preheat and interpass temperatures for all welds, including tack welds, in accordance with AWS D1.1, Table 3.2. The Contractor may specify higher preheat minimum temperatures, if desired, as a part of the Contractor's WPS for a particular application. In such cases, provide the WPS minimum preheat and interpass temperatures. For welds in Seismic Demand Categories A-H, preheat and interpass temperatures shall be in the range tested in accordance with FEMA 353 Appendix A.
2. Verify minimum preheat and interpass temperatures at a distance of 3 inches from the weld, at the point of arc initiation or for materials over 3 in. in thickness, at a distance equal to the thickness of the part.

G. Maximum Preheat and Interpass Temperature

Limit maximum preheat and maximum interpass temperature to 550 degrees Fahrenheit, measured at a distance of 1 inch from the point of arc initiation. Do not increase this maximum temperature regardless of qualification testing.

H. Nonfusible Backing

1. Nonfusible backing materials, including ceramic and copper: permitted only with satisfactory welder qualification testing performed using the type of backing proposed for use, using the test plate shown in AWS D1.1-98, Figure 4.21, except that groove dimensions shall be as provided in the WPS and PQR. Should the joint include welding a beam flange to a column flange through an access hole, perform Supplementary Welder Qualification Test of FEMA 353 Appendix B using the type of proposed backing material. Welding Procedures Specifications which incorporate nonfusible backing shall be qualified by testing, using the test plate shown in AWS D1.1-02, Figure 4.10. The weld joint geometry shall be the same as proposed for production welds including the maximum root gap that will be allowed. Five Charpy V-Notch (CVN) specimens shall be tested in accordance with AWS D1.1-02, Annex III. The CVN test location shall be in the root pass of weld metal. The high and low CVN values

- shall be discarded and the average of the remaining 3 tests shall meet 40 ft-lbs @ 70 F.
2. Nonfusible weld tabs and short segments of nonfusible backing bars may be used at the ends of welds between shear tabs and column faces, or at the ends of continuity plate welds. The welder shall be trained in the proper welding techniques for using such nonfusible weld tabs and backing bars prior to performing such welding on the project.
- I. Peening: permitted at the Contractor's option, but not required. Provide a written procedure for performing peening incorporated into the WPS for the joints to be peened.
 - J. Controlled Cooling: permitted at Contractor's option but not required.
 1. Provide written procedure for controlled cooling incorporated into the WPS for joints including method of heating, maximum temperature, cooling rate range, and method of temperature measurements.
 2. Insulation blankets without addition of heat are permitted but not required. Written procedures or temperature measurements are not required.
 - K. Restricted Area for Reduced Beam Section (RBS): No welding, cutting, drilling or welded attachments, including stud welds is permitted in the plastic hinge region as indicated on the drawings. Arc spot welds (puddle welds) for the attachment of metal decking are permitted.
 - L. Welding in the K-Area: Welding in the K-area shall be avoided. The K-area is defined as the region within 1.5 inches of the K-radius on the web. If welding is performed in the K-area, after welding the web shall be tested for cracks using magnetic particle testing (MT) by QA inspector. The MT inspection area shall include the K-area base metal within 3 inches of the weld.
 - M. Tack Welds: All tack welds to members in the plastic hinge region that attached fusible backing bars to the steel prior to to the welding of the joint shall be made within the joint.
 - N. Weld Tabs: Weld tabs shall be used for all complete penetration weld joints. Where practicable weld tabs shall extend a minimum of one inch or the thickness of the part, whichever is greater beyond the edge of the joint. For Seismic Demand Category A-H welds, weld tabs are to be removed and the end of the weld finished to a surface roughness of 500 microinches or better. The contour of the weld shall provide a smooth

transition, free of notches and sharp corners. Weld dams are prohibited.

- O. Reinforcing Fillet Welds: When reinforcing fillet welds are on drawings for SFRS beam to column welds, they shall have a minimum size of 5/16 inch. Additionally the leg of the fillet weld adjacent to the beam flange shall be such that the fillet toe is located on the beam flange base metal.
- P. Welder Identification: Each welder shall mark or stamp their identification symbol near each weldment completed.

3.6 CORRECTIVE WORK:

- A. Do not field cut or alter any structural members or connections in the Seismic Force Resisting System without prior approval of the Engineer.
- B. Submit drawings showing reasons for and details of proposed corrective work for approval by the Contracting Officer's Technical Representative.
- C. Perform corrective work in accordance with the Contract Documents.
- D. Use pre-approved repair and correction procedures when authorized by the Contracting Officer's Technical Representative for specific conditions.

3.7 QUALITY CONTROL:

- A. Provide access for Owner's Testing Agency to places where structural steel work is being fabricated and erected so that inspection and testing can be accomplished. The monitoring activities are at the Owner's discretion and in no way relieve the Contractor of sole responsibility for maintaining the Quality Control Program or the quality of the Work.
- B. Qualify welding personnel by tests, as prescribed in AWS D1.1 to perform the type of work required, including process, position and thickness. Ensure all personnel are capable of reading and following the approved written WPS.
 - 1. Conduct and interpret tests and state in each report whether test specimens comply with requirements of these specifications.
 - 2. Review and verify the Contractor's Fabrication and Erection/Inspection quality control plan.
 - 3. Review Welding Performance Qualification Records and re-qualification tests.

4. Review all Welding Procedure Specifications (WPS) and Prequalification Records (PQR).
5. Visually inspect all shop and field erection and inspect all bolted connections, verifying that all plies of connected elements are brought into firm contact.

C. Contractor Quality Control Testing

1. Pre-welding Inspection for Laminations: Prior to welding, column base metal thicker than 1.5 inches, loaded in tension in the through thickness direction in tee and corner joints, where the connected material is greater than $\frac{3}{4}$ inch and which will be subject to welds with a collective throat dimension of $\frac{3}{4}$ inch or greater, shall be ultrasonically tested for discontinuities. Testing shall be in accordance with ASTM A898, Straight Beam Ultrasonic Examination of Rolled Shapes. 1--% of the area shall be tested in the zone 3 inches on all sides of applicable joints. ASTM A898 Level 1 criteria shall apply.
2. Weld Access Holes: All weld access holes for SFRS welds shall be inspected using magnetic particle testing (MT) or dye penetrant testing (PT) for base metal cracks.

D. Owner's Independent Testing Agency: Retain qualified Special

Inspector(s) to observe the fabrication and erection of the structural steel, test and inspect welded connections, and prepare test reports.

1. Maintain Written Practice for the control and administration of Non-Destructive Testing (NDT) personnel training, examination, and certification.
2. Inspection personnel: qualified for nondestructive testing at Level II as specified in AWS D1.1, supervised by a Level III ASNT-TC-1A.
3. Submit welding inspector qualifications to the Contracting Officer's Technical Representative for approval. All welding inspectors shall be AWS-CWI.
4. Submit a welding inspection checklist to the Contracting Officer's Technical Representative for approval.
5. Ultrasonic technicians shall be qualified in accordance with FEMA 353, Appendix E for flaw detection. Submit qualification test procedure and qualification test results for each proposed UT technician.

E. Special Inspection requirements for shop and field welded structural connections include, but are not limited to those for columns, beams and braces as follows:

1. Inspect all shop and field welding accordance with AWS D1.1 and in accordance with the Special Inspection Requirements of the City of Portland. Waiving of shop inspection per City of Portland provisions is not allowed.
2. Confirm the qualification of welders, the use of AWS qualified procedures, the manufacturer's recommended use of automatic equipment and the proper use of preheat.
3. Visually inspect 100% of all fillet welds. Measuring a randomly selected sample of welds for conformance with contract documents and AWS in terms of length and profile.
4. Continuously inspect all complete joint penetration welds and multipass shop and field fillet welds.
5. Ultrasonically test 100 percent of complete joint penetration (CJP) welds.
 - a. For CJP welds assigned to Seismic Demand Categories A-H , perform ultrasonic testing at least 24 hours after completion of the weld. Acceptance criteria per AWS D1.1, Table 6.2.
 - b. After joint completion, base metal thicker than 1.5 inches loaded in tension in the through thickness direction, in tee and corner joints, where the connected material is greater than $\frac{3}{4}$ inch and contains CJP groove welds, shall be ultrasonically tested for lamellar discontinuities behind and adjacent to such welds. Any base metal discontinuities found within $t/4$ of the steel surface shall be accepted or rejected on the basis of AWS D1.1 Table 6.2 criteria.
6. For CJP welds assigned to Seismic Demand Categories A-H , use Magnetic Particle Testing (MT) for 100% of joints full length.
7. For partial joint penetration (PJP) and fillet welds assigned to Seismic Demand Category A-h, use MPT for 100% of joints full length.
8. Visually examine the weld root area for defects where back-up bars are removed,

Test 25 percent of these areas using Magnetic Particle Testing (MT) prior to placing any reinforcing fillet welds, in accordance with AWS D1.1.

9. Examine, by MT, affected areas where welds are ground smooth for defects.
10. The ends of welds from which the weld tabs have been removed, shall be inspected by MT.

F. Inspection/Tests of Shear Connectors:

1. Special Inspector: Inspect all field welding operations for shear connectors.
 - a. Check contractor's equipment daily according to manufacturer's recommendations.
 - b. At the beginning of each day's work, test 2 welded shear connectors that have been installed that day. Subject the test shear connectors to a 30 degree bend test by striking with a heavy hammer or bending by placing a pipe over the stud and mechanically bending the stud. After the test, verify the weld section does not exhibit any tearing or cracking. If bend test is performed on the Work, replace each connector bent as part of this testing with a new connector at no cost to the Owner.
 - c. Visually examine production-welded studs for full 360 degree flash with no evidence of undercut into the stud base.
 - d. Test 10 percent of production-welded connectors with a hammer to approximately a 15-degree angle to ensure proper installation. Where no evidence of failure is observed, the tested shear connector may be left in the bent position.
 - e. If a shear connector fails, perform a 30-degree bend test on 10 percent of that day's and the ensuing day's connector installation until there are no failures in 25 consecutive bend tests.
2. Replace failed shear connectors with new shear connectors.

G. Inspection of High strength bolting: Special Inspector

1. Inspect in conformance with the RCSC "Specification for Structural Joints using ASTM A325 or A490 Bolts".
2. "Slip Critical (SC)" joints: test and inspect:
 - a. Ensure faying surfaces meet the specified preparation prior to bolting.
 - b. Observe the bolt installation demonstration testing and the calibration procedures.

- c. Monitor the installation of bolts to verify that the selected installation procedure has been used to tighten all bolts to the minimum pretensioning specified in Table 4 of the "Specification for Structural Joints using ASTM A325 or A490 Bolts".
3. Complete a final written report recording the joints observed, inspected, and accepted.

3.8 SURVEY:

Upon completion of finish bolting or welding on any part of the work, and prior to start of work by other trades that may be supported, attached, or applied to the structural steel work, submit a certified report of survey to Contracting Officer's Technical Representative for approval. Reports shall be prepared by Registered Land Surveyor or Registered Civil Engineer as specified in Section, 01010, GENERAL REQUIREMENTS. Report shall specify that location of structural steel is acceptable for plumbness, level and alignment within specified tolerances specified in the AISC Manual.

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**SECTION 05311
STEEL DECKING**

PART 1 - GENERAL

1.1 DESCRIPTION:

This section specifies material and services required for installation of steel decking in interstitial floor and stair landings as shown and specified.

1.2 RELATED WORK:

- A. Materials testing and inspection during construction: Section 01410, TESTING LABORATORY SERVICES.
- B. Finish Painting: Section 09900, PAINTING.

1.3 DESIGN REQUIREMENTS:

Design steel decking in accordance with AISI publication, "Specification for the Design of Cold-formed Steel Structural Members" except as otherwise shown or specified.

1.4 SUBMITTALS:

- A. Submit in accordance with Section 01340, SAMPLES AND SHOP DRAWINGS.
- B. Shop Drawings: Shop and erection drawings showing decking unit layout, connections to supporting members, and similar information necessary for completing installation as shown and specified, including supplementary framing, sump pans, ridge and valley plates, cant strips, cut openings, special jointing or other accessories. Show welding, side lap, closure, deck reinforcing and closure reinforcing details. Show openings required for work of other trades, including openings not shown on structural drawings. Indicate where temporary shoring is required to satisfy design criteria.
- C. Manufacturer's Literature and Data: Showing steel decking section properties and specifying structural characteristics.
- D. Certification: For each type and gauge of metal deck supporting concrete slab or fill, furnish certification of the specified fire ratings. Certify that the units supplied are U.L. listed as a "Steel Floor and Form Unit."
- E. Insurance Certification: Assist the Government in preparation and submittal of roof installation acceptance certification as may be necessary in connection with fire and extended coverage insurance.

1.5 QUALITY ASSURANCE:

- A. Underwriters' Label: Provide metal floor deck units listed in Underwriters' Laboratories "Fire Resistance Directory", with each deck unit bearing the UL label and marking for specific system detailed.
- B. FM Listing: Provide metal roof deck units which have been evaluated by Factory Mutual Global and are listed in "Factory Mutual Research Approval Guide" for "Class 1" fire rated construction.

1.6 APPLICABLE PUBLICATIONS:

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
 - A36/A36M-00.....Standard Specification for Carbon Structural Steel
 - A611-97.....Standard Specification for Structural Steel (SS), Sheet, Carbon, Cold-Rolled
 - A653/A653M-99.....Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - C423-99.....Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
- C. American Institute of Steel Construction (AISC):
 - 1. Specification for Structural Steel Buildings - Allowable Stress Design and Plastic Design (ninth Edition, 1989)
 - 2. Load and Resistance Factor Design Specification for Structural Steel Buildings (Second Edition, 1994)
- D. American Iron and Steel Institute (AISI):
 - Specification and Commentary for the Design of Cold-Formed Steel Structural Members (1996)
- E. American Welding Society (AWS):
 - D1.3-89.....Structural Welding Code - Sheet Steel
- F. Factory Mutual (FM Global):
 - 1. Loss Prevention Data Sheet 1-28: Wind Loads to Roof Systems and Roof Deck Securement (1998)
 - 2. Factory Mutual Research Approval Guide (2000)
- G. Military Specifications (Mil. Spec.)

MIL-P-21035B.....Paint, High Zinc Dust Content, Galvanizing
Repair

PART 2 - PRODUCTS

2.1 MATERIALS:

- A. Steel Decking: ASTM A653 - SS Designation, Grade 33, Minimum Yield 38 ksi.
- B. Galvanizing: ASTM A653, G60.
- C. Galvanizing Repair Paint: Mil. Spec. MIL-P-21035B.
- D. Primer for Shop Painted Sheets: Manufacturer's standard primer (2 coats). When finish painting of steel decking is specified in Section, PAINTING, primer coating shall be compatible with specified finish painting.
- E. Miscellaneous Steel Shapes: ASTM A36.
- F. Welding Electrode: E60XX minimum.
- G. Sheet Metal Accessories: ASTM A653, galvanized, unless noted otherwise. Provide accessories of every kind required to complete the installation of metal decking in the system shown. Finish sheet metal items to match deck including, but not limited to, the following items:
 - 1. Metal Cover Plates: For end-abutting deck units, to close gaps at changes in deck direction, columns, walls and openings. Same quality as deck units but not less than 1.3 mm (18 gauge) sheet steel.
 - 2. Continuous Sheet Metal edging: At openings, concrete slab edges and roof deck edges. Same quality as deck units but not less than 1.3 mm (18 gauge) steel. Side and end closures supporting concrete and their attachment to supporting steel shall be designed by the manufacturer to safely support the wet weight of concrete and construction loads. The deflection of cantilever closures shall be limited to 3 mm (1/8 inch) maximum.
 - 3. Metal Closure Strips: For openings between decking and other construction, of not less than 1.3 mm (18 gauge) sheet steel of the same quality as the deck units. Form to the configuration required to provide tight-fitting closures at open ends of flutes and sides of decking.
 - 4. Seat Angles for Deck: Where a beam does not frame into a column.

2.2 REQUIREMENTS:

- A. Provide steel decking of the type, depth, gauge, and section properties as shown.

- B. Metal Form Deck - Type 1: Single pan fluted units utilized as a permanent form for reinforced concrete slabs. Comply with the depth and gauge requirements as shown on the Contract Documents.
 - 1. Finish: Galvanized G-60.
- C. Do not use steel deck for hanging supports for any type or kind of building components including suspended ceilings, electrical light fixtures, plumbing, heating, or air conditioning pipes or ducts or electrical conduits.
- D. Steel decking units used for interstitial levels shall include an integral system which provides a simple point of attachment for light duty hanger devices for flexibility for attaching hangers for support of suspended ceilings, electrical, plumbing, heating, or air conditioning items, weight not to exceed 50 kg/m² (10 psf). System shall provide for a minimum spacing pattern of 300 mm (12 inches) on centers longitudinally and 600 mm (24 inches) on centers transversely. Maximum load suspended from any hanger is 23 kg (50 pounds). System consisting of fold-down type hanger tabs or lip hanger is acceptable.

PART 3 - EXECUTION

3.1 ERECTION:

- A. Do not start installation of metal decking until corresponding steel framework has been plumbed, aligned and completed and until temporary shoring, where required, has been installed. Remove any oil, dirt, paint, ice, water and rust from steel surfaces to which metal decking will be welded.
- B. Coordinate and cooperate with structural steel erector in locating decking bundles to prevent overloading of structural members.
- C. Do not use floor deck units for storage or working platforms until permanently secured. Do not overload deck units once placed. Replace any deck units that become damaged after erection and prior to casting concrete at no cost to the Government.
- D. Provide steel decking in sufficient lengths to extend over 3 or more spans, except for interstitial levels.
- E. Place steel decking units at right angles to supporting members. End laps of sheets of roof deck shall be a minimum of 50 mm (2 inches) and shall occur over supports.
- F. Fastening Deck Units:

1. Fasten floor deck units to steel supporting members by not less than 16 mm (5/8 inch) diameter puddle welds or elongated welds of equal strength, spaced not more than 305 mm (12 inches) o.c. with a minimum of two welds per unit at each support. Where two units abut, fasten each unit individually to the supporting steel framework.
2. Tack weld or use self-tapping No. 8 or larger machine screws at 915 mm (3 feet) o.c. for fastening end closures. Only use welds to attach longitudinal end closures.
3. Weld side laps of adjacent floor deck units that span more than 1524 mm (5 feet). Fasten at midspan or 915 mm (3 feet) o.c., whichever is smaller.
4. Provide any additional fastening necessary to comply with the requirements of Underwriters Laboratories and/or Factory Mutual to achieve the required ratings.
5. Weld end laps of corrugated form deck units in valley of side lap and at middle of sheet (maximum spacing of welds is 380 mm (15 inches)).
6. Weld corrugated deck to intermediate supports in an X pattern. Weld in valley of side laps on every other support and in the valley of the center corrugation on the remaining supports (maximum spacing of welds is 760 mm (30 inches)).

G. Cutting and Fitting:

1. Cut all metal deck units to proper length in the shop prior to shipping.
2. Field cutting by the metal deck erector is restricted to bevel cuts, notching to fit around columns and similar items, and cutting openings that are located and dimensioned on the structural drawings.
3. Other penetrations shown on the approved metal deck shop drawings but not shown on the structural drawings are to be located, cut and reinforced by the trade requiring the opening.
4. Make all cuts neat and trim using a metal saw, drill or punchout device; cutting with torches is expressly prohibited.
5. Do not make any cuts in the metal deck that are not shown on the approved metal deck drawings. If an additional opening not shown on the approved shop drawings is required, submit a sketch, to scale, locating the required new opening and any other openings and

supports in the immediate area. Do not cut the opening until the sketch has been reviewed and accepted by the Contracting Officer's Technical Representative. Provide any additional reinforcing or framing required for the opening at no cost to the Government. Failure to comply with these requirements is cause for rejection of the work and removal and replacement of the affected metal deck.

6. Reinforcement at Openings: Provide additional metal reinforcement and closure pieces as required for strength, continuity of decking and support of other work shown.

3.2 WELDING:

Welds shall be made only by welders and welding operators who have been previously qualified by tests as prescribed in AWS D1.3.

3.3 FIELD REPAIR:

Areas scarred during erection and welds thoroughly cleaned and touched-up. Touch-up paint for zinc-coated units shall be zinc rich galvanizing repair paint.

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**SECTION 05321
STEEL DECKING COMPOSITE**

PART 1 - GENERAL

1.1 DESCRIPTION:

This section specifies material and services required for installation of composite steel decking including shear connector studs and miscellaneous closures required to prepare deck for concrete placement of second floor roof as shown and specified.

1.2 RELATED WORK:

Materials testing and inspection during construction: Section 01410, TESTING LABORATORY SERVICES.

1.3 DESIGN REQUIREMENTS:

- A. Design steel decking in accordance with American Iron And Steel Institute publication "Specifications for the Design of Cold Formed Steel Structural Members", except as otherwise shown or specified.
- B. Structural values of composite concrete slab consisting of deformed subfloor deck units, acting in combination with the concrete, shall be substantiated by computations developed from approved test made by an accredited independent testing laboratory.

1.4 SUBMITTALS:

- A. Submit in accordance with Section 01340, SAMPLES AND SHOP DRAWINGS.
- B. Shop Drawings: Shop and erection drawings showing decking unit layout, connections to supporting members, and information necessary to complete the installation as shown and specified, including supplementary framing, cant strips, cut openings, special jointing or other accessories. Show welding, side lap, closure, deck reinforcing and closure reinforcing details. Show openings required for work of other trades, including openings not shown on structural drawings. Indicate where temporary shoring is required to satisfy design criteria.
- C. Manufacturer's Literature and Data: Showing steel decking section properties and specifying structural characteristics as specified herein.
- D. Manufacturer's written recommendations for:
 - 1. Shape of decking section to be used.
 - 2. Cleaning of steel decking prior to concrete placement.

- E. Test Report - Establishing structural characteristics of composite concrete and steel decking system.
- F. Test Report - Stud base qualification.
- G. Welding power setting recommendation by shear stud manufacturer.
- H. Shear Stud Layouts: Submit drawings showing the number, pattern, spacing and configuration of the shear studs for each beam and girder.
- I. Certification: For each type and gauge of metal deck supporting concrete slab or fill, furnish certification of the specified fire ratings. Certify that the units supplied are U.L. listed as a "Steel Floor and Form Unit."

1.5 QUALITY ASSURANCE:

- A. Underwriters' Label: Provide metal floor deck units listed in Underwriters' Laboratories "Fire Resistance Directory", with each deck unit bearing the UL label and marking for specific system detailed.

1.6 APPLICABLE PUBLICATIONS:

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Iron and Steel Institute (AISI):
Specification and Commentary for the Design of Cold-Formed Steel Structural Members (1996).
- C. American Society of Testing and Materials (ASTM):
A36/A36M-00.....Standard Specification for Carbon Structural Steel
A108-99.....Standard Specification for Steel Bars, Carbon, Cold Finished, Standard Quality
A653/A653M-99.....Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
- D. American Institute of Steel Construction (AISC):
Load and Resistance Factor Design Specification for Structural Steel Buildings (third edition, 2001)
- E. American Welding Society (AWS):
D1.1-00.....Structural Welding Code - Steel
D1.3-98.....Structural Welding Code - Sheet Steel
- E. Military Specifications (Mil. Spec.):

MIL-P-21035B.....Paint, High Zinc Dust Content, Galvanizing
Repair

PART 2 - PRODUCTS

2.1 MATERIALS:

- A. Steel Decking and all Flashings: ASTM A653 - SS Designation, Grade 33, Minimum Yield 38 ksi, Structural Quality suitable for shear stud weld-through techniques.
- B. Galvanizing: ASTM A653, G60.
- C. Shear connector studs: ASTM A108, Grades 1015-1020, yield 350 Mpa (50,000 psi) minimum, tensile strength - 400 Mpa (60,000 psi) minimum, reduction of area 50 percent minimum. Studs of uniform diameter; heads shall be concentric and normal to shaft; stud, after welding free from any substance or defect which would interfere with its function as a shear connector. Studs shall not be painted or galvanized. Size of studs as shown on drawings. Studs manufactured by a company normally engaged in the manufacturer of shear studs and can furnish equipment suitable for weld-through installation of shear studs.
- D. Galvanizing Repair Paint: Mil. Spec. MIL-P-21035B.
- E. Miscellaneous Steel Shapes: ASTM A36.
- F. Welding Electrode: E60XX minimum.
- G. Sheet Metal Accessories: ASTM A653, galvanized, unless noted otherwise. Provide accessories of every kind required to complete the installation of metal decking in the system shown. Finish sheet metal items to match deck including, but not limited to, the following items:
 - 1. Metal Cover Plates: For end-abutting deck units, to close gaps at changes in deck direction, columns, walls and openings. Same quality as deck units but not less than 1.3 mm (18 gauge) sheet steel.
 - 2. Continuous sheet metal edging: at openings and concrete slab edges. Same quality as deck units but not less than 1.3 mm (18 gauge) steel. Side and end closures supporting concrete and their attachment to supporting steel shall be designed by the manufacturer to safely support the wet weight of concrete and construction loads. The deflection of cantilever closures shall be limited to 3 mm (1/8 inch) maximum.
 - 3. Metal Closure Strips: For openings between decking and other construction, of not less than 1.3 mm (18 gauge) sheet steel of the same quality as the deck units. Form to the configuration required

to provide tight-fitting closures at open ends of flutes and sides of decking.

4. Seat angles for deck: Where a beam does not frame into a column.

2.2 REQUIREMENTS:

- A. Steel decking depth, gage, and section properties as shown. Provide edges of deck with vertical interlocking male and female lip providing for a positive mechanical connection.
- B. Fabricate deck units with integral embossments to provide mechanical bond with concrete slab. In combination with concrete slab, capable of supporting total design loads on spans shown.
- C. Steel decking capable of safely supporting total normal construction service loads without damage to decking unit.
- D. Steel decking units shall include an integral system which provides a simple point of attachment for light duty hanger devices for flexibility for attaching hangers for support of acoustical, lathing, plumbing, heating, air conditioning and electrical items. System shall provide for minimum spacing pattern of 300 mm (12 inches) on centers longitudinally and 600 mm or 900 mm (24 or 36 inches) on centers transversely. Suspension system shall be capable of safely supporting a maximum allowable load of 45 kg (100 pounds) concentrated at any one hanger attachment point. System may consist of fold-down type hanger tabs or a lip hanger.

PART 3 - EXECUTION

3.1 ERECTION:

- A. Do not start installation of metal decking until corresponding steel framework has been plumbed, aligned and completed and until temporary shoring, where required, has been installed. Remove any oil, dirt, paint, ice, water and rust from steel surfaces to which metal decking will be welded.
- B. Coordinate and cooperate with structural steel erector in locating decking bundles to prevent overloading of structural members.
- C. Do not use floor deck units for storage or working platforms until permanently secured. Do not overload deck units once placed. Replace any deck units that become damaged after erection and prior to casting concrete at no cost to the Government.
- D. Erect steel deck in accordance with manufacturer's printed instructions.

- E. Ship steel deck units to project in standard widths and cut to proper length.
- F. Provide steel decking in sufficient lengths to extend over 3 or more spans, except where structural steel layout does not permit.
- G. Place steel decking units on supporting steel framework and adjust to final position before being permanently fastening. Bring each unit to proper bearing on supporting beams. Place deck units in straight alignment for entire length of run of flutes and with close registration of flutes of one unit with those of abutting unit. Maximum space between ends of abutting units is 13 mm (1/2 inch). If space exceeds 13 mm (1/2 inch), install closure plates at no additional cost to Government.
- H. Ceiling hanger loops if used, must be flattened or removed to obtain bearing of units on structural steel.
- I. Fastening Deck Units:
 - 1. Fasten floor deck units to steel supporting members by not less than 16 mm (5/8 inch) diameter puddle welds or elongated welds of equal strength, spaced not more than 305 mm (12 inches) o.c. with a minimum of two welds per unit at each support. Where two units abut, fasten each unit individually to the supporting steel framework.
 - 2. Tack weld or use self-tapping No. 8 or larger machine screws at 915 mm (3 feet) o.c. for fastening end closures. Only use welds to attach longitudinal end closures.
 - 3. Weld side laps of adjacent floor deck units that span more than 1524 mm (5 feet). Fasten at midspan or 915 mm (3 feet) o.c., whichever is smaller.
- J. Welding conform to AWS D1.3 and done by competent experienced welding mechanics.
- K. Areas scarred during erection and welds shall be thoroughly cleaned and touched-up with zinc rich galvanizing repair paint. Paint touch-up is not required for welds or scars that are to be in direct contact with concrete.
- L. Provide metal concrete stops at edges of deck as required.
- M. Cutting and Fitting:
 - 1. Cut all metal deck units to proper length in the shop prior to shipping.

2. Field cutting by the metal deck erector is restricted to bevel cuts, notching to fit around columns and similar items, and cutting openings that are located and dimensioned on the structural drawings.
 3. Other penetrations shown on the approved metal deck shop drawings but not shown on the structural drawings are to be located, cut and reinforced by the trade requiring the opening.
 4. Make all cuts neat and trim using a metal saw, drill or punchout device; cutting with torches is expressly prohibited.
 5. Do not make any cuts in the metal deck that are not shown on the approved metal deck drawings. If an additional opening not shown on the approved shop drawings is required, submit a sketch, to scale, locating the required new opening and any other openings and supports in the immediate area. Do not cut the opening until the sketch has been reviewed and accepted by the COTR. Provide any additional reinforcing or framing required for the opening at no cost to the Government. Failure to comply with these requirements is cause for rejection of the work and removal and replacement of the affected metal deck.
 6. Reinforcement at Openings: Provide additional metal reinforcement and closure pieces as required for strength, continuity of decking and support of other work shown.
- N. Installation of shear connector studs through previously installed metal deck conform to AWS D1.1, Section 7, except all studs will be installed with automatically timed welding equipment and as specified below:
1. Do not place reinforcing steel temperature mesh or other materials and equipment which will interfere with stud installation on steel deck until shear connector studs are installed.
 2. Steel deck sheets shall be free of oil, rust, dirt, and paint. Release water in deck's valley so that it does not become entrapped between deck and beam. Surface to which stud is to be welded shall be clean and dry.
 3. Rest metal deck tightly upon top flange of structural member with bottom of deck rib in full contact with top of beam flange.

4. Weld studs only through a single thickness of deck. Place decking so that a butt joint is obtained. Place studs directly over beam web, where one row of studs are required.
5. Ferrules specially developed for the weld-through technique must be used. Ferrules shall be appropriate for size of studs used and be removed after welding.
6. Submit report of successful test program for stud base qualification as required by AWS D1.1, Appendix K.

3.2 CLEANING:

Clean deck in accordance with manufacturer's recommendation before concrete placement.

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**SECTION 05500
METAL FABRICATIONS**

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies items and assemblies fabricated from structural steel shapes and other materials as shown and specified.
- B. Items specified.
 - 1. Support for Wall and Ceiling Mounted Items
 - 2. Ladders
 - 3. Railings at stairwells
 - 4. Counter supports

1.2 RELATED WORK

- A. Railings attached to steel stairs: Section 05510, METAL STAIRS.
- B. Colors, finishes, and textures: Section 09050, INTERIOR/EXTERIOR FINISHES.
- C. Prime and finish painting: Section 09900, PAINTING.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01340, SAMPLES AND SHOP DRAWINGS.
- B. Shop Drawings:
 - 1. Each item specified, showing complete detail, location in the project, material and size of components, method of joining various components and assemblies, finish, and location, size and type of anchors.
 - 2. Mark items requiring field assembly for erection identification and furnish erection drawings and instructions.
 - 3. Provide templates and rough-in measurements as required.
- C. Manufacturer's Certificates:
 - Live load designs as specified.
- E. Design Calculations for specified live loads including dead loads.
- F. Furnish setting drawings and instructions for installation of anchors to be preset into concrete and masonry work, and for the positioning of items having anchors to be built into concrete or masonry construction.

1.4 QUALITY ASSURANCE

- A. Each manufactured product shall meet, as a minimum, the requirements specified, and shall be a standard commercial product of a manufacturer regularly presently manufacturing items of type specified.

- B. Each product type shall be the same and be made by the same manufacturer.
- C. Assembled product to the greatest extent possible before delivery to the site.
- D. Include additional features, which are not specifically prohibited by this specification, but which are a part of the manufacturer's standard commercial product.

1.5 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society of Mechanical Engineers (ASME):
 - B18.6.1-81 (R97).....Wood Screws
 - B18.2.2-87 (R93).....Square and Hex Nuts
- C. American Society for Testing and Materials (ASTM):
 - A36/A36M-00.....Structural Steel
 - A47-99.....Malleable Iron Castings
 - A48-94 (1998).....Grey Iron Castings
 - A53-99.....Pipe, Steel, Black and Hot-Dipped, Zinc-Coated
Welded and Seamless
 - A123-00.....Zinc (Hot-Dip Galvanized) Coatings on Iron and
Steel Products
 - A167-99.....Stainless and Heat-Resisting Chromium-Nickel
Steel Plate, Sheet and Strip
 - A269-00.....Seamless and Welded Austenitic Stainless Steel
Tubing for General Service
 - A307-00.....Carbon Steel Bolts and Studs, 60,000 PSI
Tensile Strength
 - A312/A312M-00.....Seamless and Welded Austenitic Stainless Steel
Pipes
 - A391/A391M-98.....Alloy Steel Chain
 - A653/A653M-00.....Steel Sheet, Zinc Coated (Galvanized) or Zinc-
Iron Alloy Coated (Galvannealed) by the Hot-Dip
Process
 - A786/A786M-00.....Rolled Steel Floor Plate
 - B221-00.....Aluminum and Aluminum-Alloy Extruded Bars,
Rods, Wire, Shapes, and Tubes

- B456-95.....Electrodeposited Coatings of Copper Plus Nickel
Plus Chromium and Nickel Plus Chromium
- B632-00.....Aluminum-Alloy Rolled Tread Plate
- C1107-99.....Packaged Dry, Hydraulic-Cement Grout
(Nonshrink)
- D3656-97.....Insect Screening and Louver Cloth Woven from
Vinyl-Coated Glass Yarns
- F436-93.....Hardened Steel Washers
- F468-98.....Nonferrous Bolts, Hex Cap Screws, and Studs for
General Use
- F593-98.....Stainless Steel Bolts, Hex Cap Screws, and
Studs
- F1667-00.....Driven Fasteners: Nails, Spikes and Staples
- D. American Welding Society (AWA):
 - D1.1-00.....Structural Welding Code Steel
 - D1.2-97.....Structural Welding Code Aluminum
 - D1.3-98.....Structural Welding Code Sheet Steel
- E. National Association of Architectural Metal Manufacturers (NAAMM)
Second Edition - 1985...Pipe Railing Manual
 - AMP 500 Series.....Metal Finishes Manual
 - AMP 500.....Introduction to Metal Finishing
 - AMP 501.....Finishes for Aluminum
 - AMP 502.....Finishes for Copper Alloys
 - AMP 503.....Finishes for Stainless Steel
 - AMP 504.....Finishes for Carbon Steel and Iron
 - AMP 505.....Applied Coatings
- F. American National Standards Institute/National Association of
Architectural Metal Manufacturers (ANSI/NAAMM):
 - MBG 531-93.....Metal Bar Grating Manual
 - MBG 532-88.....Heavy Duty Metal Bar Grating Manual
- G. Structural Steel Painting Council (SSPC):
 - SPC-SP 1-82.....No. 1, Solvent Cleaning
 - SPC-SP 2-95.....No. 2, Hand Tool Cleaning
 - SPC-SP 3-95.....No. 3, Power Tool Cleaning
- H. Federal Specifications (Fed. Spec):
 - FF-B-588D.....Bolt, Toggle; and Expansion Sleeve, Screw

- FF-P-395B.....Pin, Drive, Guided And Pin Drive, Powder
Actuated (Fasteners for Powder Actuated and
Hand Actuated Fastening Tools)
- RR-G-1602D.....Grating, Metal, other than Bar Type (Floor
except for Naval Vessels)
- RR-T-650E.....Treads, Metallic and Nonmetallic, Nonskid

PART 2 - PRODUCTS

2.1 DESIGN CRITERIA

- A. In addition to the dead loads, design fabrications to support the following live loads unless otherwise specified.
- B. Ladders and Rungs: 120 kg (250 pounds) at any point.
- C. Railings and Handrails: 900 N (200 pounds) in any direction at any point.

2.2 MATERIALS

- A. Structural Steel: ASTM A36.
- B. Steel Pipe: ASTM A53.
 - 1. Galvanized for exterior locations.
 - 2. Type S, Grade A unless specified otherwise.
 - 3. NPS (inside diameter) as shown.
- C. Malleable Iron Castings: A47.
- D. Primer Paint: As specified in Section 09900, PAINTING.
- E. Modular Channel Units:
 - 1. Factory fabricated, channel shaped, cold formed sheet steel shapes, complete with fittings bolts and nuts required for assembly. Manufactured by "Unistrut" or equal.
 - 2. Form channel with in turned pyramid shaped clamping ridges on each side.
 - 3. Provide case hardened steel nuts with serrated grooves in the top edges designed to be inserted in the channel at any point and be given a quarter turn so as to engage the channel clamping ridges. Provide each nut with a spring designed to hold the nut in place.
 - 4. Channels fabricated of ASTM A525, G90 galvanized steel. Finish screws and nuts with zinc coating.
 - 5. Fabricate snap-in closure plates to fit and close exposed channel openings of not more than 0.3 mm (0.0125 inch) thick stainless steel.

2.3 HARDWARE

A. Rough Hardware:

1. Furnish rough hardware with a standard plating, applied after punching, forming and assembly of parts; galvanized, cadmium plated, or zinc-coated by electro-galvanizing process. Galvanized G-90 where specified.
2. Use G90 galvanized coating on ferrous metal for exterior work unless non-ferrous metal or stainless is used.

B. Fasteners:

1. Powder Actuated Drive Pins: Fed. Spec. FF-P-395, style to suit material.
2. Expansion Bolts (Shields): Fed. Spec. FF-B-588, Group II, type 1 or 2. Lead, fiber and plastic shields are not acceptable. Furnish with bolts or screws.
3. Toggle Bolts: Fed. Spec. FF-B-588, Type I, Class A, Style 1, wire wings are not acceptable.
4. Bolts with Nuts:
 - a. ASME B18.2.2.
 - b. ASTM A307 for 415 MPa (60,000 psi) tensile strength bolts.
 - c. ASTM F468 for nonferrous bolts.
 - d. ASTM F593 for stainless steel.
5. Screws: ASME B18.6.1.
6. Washers: ASTM F436, type to suit material and anchorage.
7. Nails: ASTM F1667, Type I, style 6 or 14 for finish work.

2.4 FABRICATION GENERAL

A. Material

1. Use material as specified. Use material of commercial quality and suitable for intended purpose for material that is not named or its standard of quality not specified.
2. Use material free of defects which could affect the appearance or service ability of the finished product.

B. Size:

1. Size and thickness of members as shown.
2. When size and thickness is not specified or shown for an individual part, use size and thickness not less than that used for the same component on similar standard commercial items or in accordance with established shop methods.

C. Connections

1. Except as otherwise specified, connections may be made by welding, riveting or bolting.
2. Field riveting will not be approved.
3. Design size, number and placement of fasteners, to develop a joint strength of not less than the design value.
4. Holes, for rivets and bolts: Accurately punched or drilled and burrs removed.
5. Weld in accordance with AWS.
6. Size and shape welds to develop the full design strength of the parts connected by welds and to transmit imposed stresses without permanent deformation or failure when subject to service loadings.
7. Use Rivets and bolts of material selected to prevent corrosion (electrolysis) at bimetallic contacts. Plated or coated material will not be approved.
8. Use stainless steel connectors for removable members machine screws or bolts.

D. Fasteners and Anchors

1. Use methods for fastening or anchoring metal fabrications to building construction as shown or specified.
2. Where fasteners and anchors are not shown, design the type, size, location and spacing to resist the loads imposed without deformation of the members or causing failure of the anchor or fastener, and suit the sequence of installation.
3. Use material and finish of the fasteners compatible with the kinds of materials which are fastened together and their location in the finished work.
4. Fasteners for securing metal fabrications to new construction only, may be by use of threaded or wedge type inserts or by anchors for welding to the metal fabrication for installation before the concrete is placed or as masonry is laid.
5. Fasteners for securing metal fabrication to existing construction or new construction may be expansion bolts, toggle bolts, power actuated drive pins, welding, self drilling and tapping screws or bolts.

E. Workmanship

1. General:

- a. Fabricate items to design shown.
 - b. Furnish members in longest lengths commercially available within the limits shown and specified.
 - c. Fabricate straight, true, free from warp and twist, and where applicable square and in same plane.
 - d. Provide holes, sinkages and reinforcement shown and required for fasteners and anchorage items.
 - e. Provide openings, cut-outs, and tapped holes for attachment and clearances required for work of other trades.
 - f. Prepare members for the installation and fitting of hardware.
 - g. Cut openings in gratings and floor plates for the passage of ducts, sumps, pipes, conduits and similar items. Provide reinforcement to support cut edges.
 - h. Fabricate surfaces and edges free from sharp edges, burrs and projections which may cause injury.
2. Welding:
- a. Weld in accordance with AWI.
 - b. Welds shall show good fusion, be free from cracks and porosity and accomplish secure and rigid joints in proper alignment.
 - c. Where exposed in the finished work, continuous weld for the full length of the members joined and have depressed areas filled and protruding welds finished smooth and flush with adjacent surfaces.
 - d. Finish welded joints to match finish of adjacent surface.
3. Joining:
- a. Miter or butt members at corners.
 - b. Where frames members are butted at corners, cut leg of frame member perpendicular to surface, as required for clearance.
4. Anchors:
- a. Where metal fabrications are shown to be preset in concrete, weld 32 x 3 mm (1-1/4 by 1/8 inch) steel strap anchors, 150 mm (6 inches) long with 25 mm (one inch) hooked end, to back of member at 600 mm (2 feet) on center, unless otherwise shown.
 - b. Where metal fabrications are shown to be built into masonry use 32 x 3 mm (1-1/4 by 1/8 inch) steel strap anchors, 250 mm (10 inches) long with 50 mm (2 inch) hooked end, welded to back of member at 600 mm (2 feet) on center, unless otherwise shown.

5. Cutting and Fitting:

- a. Accurately cut, machine and fit joints, corners, copes, and miters.
- b. Fit removable members to be easily removed.
- c. Design and construct field connections in the most practical place for appearance and ease of installation.
- d. Fit pieces together as required.
- e. Fabricate connections for ease of assembly and disassembly without use of special tools.
- f. Joints firm when assembled.
- g. Conceal joining, fitting and welding on exposed work as far as practical.
- h. Do not show rivets and screws prominently on the exposed face.
- i. The fit of components and the alignment of holes shall eliminate the need to modify component or to use exceptional force in the assembly of item and eliminate the need to use other than common tools.

F. Finish:

1. Finish exposed surfaces in accordance with NAAMM Metal Finishes Manual.
2. Steel and Iron: NAAMM AMP 504.
 - a. Zinc coated (Galvanized): ASTM A123, G90 unless noted otherwise.
 - b. Surfaces exposed in the finished work:
 - 1) Finish smooth rough surfaces and remove projections.
 - 2) Fill holes, dents and similar voids and depressions with epoxy type patching compound.
 - c. Shop Prime Painting:
 - 1) Surfaces of Ferrous metal:
 - a) Items not specified to have other coatings.
 - b) Galvanized surfaces specified to have prime paint.
 - c) Remove all loose mill scale, rust, and paint, by hand or power tool cleaning as defined in SSPC-SP2 and SP3.
 - d) Clean of oil, grease, soil and other detrimental matter by use of solvents or cleaning compounds as defined in SSPC-SP1.
 - e) After cleaning and finishing apply one coat of primer as specified in Section PAINTING.

- 2) Non ferrous metals: Comply with MAAMM-500 series.
3. Stainless Steel: NAAMM AMP-504 Finish No. 4.

G. Protection:

1. Insulate aluminum surfaces that will come in contact with concrete, masonry, plaster, or metals other than stainless steel, zinc or white bronze by giving a coat of heavy-bodied alkali resisting bituminous paint or other approved paint in shop.
2. Spot prime all abraded and damaged areas of zinc coating which expose the bare metal, using zinc rich paint on hot-dip zinc coat items and zinc dust primer on all other zinc coated items.

2.5 SUPPORTS

A. General:

1. Fabricate ASTM A36 structural steel shapes as shown.
2. Use clip angles or make provisions for welding hangers and braces to overhead construction.
3. Field connections may be welded or bolted.

B. For Ceiling Hung Toilet Stall:

1. Use a continuous steel channel above pilasters with hangers centered over pilasters.
2. Make provision for installation of stud bolts in lower flange of channel.
3. Provide a continuous steel angle at wall and channel braces spaced as shown.
4. Use threaded rod hangers.
5. Provide diagonal angle brace where the suspended ceiling over toilet stalls does not extend to side wall of room.

C. For Wall Mounted Items:

Use steel angles for thru wall counters. Drill angle for fasteners at ends and not over 100 mm (4 inches) on center between ends.

D. For Trapeze Bars:

1. Construct assembly above ceilings as shown and design to support not less than a 340 kg (750 pound) working load at any point.
2. Fabricate trapeze supports as shown, with all exposed members, including screws, nuts, bolts and washers, fabricated of stainless steel.
3. Fabricate concealed components of structural steel shapes unless shown otherwise.

4. Stainless steel ceiling plate drilled for eye bolt.
 5. Continuously weld connections where welds shown.
 6. Use modular channel where shown with manufacturers bolts and fittings.
 - a. Weld ends of steel angle braces to steel plates and secure to modular channel units as shown. Drill plates for anchor bolts.
 - b. Fabricate eye bolt, special clamp bolt, and plate closure full length of modular channel at ceiling line and secure to modular channel unit with manufacturers standard fittings.
- E. For Procedure Light:
1. Fabricate from modular channel units as shown to suit equipment furnished.
 2. Anchor to slab above.
- F. Supports for Moveable Partitions at Various Conditions at Suspended Ceilings:
1. Fabricate of modular channel units as shown on the Drawings.
 2. Drill for anchor bolts of suspended item.
 3. Coordinate location of supports with manufacturer's shop drawings.

2.6 LADDERS

- A. Steel Ladders:
1. Fixed-rail type with steel rungs shouldered and headed into and welded to rails.
 2. Fabricate angle brackets of 50 mm (2 inch) wide by 13 mm (1/2 inch) thick steel; brackets spaced maximum of 1200 mm (4 feet) apart and of length to hold ladder 175 mm (7 inches) from wall to center of rungs. Provide turned ends or clips for anchoring.
 3. Provide holes for anchoring with expansion bolts through turned ends and brackets.
 4. Where shown, fabricate side rails curved, twisted and formed into a gooseneck.
- C. Ladder Rungs:
1. Fabricate from 25 mm (one inch) diameter steel bars.
 2. Fabricate so that rungs will extend at least 100 mm (4 inches) into wall with ends turned 50 mm (2 inches), project out from wall 175 mm (7 inches), be 400 mm (16 inches) wide and be designed so that foot cannot slide off end.
 3. Prime and paint ladder.

2.7 RAILINGS

- A. In addition to the dead load design railing assembly to support live load specified.
- B. Fabrication General:
 - 1. Provide continuous welded joints, dressed smooth and flush.
 - 2. Standard flush fittings, designed to be welded, may be used.
 - 3. Exposed threads will not be approved.
 - 4. Form handrail brackets to size and design shown.
 - 5. Exterior Post Anchors.
 - a. Fabricate tube or pipe sleeves with closed ends or plates as shown.
 - b. Where inserts interfere with reinforcing bars, provide flanged fittings welded or threaded to posts for securing to concrete with expansion bolts.
 - c. Provide heavy pattern sliding flange base plate with set screws at base of pipe or tube posts. // Base plates are not required on pipe sleeves where ornamental railings occur. //
 - 6. Interior Post Anchors:
 - a. Provide flanged fittings for securing fixed posts to floor with expansion bolts, unless shown otherwise.
 - b. Weld or thread flanged fitting to posts at base.
 - c. For securing removable posts to floor, provide close fitting sleeve insert or inverted flange base plate with stud bolts or rivets concrete anchor welded to the base plate.
 - d. Provide sliding flange base plate on posts secured with set screws.
 - e. Weld flange base plate to removable posts set in sleeves.
- C. Handrails:
 - 1. Turn handrails back to the wall and close with flush metal caps welded in place except where flanges for securing to walls with bolts are shown.
 - 2. Make provisions for attaching handrail brackets to wall, posts, and handrail as shown.
- D. Steel Pipe Railings:
 - 1. Fabricate of steel pipe with welded joints.
 - 2. Number and space of rails as shown.

3. Space posts for railings not over 1800 mm (6 feet) on centers between end posts.
4. Form handrail brackets from malleable iron.
5. Fabricate removable sections with posts at end of section.
6. Removable Rails:
 - a. Provide "U" shape brackets at each end to hold removable rail as shown. Use for top and bottom horizontal rail when rails are joined together with vertical members.
 - b. Secure rail to brackets with 9 mm (3/8 inch) stainless steel through bolts and nuts at top rail only when rails joined with vertical members.
 - c. Continuously weld brackets to post.
 - d. Provide slotted bolt holes in rail bracket.
 - e. Weld bolt heads flush with top of rail.
 - f. Weld flanged fitting to post where posts are installed in sleeves.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Set work accurately, in alignment and where shown, plumb, level, free of rack and twist, and set parallel or perpendicular as required to line and plane of surface.
- B. Items set into concrete.
 1. Provide temporary bracing for such items until concrete is set.
 2. Place in accordance with setting drawings and instructions.
 3. Build strap anchors, into masonry as work progresses.
- C. Set frames of gratings, covers, corner guards, and similar items flush with finish floor or wall surface and, where applicable, flush with side of opening.
- D. Field weld in accordance with AWS.
 1. Design and finish as specified for shop welding.
 2. Use continuous weld unless specified otherwise.
- E. Install anchoring devices and fasteners as shown and as necessary for securing metal fabrications to building construction as specified. Power actuated drive pins may be used except for removable items and where members would be deformed or substrate damaged by their use.

- F. Spot prime all abraded and damaged areas of zinc coating as specified and all abraded and damaged areas of shop prime coat with same kind of paint used for shop priming.
- G. Isolate aluminum from dissimilar metals and from contact with concrete and masonry materials as required to prevent electrolysis and corrosion.
- H. Secure escutcheon plate with set screw.

3.2 INSTALLATION OF SUPPORTS

- A. Anchorage to structure.
 - 1. Secure angles or channels and clips to overhead structural steel by continuous welding unless bolting is shown.
 - 2. Secure supports to concrete inserts by bolting or continuous welding as shown.
 - 3. Secure supports to mid height of concrete beams when inserts do not exist with expansion bolts and to slabs, with expansion bolts. unless shown otherwise.
 - 4. Secure steel plate or hat channels to studs as detailed.
- B. Ceiling Hung Toilet Stalls:
 - 1. Securely anchor hangers of continuous steel channel above pilasters to structure above.
 - 2. Install diagonal angle brace where the suspended ceiling over toilet stalls does not extend to side wall of room.
 - 3. Install stud bolts in lower flange of channel before installing furred down ceiling over toilet stalls.
- C. Ceiling Support for Procedure Light:
 - 1. Anchor support to structure above as shown.
 - 2. Set leveling plate as shown level with ceiling.
 - 3. Secure operating light to leveling plate in accordance with light manufacturer's requirements.
- D. Supports for Trapeze Bars:
 - 1. Secure plates to overhead construction with fasteners as shown.
 - 2. Secure angle brace assembly to overhead construction with fasteners as shown and bolt plate to braces.
 - 3. Fit modular channel unit flush with finish ceiling, and secure to plate with modular channel unit manufacturer's standard fittings through steel shims or spreaders as shown.
 - a. Install closure plates in channel between eye bolts.

- b. Install eyebolts in channel.

3.3 LADDERS

- A. Anchor ladders to walls and floors with expansion bolts through turned lugs or angle clips or brackets.
- C. Ladder Rungs:
 - 1. Set step portion of rung 150 mm (6 inches) from wall.
 - 2. Space rungs approximately 300 mm (12 inches) on centers.

3.4 RAILINGS

- A. Anchor to Walls:
 - 1. Anchor rails to concrete with machine screws through flanged fitting to steel plate.
 - a. Anchor steel plate to concrete with expansion bolts.
 - 2. Anchor flanged fitting with toggle bolt to steel support in frame walls.
- B. Handrails:
 - 1. Anchor brackets for metal handrails as detailed.
 - 2. Install brackets within 300 mm (12 inches) of return of walls, and at evenly spaced intermediate points not exceeding 1200 mm (4 feet) on centers unless shown otherwise.
 - 3. Expansion bolt to concrete or solid masonry.
 - 4. Toggle bolt to installed supporting frame wall and to hollow masonry unless shown otherwise.

3.5 CLEAN AND ADJUSTING

- A. Adjust movable parts including hardware to operate as designed without binding or deformation of the members centered in the opening or frame and, where applicable, contact surfaces fit tight and even without forcing or warping the components.

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**SECTION 05510
METAL STAIRS**

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Section specifies steel stairs with railings.
- B. Types:
Closed riser stairs with concrete filled treads and platforms.

1.2 RELATED WORK

- A. Concrete fill for treads and platforms: Section 03300, CAST-IN-PLACE CONCRETE.
- B. Wall handrails and railings for other than steel stairs: Section 05500, METAL FABRICATIONS.
- C. Requirements for shop painting: Section 09900, PAINTING.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01340, SAMPLES AND SHOP DRAWINGS.
- B. Shop Drawings: Show design, fabrication details, installation, connections, material, and size of members.

1.4 APPLICATION PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation.
- B. American Society for Testing and Materials (ASTM):
 - A36/A36M-00.....Structural Steel
 - A47-99.....Ferritic Malleable Iron Castings
 - A48-(1998).....Gray Iron Castings
 - A53-99.....Pipe, Steel, Black and Hot-Dipped Zinc-Coated
Welded and Seamless
 - A307-00.....Carbon Steel Bolts and Studs, 60000 psi Tensile
Strength
 - A366/A366M-97(1998).....Steel, Sheet, Carbon, Cold-Rolled, Commercial
Quality
 - A653/653M-00.....Steel Sheet, Zinc Coated (Galvanized) or Zinc
Alloy Coated (Galvannealed) by the Hot-Dip
Process
 - A563-00.....Carbon and Alloy Steel Nuts
 - A570/A570M-98.....Steel, Sheet and Strip, Carbon Hot-Rolled
Structural Quality

A786/A786M-00.....Rolled Steel Floor Plates

C. American Welding Society (AWS):

D1.1-00.....Structural Welding Code-Steel

D1.3-98.....Structural Welding Code-Sheet Steel

D. The National Association of Architectural Metal Manufacturers (NAAMM)
Manuals:

Metal Bar Gratings (ANSI/NAAMM MBG 531-93)

2nd Edition-1985.....Pipe Railing Manual, Including Round Tube

E. American Iron and Steel Institute (AISI):

Specification for the Design of Cold-Formed Steel Structural Members

PART 2 - PRODUCTS

2.1 DESIGN CRITERIA

A. Design stairs to support a live load of 500 kg/m² (100 pounds per square foot).

B. Structural design, fabrication and assembly in accordance with requirements of NAAMM Metal Stairs Manual, except as otherwise specified or shown.

D. Design pipe railings in accordance with NAAMM Pipe Railing Manual for 900 N (200 pounds) in any direction at any point.

2.2 MATERIALS

A. Steel Pipe: ASTM A53, Standard Weight, zinc coated.

B. Steel Grating: Metal bar type grating NAAMM BG.

C. Sheet Steel: ASTM A366.

D. Structural Steel: ASTM A36.

E. Steel Floor Plate: ASTM 786.

F. Steel Decking: Form from zinc coated steel conforming to ASTM A446, with properties conforming to AISI Specification for the Design of Cold-Formed Steel Structural Members.

G. Steel Plate: ASTM A570.

H. Iron Castings: ASTM A48, Class 30.

I. Malleable Iron Castings: ASTM A47.

2.3 FABRICATION GENERAL

A. Fasteners:

1. Conceal bolts and screws wherever possible.

2. Use countersunk heads on exposed bolts and screws with ends of bolts and screws dressed flush after nuts are set.

B. Welding:

1. Structural steel, AWS D1.1 and sheet steel, AWS D1.3.
 2. Where possible, locate welds on unexposed side.
 3. Grind exposed welds smooth and true to contour of welded member.
 4. Remove welding splatter.
- C. Remove sharp edges and burrs.
- D. Fit stringers to head channel and close ends with steel plates welded in place where shown.
- E. Fit face stringer to newel post by tenoning into newel post, or by notching and fitting face stringer to side of newel where shown.
- F. Shop Prime Painting: Prepare surface and apply primer as specified for ferrous metals in Section 09900, PAINTING.

2.4 RAILINGS

- A. Fabricate railings, including handrails, from steel pipe with flush.
1. Connections may be standard fittings designed for welding, or coped or mitered pipe with full welds.
 2. Wall handrails are provided under Section, METAL FABRICATIONS.
- B. Return ends of handrail to wall and close free end.
- C. Provide standard terminal castings where fastened to newel.
- D. Space intermediate posts not over six feet on center between end post.
- E. Fabricate handrail brackets from cast malleable iron.
- F. Provide standard terminal fittings at ends of post and rails.
- G. Where new railing abuts existing railing, grind protrusion off the old railing and weld new railing to existing, maintaining 4" maximum center-to-center spacing of rails.

2.5 CLOSED RISER STAIRS

- A. Provide treads, risers, platforms, railings, stringers, headers and other supporting members.
- B. Fabricate pans for treads and platforms, and risers from sheet steel. Fabricate pans for platforms from steel decking where shown.
- C. Form risers with sanitary cove.
- D. Fabricate stringers, headers, and other supporting members from structural steel.

PART 3 - EXECUTION

3.1 STAIR INSTALLATION

- A. Provide hangers and struts required to support the loads imposed.
- B. Perform job site welding and bolting as specified for shop fabrication.

C. Set stairs and other members in position and secure to structure as shown.

D. Install stairs plumb, level and true to line.

3.2 RAILING INSTALLATION

Set rails horizontal or parallel to rake of stairs to within 3 mm in 3650 mm (1/8-inch in 12 feet).

3.3 FIELD PRIME PAINTING TOUCH UP

A. When installation is complete, clean field welds and surrounding areas to bright metal, and coat with same primer paint used for shop priming.

B. Touch-up abraded areas with same primer paint used for shop priming.

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**SECTION 06100
ROUGH CARPENTRY**

PART 1 - GENERAL

1.1 DESCRIPTION:

Section specifies wood blocking, furring, nailers, rough hardware, and light wood construction.

1.2 RELATED WORK:

- A. Milled woodwork: Section 06200, FINISH CARPENTRY AND MILLWORK.
- B. Gypsum sheathing: Section 09260, GYPSUM BOARD SYSTEM.

1.3 SUBMITTALS:

- A. Submit in accordance with Section 01340, SAMPLES AND SHOP DRAWINGS.
- B. Shop Drawings showing framing connection details, fasteners, connections and dimensions.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING:

- A. Protect lumber and other products from dampness both during and after delivery at site.
- B. Pile lumber in stacks in such manner as to provide air circulation around surfaces of each piece.
- C. Stack plywood and other board products so as to prevent warping.
- D. Locate stacks on well drained areas, supported at least 150 mm (6 inches) above grade and cover with well ventilated sheds having firmly constructed over hanging roof with sufficient end wall to protect lumber from driving rain.

1.5 APPLICABLE PUBLICATIONS:

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in the text by basic designation only.
- B. American Forest and Paper Association (AFPA):
National Design Specification for Wood Construction
WCD Number 1-01.....Conventional Wood Frame Construction
- D. American Society of Mechanical Engineers (ASME):
B18.2.1A-99.....Square and Hex Bolts and Screws
B18.2.2-87 (R99).....Square and Hex Nuts
B18.6.1-81 (R97).....Wood Screws
B18.6.4-98.....Thread Forming and Thread Cutting Tapping
Screws and Metallic Drive Screws
- E. American Plywood Association (APA):

- E30-1996.....Design/Construction Guide - Residential and Commercial
- F. American Society for Testing And Materials (ASTM):
 - A47-99.....Ferritic Malleable Iron Castings
 - A48-00.....Gray Iron Castings
 - A653/A653M-00.....Steel Sheet Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot Dip Process
 - C954-00.....Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases to Steel Studs from 0.033 inch (2.24 mm) to 0.112-inch (2.84 mm) in thickness
 - C1002-01.....Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases
 - D143-(R00).....Small Clear Specimens of Timber, Method of Testing
 - D1760-01.....Pressure Treatment of Timber Products
 - D2559-00.....Adhesives for Structural Laminated Wood Products for Use Under Exterior (Wet Use) Exposure Conditions
 - D3498-01.....Adhesives for Field-Gluing Plywood to Lumber Framing for Floor Systems
 - F844-00.....Washers, Steel, Plan (Flat) Unhardened for General Use
 - F1667-01.....Nails, Spikes, and Staples
- G. Federal Specifications (Fed. Spec.):
 - MM-L-736C.....Lumber; Hardwood
- H. Commercial Item Description (CID):
 - A-A-55615.....Shield, Expansion (Wood Screw and Lag Bolt Self Threading Anchors)
- I. Military Specification (Mil. Spec.):
 - MIL-L-19140E.....Lumber and Plywood, Fire-Retardant Treated
- J. Truss Plate Institute (TPI):
 - TPI-1 (1995).....Design Specifications for Metal Plate Connected Wood Trusses
- K. U.S. Department of Commerce Product Standard (PS)
 - PS 1-95.....Construction and Industrial Plywood

PS 20-70 (R86).....American Softwood Lumber Standard

PS 58-74.....Basic Hardboard

PART 2 - PRODUCTS

2.1 LUMBER:

- A. Unless otherwise specified, each piece of lumber bear grade mark, stamp, or other identifying marks indicating grades of material, and rules or standards under which produced.
 - 1. Identifying marks in accordance with rule or standard under which material is produced, including requirements for qualifications and authority of the inspection organization, usage of authorized identification, and information included in the identification.
 - 2. Inspection agency for lumber approved by the Board of Review, American Lumber Standards Committee, to grade species used.
- C. Lumber Other Than Structural:
 - 1. Unless otherwise specified, species graded under the grading rules of an inspection agency approved by Board of Review, American Lumber Standards Committee.
 - 3. Furring, blocking, nailers and similar items 100 mm (4 inches) and narrower Standard Grade; and, members 150 mm (6 inches) and wider, Number 2 Grade.
- D. Sizes:
 - 1. Conforming to Prod. Std., PS20.
 - 2. Size references are nominal sizes, unless otherwise specified, actual sizes within manufacturing tolerances allowed by standard under which produced.
- E. Moisture Content:
 - 1. At time of delivery and maintained at the site.
 - 2. Boards and lumber 50 mm (2 inches) and less in thickness: 19 percent or less.
 - 3. Lumber over 50 mm (2 inches) thick: 25 percent or less.
- F. Preservative Treatment:
 - 1. Treat wood members and plywood exposed to weather or in contact with plaster OR concrete, including sills, sole plates, furring, and sleepers that are less than 600 mm (24 inches) from ground; nailers, edge strips, blocking, crickets, curbs, cant, vent strips and other members used in connection with roofing and flashing materials.
 - 2. Treat other members specified as preservative treated (PT).

3. Preservative treat by the pressure method complying with ASTM D1760, except any process involving the use of Chromated Copper arsenate (CCA) for pressure treating wood is not permitted.

2.2 PLYWOOD

- A. Comply with Prod. Std., PS 1.
- B. Bear the mark of a recognized association or independent inspection agency that maintains continuing control over quality of plywood which identifies compliance by veneer grade, group number, span rating where applicable, and glue type.
- C. Sheathing:
 1. APA rated Exposure 1 or Exterior; panel grade CD or better.
 2. Wall sheathing:
 - a. Minimum 9 mm (11/32 inch) thick with supports 400 mm (16 inches) on center and 12 mm (15/32 inch) thick with supports 600 mm (24 inches) on center unless specified otherwise.
 - b. Minimum 1200 mm (48 inches) wide at corners without corner bracing of framing.
- D. Fire Retardant Treatment:
 1. Mil Spec. MIL-L-19140 with piece of treated material bearing identification of testing agency and showing performance rating.
 2. Treatment and performance inspection, by an independent and qualified testing agency that establishes performance ratings.

2.4 ROUGH HARDWARE AND ADHESIVES:

- A. Anchor Bolts:
 1. ASME B18.2.1 and ANSI B18.2.2 galvanized, 13 mm (1/2 inch) unless shown otherwise.
 2. Extend at least 200 mm (8 inches) into concrete with ends bent 50 mm (2 inches).
- B. Miscellaneous Bolts: Expansion Bolts: C1D, A-A-55615; lag bolt, long enough to extend at least 65 mm (2-1/2 inches) into concrete. Use 13 mm (1/2 inch) bolt unless shown otherwise.
- C. Washers
 1. ASTM F844.
 2. Use zinc or cadmium coated steel or cast iron for washers exposed to weather.
- D. Screws:
 1. Wood to Wood: ANSI B18.6.1 or ASTM C1002.

2. Wood to Steel: ASTM C954, or ASTM C1002.

E. Nails:

1. Size and type best suited for purpose unless noted otherwise. Use aluminum-alloy nails, plated nails, or zinc-coated nails, for nailing wood work exposed to weather and on roof blocking.

2. ASTM F1667:

- a. Common: Type I, Style 10.
- b. Concrete: Type I, Style 11.
- c. Barbed: Type I, Style 26.

F. Plywood clips: Extruded Aluminum "H"-shaped clisp for use at plywood joints without backing.

PART 3 - EXECUTION

3.1 INSTALLATION OF FRAMING AND MISCELLANEOUS WOOD MEMBERS:

A. Conform to applicable requirements of the following:

B. Fasteners:

1. Bolts:

- a. Fit bolt heads and nuts bearing on wood with washers.
- b. Countersink bolt heads flush with the surface of nailers.
- c. Embed in concrete or use expansion bolts. Special bolts or screws designed for anchor to solid masonry or concrete in drilled holes may be used.
- d. Use toggle bolts to sheet metal.
- e. Use bolts to steel over 2.84 mm (0.112 inch, 11 gage) in thickness. Secure wood nailers to vertical structural steel members with bolts, placed one at ends of nailer and 600 mm (24 inch) intervals between end bolts. Use clips to beam flanges.

3. Drill Screws to steel less than 2.84 mm (0.112 inch) thick.

- a. ASTM C1002 for steel less than 0.84 mm (0.033 inch) thick.
- b. ASTM C 954 for steel over 0.84 mm (0.033 inch) thick.

4. Power actuated drive pins may be used where practical to anchor to solid masonry, concrete, or steel.

5. Do not anchor to wood plugs or nailing blocks in concrete. Use metal plugs, inserts or similar fastening.

6. Screws to Join Wood:

- a. Where shown or option to nails.
- b. ASTM C1002, sized to provide not less than 25 mm (1 inch) penetration into anchorage member.

- c. Spaced same as nails.
- C. Set sills or plates level in full bed of mortar on concrete walls.
 - 1. Space anchor bolts 1200 mm (4 feet) on centers between ends and within 150 mm (6 inches) of end. Stagger bolts from side to side on plates over 175 mm (7 inches) in width.
 - 2. Use shims of slate, tile or similar approved material to level wood members resting on concrete. Do not use wood shims or wedges.
 - 3. Closely fit, and set to required lines.
- D. Blocking Nailers, and Furring:
 - 1. Install furring, blocking, nailers, and grounds where shown.
 - 2. Use longest lengths practicable.
 - 3. Use fire retardant treated wood blocking where shown at openings and where shown or specified.
 - 4. Layers of Blocking or Plates:
 - a. Stagger end joints between upper and lower pieces.
 - b. Nail at ends and not over 600 mm (24 inches) between ends.
 - c. Stagger nails from side to side of wood member over 125 mm (5 inches) in width.
- E. Parapet:
 - 1. Use fire-rated plywood or structural-use panels for parapet walls.
 - 2. Install with plywood clips at joints 12" on center maximum.

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**SECTION 06200
FINISH CARPENTRY AND MILLWORK**

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies exterior and interior millwork.
- B. Items specified:
 - 1. Wood chair rails
 - 2. Window sills

1.2 RELATED WORK

- A. Framing, furring and blocking: Section 06100, ROUGH CARPENTRY.
- B. Color and texture of finish: Section 09050, INTERIOR/EXTERIOR FINISHES.
- C. Casework: Section 12302, WOOD CASEWORK.
- D. Wall guards: Section 10260, WALL GUARDS AND CORNER GUARDS.
- E. Clear wood finish: Section 09900, PAINTING.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01340, SAMPLES AND SHOP DRAWINGS.
- B. Shop Drawings:
 - 1. Millwork items - Half full size scale for sections and details 1:50 (1/4-inch) for elevations and plans.
 - 2. Show construction and installation.
- C. Samples:
 - 1. Sample of wood trim.
 - 2. Screw for attachment.
- D. Certificates:
 - Indicating moisture content of materials meet the requirements specified.
- E. List of acceptable sealers for fire retardant and preservative treated materials.
- F. Manufacturer's literature and data:

1.4 DELIVERY, STORAGE AND HANDLING

- A. Protect lumber and millwork from dampness, maintaining moisture content specified both during and after delivery at site.
- B. Store finishing lumber and millwork in weathertight well ventilated structures or in space in existing buildings designated by COTR. Store at a minimum temperature of 21⁰C (70⁰F) for not less than 10 days before installation.

- C. Pile lumber in stacks in such manner as to provide air circulation around surfaces of each piece.

1.5 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. Federal Specifications (Fed. Spec.):
 - A-A-1922A.....Shield Expansion
 - A-A-1936.....Contact Adhesive
 - A-A-3052.....Urea Resin Type Adhesive
 - FF-N-836D.....Nut, Square, Hexagon Cap, Slotted, Castle
 - FF-S-111D(1).....Screw, Wood
 - MM-L-736(C).....Lumber, Hardwood

PART 2 - PRODUCTS

2.1 LUMBER

- A. Grading and Marking:
 - 1. Lumber shall bear the grade mark, stamp, or other identifying marks indicating grades of material.
 - 2. Such identifying marks on a material shall be in accordance with the rule or standard under which the material is produced, including requirements for qualifications and authority of the inspection organization, usage of authorized identification, and information included in the identification.
 - 3. The inspection agency for lumber shall be approved by the Board of Review, American Lumber Standards Committee, to grade species used.
- B. Sizes:
 - 1. Lumber Size references, unless otherwise specified, are nominal sizes, and actual sizes shall be within manufacturing tolerances allowed by the standard under which product is produced.
 - 2. Millwork, standing and running trim, and rails: Actual size as shown or specified.
- C. Hardwood: MM-L-736, maple, clear grade.

2.2 PLASTIC LAMINATE

- A. NEMA LD-3.
- B. Exposed decorative surfaces including window sills.
- C. Backing sheet on bottom of plastic laminate covered wood tops. Backer Type BKL.

2.3 MDF

Moisture resistant ANSI 2209-2-2002, Grade 140-MR10.

2.4 SOLID WOOD

Wood required for edge banding moldings; legs shall be of same species as wood-face veneer.

2.5 EDGE BANDING

3mm PVC edgeband, color as selected by COTR.

2.6 HARDWARE

Rough Hardware:

1. Furnish rough hardware with a standard plating, applied after punching, forming and assembly of parts; galvanized, cadmium plated, or zinc-coated by electric-galvanizing process. Galvanized where specified.
2. Use galvanized coating on ferrous metal for exterior work unless non-ferrous metals or stainless is used.
3. Fasteners:
 - a. Bolts with Nuts: FF-N-836.
 - b. Expansion Bolts: A-A-1922A.
 - c. Screws: Fed. Spec. FF-S-111.

2.3 MOISTURE CONTENT

A. Moisture content of lumber and millwork at time of delivery to site.

1. Interior finish lumber, trim, and millwork 32 mm (1-1/4 inches) or less in nominal thickness: 12 percent on 85 percent of the pieces and 15 percent on the remainder.
2. Exterior treated or untreated finish lumber and trim 100 mm (4 inches) or less in nominal thickness: 15 percent.
3. Moisture content of other materials shall be in accordance with the standards under which the products are produced.

2.4 FABRICATION

A. General:

1. Except as otherwise specified, use AWI Custom Grade for architectural woodwork and interior millwork.
2. Finish woodwork shall be free from pitch pockets, knots, discolored areas.
3. Except where special profiles are shown, trim shall be standard stock molding and members of the same species.

4. Fabricate members less than 4 m (14 feet) in length from one piece of lumber, back channeled and molded as shown.
5. Interior trim and items of millwork to be painted may be fabricated from jointed, built-up, or laminated members, unless otherwise shown on drawings or specified.

PART 3 - EXECUTION

3.1 ENVIRONMENTAL REQUIREMENTS

- A. Maintain work areas and storage areas to a minimum temperature of 21⁰C (70⁰F) for not less than 10 days before and during installation of interior millwork.
- B. Do not install finish lumber or millwork in any room or space where wet process systems such as concrete, masonry, or plaster work is not complete and dry.

3.2 INSTALLATION

- A. General:
 1. Millwork receiving transparent finish shall be finished on concealed surfaces. Set no millwork until finished.
 2. Secure trim with fine finishing nails, screws, or glue as required.
 3. Set nails for putty stopping.
- B. Hardwood Trim
 1. Install in one piece and one length when practical
 2. Scarf joints at 45 degrees where joints are required.
 3. Recess fasteners below the surface of the wood; install with trim head screws for anchoring into steel studs or backing.
 4. Set in sealant at joint with wallcovering.
 5. Cover holes at fasteners and sand smooth.

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**SECTION 07210
BUILDING INSULATION**

PART 1 - GENERAL

1.1 DESCRIPTION:

- A. This section specifies thermal and acoustical insulation for buildings.
- B. Acoustical insulation is identified by thickness and words "Acoustical Insulation".

1.2 RELATED WORK

- A. Insulation for insulated wall panels: Section 07410, PREFORMED WALL AND ROOF PANELS.
- B. Insulation in connection with roofing and waterproofing: Section 07220, ROOF AND DECK INSULATION.
- C. Safing insulation: Section 07270, FIRESTOPPING SYSTEMS.

1.3 SUBMITTALS:

- A. Submit in accordance with Section 01340, SAMPLES AND SHOP DRAWINGS.
- B. Manufacturer's Literature and Data:
 - 1. Insulation, each type used
 - 2. Adhesive, each type used.
 - 3. Tape
- C. Certificates: Stating the type, thickness and "R" value (thermal resistance) of the insulation to be installed.

1.4 STORAGE AND HANDLING:

- A. Store insulation materials in weathertight enclosure.
- B. Protect insulation from damage from handling, weather and construction operations before, during, and after installation.

1.5 APPLICABLE PUBLICATIONS:

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
 - C553-02.....Mineral Fiber Blanket Thermal Insulation for
Commercial and Industrial Applications
 - C612-00.....Mineral Fiber Block and Board Thermal
Insulation
 - E84-03.....Surface Burning Characteristics of Building
Materials

PART 2 - PRODUCTS

2.1 INSULATION - GENERAL:

- A. Where thermal resistance ("R" value) is specified or shown for insulation, the thickness shown on the drawings is nominal. Use only insulation with actual thickness that is not less than that required to provide the thermal resistance specified.
- B. Where "R" value is not specified for insulation, use the thickness shown on the drawings.
- C. Where more than one type of insulation is specified, the type of insulation for each use is optional, except use only one type of insulation in any particular area.
- D. Insulation Products shall comply with following minimum content standards for recovered materials:

Material Type	Percent by Weight
Glass fiber reinforced	6 percent recovered material

The minimum-content standards are based on the weight (not the volume) of the material in the insulating core only.

2.2 EXTERIOR FRAMING OR FURRING INSULATION:

- A. Batt or Blanket: Optional.
- B. Mineral Fiber: ASTM C665, Type II, Class C, Category I where framing is faced with gypsum board.
- C. Mineral Fiber: ASTM C665, Type III, Class A where framing is not faced with gypsum board.

2.5 ACOUSTICAL INSULATION:

- A. Mineral Fiber boards: ASTM C553, Type II, flexible, or Type III, semirigid (4.5 pound nominal density).
- B. Mineral Fiber Batt or Blankets: ASTM C665. Maximum flame spread of 25 and smoke development of 450 when tested in accordance with ASTM E84.
- C. Thickness as shown; of widths and lengths to fit tight against framing.

2.6 SOUND DEADENING BOARD:

Mineral Fiber Board: ASTM C612, Type IB, 13 mm (1/2 inch thick).

2.7 RIGID INSULATION:

- A. On the inside face of exterior walls, spandrel beams, floors, bottom of slabs, and where shown.
- B. Mineral Fiber Board: ASTM C612, Type IB or 2.

2.8 FASTENERS:

- A. Staples or Nails: ASTM F1667, zinc-coated, size and type best suited for purpose.
- B. Screws: ASTM C954 or C1002, size and length best suited for purpose with washer not less than 50 mm (two inches) in diameter.
- C. Impaling Pins: Steel pins with head not less than 50 mm (two inches) in diameter with adhesive for anchorage to substrate. Provide impaling pins of length to extend beyond insulation and retain cap washer when washer is placed on the pin.

2.10 ADHESIVE:

- A. As recommended by the manufacturer of the insulation.

2.11 TAPE:

- A. Pressure sensitive adhesive on one face.
- B. Perm rating of not more than 0.50.

PART 3 - EXECUTION

3.1 INSTALLATION - GENERAL

- A. Install insulation with the vapor barrier facing the heated side, unless specified otherwise.
- B. Install rigid insulating units with joints close and flush, in regular courses and with cross joints broken.
- C. Install batt or blanket insulation with tight joints and filling framing void completely. Seal cuts, tears, and unlapped joints with tape.
- D. Fit insulation tight against adjoining construction and penetrations, unless specified otherwise.

3.2 EXTERIOR FRAMING OR FURRING BLANKET INSULATION:

- A. Pack insulation around door frames and windows and in building expansion joints, door soffits and other voids. Pack behind outlets around pipes, ducts, and services encased in walls. Open voids are not permitted. Hold insulation in place with pressure sensitive tape.
- B. Lap vapor retarder flanges together over face of framing for continuous surface. Seal all penetrations through the insulation.
- C. Fasten blanket insulation between metal studs or framing and exterior wall furring by continuous pressure sensitive tape along flanged edges.
- D. Fasten blanket insulation between wood studs or framing with nails or staples through flanged edges on face of stud. Space fastenings not more than 150 mm (six inches) apart.

3.3 ACOUSTICAL INSULATION:

- A. Fasten blanket insulation between metal studs and wall furring with continuous pressure sensitive tape along edges or adhesive.
- B. Pack insulation around door frames and windows and in cracks, expansion joints, control joints, door soffits and other voids. Pack behind outlets, around pipes, ducts, and services encased in wall or partition. Hold insulation in place with pressure sensitive tape or adhesive.
- C. Do not compress insulation below required thickness except where embedded items prevent required thickness.
- D. Where semirigid insulation is used which is not full thickness of cavity, adhere to one side of cavity maintaining continuity of insulation and covering penetrations or embedments in insulation.

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**SECTION 07220
ROOF AND DECK INSULATION**

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Installation of roof and deck insulation on new construction ready to receive roofing or waterproof membrane.

1.2 RELATED WORK

- A. Wood blocking and edge strips: Section 06100, ROUGH CARPENTRY.
- B. Perimeter, rigid, and batt or blanket insulation: Section 07210, BUILDING INSULATION.
- C. Sheet metal components: Section 07600, FLASHING AND SHEET METAL.
- D. Membrane roofing SECTION 07526 SBS MODIFIED BITUMINOUS SHEET ROOFING

1.3 QUALITY CONTROL

- A. Supervision of work by persons that are knowledgeable and experienced in roofing. See submittals for documentation of supervisors qualification.
- B. Unless specified otherwise, comply with the recommendations of the NRCA "Roofing and Waterproofing Manual" applicable to insulation for storage, handling, and application.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01340, SAMPLES AND SHOP DRAWINGS.
- B. Manufacturer's Literature and Data:
 - 1. Bonding Adhesive, each type
 - 2. Roofing cement, each type
 - 3. Roof insulation, each type
 - 4. Fastening / Adhesive coverage rate requirements
- C. Samples:
 - 1. Roof insulation, each type
 - 2. Roof Insulation adhered with adhesive
- D. Certificates:
 - 1. Indicating type, thickness and thermal conductance of insulation. (Average thickness for tapered insulation).
 - 2. Indicating materials and method of application of insulation system on metal decks meet the requirements of Factory Mutual Research Corporation for Class 1 Insulated Steel Deck Roofs.
- E. Layout of tapered roof system showing units required.

- F. Documentation of supervisors training and experience showing knowledge of roofing procedures.

1.5 DELIVERY, STORAGE AND MARKING

- A. Deliver materials to the site in original sealed packages or containers marked with the name and brand, or trademark of the manufacturer or seller.
- B. Keep materials dry, and store in dry, weathertight facilities or under canvas tarps. Use of polyethylene or plastic tarps to cover materials is not permitted. Store above ground or deck level on wood pallets. Cover ground under stored materials with plastic tarp.
 - 1. Store rolled materials (felts, base sheets, paper) on end. Do not store materials on top of rolled material.
 - 2. Store foam insulation away from areas where welding is being performed and where contact with open flames is possible.
- C. Protect from damage from handling, weather and construction operations before, during, and after installation.

1.6 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. Federal Specifications (Fed. Spec.):
 - UU-B-790A.....Building Paper, Vegetable Fiber: (Kraft, Waterproofed, Water Repellent and Fire Resistant)
- C. American Society for Testing and Materials (ASTM):
 - C208-95.....Cellulosic Fiber Insulating Board
 - C209-98.....Test Methods for Cellulosic Fiber Insulating Board
 - C552-00.....Cellular Glass Thermal Insulation
 - C726-00.....Mineral Fiber Roof Insulation Board
 - C728-97.....Perlite Thermal Insulation Board
 - C1289-98.....Faced Rigid Cellular Polyisocynurate Thermal Insulation Board
 - D41-94.....Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
 - D2178-97.....Asphalt Glass Felt Used in Roofing and Waterproofing

- D2822-91 (R-97).....Asphalt Roof Cement
- F1667-00.....Driven Fasteners: Nails, Spikes, and Staples
- D. Factory Mutual Engineering and Research Corporation (FM):
Construction Bulletin 1-28 Insulated Steel Decks.
P8016-88.....Specification Tested Product Guide
- E. National Roofing Contractors Association (NRCA):
The NRCA Roofing and Waterproofing Manual - Fourth Edition.
- F. Underwriters Laboratories, Inc. (UL):
Fire Resistance Directory
- G. U.S. Department of Commerce (NBS):
PS 1-83.....Construction and Industrial Plywood
- H. National Particleboard Association (NPA):
A208.1-93.....Mat-Formed Wood Particleboard

PART 2 - PRODUCTS

2.1 ASPHALT MATERIALS

- A. Primer: ASTM D41. Johns Manville Concrete Primer
- B. Asphalt: Johns Manville MBR 2 Part Bonding Adhesive for insulation.
- C. Roof Cement: ASTM D2822, Type I or Type II, asbestos free; or, D4586,
Type I or Type II. Johns Manville Bestile Industrial Roof Cement

2.2 INSULATION

- A. Perlite Board: ASTM C728. Johns Manville ½" DuraBoard
- B. Isocyanurate Board: ASTM C1289, Type II, Class 1, Grade 2. Johns
Manville E'NRG'Y 3 Polyisocyanurate Foam.
 - 1. Manufacturer shall mark each package, giving kind of chemical and
guarantee minimum quantity contained.
- G. Tapered Roof Insulation System Segments:
 - 1. Fabricate of isocyanurate per Johns Manville Tapered Design WA-2004-
868 as approved by architect.
 - 2. Cut to provide high and low points with crickets and slopes as
shown.

2.3 MISCELLANEOUS

- A. Building Paper (Sheathing Paper):
 - 1. Fed. Spec. UU-B-790, Type I, Barrier paper, Grade D, Water - Vapor
permeable, Style 1a, Uncreped, not reinforced; or, Style 1b,
Uncreped, not reinforced, red rosin sized.
 - 2. Weighing approximately 3 kg/10 m² (six pounds per 100 square feet).
- B. Tapered Edge Strips:

1. Tapered 1:12 (one inch per foot), from 0 mm (0 inches), 300 mm to 450 mm (12 inches to 18 inches) wide.
2. Perlite Board: ASTM C728.

2.4 FASTENERS

- A. Staples and Nails: ASTM F1667. Type as designated for item anchored and for substrate.
1. Type I, Style 20, zinc coated steel roofing nails with minimum head diameter of 10 mm (3/8 inch) through metal discs at least 25 mm (one inch) across; or,
 2. One piece nails with an integral flat cap at least 24 mm (15/16 inch) across.

2.5 RECOVERED MATERIALS

- A. Comply with following minimum content standards for recovered materials:

Material Type	Percent by Weight
Perlite composite board	23 percent post consumer recovered paper
Plastic rigid foams: Polyisocyanurate/polyurethane	
Rigid foam	9 percent recovered material

- B. The minimum-content standards are based on the weight (not the volume) of the material in the insulating core only.

PART 3 - EXECUTION

3.1 GENERAL

- A. Do not apply roof insulation if deck will be used for subsequent work platform, storage of materials, or staging or scaffolding will be erected thereon.
- B. Entire roof deck construction of any section of the building shall be completed before insulation system work is begun. Curbs, blocking, edge strips, and other components which insulation, roofing and base flashing is attached to shall be in place ready to receive insulation and roofing. Coordinate roof insulation operations with roofing and sheet metal work so that insulation is installed to permit continuous roofing operations.
- C. Insulation system materials shall be dry and damage free when applied. Do not use broken insulation or insulation with damaged facings. Remove damaged insulation from the site immediately.

- D. Dry out surfaces that become wet from any cause during progress of the work before roofing work is resumed. Apply materials only to dry substrates.
- E. Except for temporary protection specified, do not apply materials during damp or rainy weather, during excessive wind conditions, nor while moisture (dew, fog, snow, ice) or frost is present in any amount in or on the materials when temperature is below 10 °C (50 °F). Do not apply materials to substrate having temperature of 10 °C (50 °F) or less.
- F. Phased construction is not permitted. The complete installation of all flashing, insulation, and roofing shall be completed in the same day except for the area where temporary protection is required when work is stopped.

3.2 SURFACE PREPARATION

- A. Sweep decks to broom clean condition. Remove all dust, dirt or debris.
- B. Remove projections that might damage materials.
- C. Concrete Decks, Except Insulating Concrete:
 - 1. Test concrete decks for moisture prior to application of materials.
 - 2. Prime concrete decks with primer and allow to dry before application of bitumen.

3.4 SELECTION OF RIGID INSULATION

- A. Insulation Type:
 - 1. Use Johns Manville E'NRG'Y 3 polyisocyanurate board,
 - 2. Use not less than two layers of insulation unless specified otherwise.
 - 3. Use ½" thick Johns Manville DuraBoard
 - 4. Where tapered insulation is used, all insulation shall be factory tapered, except perlite board may be field tapered.
- B. Insulation Thickness:
 - 1. Thickness of roof insulation shown on drawings is nominal. Actual thickness shall provide the thermal resistance "R" value of an average R-30.
 - 2. When thickness of insulation to be used is more or less than that shown on the drawings, make adjustments in the alignment and location of roof drains, flashing, gravel stops, fascias and similar items at no additional cost to the Government.

3. Where tapered insulation is used, the thickness of the insulation at high points and roof edges shall be as shown on the drawings; the thickness at the low point (drains) shall be not less than 38 mm (1-1/2 inches).

3.5 INSTALLATION OF INSULATION

- A. Lay insulating units with close joints, in regular courses and with cross joints broken. When laid in more than one layer, break joints of succeeding layers of roof insulation with those in preceding layer. Only 4'x4' boards may be used. Bed insulation layers in Johns Manville 2 Part Bonding Adhesive firmly pressed into the adhesive.
- B. Cover all insulation installed on the same day by either:
 1. The roofing membrane as specified.
 2. Temporary protection as specified.
- D. Seal all cut edges at penetrations and at edges against blocking with bitumen or roof cement.
- E. Cut to fit tight against blocking or penetrations.
- F. Concrete Deck: Lay insulation in adhesive as specified.

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**SECTION 07253
SPRAYED-ON FIREPROOFING**

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies mineral fiber coverings to provide fire resistance to interior structural steel members shown. Work includes fireproofing on new structural steel and repair to damaged fireproofing on existing steel.

1.2 SUBMITTALS

- A. Submit in accordance with Section 01340, SAMPLES AND SHOP DRAWINGS.
- B. Manufacturer's Literature and Data:
 - 1. Manufacturer's complete and detailed application instructions and specifications.
 - 2. Manufacturer's repair and patching instructions.
- C. Certificates:
 - 1. Certificate from testing laboratory attesting fireproofing material and application method meet the specified fire ratings.
 - a. List thickness and density of material required to meet fire ratings.
 - b. Accompanied by complete test report and test record.
 - 2. Manufacturer's certificate indicating sprayed-on fireproofing material supplied under the Contract is same within manufacturing tolerance as fireproofing material tested.
- D. Miscellaneous:
 - 1. Manufacturer's written approval of surfaces to receive sprayed-on fireproofing.
 - 2. Manufacturer's written approval of completed installation.
 - 3. Manufacturer's written approval of the applicators of fireproofing material.

1.3 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver to job-site in sealed containers marked and labeled to show manufacturer's name and brand and certification of compliance with the specified requirements.
- B. Remove damaged containers from the site.
- C. Store the materials off the ground, under cover, away from damp surfaces.
- D. Keep dry until ready for use.

- E. Remove materials that have been exposed to water before installation from the site.

1.4 QUALITY CONTROL

- A. Test for fire endurance in accordance with ASTM E119, for fire rating specified, in a nationally recognized laboratory.
- B. Manufacturer's inspection and approval of surfaces to receive fireproofing as specified under paragraph Examination.
- C. Manufacturer's approval of fireproofing applications.
- D. Manufacturer's approval of completed installation.
- E. Manufacturer's representative shall observe and advise at the commencement of application, and shall visit the site as required thereafter for the purpose of ascertaining proper application.
- F. Pre-Application Test Area.
 - 1. Apply a test area consisting of a typical overhead fireproofing installation, including not less than 4.5 m (15 feet) of beam and deck.
 - b. Apply for the hourly ratings used.
 - 2. Install in location selected by the COTR, for approval by the representative of the fireproofing material manufacturer and by the Government.
 - 3. Perform Bond test on painted steel in accordance with ASTM E736.
 - 4. Do not proceed in other areas until installation of test area has been completed and approved.
 - 5. Keep approved installation area open for observation as criteria for sprayed-on fireproofing.

1.5 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
 - E84-98.....Surface Burning Characteristics of Building Materials
 - E119-98.....Fire Tests of Building Construction and Materials
 - E605-93.....Thickness and Density of Sprayed Fire-Resistive Materials Applied to Structural Members

- E736-92.....Cohesion/Adhesion of Sprayed Fire-Resistive
Materials Applied to Structural Members
- E759-92.....The Effect of Deflection on Sprayed Fire-
Resistive Material Applied to Structural
Members
- E760-92.....Impact on Bonding of Sprayed Fire-Resistive
Material Applied to Structural Members
- E761-92.....Compressive Strength of Fire-Resistive Material
Applied to Structural Members
- E859-93.....Air Erosion of Sprayed Fire-Resistive Materials
Applied to Structural Members
- E937-93.....Corrosion of Steel by Sprayed Fire-Resistive
Material Applied to Structural Members
- G21-96.....Determining Resistance of Synthetic Polymeric
Materials to Fungi
- C. Underwriters Laboratories, Inc. (UL):
Fire Resistance Directory...Latest Edition including Supplements
- D. Warnock Hersey (WH):
Certification Listings..Latest Edition
- E. Factory Mutual System (FM):
Approval Guide.....Latest Edition including Supplements
- F. U.S. Department of Commerce:
NISTIR 5560, Fire Performance of an Interstitial Space Construction
System, Feb. 1995.

PART 2 - PRODUCTS

2.1 SPRAYED-ON FIREPROOFING

- A. ASTM E1042, Class (a), Category A except that the dust removed shall
not exceed 0.027 grams/m² (0.0025 g/ft²) of fire proofing material
applied.
 - 2. Type II, factory mixed mineral fiber with integral inorganic binders
minimum 240 kg/m³ (15 lb/ft³) density per ASTM E605 test unless
specified otherwise.
- B. Materials containing asbestos are not permitted.
- C. Fireproofing characteristics when applied in the thickness and density
required to achieve the fire-rating specified.

	Characteristic	Test	Results
1.	Deflection	ASTM E759	No cracking, spalling, or delamination when backing to which it is applied has a deflection up to 1/120 in 3m (10 ft.)
2.	Corrosion-Resistance	ASTM E937	No promotion of corrosion of steel.
3.	Bond Impact	ASTM E760	No cracking, spalling, or delamination.
4.	Cohesion/Adhesion (Bond Strength)	ASTM E736	Minimum cohesive/adhesive strength of 9.57 kPa (200 lbf/ft ²) for protected areas. 19.15 kPa (400 lbf/ft ²) for exposed areas.
5.	Air Erosion	ASTM E859	Maximum gain weight of the collecting filter 0.27gm/m ² (0.025 gm/ft ²).
6.	Compressive Strength	ASTM E761	Minimum compressive strength 36 kPa (5 lbf/in ²).
7.	Surface Burning Characteristics with adhesive and sealer to be used	ASTM E84	Flame spread 25 or less smoke developed 50 or less
8.	Fungi Resistance	ASTM G21	Resistance to mold growth when inoculated with aspergillus niger (28 days for general application)

2.2 ADHESIVE

- A. Bonding adhesive for Type II (fibrous) materials as recommended and supplied by the fireproofing material manufacturer.
- B. Adhesive may be an integral part of the material or applied separately to surface receiving fireproofing material.

2.3 SEALER

- A. Sealer for Type II (fibrous) material as recommended and supplied by the fireproofing material manufacturer.
- B. Surface burning characteristics as specified for fireproofing material.
- C. Fungus resistant.
- D. Sealer may be an integral part of the material or applied separately to the exposed surface. When applied separately use contrasting color pigmented sealer, white preferred.

2.4 WATER

- A. Clean, fresh, and free from organic and mineral impurities.

B. pH of 6.9 to 7.1.

2.5 MECHANICAL BOND MATERIAL

A. Expanded Metal Lath: ASTM C847, minimum weight of 0.92 kg/m² (1.7 pounds per square yard).

B. Fasteners: ASTM C841.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify surfaces to receive fireproofing are clean and free of dust, soot, oil, grease, water soluble materials or any foreign substance which would prevent adhesion of the fireproofing material.
- B. Verify hangers, inserts and clips are installed before the application of fireproofing material.
- C. Verify ductwork, piping, and other obstructing material and equipment is not installed that will interfere with fireproofing installation.
- D. Verify concrete work on steel decking and concrete encased steel is completed.
- E. Verify temperature and enclosure conditions are required by fireproofing material manufacturer.

3.2 APPLICATION

- A. Do not start application until written approval has been obtained from manufacturer of fireproofing materials that surfaces have been inspected by the manufacturer or his representative, and are suitable to receive sprayed-on fireproofing.
- B. Coordinate application of fireproofing material with other trades.
- C. Application of Metal Lath:
 - 1. Apply to beam and columns having painted surfaces which fail ASTM E736 Bond Test requirements in pre-application test area.
 - 2. Apply to beam flanges 300 mm (12-inches) or more in width.
 - 3. Apply to column flanges 400 mm (16-inches) or more in width.
 - 4. Apply to beam or column web 400 mm (16-inches) or more in depth.
 - 5. Tack weld or mechanically fasten on maximum of 300 mm (12-inch) center.
 - 6. See design criteria section of the approved assemblies used.
 - 7. Lap and tie lath member in accordance with ASTM C841.
 - 8. Attach to bottom of beams of the interstitial space.
- D. Mix and apply in accordance with manufacturer's instructions.
 - 1. Mechanically control material and water ratios.

2. Apply adhesive and sealer, when not an integral part of the materials, in accordance with the manufacturer's instructions.
3. Apply to density and thickness indicated in UL Fire Resistance Directory, FM Approval Guide, or WH Certification Listings unless specified otherwise. Test in accordance with ASTM E119.
4. Minimum applied dry density per cubic meter (cubic foot) for the underside of the walk on deck (interstitial) hung purlin or beam and steel deck, columns in interstitial spaces and mechanical equipment rooms shall be as follows:

Type II - 350 kg/m³ (22 lb/ft³).

- E. Application shall be completed in one area, inspected and approved by COTR before removal of application equipment and proceeding with further work.

3.3 FIELD TESTS

- A. Tests of applied material will be performed by VA retained Testing Laboratory. See Section 01410, TESTING LABORATORY SERVICES.
- B. COTR will select area to be tested in specific bays on each floor using a geometric grid pattern.
- C. Test for thickness and density in accordance with ASTM E605. Areas showing thickness less than that required as a result of fire endurance test will be rejected.
- D. Areas showing less than required fireproofing characteristics will be rejected on the following field tests.
 1. Test for cohesion/adhesion: ASTM E736.
 2. Test for bond impact strength: ASTM E760.

3.3 PATCHING AND REPAIRING

- A. Inspect after mechanical, electrical and other trades have completed work in contact with fireproofing material, but before sprayed material is covered by subsequent construction.
- B. Perform corrective measures in accordance with fireproofing material Manufacturer's recommendations.
 1. Respray areas requiring additional fireproofing material to provide the required thickness, and replace dislodged or removed material.
 2. Spray material for patching by machine directly on point to be patched, or into a container and then hand apply.
 3. Hand mixing of material is not permitted.
- C. Repair:

1. Respray all test and rejected areas.
2. Patch fireproofing material which is removed or disturbed after approval.

D. Perform final inspection of sprayed areas after patching and repair.

3.5 SCHEDULE

A. Apply fireproofing material in interior structural steel members and on underside of interior steel floor and roof decks.

B. Schedule:

1. Columns: two hours - full height.
2. Beams, Girders:
 - a. Perimeter beams and girders along the outside edges of the building above the interstitial floor: 2 hours
 - b. Perimeter beam of the interstitial floor: 2 hours
 - c. Beams and girders where no interstitial floor occurs: 2 hours
 - d. Beams forming the interstitial floor; bottom flange below the concrete: 2 hours
3. Floor construction: two hours.
4. Roof construction: one and one-half hours.

C. Where existing fireproofing is removed or damaged, repair to meet the existing fire rating, minimum 2 hours.

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**SECTION 07270
FIRESTOPPING SYSTEMS**

PART 1 GENERAL

1.1 DESCRIPTION

- A. Provide firestop systems consisting of a material, or combination of materials, installed to retain the integrity of fire-rated construction by maintaining an effective barrier against the spread of flame, smoke and/or hot gases through penetrations, blank openings, construction joints, or at a perimeter fire containment in or adjacent to fire-rated barriers.
- B. Firestop systems shall be used in locations including, but not limited to, the following:
 - 1. Penetrations through fire-resistance-rated floor assemblies, interstitial decks and roof assemblies requiring protected openings including both empty openings and openings that contain penetrations.
 - 2. Penetrations through fire-resistance-rated wall assemblies including both empty openings and openings that contain penetrations.
 - 3. Membrane penetrations in fire-resistance-rated wall assemblies where items penetrate one side of the barrier.
 - 4. Perimeter Fire Barrier System between a rated floor/roof and the exterior wall assembly.

1.2 RELATED WORK

- A. Spray applied fireproofing: Section 07253, SPRAYED ON FIREPROOFING (Mineral Fiber).
- B. Sealants and application: Section 07920, SEALANTS AND CAULKING.
- C. Fire and smoke damper assemblies in ductwork: Section 15840, DUCTWORK AND ACCESSORIES.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01340, SAMPLES AND SHOP DRAWINGS.
- B. Manufacturers literature, data, and installation instructions for types of firestopping and smoke stopping used.
- C. List of FM, UL, or WH classification number of systems installed.
- D. Certified laboratory test reports for ASTM E814 tests for systems not listed by FM, UL, or WH proposed for use.

1.4 DELIVERY AND STORAGE

- A. Deliver materials in their original unopened containers with manufacturer's name and product identification.
- B. Store in a location providing protection from damage and exposure to the elements.

1.5 GUARANTEE

Firestopping work subject to the terms of the Article GUARANTY of Section GENERAL CONDITIONS, except extend the guaranty period to five years.

1.6 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Provide firestopping System Design Listing by a testing and inspection agency in accordance with the appropriate ASTM Standard(s) per Article 1.4. A qualified testing and inspection agency may be UL, FM Research, Intertek Testing Services, Omega Point Laboratories (OPL) or another agency performing testing and follow-up inspection services for firestop materials that is acceptable to the authority having jurisdiction.
- B. Contractor Qualifications: Acceptable installer firms shall be:
 - 1. FM approved in accordance with FM STandar 4991 -- Approval of Firestop Contractors.
 - 2. Licensed by the State or local authority, where applicable.
 - 3. Shown to have successfully completed not less than five comparable scale projects.
 - 4. Firestop Contractors International Association Contractor Member in good standing.
- C. Single-Source Responsibility: Obtain firestop systems for each kind of penetration and construction condition indicated from a single manufacturer.
 - 1. Materials of different manufacture shall not be intermixed in the same firestop system or opening.
 - 2. Tested and listed firestop systems are to be used before an Engineering Judgment (EJ) or Equivalent Fire Resistance Rated Assembly (EFRRA) is installed.

1.7 REFERENCES

- A. Comply with applicable requirements of the following standards. Where those standards conflict with other specified requirements, the most restrictive requirement shall govern.

1. American Society for Testing and Materials (ASTM):
 - E 84 Test Method for Surface Burning Characteristics of Building Materials
 - E 119 Test Method for Fire Tests of Building Construction and Materials
 - E 136 Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°
 - E 814 Fire Tests of Through-Penetration Fire Stops
 - E 1399 Cyclic Movement and Measuring Minimum and Maximum Joint Widths
 - E 1966 Test Method for Resistance of Building Joint
 - E 2174 Standard Practice for On-Site Inspection of Installed Fire Stops
 - E 05.11.14 Standard Test Method for Determining the Fire Endurance of Perimeter Fire Barrier Systems Using the Intermediate-Scale, Multi-Story Test Apparatus (ISMA); ASTM permanent number assignment pending approval of Draft
2. Factory Mutual Engineering and Research Corporation (FM):

FM Approval Standard of Firestop Contractors - Class 4991
3. Firestop Contractors International Association (F.C.I.A.):

M.O.P. Manual of Practice
4. International Firestop Council (IFC):
 - a. Ref. 1 Recommended IFC Guidelines for Evaluating Firestop Engineering Judgments (April 2001)
 - b. Ref. 2 Inspectors Field Pocket Guide
5. National Fire Protection Association (NFPA):
 - a. NFPA 70 - National Electric Code
 - b. NFPA 101 - Life Safety Code
 - c. NFPA 221 - Fire Walls and Fire Barriers (preliminary to be released)
 - d. NFPA 251 - Fire Tests of Building Construction and Materials
6. Underwriters Laboratories, Inc. (UL):
 - a. UL 263 Fire Tests of Building Construction and Materials
 - b. UL 723 Surface Burning Characteristics of Building Materials
 - c. UL 1479 Fire-Tests of Through-Penetration Fire Stops
 - d. UL 2079 Tests for Fire Resistance of Building Joint Systems

1.8 SYSTEM PERFORMANCE REQUIREMENTS

- A. Penetrations: Provide and install firestopping systems that are produced to resist the spread of fire, and the passage of smoke and other gases according to requirements indicated, including but not limited to the following:
1. Firestop all penetrations passing through fire resistance rated wall and floor assemblies and other locations as indicated on the drawings.
 2. Provide and install complete penetration firestopping systems that have been tested and approved by third-party testing agency.
 3. F-Rated Through-Penetration Firestop Systems: Provide through-penetration firestop systems with F ratings indicated, as determined per ASTM E 814, but not less than one hour or the fire-resistance rating of the construction being penetrated.
 4. T-Rated Through-Penetration Firestop Systems: Provide firestop systems with T ratings, in addition to F ratings, as determined per ASTM E 814, where indicated by Code.

PART 2 - PRODUCTS

2.1 FIRESTOP SYSTEMS

- A. Use either factory built (Firestop Devices) or field erected (through-Penetration Firestop Systems) to form a specific building system maintaining required integrity of the fire barrier and stop the passage of gases or smoke.
- B. Through-penetration firestop systems and firestop devices tested in accordance with ASTM E814 or UL 1479 using the "F" or "T" rating to maintain the same rating and integrity as the fire barrier being sealed. "T" ratings are not required for penetrations smaller than or equal to 100 mm (4 in) nominal pipe or 0.01 m² (16 sq. in.) in overall cross sectional area.
- C. Products requiring heat activation to seal an opening by its intumescence shall exhibit a demonstrated ability to function as designed to maintain the fire barrier.
- D. Firestop sealants used for firestopping or smoke sealing shall have following properties:
1. Contain no flammable or toxic solvents.
 2. Have no dangerous or flammable outgassing during the drying or curing of products.

3. Water-resistant after drying or curing and unaffected by high humidity, condensation or transient water exposure.
 4. When used in exposed areas, shall be capable of being sanded and finished with similar surface treatments as used on the surrounding wall or floor surface.
- E. Firestopping system or devices used for penetrations by glass pipe, plastic pipe or conduits, unenclosed cables, or other non-metallic materials shall have following properties:
1. Classified for use with the particular type of penetrating material used.
 2. Penetrations containing loose electrical cables, computer data cables, and communications cables protected using firestopping systems that allow unrestricted cable changes without damage to the seal.
 3. Intumescent products which would expand to seal the opening and act as fire, smoke, toxic fumes, and, water sealant.
- F. Maximum flame spread of 25 and smoke development of 50 when tested in accordance with ASTM E84.
- G. FM, UL, or WH rated or tested by an approved laboratory in accordance with ASTM E814.
- H. Materials to be asbestos free.

2.2 SMOKE STOPPING IN SMOKE PARTITIONS

- A. Use silicone sealant in smoke partitions as specified in section SEALANTS AND CAULKING.
- B. Use mineral fiber filler and bond breaker behind sealant.
- C. Sealants shall have a maximum flame spread of 25 and smoke developed of 50 when tested in accordance with E84.
- D. When used in exposed areas capable of being sanded and finished with similar surface treatments as used on the surrounding wall or floor surface.

PART 3 - EXECUTION

3.1 EXAMINATION

Submit product data and installation instructions, as required by article, submittals, after an on site examination of areas to receive firestopping.

3.2 PREPARATION

- A. Remove dirt, grease, oil, loose materials, or other substances that prevent adherence and bonding or application of the firestopping or smoke stopping materials.
- B. Remove insulation on insulated pipe for a distance of 150 mm (six inches) on either side of the fire rated assembly prior to applying the firestopping materials unless the firestopping materials are tested and approved for use on insulated pipes.

3.3 INSTALLATION

- A. Do not begin work until the specified material data and installation instructions of the proposed firestopping systems have been submitted and approved.
- B. Install firestopping systems with smoke stopping in accordance with FM, UL, WH, or other approved system details and installation instructions.
- C. Install smoke stopping seals in smoke partitions.

3.4 INSTALLING PENETRATION FIRESTOPS

- A. General: Comply with the "System Performance Requirements" article in Part 1 and the through-penetration firestop manufacturer's installation instructions and drawings pertaining to products and applications indicated.
 - 1. Coordinate with other trades to assure that all pipes, conduit, cable and other items, which penetrate fire-rated construction, have been permanently installed prior to installation of firestop assemblies.
 - 2. Schedule the work to assure that partitions and all other construction that conceals penetrations are not erected prior to the installation of firestop and smoke seals.
- B. Install forming/damming materials and other accessories in accordance with manufacturer's written instructions.
- C. Install fill materials for through-penetration firestop systems by proven techniques to produce the following results:
 - 1. Completely fill voids and cavities formed by openings, forming materials, accessories and penetrating items.
 - 2. Install materials so they contact and adhere to substrates formed by openings and penetrating items.
 - 3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces.

3.5 INSTALLING PERIMETER FIRE BARRIER SYSTEM

- A. General: Comply with "System Performance Requirements" article in Part 1 and with the firestop manufacturer's installation and drawings pertaining to products and applications indicated.
- B. Install metal framing, curtain wall insulation, mechanical attachments, safing materials and firestop materials as applicable within the system design.

3.6 CLEAN-UP AND ACCEPTANCE OF WORK

- A. As work on each floor is completed, remove materials, litter, and debris.
- B. Do not move materials and equipment to the next-scheduled work area until completed work is inspected and accepted by the COTR.

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SECTION 07410
PREFORMED WALL AND ROOF PANELS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. All engineering, manufacturing and installation of the items listed by a single manufacturer and wall systems contractor certified by the manufacturer for proficiency in erecting the specified products. Metal wall panels and window system to be engineered by the panel manufacturer.
1. Steel faced factory foamed in-place wall panel units. Flat panels with integral reveals and profiled panels with universal joinery for use in either vertical or horizontal orientations.
 2. Integrated window system with thermal barrier, including glazing.
 3. Extruded aluminum trim related to the wall and window system and its intersection with adjacent materials.
 4. Louvers in the exterior wall.
 5. Sealants and gasketing between panels, windows and their intersections.
 6. Design and installation of the secondary support system.
 7. Flashings attached to other panel system elements.
 8. Alterations to existing panels as necessary to form a complete weatherproof assembly.

1.2 RELATED WORK

- A. Steel fabrications: Section 01340, SAMPLES AND SHOP DRAWINGS; Section 05120, STRUCTURAL STEEL; Section 13081, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.
- B. Glass and glazing related to the window system: Section 08810, GLASS AND GLAZING.
- C. Color and texture of finish: Section 09050, INTERIOR/EXTERIOR FINISHES, MATERIALS, AND FINISH SCHEDULE.
- D. Sealants: Section 07920, SEALANTS AND CAULKING.
- E. Flashing: Section 07600, FLASHING AND SHEET METAL.
- F. Windows: Section 08520, ALUMINUM WINDOWS.
- G. Louvers: Section 10200, LOUVERS AND WALL VENTS.

1.3 MANUFACTURER'S QUALIFICATIONS

- A. CENTRIA, 1005 Beaver Grade Road, Moon Township, PA 15108 products and services shall establish the minimum level of quality, performance, dimension and appearance required.
- B. Manufacturer and wall systems contractor shall demonstrate a minimum of ten years of experience in the successful completion of projects employing similar materials, applications and performance requirements. Manufacturer certifies that the following contractors have attended the required training seminars, and are qualified to bid and execute this work.
 - 1. (Crown Corr Inc, Rodney Bassett, 360 335 9433)
 - 2. (McKinstry, Rod Smith, 206 762 3311)
 - 3. (Northshore Sheetmetal, Dave Masters, 425 487 1111)
- C. Manufacturer and wall systems contractor shall provide a list of five similar completed projects with addresses of the location, architect and owner.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01340, SAMPLES AND SHOP DRAWINGS.
- B. Samples: Metal panel, 150 mm (six inch) square, showing finish, each color and texture.
- C. Shop and erection drawings shall clearly illustrate the details required to comply with the performance requirements specified including interface of the wall and window system with adjoining construction.
 - 1. Materials and finish for each component shall be defined.
 - 2. Erection procedures will be included where required to clearly explain proper installation of fasteners, trim, gaskets and sealants.
 - 3. Calculations supporting structural performance shall be prepared and drawings stamped by a Professional Engineer in the state of Washington.
 - 4. Samples shall be submitted to illustrate the panel design, texture, color and other features specified.
- D. Manufacturer's Literature and Data: Wall and roof panels
- E. Submit test reports and certifications to demonstrate compliance with performance requirements and building code acceptance specified.

1.5 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extend referenced. The publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
 - A36/A36M-00.....Structural Steel
 - A653/A653M-01.....Steel Sheet, Zinc-Coated (Galvanized), or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - A463-01.....Steel Sheet, Cold-Rolled, Aluminum-Coated, by the Hot-Dip Process
 - A611-97.....Structural Steel, Sheet, Carbon, Cold-Rolled
 - A924/A924M-99.....Steel Sheet, Metallic Coated by the Hot-Dip Process
 - B209/209M-01.....Aluminum and Aluminum Alloy Sheet and Plate
 - C442-99.....Gypsum Backing Board, Gypsum Coreboard, and Gypsum Shaftliner Board
 - C553-00.....Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
 - C591-00.....Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation
 - C612-00.....Mineral Fiber Block and Board Thermal Insulation
 - E119-00.....Fire Test of Building Construction and Materials
- C. National Association of Architectural Metal Manufacturers (NAAMM):
 - AMP 500 Series Metal Finishes Manual

1.6 SUBSTITUTIONS

- A. Materials, accessories and testing specified shall establish the minimum level of quality, performance, dimension and appearance required of any substitution. Specified system incorporates foamed in place construction with a vented and drainable pressure equalization chamber providing true curtainwall performance. Only fabricated thin composites with comparable joinery, equivalent insulation and a separate vapor barrier can be considered "as equal")

- B. Laminated panels manufactured utilizing glue and board stock insulation will not be considered an acceptable substitution for the specified Foamed in Place manufactured panels.
- C. No substitution will be considered unless written request for approval has been received by the specifying architect at least ten days prior to the established bid date. Evidence shall be submitted to demonstrate equivalency to the products and performance levels specified. Laminated panels shall not be considered acceptable substitutes for the specified foamed in-place panels.
 - 1. A complete description of the substitution including details referenced to the wall and window conditions shown on the contract drawings.
 - 2. Independent test reports verifying compliance with specified performance requirements.
 - 3. A detailed listing of each specification item with which the substitution does not fully comply.
- D. The manufacturer or wall systems contractor proposing the substitute shall pay the costs of any other subcontractor affected by the proposed substitute.

1.8 PERFORMANCE

- A. Panels, windows and secondary support systems shall be designed for component and cladding wind loads determined in accordance with the more stringent of the local building code or ASCE 7-02 for the parameters specified.
 - 1. Building Classification enclosed
 - 2. Importance Factor 1.15
 - 3. Exposure Category B
 - 4. Basic Wind Speed 85 mph
- B. Secondary supports for the window and wall system shall be designed in accordance with AISC or Aluminum Association design procedures.
 - 1. Secondary supports shall not vary from the theoretical plane by more than the specified tolerances. (Note: These are more stringent than AISC or ACI tolerances to ensure optimal appearance and performance of the wall system.)
 - a. $\frac{3}{4}$ inch in any 20-foot length vertically or horizontally.
 - b. $\frac{1}{2}$ inch in any building elevation.
 - c. $\frac{1}{8}$ inch within 5 feet of any change in plane such as corners and

soffits.

- C. The wall and window system or secondary supports shall be designed to allow differential movement of the buildings roof and floor structures. The wall panel system shall accommodate the following building movements without damage to the panel system or other building elements and without losing weathertight condition.

Deflection of beams:	Maximum 1.5"
Interstory drift, moment-frame direction	2.46"
Interstory drift, braced-frame direction:	1.72"

- D. Performance of the wall and window system shall be verifiable with tests witnessed or conducted by independent agencies.
1. Structural performance of the wall panels shall be derived from ASTM E72 Chamber Method with a deflection limit of 1/180 applied to positive load. Ultimate structural values shall be achieved without the use of backside mechanical attachments to the structure.
 2. There shall be no evidence of delamination of the wall panels after two million cycles of positive and negative L/180 deflection.
 3. Thermal performance of the wall panels shall be based on tests in accordance with ASTM C236 corrected to 15 mph outside and still air inside. Tests shall include side-joint, standard fastening and integral reveals or profiling. Where reveals exceed the standards the manufacturer shall provide similar testing to document any adjustments required to the standard conditions.
 - a. R value for 2" flat panel shall be 14
 4. Air infiltration of the wall panels and windows shall not exceed .06 CFM/Ft² at a static pressure of 6.24 PSF (equivalent to 49 mph wind) when tested in accordance with ASTM E283.
 5. There shall be no uncontrolled water penetration through the panel joints and integrated window, louver or sunscreen components at 12 PSF (equivalent to 68.5 mph wind) when tested in accordance with ASTM E331.
 6. The standard horizontal panel joint shall demonstrate effective rain screen and pressure equalization principles with liner seals broken at a static pressure of 12 PSF (equivalent to 68.5 mph wind) when tested in accordance with ASTM E331. Effective performance shall mean no water rising within the equalization chamber, leakage to the

interior and the ability of any dynamically driven water to drain to the exterior.

1.8 BUILDING CODE ACCEPTANCE

- A. Wall panel system shall comply with requirements for foam plastics and finished panel performance as established by the applicable building code for use where non-load bearing, non-combustible wall construction is permitted. Laboratory and full scale testing including, but not limited to the following shall be available. (Note: Tests of building units shall be conducted with the joinery, sealant, clips and fastening intended for the project.)
1. Foam core and interior surface of the complete panel system shall demonstrate compliance with the following criteria for surface burning characteristics per UL Standard 723 (ASTM E84).
Flame Spread - 25* or less
Smoke Developed - 450 or less
* Numerical flame spread ratings are not intended to reflect hazards presented by these materials under actual fire conditions.
 2. Classified as Building Units for Interior Building Construction per UL Standard 1715.
 3. Classified as a component of fire rated non-load bearing wall assemblies per UL Standard 263.
 4. Approved per FM Standard 4880 as a Class 1 insulated wall and/or ceiling panel.
 5. Evaluated per UBC 26-9 Intermediate Scale Fire Test for flammability characteristics of exterior non-load bearing wall panel assemblies.
 6. Ignition temperature of the foam plastic core shall have been established per ASTM D1929.
 7. Panels shall be approved for use without the requirement of thermal barrier or automatic sprinkler.

1.9 WARRANTY

- A. The manufacturer shall warrant for a period of five years that the wall and window system materials will be free from defects. The wall systems contractor shall warrant for a period of five years that the installation workmanship will be free from defects.
- B. Painted finish warranties shall be the paint manufacturer's standard for wall panels and finished extrusions.

- C. Glass warranties shall be the standard for the manufacturer of those items.

PART 2 - PRODUCTS

2.1 BASIS OF DESIGN

- A. CENTRIA Formawall Dimension Series FWDS2H
 1. 2" thickness in the main panel field, no reveals.
 2. Panel size to match existing construction.
 3. Reveal width for vertical panels is 1/8 .
 4. The face of the panel shall be smooth 22gage or heavier material.
 5. The liner of the panel shall be non-directionally embossed and planked with 26 gage or heavier material.
- B. Joinery for flat panels.
 1. Universal double tongue and groove joint that can be used vertically and horizontally and can join any combination of flat and profiled panel units.
 2. Adjustable plus 1/16-inch to minus 1/8-inch from the specified panel module.
 3. Horizontal joints shall have a positive drip edge, sloped drain shelf and integral venting to the exterior where required along the panel length and a 2-3/8-inch gutter interlock to provide effective rain screen and pressure equalized performance as demonstrated by testing specified in 1.04, D, 6.
 4. Joinery shall be designed to be fully drainable to prevent entrapment of moisture present during the storage and construction processor due to dynamically driven rain. Gutter interlock shall be designed to prevent moisture from becoming trapped within the foam core and shall clearly demonstrate the ability of moisture to escape to the exterior.
- C. Trimless ends where used shall be integral to the panel face or tabbed and effectively sealed to the inside surface of the panel face with no edges exposed to view.
- E. Panels shall be foamed in-place between the metal skins so that no internal voids exist that could trap moisture or condensation and so that the initial insulating integrity of the foam core is preserved by the impermeable steel skins.
- F. All panel skins shall be roll formed to insure consistency of shape and joinery.

- G. Panel attachment clips shall be designed to prevent crushing of the foam core during fastening and shall mechanically engage both face and liner elements to the panel supports.
- H. The polyisocyanurate foam core shall have a minimum density of 2.7 PCF and minimum tensile and compressive strength of 20 PSI.

2.02 INTEGRATED WINDOW DESIGN

- A. Window integration extrusions shall be supplied by the panel manufacturer and be designed to be fully compatible with the panels and secondary support system.
 - 1. Head, jamb, and sill extrusions shall be designed to receive the specified window system and integrate with the Formawall Dimension Series Panels.
 - 2. Minimum extrusion thickness shall be 1/16 inch for trim, stops and appendages and 3/32 inch for structural components.
 - 3. Where required, the window system shall allow up to ¼ inch of differential floor movement.
 - 4. Glazing gaskets, sealants, fasteners, setting and splice blocks shall be included as required for a complete window system.
 - 5. Units shall be re-glazeable without dismantling the system. .
 - 6. Head, sill and jamb extrusions shall be thermally broken.
 - 7. Glazing, as specified under 08810, shall be furnished as part of the window system.

2.03 TRIM

- A. Extruded trim shall be furnished by the panel manufacturer. Installation shall be by the certified wall systems contractor except for those that require completion of work by other trades such as gravel stops.

2.04 MATERIALS AND FINISHES

- A. Panels
 - 1. Exterior skin of the flat panels with integral reveals shall be ASTM A653, grade 37, 22 G90 galvanized steel.
 - 2. Interior skin for all panels shall be ASTM A653, grade 37, 26 gage G90 galvanized steel.
 - 3. Exterior finish on G90 galvanized steel shall be DURAGARD, DURANAR SUNSTORM, OR DURANAR XLE FINISH as selected by the COTR.

4. Interior finish shall consist of 0.2 mil primer with 0.6 mil acrylic in Arctic Ice color or other finish and color from the manufacturer's standards.

B. Integrated Windows

1. Extrusion material shall be 6063 - T5 aluminum.

2. All exposed extrusion areas shall be clear anodized aluminum.

a. Interior shall be finished with PVDF or other finish from the manufacturers standards.

C. Trim

1. Extrusion material shall be 6063 - T5 aluminum

2. All exposed areas shall be clear anodized aluminum.

D. All materials used in the manufacture of Formawall Dimension Series and related trim shall be Made in the USA.

2.05 SECONDARY SUPPORT MEMBERS

A. Contractor supplying the preformed wall and roof panels shall also be responsible for the design and installation of the secondary steel support system.

B. The secondary support system is to be shop primed and touched up after installation.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install panels in accordance with the manufacturer's approved erection instructions and diagrams, except as specified otherwise. Panels shall be in full and firm contact with supports and with each other at side and end laps. Where panels are cut in the field, or where any of the factory applied coverings or coatings are abraded or damaged in handling or installation, they shall, after the necessary repairs have been made with material of the same type and color as the weather coating, be approved before being installed. All cut ends and edges, including those at openings through the sheets shall be sealed completely. Correct defects or errors in the materials in an approved manner. Replace materials which cannot be corrected in an approved manner with nondefective material. Provide molded closure strips where indicated and whenever sheets terminate with open ends after installation.

B. INSPECTION

1. Final alignment of the secondary steel supports for the wall and window system shall be checked and approved by the wall systems contractor prior to panel installation.
2. All materials shall be inspected for damage and conformance to the specifications and shop drawings prior to installation.

C. FABRICATION

1. The wall and window components shall be prefabricated for field assembly in accordance with the procedures and details shown on the shop drawings.
2. The wall panels shall be fabricated in accordance with the quality procedures established for the specified UL classifications, FM and building code approvals.

D. INSTALLATION

1. Manufacturer shall provide detailed instructions covering the tools, fasteners, sealants, gaskets, and procedures required to assure performance of the wall and window assembly as specified.
2. Install the wall and window system, fasteners, trim and related items in accordance with dimensions and procedures shown on the approved shop and erection drawings.
3. Sealants and gaskets shall be installed where shown and in accordance with the approved shop and erection drawings to assure air and water infiltration performance specified.
4. Windows shall be glazed in accordance with the approved shop and erection drawings and the Flat Glass Manufacturers Association standards.
5. Paint, bituminous coating, or sealant as recommended by the manufacturer shall separate dissimilar metals .
6. Work shall be coordinated with other trades as required to insure proper flashing and seals to intersecting construction.

- E. Wall Panels: Apply panels with the configuration in a vertical position. Seal side and end laps with joint sealing material. Flash and seal walls at the base, at the top, around windows, door frames, framed louvers, and other similar openings. Install closure strips, flashings, and sealing material in an approved manner that will assure complete weather tightness. Flashing will not be required where approved "self-flashing" panels are used.

- F. Flashing: All flashing and related closures and accessories in connection with the preformed metal panels shall be provided as indicated and as necessary to provide a watertight installation. Details of installation, which are not indicated, shall be in accordance with the panel manufacturer's printed instruction and details, or the approved shop drawings. Installation shall allow for expansion and contraction of flashing.
- G. Fasteners: Fastener spacings shall be in accordance with the manufacturer's recommendations, and as necessary to withstand the design loads indicated. Install fasteners in valleys or crowns as recommended by the manufacturer of the sheet being used. Install fasteners in straight lines within a tolerance of 13 mm (1/2-inch) in the length of a bay. Drive exposed penetrating type fasteners normal to the surface, and to a uniform depth to seat gasketed washers properly, and drive so as not to damage factory applied coating. Exercise extreme care in drilling pilot holes for fastenings to keep drills perpendicular and centered in valleys, or crowns, as applicable. After drilling, remove metal filings and burrs from holes prior to installing fasteners and washers. Torque used in applying fasteners shall not exceed that recommended by the manufacturer. Remove panels deformed or otherwise damaged by over-torqued fastenings, and provide new panels. Remove metal shavings and filings from roofs on completion to prevent rusting and discoloration of the panels.

3.2 ISOLATION OF ALUMINUM

- A. Isolate aluminum in contact with or fastened to dissimilar metals other than stainless steel, white bronze, or other metal compatible with aluminum by one of the following:
1. Painting the dissimilar metal with a prime coat of Zinc-Molybdate followed by two coats of aluminum paint.
 2. Placing a non-abrasive tape or gasket between the aluminum and the dissimilar metal.
- B. Paint aluminum in contact with or built into concrete with a coat of alkali-resistant bituminous paint.
- C. The wall systems contractor shall remove all protective materials and labels from the wall and window system as the system is erected.
- E. Damage caused by the manufacturer or wall systems contractor shall be replaced or repaired to as new condition.

F. The construction manager for the project shall inspect and approve each completed wall and window area and be responsible for protection of completed work from damage by other trades.

3.3 PROTECTION AND CLEANING

A. Protect panels and other components from damage during and after erection, and until project is accepted by the Government.

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SECTION 07526
SBS MODIFIED BITUMINOUS SHEET ROOFING

1.1 DESCRIPTION:

- A. This section specifies two-ply, torch-down modified bituminous sheet roofing and base flashing installed on new construction with granular surface.

1.2 RELATED WORK:

- A. Wood cants, blocking and wood edge strips: Section 06100, ROUGH CARPENTRY.
- B. Sheet metal components: Section 07600, FLASHING AND SHEET METAL.
- C. Miscellaneous items: Section 07700, ROOF SPECIATIES AND ACCESSORIES.
- D. Insulating Concrete Systems: Section 03520, INSULATING CONCRETE; SECTION 03521, INSULATING CONCRETE COMPOSITE.
- E. Roof Insulation under Membrane: Section 07220, ROOF AND DECK INSULATION.
- F. Roof Insulation on top of Membrane: Section 07221, PROTECTIVE MEMBRANE ROOF INSULATION.

1.3 QUALITY CONTROL:

- A. Supervision of work by persons that are knowledgeable and experienced in roofing.
- B. Unless specified otherwise, comply with the recommendations of the NRCA "Roofing and Waterproofing Manual" applicable to modified bituminous sheet roofing for storage, handling and application.
- C. Applicator licensed by manufacturer, Johns Manville Peak Advantage Contractor.

1.4 SUBMITTALS:

- A. Submit in accordance with Section 01340, SAMPLES AND SHOP DRAWINGS.
- B. Manufacturer's Literature and Data:
 - 1. Asphalt materials.
 - 2. Modified bituminous sheet roofing.
 - 3. Roofing cement.
 - 4. Roof walkway (asphalt plank).
 - 5. Fastening requirements.
 - 6. Application instructions.
- C. Samples:
 - 1. Nails and fasteners, each type.
 - 2. Cutout samples in plastic bag after testing.

- D. Certificates: Indicating materials and method of application of roofing system meets requirements of Factory Mutual Research Corporation for 1-90 Roofs.
- E. Guarantee: As specified.
- G. Documentation of supervisors training and experience showing knowledge of roofing procedure.

1.5 DELIVERY, STORAGE AND MARKING:

- A. Deliver materials to the site in original sealed packages or containers marked with the name and brand, or trademark of the manufacturer or seller.
- B. Keep materials dry, and store in dry, weathertight facilities or under canvas tarps. Use of polyethylene or plastic tarps to cover materials is not permitted:
 - 1. Store above ground or deck level on wood pallets. Cover ground under pallet stored materials with plastic tarp.
 - 2. Store rolled materials on end. Do not store materials on top of rolled materials.
- C. Protect from damage from handling, weather and construction operations before, during, and after installation.

1.6 GUARANTEE:

Roofing work subject to the terms of the Article GUARANTEE of Section, GENERAL CONDITIONS, except extend guarantee period to two years from acceptance of facility from the contractor.

1.7 APPLICABLE PUBLICATIONS:

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. Federal Specifications (Fed. Spec.):
 - UU-B-790A.....Building Paper, Vegetable Fiber: (Kraft, INT AMD 1 Waterproofed, Water Repellent And Fire Resistant)
- C. American Society for Testing and Materials (ASTM):
 - C90-02.....Load Bearing Concrete Masonry Units.
 - D41-94(R2000).....Asphalt Primer Used in Roofing, Dampproofing and Waterproofing

D226-97.....Asphalt-Saturated Organic Felt Used in Roofing
Waterproofing

D312-00.....Asphalt Used in Roofing

D3617-02.....Sampling And Analysis of New Built-up Roof
Membranes

D4586-00.....Asphalt Roof Cement, Asbestos Free

D6163-01.....Styrene Butadiene Styrene (SBS) Modified
Bituminous Sheet Materials Using Glass Fiber
Reinforcements

D. Factory Mutual Engineering and Research Corporation (FM):
Annual issue.....Approval Guide Building Materials.

E. Underwriters Laboratories, Inc. (UL):
Annual issue.....Building Materials Directory
Annual issue.....Fire Resistance Directory

F. Warnock Hersey (WH):
Annual issue.....Certification Listings

G. National Roofing Contractors Association (NRCA):
The NRCA Roofing and Waterproofing Manual - Fifth Edition.

PART 2 - PRODUCTS

2.1 ASPHALT MATERIALS:

A. Primer: ASTM D41. Johns Manville Concrete Primer

E. Roof Cement: ASTM D4586, Type I. Johns Manville Bestile Industrial
Roof Cement.

F. Modified Asphalt Sheet:

1. A heat-weld applied membrane composed primarily of SBS modified
asphalt material fabricated in sheet form and designed for roofing
exposed to the weather.

2. Reinforced sheet with glass fiber,

3. Cap Sheet ASTM D6163, Type I, Grade G Johns Manville DynaWeld Cap
FR.

4. Base Sheet ASTM D6163 Type I, Grade S Johns Manville DynaWeld Base.

G. Building Paper (Sheathing Paper):

1. Fed. Spec. UU-B-790, Type I, Barrier paper, Grade D, Water-Vapor
permeable, Style 1a, Uncreped, not reinforced; or, Style 1b,
Uncreped, not reinforced; red rosin sized.

2. Weighing approximately 0.3 Kg/m² (six pounds per 100 square feet.).

2.2 ROOF WALKWAY:

A. Johns Manville DynaTred 7/16" Thick 32" x 32"

2.3 FASTENERS:

A. Nails for securing built-up flashing and base sheets to wood nailers and deck:

1. Zinc coated steel roofing nails with minimum head diameter of 10 mm (3/8-inch) through metal discs at least one inch across.

2. Nails with an integral flat cap at least 24 mm (15/16-inch) across.

B. Fasteners for securing building paper and dry felt edge strips to wood nailer and decks:

1. Zinc coated steel roofing nails, 16 mm (5/8-inch) minimum head diameter.

2. Flat top crown, zinc coated.

C. Nails for Plywood:

1. Use annular thread type and length to penetrate plywood at least 19 mm (3/4-inch).

2. Through flat cap at least 24 mm (15/16-inch) across.

D. Nails for Securing Built-up Flashing to Masonry:

1. Hardened steel nails through metal discs at least 25 mm (one inch) in diameter.

2. One piece nails with an integral flat cap at least 24 mm (15/16-inch) across.

PART 3 - EXECUTION

3.1 GENERAL:

A. Do not apply roofing if deck will be used for subsequent work platform, storage of materials, or staging or scaffolding will be erected thereon unless system is protected.

B. Entire roof deck construction of section of the building shall be completed before roofing work is begun.

1. Install curbs, blocking, edge strips, cants, and other components where insulation, roofing and base flashing is attached to, in place ready to receive insulation and roofing.

2. Coordinate roof operations with roof insulation and sheet metal work so that insulation and flashings are installed concurrently to permit continuous roofing operations.

C. Apply dry roofing materials.

D. Dry out surfaces, apply materials to only dry substrates.

- E. Except for temporary protection, do not apply materials during damp or rainy weather, during excessive wind conditions, nor while moisture (dew, snow, ice, fog or frost) is present in any amount in or on the materials to be covered or installed:
1. Do not apply materials when the temperature is below 10°C (50 degrees F).
 2. Do not apply materials to substrate having temperature of 10°C (50 degrees F) or less.
- F. Phased construction is not permitted. Complete roofing membrane in the same day, including insulation, base flashings, and stripping except for the area where temporary protection is required when work is stopped.
- G. Temporary Protection:
1. Install temporary protection consisting of water cut offs at the end of day's work and when work is halted for an indefinite period or work is stopped when precipitation is imminent.
 2. Install temporary cap flashing over the top of base flashings where permanent flashings are not in place to provide complete protection against moisture entering the roof system through or behind the base flashing. Securely anchor in place to prevent blow off and damage by construction activities.
 3. Provide for removal of water or drainage of water away from the work.
 4. Provide temporary protection for roofing by means of duckboard walkways, plywood platforms, or other materials, as approved by COTR, for roof areas that are to remain intact, and that are subject to foot traffic and damage. Provide notches in sleepers to permit free drainage.
- I. Application of Materials with a torch:
1. Apply materials per manufacturers recommendations.
 2. Roll sheets, brushing down to firmly embed in the hot bitumen free of wrinkles, fish mouths, blisters, bubbles, voids, air pockets or other defects that prevent complete adhesion:
 - a. Lap sheets shingle fashion starting with starter strips at right angles to slope of roof.
 - b. Commence the laying of sheets at the low points.

3. Separate sheets or substrate so that subsequent plies do not touch previous placed sheets or substrate unless noted specifically.
4. Cut to fit closely around pipes, roof drains, bitumen stops, and similar roof projections.
5. Do not walk on roofing until bitumen has cooled hard and is not tacky.

J. Laps for Top Sheet and Base Sheet:

1. Base sheet, lapped 75 mm (three inches).
2. Use 450 mm (18 inch) starting widths, lap top sheet 475 mm (19 inches).
3. Lap end joints of sheet 150 mm (six inches). Stagger end joints in relation to end joints in adjacent and preceding plies. Granules must be buried.

K. Primer Use 4L/m² (one gallon of primer per 100 square feet) of surface area.

L. Nailing or Anchorage of Sheets to Nailable Decks:

1. Use nails or fasteners appropriate for type of deck.
 - a. Nail down along bottom edges at intervals not to exceed 225 mm (nine inches).
 - b. Nail down through last 475 mm (19-inch) wide sheet to both edges at intervals not to exceed 225 mm (9-inches).
 - c. Stagger nails down center of sheet in two rows 280 mm (11 inches) apart at intervals of not more than 450 mm (18 inches) in each row.
 - d. Nail to edge blocking at not more than 225 mm (9 inches) on center.

3.2 SURFACE PREPARATION:

- A. Sweep decks to broom clean condition. Remove all dust, dirt or debris.
- B. Remove projections that might damage materials.
- C. Concrete Decks:
 1. Apply roofing materials only to dry roof deck.
 2. Prime concrete decks, including precast units, with primer as specified. Keep primer back four inches from joints in precast units.
 3. Allow primer to dry before application of adhesive.

3.3 INSTALLATION OF MODIFIED BITUMEN MEMBRANE:

- A. General:

1. Where nailers occur at roof edges under gravel stops or penetrations to receive metal base flashing, nail a continuous strip of 400 mm (16-inch) wide dry organic felt envelope over the nailers before the first ply sheet is applied. Strip shall be installed on top of venting base sheet. After membrane is installed, turn the dry felt back over the roofing, and secure in place with hot bitumen before gravel stops or other metal flanges extending out onto the membrane are installed.
2. Where cants occur at vertical surfaces, cut off roofing sheets two inches above top of cant strips, except at prefabricated curbs, scuttles and other roof accessories having integral cants, extend membrane over cant and up vertical surface to top of curb or nailer as shown.
3. Where fascia-cant occurs at roof edges, extend membrane beyond outside cant face and cut off at outside after base flashing is installed.
4. Where reglet occurs at vertical surfaces, extend plies roofing sheets up into reglet the full depth of the reglet.

B. Roofing on Insulation:

Torch down membrane as specified.

3.4 BASE FLASHING:

- A. Provide built-up base flashing over cants and as necessary to make work watertight.
- B. Prime vertical surfaces of masonry and concrete with asphalt primer.
- C. Apply flashing on top of roofing, up face of cant and up the face of the vertical surface, at least 200 mm (eight inches) above the roofing but not more than 350 mm (14 inches) above the roofing, generally full height beneath counter flashing or top of curb flashing.
 1. At fascia-cants, extend to top of cant and cut off at top of cant.
 2. At reglet, extend full depth into the reglet.
- D. Use two plies of modified bituminous sheet.
 1. Extend the first ply 100 mm (four inches) out on the roofing, and the second ply 75 mm (three inches) beyond the first ply. Lap ends 75 mm (three inches) with joints broken 450 mm (18 inches) in each ply. Use smooth surface modified bituminous sheet for first ply.
 2. Use granular surfaced modified bitumen cap sheet.

- E. Set base flashing using heat-weld techniques.
- F. Except at metal fascia cants, secure top edge of base flashing with nails on a line approximately 25 mm (one inch) below top edge, spaced not more than 200 mm (eight inches) on center.
 - 1. Cover nail heads with roof cement.
 - 2. Cover the top of the base flashing with counterflashing as specified in Section 07600, FLASHING AND SHEET METAL. At the fascia cants secure the top edge of the flashing with fascia compression clamp as specified in Section 07600, FLASHING AND SHEET METAL.

3.5 STRIPPING:

- A. Coordinate to set flanges of metal flashing in roof cement on top sheet of the modified bituminous roofing and mailing to blocking with Section 07600.
- B. Cover that portion of the horizontal flanges of metal base flashings, gravel stops, and other flanges extending out onto the roofing with modified bituminous sheet.
- C. Extend the sheet out on the roofing 150 mm six inches beyond the edge of the metal flange. Cut edge to fit tight against vertical members of flange.
- D. Prime flange before stripping, embed sheet in hot bitumen.

3.6 ROOF WALKWAYS:

- A. Install roof walkways where shown.
- B. When prefabricated asphalt plank is used. Set the planks in Johns Manville MBR Utility Cement poured over the roof. Maintain minimum 75 mm (three inch) to maximum of 150 mm (six-inch) space between planks.

- - - E N D - - -

**SECTION 07600
FLASHING AND SHEET METAL**

PART 1 - GENERAL

1.1 DESCRIPTION

Formed sheet metal work for flashing and beam covers in interstitial space are specified in this section.

1.2 RELATED WORK

- A. Composition base flashing and stripping in metal roof flages: Section 07550, TWO-PLY MODIFIED BITUMINOUS SHEET ROOFING.
- C. Flashing components of factory finished roofing and wall systems: Section 07410, PREFORMED WALL AND ROOF PANELS.
- D. Sealant compound and installation: Section 07920, SEALANT AND CAULKING.
- E. Color of factory coated metal and anodized aluminum: Section 09050, INTERIOR/EXTERIOR FINISHES, MATERIALS, AND FINISH SCHEDULES.
- F. Integral flashing component of manufactured roof specialties and accessories or equipment: Section 07700, ROOF SPECIALTIES AND ACCESSORIES, and Division 15, MECHANICAL.
- G. Paint materials and application: Section 09900, PAINTING.
- H. Flashing of Roof Drains: Section 15400, PLUMBING SYSTEMS.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01340, SAMPLES AND SHOP DRAWINGS.
- B. Shop Drawings:
 - Flashings
 - Copings
 - Beam Cover
- C. Manufacturer's Literature and Data:
 - Two-piece counterflashing
- D. Certificates: Stating that aluminum has been given - specified finish thickness of anodizing. Coating formulators approvals as specified.

1.4 APPLICABLE PUBLICATIONS

- A. The publications listed below for a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
 - A167-99.....Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip

- A653/A653M-02.....Steel Sheet Zinc-Coated (Galvanized) or Zinc Alloy Coated (Galvanized) by the Hot- Dip Process
- B32-00.....Solder Metal
- B209-02.....Aluminum and Aluminum-Alloy Sheet and Plate
- D412-98.....Vulcanized Rubber and Thermoplastic Elastomers-Tension
- D1187-97.....Asphalt Base Emulsions for Use as Protective Coatings for Metal
- D3656-97.....Insect Screening and Louver Cloth Woven from Vinyl-Coated Glass Yarns
- D4586-00.....Asphalt Roof Cement, Asbestos Free
- C. Sheet Metal and Air Conditioning Contractors National Association (SMACNA): Architectural Sheet Metal Manual (Fifth Edition, 1993).
- D. National Association of Architectural Metal Manufacturers (NAAMM): AMP 500 Series.....Metal Finishes Manual
- E. American Architectural Manufacturers Association (AAMA): 605-98.....Voluntary Specification for High Performance Organic Coatings on Architectural Extrusions Panels
- F. Federal Specification (Fed. Spec):
 - A-A-1925A.....Shield, Expansion; (Nail Anchors)
 - UU-B-790A.....Building Paper, Vegetable Fiber

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Solder: ASTM B32; flux type and alloy composition as required for use with metals to be soldered.
- B. Stainless Steel: ASTM A167, Type 302 or 304, dead soft temper.
- C. Aluminum Sheet: ASTM B209, alloy 3003-H14. // Except alloy used for color anodized aluminum shall be as required to produce specified color. Alloy required to produce specified color shall have the same structural properties as alloy 3003-H14. //
- D. Galvanized Sheet: ASTM, A653.
- E. Nonreinforced, Elastomeric Sheeting: Elastomeric substances reduced to thermoplastic state and extruded into continuous homogenous sheet (0.056 inch) thick. Sheeting shall have not less than 7 MPa (1,000 psi) tensile strength and not more than seven percent tension-set at 50

percent elongation when tested in accordance with ASTM D412. Sheetting shall show no cracking or flaking when bent through 180 degrees over a 1 mm (1/32 inch) diameter mandrel and then bent at same point over same size mandrel in opposite direction through 360 degrees at temperature of -30°C (-20 °F).

F. Bituminous Paint: ASTM D1187, Type I.

L. Fasteners:

1. Use stainless steel for stainless steel and aluminum alloy. Use galvanized steel or stainless steel for galvanized steel.

2. Nails:

a. Minimum diameter for aluminum nails 3 mm (0.105 inch).

b. Minimum diameter for stainless steel nails: 2 mm (0.095 inch) and annular threaded.

c. Length to provide not less than 22 mm (7/8 inch) penetration into anchorage.

3. Rivets: Not less than 3 mm (1/8 inch)diameter.

4. Expansion Shields: Fed. Spec. A-A-1925A.

H. Sealant: As specified in Section SEALANTS AND CAULKING for exterior locations.

I. Insect Screening: ASTM D3656, 18 by 18 regular mesh.

J. Roof Cement: ASTM D4586.

2.2 SHEET METAL THICKNESS

A. Except as otherwise shown or specified use thickness or weight of sheet metal as follows:

Stainless Steel: 0.4mm (0.015 inch)

B. Thickness of aluminum or galvanized steel as specified with each item or as indicated on the Drawings.

2.3 FABRICATION, GENERAL

A. Jointing:

1. In general, stainless steel shall be locked and soldered.

2. Joints shall conform to following requirements:

a. Flat-lock joints shall finish not less than 19 mm (3/4 inch) wide.

b. Lap joints subject to stress shall finish not less than 25 mm (one inch) wide and shall be soldered and riveted.

c. Unsoldered lap joints shall finish not less than 100 mm (4 inches) wide.

3. Flat and lap joints shall be made in direction of flow.
4. Soldering:
 - a. Pre tin both mating surfaces with solder for a width not less than 38 mm (1 1/2 inches).
 - b. Wire brush to produce a bright surface before soldering lead coated copper.
 - c. Treat in accordance with metal producers recommendations other sheet metal required to be soldered.
 - d. Completely remove acid and flux after soldering is completed.

B. Expansion and Contraction Joints:

1. Fabricate in accordance with the Architectural Sheet Metal Manual recommendations for expansion and contraction of sheet metal work in continuous runs.
2. Space joints as shown or as specified.
3. Space expansion and contraction joints for copper, stainless steel, and copper clad stainless steel at intervals not exceeding 7200 mm (24 feet).
4. Space expansion and contraction joints for aluminum at intervals not exceeding 5400 mm (18 feet), except do not exceed 3000 mm (10 feet) for gravel stops and fascia-cant systems.
5. Fabricate slip-type or loose locked joints and fill with sealant unless otherwise specified.
6. Fabricate joint covers of same thickness material as sheet metal served.

C. Cleats:

1. Fabricate cleats to secure flashings and sheet metal work over 300 mm (12 inches) wide and where specified, or show on Drawings.
2. Provide cleats for maximum spacing of 300 mm (12 inch) centers unless specified otherwise.
3. Form cleats of same metal and weights or thickness as the sheet metal being installed unless specified otherwise.
4. Fabricate cleats from 50 mm (2 inch) wide strip. Form end with not less than 19 mm (3/4 inch) wide loose lock to item for anchorage. Form other end of length to receive nails free of item to be anchored and end edge to be folded over and cover nail heads.

D. Edge Strips or Continuous Cleats:

1. Fabricate continuous edge strips where shown and specified to secure loose edges of the sheet metal work.
2. Except as otherwise specified, fabricate edge strips or minimum 0.6mm (0.024 inch) thick stainless steel/
3. Use material compatible with sheet metal to be secured by the edge strip.
4. Fabricate in 3000 mm (10 feet) maximum lengths with not less than 19 mm (3/4 inch) loose lock into metal secured by edge strip.
5. Fabricate Strips for fascia anchorage to extend below the supporting wood construction to form a drip and to allow the flashing to be hooked over the lower edge at least 19 mm (3/4-inch).
6. Fabricate anchor edge maximum width of 75 mm (3 inches) or of sufficient width to provide adequate bearing area to insure a rigid installation using thick stainless steel or 1.6 mm (0.0625 inch) thick aluminum.

E. Drips:

1. Form drips at lower edge of sheet metal counter-flashings (cap flashings), fascias, gravel stops, wall copings, by folding edge back 13 mm (1/2 inch) and bending out 45 degrees from vertical to carry water away from the wall.
2. Form drip to provide hook to engage cleat or edge strip for fastening for not less than 19 mm (3/4 inch) loose lock where shown.

F. Edges:

Finish exposed edges of flashing with a 6 mm (1/4 inch) hem formed by folding edge of flashing back on itself when not hooked to edge strip or cleat. Use 6 mm (1/4 inch) minimum penetration beyond wall face with drip for through-wall flashing exposed edge.

G. Metal Options:

1. Where options are permitted for different metals use only one metal throughout.
2. Stainless steel may be used in concealed locations for fasteners of other metals exposed to view.

2.4 FINISH

- A. Use same finish on adjacent metal or components and exposed metal surfaces unless specified or shown otherwise.
- B. In accordance with NAAMM Metal Finishes Manual, unless otherwise specified.

- C. Finish exposed metal surfaces as follows, unless specified otherwise:
1. Stainless Steel: Finish No. 2B or 2D.
 2. Aluminum:
 - a. Clear Finish: AA-C22A41 medium matte, clear anodic coating, Class 1 Architectural, 18 mm (0.7 mils) thick.
 - b. Fluorocarbon Finish: AAMA 605.2, high performance organic coating.
 3. Steel and Galvanized Steel:
 - a. Finish painted under Section PAINTING unless specified as prefinished item.
 - b. Manufacturer's finish:

Fluorocarbon Finish: AAMA 605.2, high performance organic coating.

2.5 BASE FLASHING

- A. Use metal base flashing at vertical surfaces intersecting built-up roofing without cant strips or where shown.
1. Use either copper, or stainless steel, thickness specified unless specified otherwise.
 2. When flashing is over 250 mm (10 inches) in vertical height or horizontal width use either 0.5 Kg (20 oz) copper or 0.5 mm (0.018 inch) stainless steel.
 3. Use stainless steel at aluminum roof curbs where flashing contacts the aluminum.
 4. Use either copper, or stainless steel at pipe flashings.
- B. Fabricate metal base flashing up vertical surfaces not less than 200 mm (8 inch) nor more than 400 mm (16 inch).
- C. Fabricate roof flange not less than 100 mm (4 inches) wide unless shown otherwise. When base flashing length exceeds 2400 mm (8 feet) form flange edge with 13 mm (1/2 inch) hem to receive cleats.
- D. Form base flashing bent from strip except pipe flashing. Fabricate ends for riveted soldered lap seam joints. Fabricate expansion joint ends as specified.
- E. Pipe Flashing: (Other than engine exhaust or flue stack)
1. Fabricate roof flange not less than 100 mm (4 inches) beyond sleeve on all sides.

2. Extend sleeve up and around pipe and flange out at bottom not less than 13 mm (1/2 inch) and solder to flange and sleeve seam to make watertight.
3. At low pipes 200 mm (8 inch) to 450 mm (18 inch) above roof:
 - a. Form top of sleeve to turn down into the pipe at least 25 mm (one inch).
 - b. Allow for loose fit around and into the pipe.
4. At high pipes and pipes with goosenecks or other obstructions which would prevent turning the flashing down into the pipe:
 - a. Extend sleeve up not less than 300 mm (12 inch) above roofing.
 - b. Allow for loose fit around pipe.

2.6 COUNTERFLASHING (CAP FLASHING OR HOODS)

- A. Either copper or stainless steel, unless specified otherwise.
- B. Fabricate to lap base flashing a minimum of 100 mm (4 inches) with drip.
 1. Form lock seams for outside corners. Allow for lap joints at ends and inside corners.
 2. In general, form flashing in lengths not less than 2400 mm (8 feet) and not more than 3000 mm (10 feet).
 3. Two-piece, lock in type flashing may be used in lieu of one piece counter-flashing.
 4. Manufactured assemblies may be used.
 5. Where counterflashing is installed at new work use an integral flange at the top designed to be extended into the masonry joint or reglet in concrete.
 6. Where counterflashing is installed at existing work use surface applied type, formed to provide a space for the application of sealant at the top edge.
- C. One-piece Counterflashing.
 1. Back edge turned up and fabricate to lock into reglet in concrete.
- D. Two-Piece Counterflashing:
 1. Counterflashing upper edge designed to snap lock into receiver.
- E. Surface Mounted Counterflashing; one or two piece:
 1. Use at existing or new surfaces where flashing can not be inserted in vertical surface.
 2. One piece fabricate upper edge folded double for 65 mm (2 1/2 inches) with top 19 mm (3/4 inch) bent out to form "V" joint sealant

- pocket with vertical surface. Perforate flat double area against vertical surface with horizontally slotted fastener holes at 400 mm (16 inch) centers between end holes. Option: One piece surface mounted counter-flashing (cap flashing) may be used. Fabricate as detailed on Plate 51 of SMACNA Architectural Sheet Metal Manual.
3. Two pieces: Fabricate upper edge to lock into surface mounted receiver. Fabricate receiver joint sealant pocket on upper edge and lower edge to receive counterflashing, with slotted fastener holes at 400 mm (16 inch) centers between upper and lower edge.
- F. Pipe Counterflashing:
1. Form flashing for water-tight umbrella with upper portion against pipe to receive a draw band and upper edge to form a "V" joint sealant receiver approximately 19 mm (3/4 inch) deep.
 2. Fabricate 100 mm (4 inch) over lap at end.
 3. Fabricate draw band of same metal as counter flashing. Use 0.6 Kg (24 oz) copper or 0.33 mm (0.013 inch) thick stainless steel or copper coated stainless steel.
 4. Use stainless steel bolt on draw band tightening assembly.
 5. Vent pipe counter flashing may be fabricated to omit draw band and turn down 25 mm (one inch) inside vent pipe.
- G. Where vented edge decks intersect vertical surfaces, form in one piece, shape to slope down to a point level with and in front of edge-set notched plank; then, down vertically, overlapping base flashing.

2.7 COPINGS

- A. Fabricate of 1.25 mm (0.050 inch) thick aluminum sheets 2400 mm to 3000 mm (8 to 10 feet) long.
- B. Fabricate coping to profile shown.
- C. Use continuous edge strips with drips at bottom edges on exterior wall side. Use slotted holes for fasteners on roof wall side if continuous cleats or edge strips are not used.
- D. Form joints between sections with either alternate 4 or 5 as shown on plate 68, SMACNA, unless shown otherwise.
- E. Fabricate corners with mitered joints locked and sealed if aluminum.
- F. Fabricate ends of coping terminating at vertical building surfaces to form a slot for the installation of sealant.
- G. Fabricate exterior ends of coping closures of same appearance as exterior wall side.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:

1. Install flashing and sheet metal items as shown in Sheet Metal and Air Conditioning Contractors National Association, Inc., publication, ARCHITECTURAL SHEET METAL MANUAL, except as otherwise shown or specified.
2. Apply Sealant as specified in Section, SEALANTS AND CAULKING.
3. Apply sheet metal and other flashing material to surfaces which are smooth, sound, clean, dry and free from defects that might affect the application.
4. Remove projections which would puncture the materials and fill holes and depressions with material compatible with the substrate. Cover holes or cracks in wood wider than 6 mm (1/4 inch) with sheet metal compatible with the roofing and flashing material used.
5. Confine direct nailing of sheet metal to strips 300 mm (12 inch) or less wide. Nail flashing along one edge only. Space nail not over 100 mm (4 inches) on center unless specified otherwise.
6. Install bolts, rivets, and screws where indicated, specified, or required in accordance with the SMACNA Sheet Metal Manual. Space rivets at 75 mm (3 inch) on centers in two rows in a staggered position. Use neoprene washers under fastener heads when fastener head is exposed.
7. Coordinate with roofing work for the installation of metal base flashings and other metal items having roof flanges for anchorage and watertight installation.
8. Nail continuous cleats on 75 mm (3 inch) on centers in two rows in a staggered position.
9. Nail individual cleats with two nails and bend end tab over nail heads. Lock other end of cleat into hemmed edge.
10. Install flashings in conjunction with other trades so that flashings are inserted in other materials and joined together to provide a water tight installation.
11. Where required to prevent galvanic action between dissimilar metal isolate the contact areas of dissimilar metal with sheet lead, waterproof building paper, or a coat of bituminous paint.

12. Isolate aluminum in contact with dissimilar metals others than stainless steel, white bronze or other metal compatible with aluminum by:
 - a. Paint dissimilar metal with a prime coat of zinc-chromate or other suitable primer, followed by two coats of aluminum paint.
 - b. Paint dissimilar metal with a coat of bituminous paint.
 - c. Apply an approved caulking material between aluminum and dissimilar metal.
13. Paint aluminum in contact with or built into concrete with a coat of bituminous paint.
14. Paint aluminum in contact with absorptive materials that may become repeatedly wet with two coats of bituminous paint or two coats of aluminum paint.

3.2 BASE FLASHING

- A. Install where roof membrane type base flashing is not used and where shown.
 1. Install flashing at intersections of roofs with vertical surfaces or at penetrations through roofs, to provide watertight construction.
 2. Install metal flashings and accessories having flanges extending out on top of the built-up roofing before final bituminous coat and roof aggregate is applied.
 3. Set flanges in heavy trowel coat of roof cement and nail through flanges into wood nailers over bituminous roofing.
 4. Secure flange by nailing through roofing into wood blocking with nails spaced 75 mm (3 inch) on centers or, when flange over 100 mm (4 inch) wide terminate in a 13 mm (1/2 inch) folded edge anchored with cleats spaced 200 mm (8 inch) on center. Secure one end of cleat over nail heads. Lock other end into the seam.
- C. For long runs of base flashings install in lengths of not less than 2400 mm (8 feet) nor more than 3000 mm (ten feet). Install a 75 mm (3 inch) wide slip type, loose lock expansion joint filled with sealant in joints of base flashing sections over 2400 mm (8 feet) in length. Lock and solder corner joints at corners.
- D. Extend base flashing up under counter flashing of roof specialties and accessories or equipment not less than 75 mm (3 inch).

3.4 COUNTERFLASHING (CAP FLASHING OR HOODS)

- A. General:

1. Install counterflashing over and in conjunction with installation of base flashings, except as otherwise specified or shown.
 2. Install counterflashing to lap base flashings not less than 100 mm (4 inch).
 3. Install upper edge or top of counterflashing not less than 225 mm (9 inch) above top of the roofing.
 4. Lap joints not less than 100 mm (4 inch). Stagger joints with relation to metal base flashing joints.
 5. Use surface applied counterflashing on existing surfaces and new work where not possible to integrate into item.
 6. When fastening to concrete, use screws driven in expansion shields set in concrete. Use screws to wood and sheet metal.
- B. One Piece Counterflashing:
1. Where flashing is surface mounted on flat surfaces.
 - a. When top edge is double folded anchor flat portion below sealant "V" joint with fasteners spaced not over 400 mm (16 inch) on center.
 - 1) Locate fasteners in masonry mortar joints.
 - 2) Use screws to sheet metal or wood.
 - b. Fill joint at top with sealant.
 2. Where flashing or hood is mounted on pipe.
 - a. Secure with draw band tight against pipe.
 - b. Set hood and secure to pipe with a one by 25 mm x 3 mm (1 x 1/8 inch) bolt on stainless steel draw band type clamp, or a stainless worm gear type clamp.
 - c. Completely fill joint at top with sealant.
- C. Two-Piece Counterflashing.
1. Surface applied type receiver:
 - a. Secure to face construction in accordance, with manufacturers instructions.
 - b. Completely fill space at the top edge of receiver with sealant.
 2. Insert counter flashing in receiver in accordance with fabricator or manufacturer's instructions and to fit tight against base flashing.
- D. Where vented edge occur install so lower edge of counterflashing is against base flashing.
- E. When counter flashing is a component of other flashing install as shown.

3.5 COPINGS

A. General:

1. On walls topped with a wood plank, install a continuous edge strip on the front and rear edge of the plank. Lock the coping to the edge strip with a 19 mm (3/4 inch) loose lock seam.
2. Where shown turn down roof side of coping and extend down over base flashing as specified for counter-flashing. Secure counter-flashing to lock strip in coping at continuous cleat.
3. Install ends adjoining existing construction so as to form space for installation of sealants. Sealant is specified in Section, SEALANTS AND CAULKING.

B. Aluminum Coping:

1. Install with 6 mm (1/4 inch) joint between ends of coping sections.
2. Install joint covers, centered at each joint, and securely lock in place.

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**SECTION 07700
ROOF SPECIALTIES AND ACCESSORIES**

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies roof hatches and equipment supports.

1.2 RELATED WORK

- A. Color and texture of finish: Section 09050, INTERIOR/EXTERIOR FINISHES, MATERIALS, AND FINISH SCHEDULES.
- B. Sealant material and installation: Section 07920, SEALANTS AND CAULKING.
- C. General insulation: Section 07210, BUILDING INSULATION.
- D. Rigid insulations for roofing: Section 07220, ROOF AND DECK INSULATION.
- E. Painting: Section 09900, PAINTING.

1.3 QUALITY CONTROL

- A. All roof accessories shall be the products of manufacturers regularly engaged in producing the kinds of products specified.
- B. Each accessory type shall be the same and be made by the same manufacturer.
- C. Each accessory shall be completely assembled to the greatest extent possible before delivery to the site.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01340, SAMPLES AND SHOP DRAWINGS.
- B. Samples: Representative sample panel of color anodized aluminum not less than 100 mm X 100 mm (four by four inches), except extrusions shall be a width not less than section to be used. Sample shall show coating with integral color and texture and shall include manufacturer's identifying label.
- C. Shop Drawings: Each item specified showing design, details of construction, installation and fastenings.
- D. Manufacturer's Literature and Data: Each item specified.
- E. Certificates: Stating that aluminum has been given specified thickness of anodizing.

1.5 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extend referenced. The publications are referenced in the text by the basic designation only.
- B. Federal Specifications (Fed. Spec.):

- RR-G-1602D.....Grating, Metal, Other Than Bar Type (Floor,
Except for Naval Vessels)
- C. American Society for Testing and Material (ASTM):
- A653/A653M-02.....Steel Sheet, Zinc-Coated (Galvanized) or Zinc-
Iron Alloy-Coated (Galvannealed) By the Hot-Dip
Process
- B209/209M-02.....Aluminum and Aluminum Alloy-Sheet and Plate
- B221/221M-02.....Aluminum-Alloy Extruded Bars, Rods, Wire,
Shapes, and Tubes
- C612-00.....Mineral Fiber Block and Board Thermal
Insulation
- D1187-97.....Asphalt-Base Emulsions for Use as Protective
Coatings for Metal
- D. National Association of Architectural Metal Manufacturers (NAAMM):
- AMP 500 Series.....Metal Finishes Manual
- E. American Architectural Manufacturers Association (AAMA):
- 605-98.....High Performance Organic Coatings on
Architectural Extrusions and Panels.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Aluminum, Extruded: ASTM B221/B221M.
- B. Aluminum Sheet: ASTM B209/B209M.
- C. Galvanized Sheet Steel: ASTM A526/A526M; G-90 coating.
- D. Metal Grating for Roof Walkway: Fed. Spec. RR-G-1602.
- E. Insulation: ASTM C612, Class 1 or 2.
- F. Asphalt Coating: ASTM D 1187, Type I, quick setting.

2.2 ROOF HATCH (SCUTTLE)

- A. Fabricate from aluminum with mill finish.
- B. Curb and Cover:
1. Exterior facing: Minimum 2.3 mm (0.09 inch) thick sheet aluminum.
 2. Interior facing : Minimum 1 mm (0.04 inch) thick sheet aluminum.
 3. Minimum of 25 mm (one inch) thick mineral fiber insulation between facings of cover and over exterior face of curb.
 4. Form exterior curb facing with an integral three inch wide roof flange and cap flashing minimum 2.3 mm (0.09 inch) thick sheet aluminum.

5. Construct curb as indicated on the Drawings; coordinate size with hatch size.
6. Form cover to lap curb and cap flashing.
7. Nominal clear hatch opening: 30"x36"

C. Hardware:

1. Provide spring snap latch with inside and outside operating handles and padlock hasp on inside. Provide two snap latches when hinge side is over 2100 mm (7 feet) long.
2. Provide pintle hinges.
3. Provide automatic hold open and operating arm with enclosed torsion or compression spring lifting mechanism.
4. Covers shall automatically lock in the open position at not less than 70 degrees.
5. Provide weatherstripping at cover closure.
6. Galvanize all hardware items.

D. Assembly:

1. Completely shop assemble roof scuttle.
2. Fully weld all joints exposed to the weather and built into the roofing.
3. Finish weld smooth where exposed.
4. Operation with minimum force to open and close.
5. Finish per Section 09900, PAINTING.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install roof specialties and accessories where shown.
- B. Secure with fasteners in accordance with manufacture's printed installation instructions and approved shop drawings unless shown otherwise.
- C. Coordinate to install insulation where shown; see Section on BUILDING INSULATION and ROOF AND DECK INSULATION.
- D. Comply with section on SEALANTS AND CAULKING to install sealants where manufactures installation instructions require sealant.
- E. Coordinate with roofing work for installation of items in sequence to prevent water infiltration.
- F. Equipment Supports: Do not anchor to insulating concrete or metal deck. Anchor only to building structure as per manufacturers recommendations.

3.2 PROTECTION OF ALUMINUM

- A. Provide protection for aluminum against galvanic action wherever dissimilar materials are in contact, by painting the contact surfaces of the dissimilar material with two coats of asphalt coating (complete coverage), or by separating the contact surfaces with a preformed neoprene tape having pressure sensitive adhesive coating on side.
- B. Paint aluminum in contact with wood, concrete and masonry, or other absorptive materials, that may become repeatedly wet, with two coats of asphalt coating.

3.3 ADJUSTING

- A. Adjust roof hatch hardware to operate freely and so that cover will operate without binding, close tightly at perimeter, and latch securely.
- B. Adjust expansion joints to close tightly and be watertight; insuring maximum allowance for building movement.

3.4 PROTECTION

Protect roof accessories from damage during installation and after completion of the work from subsequent construction.

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**SECTION 07920
SEALANTS AND CAULKING**

PART 1 - GENERAL

1.1 DESCRIPTION:

Section covers all sealant and caulking materials and their application, wherever required for complete installation of building materials or systems.

1.2 RELATED WORK:

- A. Firestopping penetrations: Section 07270, FIRESTOPPING SYSTEMS.
- B. Glazing: Section 08810, GLASS AND GLAZING.
- C. Sound rated gypsum partitions/sound sealants: Section 09250, GYPSUM WALLBOARD.
- D. Flashing: Section 07600m FLASHING AND SHEET METAL.

1.3 QUALITY CONTROL:

- A. Installer Qualifications: An experienced installer who has specialized in installing joint sealants similar in material, design, and extent to those indicated for this Project and whose work has resulted in joint-sealant installations with a record of successful in-service performance.
- B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.
- C. Product Testing: Obtain test results from a qualified testing agency based on testing current sealant formulations within a 12-month period.
 - 1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021.
 - 2. Test elastomeric joint sealants for compliance with requirements specified by reference to ASTM C920, and where applicable, to other standard test methods.
 - 3. Test elastomeric joint sealants according to SWRI's Sealant Validation Program for compliance with requirements specified by reference to ASTM C920 for adhesion and cohesion under cyclic movement, adhesion-in peel, and indentation hardness.
 - 4. Test other joint sealants for compliance with requirements indicated by referencing standard specifications and test methods.

1.4 SUBMITTALS:

- A. Submit in accordance with Section 01340, SAMPLES AND SHOP DRAWINGS.
- B. Manufacturer's installation instructions for each product used.

- C. Cured samples of exposed sealants for each color where required to match adjacent material.
- D. Manufacturer's Literature and Data:
 - 1. Caulking compound
 - 2. Primers
 - 3. Sealing compound, each type, including compatibility when different sealants are in contact with each other.

1.5 PROJECT CONDITIONS:

- A. Environmental Limitations:
 - 1. Do not proceed with installation of joint sealants under following conditions:
 - a. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 4.4 °C (40 °F).
 - b. When joint substrates are wet.
- B. Joint-Width Conditions:
 - 1. Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.
- C. Joint-Substrate Conditions:
 - 1. Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

1.6 DELIVERY, HANDLING, AND STORAGE:

- A. Deliver materials in manufacturers' original unopened containers, with brand names, date of manufacture, shelf life, and material designation clearly marked thereon.
- B. Carefully handle and store to prevent inclusion of foreign materials.
- C. Do not subject to sustained temperatures exceeding 5 °C (90 °F) or less than 32 °C (40 °F).

1.7 DEFINITIONS:

- A. Definitions of terms in accordance with ASTM C717 and as specified.
- B. Back-up Rod: A type of sealant backing.
- C. Bond Breakers: A type of sealant backing.
- D. Filler: A sealant backing used behind a back-up rod.

1.8 GUARANTY:

- A. Guaranty exterior sealing against leaks, adhesion, and cohesive failure, and subject to terms of "Guaranty" Article specified in Section 01001, GENERAL CONDITIONS, except that guaranty period shall be extended to two years.
- B. General Guaranty: Special guarantees specified in this Article shall not deprive Government of other rights Government may have under other provisions of Contract Documents and shall be in addition to, and run concurrent with, other guarantees made by Contractor under requirements of Contract Documents.

1.9 APPLICABLE PUBLICATIONS:

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
 - C509-00.....Elastomeric Cellular Preformed Gasket and Sealing Material.
 - C612-00.....Mineral Fiber Block and Board Thermal Insulation.
 - C717-03.....Standard Terminology of Building Seals and Sealants.
 - C834-00.....Latex Sealants.
 - C919-02.....Use of Sealants in Acoustical Applications.
 - C920-02.....Elastomeric Joint Sealants.
 - C1021-01.....Laboratories Engaged in Testing of Building Sealants
 - C1193-00.....Standard Guide for Use of Joint Sealants.
 - C1330-02.....Specification for Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants.
 - D1056-00.....Specification for Flexible Cellular Materials—Sponge or Expanded Rubber.
 - E84-03.....Surface Burning Characteristics of Building Materials.
- C. Sealant, Waterproofing and Restoration Institute (SWRI).
The Professionals' Guide

PART 2 - PRODUCTS

2.1 SEALANTS:

- A. S-1:
 - 1. ASTM C920, polyurethane or polysulfide.
 - 2. Type M.
 - 3. Class 25.
 - 4. Grade NS.
 - 5. Shore A hardness of 20-40
- B. S-2:
 - 1. ASTM C920, polyurethane or polysulfide.
 - 2. Type M.
 - 3. Class 25.
 - 4. Grade P.
 - 5. Shore A hardness of 25-40.
- C. S-3:
 - 1. ASTM C920, polyurethane or polysulfide.
 - 2. Type S.
 - 3. Class 25, joint movement range of plus or minus 50 percent.
 - 4. Grade NS.
 - 5. Shore A hardness of 15-25.
 - 6. Minimum elongation of 700 percent.
- D. S-4:
 - 1. ASTM C920 polyurethane or polysulfide.
 - 2. Type S.
 - 3. Class 25.
 - 4. Grade NS.
 - 5. Shore A hardness of 25-40.
- E. S-5:
 - 1. ASTM C920, polyurethane or polysulfide.
 - 2. Type S.
 - 3. Class 25.
 - 4. Grade P.
 - 5. Shore hardness of 15-45.
- F. S-6:
 - 1. ASTM C920, silicone, neutral cure.
 - 2. Type S.
 - 3. Class: Joint movement range of plus 100 percent to minus 50 percent.

4. Grade NS.
 5. Shore A hardness of 15-20.
 6. Minimum elongation of 1200 percent.
- G. S-7:
1. ASTM C920, silicone, neutral cure.
 2. Type S.
 3. Class 25.
 4. Grade NS.
 5. Shore A hardness of 25-30.
 6. Structural glazing application.
- H. S-8:
1. ASTM C920, silicone, acetoxy cure.
 2. Type S.
 3. Class 25.
 4. Grade NS.
 5. Shore A hardness of 25-30.
 6. Structural glazing application.
- I. S-9:
1. ASTM C920 silicone.
 2. Type S.
 3. Class 25.
 4. Grade NS.
 5. Shore A hardness of 25-30.
 6. Non-yellowing, mildew resistant.
- J. S-10:
1. ASTM C920, coal tar extended fuel resistance polyurethane.
 2. Type M/S.
 3. Class 25.
 4. Grade P/NS.
 5. Shore A hardness of 15-20.
- K. S-11:
1. ASTM C920 polyurethane.
 2. Type M/S.
 3. Class 25.
 4. Grade P/NS.
 5. Shore A hardness of 35 to 50.
- L. S-12:

1. ASTM C920, polyurethane.
2. Type M/S.
3. Class 25, joint movement range of plus or minus 50 percent.
4. Grade P/NS.
5. Shore A hardness of 25 to 50.

2.2 CAULKING COMPOUND:

- A. C-1: ASTM C834, acrylic latex.
- B. C-2: One component acoustical caulking, non drying, non hardening, synthetic rubber.

2.3 COLOR:

- A. Color of sealants shall match color of adjacent materials, unless specified otherwise.
- D. Caulking shall be light gray or white, unless specified otherwise.

2.4 JOINT SEALANT BACKING:

- A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C1330, of type indicated below and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
 1. Type C: Closed-cell material with a surface skin.
- C. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 32 °C (minus 26 °F). Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and otherwise contribute to optimum sealant performance.
- D. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.5 FILLER:

- A. Mineral fiber board: ASTM C612, Class 1.
- B. Thickness same as joint width.
- C. Depth to fill void completely behind back-up rod.

2.6 PRIMER:

- A. As recommended by manufacturer of caulking or sealant material.
- B. Stain free type.

2.7 CLEANERS-NON POUROUS SURFACES:

- A. Chemical cleaners acceptable to manufacturer of sealants and sealant backing material, free of oily residues and other substances capable of staining or harming joint substrates and adjacent non-porous surfaces and formulated to promote adhesion of sealant and substrates.

PART 3 - EXECUTION

3.1 INSPECTION:

- A. Inspect substrate surface for bond breaker contamination and unsound materials at adherent faces of sealant.
- B. Coordinate for repair and resolution of unsound substrate materials.
- C. Inspect for uniform joint widths and that dimensions are within tolerance established by sealant manufacturer.

3.2 PREPARATIONS:

- A. Prepare joints in accordance with manufacturer's instructions and SWRI.
- B. Clean surfaces of joint to receive caulking or sealants leaving joint dry to the touch, free from frost, moisture, grease, oil, wax, lacquer paint, or other foreign matter that would tend to destroy or impair adhesion.
 - 1. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants.
 - 2. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air. Porous joint surfaces include the following:
 - a. Concrete.
 - 3. Remove laitance and form-release agents from concrete.
 - 4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.
 - a. Metal.
 - b. Glass.
 - c. Glazed surfaces of ceramic tile.
- C. Do not cut or damage joint edges.

- D. Apply masking tape to face of surfaces adjacent to joints before applying primers, caulking, or sealing compounds.
 - 1. Do not leave gaps between ends of sealant backings.
 - 2. Do not stretch, twist, puncture, or tear sealant backings.
 - 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- E. Apply primer to sides of joints wherever required by compound manufacturer's printer instructions.
 - 1. Apply primer prior to installation of back-up rod or bond breaker tape.
 - 2. Use brush or other approved means that will reach all parts of joints.
- F. Take all necessary steps to prevent three sided adhesion of sealants.

3.3 BACKING INSTALLATION:

- A. Install back-up material, to form joints enclosed on three sides as required for specified depth of sealant.
- B. Where deep joints occur, install filler to fill space behind the back-up rod and position the rod at proper depth.
- C. Cut fillers installed by others to proper depth for installation of back-up rod and sealants.
- D. Install back-up rod, without puncturing the material, to a uniform depth, within plus or minus 3 mm (1/8 inch) for sealant depths specified.
- E. Where space for back-up rod does not exist, install bond breaker tape strip at bottom (or back) of joint so sealant bonds only to two opposing surfaces.
- F. Take all necessary steps to prevent three sided adhesion of sealants.

3.4 SEALANT DEPTHS AND GEOMETRY:

- A. At widths up to 6 mm (1/4 inch), sealant depth equal to width.
- B. At widths over 6 mm (1/4 inch), sealant depth 1/2 of width up to 13 mm (1/2 inch) maximum depth at center of joint with sealant thickness at center of joint approximately 1/2 of depth at adhesion surface.

3.5 INSTALLATION:

- A. General:
 - 1. Apply sealants and caulking only when ambient temperature is between 5 degrees C and 38 degrees C (40 and 100 degrees F).

2. Do not use polysulfide base sealants where sealant may be exposed to fumes from bituminous materials, or where water vapor in continuous contact with cementitious materials may be present.
 3. Do not use sealant type listed by manufacture as not suitable for use in locations specified.
 4. Apply caulking and sealing compound in accordance with manufacturer's printer instructions.
 5. Avoid dropping or smearing compound on adjacent surfaces.
 6. Fill joints solidly with compound and finish compound smooth.
 7. Tool joints to concave surface unless shown or specified otherwise.
 8. Finish paving or floor joints flush unless joint is otherwise detailed.
 9. Apply compounds with nozzle size to fit joint width.
 10. Test sealants for compatibility with each other and substrate. Use only compatible sealant.
- B. For application of sealants, follow requirements of ASTM C1193 unless specified otherwise.
- C. Where gypsum board partitions are of sound rated, fire rated, or smoke barrier construction, follow requirements of ASTM C919 only to seal all cut-outs and intersections with the adjoining construction unless specified otherwise.
1. Apply a 6 mm (1/4 inch) minimum bead of sealant each side of runners (tracks), including those used at partition intersections with dissimilar wall construction.
 2. Coordinate with application of gypsum board to install sealant immediately prior to application of gypsum board.
 3. Partition intersections: Seal edges of face layer of gypsum board abutting intersecting partitions, before taping and finishing or application of veneer plaster-joint reinforcing.
 4. Openings: Apply a 6 mm (1/4 inch) bead of sealant around all cut-outs to seal openings of electrical boxes, ducts, pipes and similar penetrations. To seal electrical boxes, seal sides and backs.
 5. Control Joints: Before control joints are installed, apply sealant in back of control joint to reduce flanking path for sound through control joint.

3.6 FIELD QUALITY CONTROL:

- A. Field-Adhesion Testing: Field-test joint-sealant adhesion to joint substrates as recommended by sealant manufacturer:
 - 1. Extent of Testing: Test completed elastomeric sealant joints as follows:
 - a. Perform 10 tests for first 300 m (1000 feet) of joint length for each type of elastomeric sealant and joint substrate.
 - b. Perform one test for each 300 m (1000 feet) of joint length thereafter or one test per each floor per elevation.
- B. Inspect joints for complete fill, for absence of voids, and for joint configuration complying with specified requirements. Record results in a field adhesion test log.
- C. Inspect tested joints and report on following:
 - 1. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate.
 - 2. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.
 - 3. Whether sealants filled joint cavities and are free from voids.
 - 4. Whether sealant dimensions and configurations comply with specified requirements.
- D. Record test results in a field adhesion test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.
- E. Repair sealants pulled from test area by applying new sealants following same procedures used to originally seal joints. Ensure that original sealant surfaces are clean and new sealant contacts original sealant.
- F. Evaluation of Field-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements, will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.7 CLEANING:

- A. Fresh compound accidentally smeared on adjoining surfaces: Scrape off immediately and rub clean with a solvent as recommended by the caulking or sealant manufacturer.
- B. After filling and finishing joints, remove masking tape.
- C. Leave adjacent surfaces in a clean and unstained condition.

3.8 LOCATIONS:

- A. Exterior Building Joints, Horizontal and Vertical:
 - 1. Metal to Metal: Type S-1, S-2
 - 2. Threshold Setting Bed: Type S-1, S-3, S-4
- B. Metal Reglets and Flashings:
 - 1. Flashings to Wall: Type S-6
 - 2. Metal to Metal: Type S-6
- C. Sanitary Joints:
 - 1. Walls to Plumbing Fixtures: Type S-9
 - 2. Counter Tops to Walls: Type S-9
 - 3. Pipe Penetrations: Type S-9
- D. Interior Caulking:
 - 1. Typical Narrow Joint 6 mm, (1/4 inch) or less at Walls and Adjacent Components: Type C-1, C-2, C-3.
 - 2. Perimeter of Doors, Windows, Access Panels which Adjoin Concrete Surfaces: Type C-1, C-2, C-3.
 - 3. Joints at Piers, Concrete Walls or Exterior Walls: Type C-1, C-2, C-3.
 - 4. Perimeter of Lead Faced Control Windows and Plaster or Gypsum Wallboard Walls: Type C-1, C-2, C-3.
 - 5. Exposed Isolation Joints at Top of Full Height Walls: Type C-1, C-2, C-3.
 - 6. Exposed Acoustical Joint at Sound Rated Partitions Type C-2
 - 7. Concealed Acoustic Sealant Type S-4, C-1, C-2, C-3.

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**SECTION 08110
STEEL DOORS AND FRAMES**

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies steel doors, steel frames and related components.
- B. Terms relating to steel doors and frames as defined in ANSI A123.1 and as specified.

1.2 WORK

- A. Wood doors with steel frames: Section 08210, PLASTIC-LAMINATE-FACED WOOD DOORS.
- B. Hardware: Section 08710, BUILDERS HARDWARE.
- C. Installation: Section 08750, INSTALLATION OF DOORS AND HARDWARE.

1.3 TESTING

An independent testing laboratory shall perform testing.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01340, SAMPLES AND SHOP DRAWINGS.
- B. Manufacturers Literature and Data:
 - 1. Fire rated doors and frames, showing conformance with NFPA 80 and Underwriters Laboratory, Inc., or Inchcape Testing Services or Factory Mutual fire rating requirements and temperature rise rating for stairwell doors. Submit proof of temperature rating.
 - 2. Sound rated doors, including test report from Testing Laboratory.

1.5 SHIPMENT

- A. Prior to shipment label each door and frame to show location, size, door swing and other pertinent information.
- B. Fasten temporary steel spreaders across the bottom of each door frame.

1.6 STORAGE AND HANDLING

- A. Store doors and frames at the site under cover.
- B. Protect from rust and damage during storage and erection until completion.

1.7 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. Federal Specifications (Fed. Spec.):
 - L-S-125B.....Screening, Insect, Nonmetallic

- C. Door and Hardware Institute (DHI):
 - A115 Series.....Steel Door and Frame Preparation for Hardware,
Series A115.1 through A115.17 (Dates Vary)
- D. Steel Door Institute (SDI):
 - 113-1979.....Apparent Thermal Performance for Steel Door and
Frame Assemblies
 - 114-1979.....Acoustical Performance for Steel Door and Frame
Assemblies
 - A250.8-98.....Standard Steel Doors and Frames
- E. American Society for Testing and Materials (ASTM):
 - A167-99.....Stainless and Heat-Resisting Chromium-Nickel
Steel Plate, Sheet, and Strip
 - A568/568-M-03.....Steel, Sheet, Carbon, and High-Strength, Low-
alloy, Hot-Rolled and Cold-Rolled
 - A1008-04.....Steel, sheet, Cold-Rolled, Carbon, Structural,
High Strength Low Alloy and High Strength Low
Alloy with Improved Formability
 - B209/209M-02.....Aluminum and Aluminum-Alloy Sheet and Plate
 - B221/221M-02.....Aluminum and Aluminum-Alloy Extruded Bars,
Rods, Wire, Profiles and Tubes
 - D1621-00.....Compressive Properties of Rigid Cellular
Plastics
 - D3656-97.....Insect Screening and Louver Cloth Woven from
Vinyl Coated Glass Yarns
 - E90-02.....Laboratory Measurement of Airborne Sound
Transmission Loss of Building Partitions
- F. The National Association Architectural Metal Manufacturers (NAAMM):
 - Metal Finishes Manual (1988 Edition)
- G. National Fire Protection Association (NFPA):
 - 80-99.....Fire Doors and Fire Windows
- H. Underwriters Laboratories, Inc. (UL):
 - Fire Resistance Directory
- I. Inchcape Testing Services (ITS):
 - Certifications Listings...Latest Edition
- J. Factory Mutual System (FM):
 - Approval Guide

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Sheet Steel: ASTM A1008, cold-rolled for panels (face sheets) of doors.
- B. Anchors, Fastenings and Accessories: Fastenings anchors, clips connecting members and sleeves from zinc coated steel.
- C. Prime Paint: Paint that meets or exceeds the requirements of A250.8.

2.2 FABRICATION GENERAL

A. GENERAL:

- 1. Follow SDI A250.8 for fabrication of standard steel doors, except as specified otherwise. Doors to receive hardware specified in Section 08710, Door Hardware. Tolerances as per SDI A250.8. Thickness, 44 mm (1-3/4 inches), unless otherwise shown.
- 2. Close top edge of exterior doors flush and seal to prevent water intrusion.

B. Fire Rated Doors (Labeled):

- 1. Conform to NFPA 80 when tested by Underwriters Laboratories, Inc., Inchcape Testing Services, or Factory Mutual for the class of door or door opening shown.
- 2. Fire rated labels of metal, with raised or incised markings of approving laboratory shall be permanently attached to doors.
- 3. Close top and vertical edges of doors flush. Vertical edges shall be seamless. Apply steel astragal to the meeting stile of the active leaf of pairs of fire rated doors, except where vertical rod exit devices are specified for both leaves swinging in the same direction.
- 4. Construct fire rated doors in stairwell enclosures for maximum transmitted temperature rise of 230 °C (450 °F) above ambient temperature at end of 30 minutes of fire exposure when tested in accordance with ASTM E152.

C. Sound Rated Doors:

- 1. SDI 114, except as specified otherwise.
- 2. Sound Transmission Class minimum of 45 when tested in accordance with ASTM E90.
- 3. Doors complete with integral spring type automatic door bottom seal and with integral continuous gaskets on the frames. Applied spring type automatic door bottom seal and applied continuous gaskets for

the frames for doors that are not sound rated but sealed for flanking noises are specified in Section, BUILDERS' HARDWARE.

4. Fabricate vision panels to receive double glazing where shown.

2.3 METAL FRAMES

A. General:

1. SDI A250.8, 1.3 mm (0.053 inch) thick sheet steel, types and styles as shown or scheduled.
2. Frames for exterior doors: Fabricate from 1.7 mm (0.067 inch) thick galvanized steel conforming to ASTM A525.
3. Frames for labeled fire rated doors.
 - a. Comply with NFPA 80. Test by Underwriters Laboratories, Inc., Inchcape Testing Services, or Factory Mutual.
 - b. Fire rated labels of approving laboratory permanently attached to frames as evidence of conformance with these requirements. Provide labels of metal or engraved stamp, with raised or incised markings.
4. Knocked-down frames are not acceptable.

B. Reinforcement and Covers:

1. SDI A250.8 for, minimum thickness of steel reinforcement welded to back of frames.
2. Provide mortar guards securely fastened to back of hardware.

C. Frame Anchors:

Jamb anchors:

- a. Locate anchors on jambs near top and bottom of each frame, and at intermediate points not over 600 mm (24 inches) apart, except for fire rated frames space anchors as required by labeling authority.
- b. Form jamb anchors of not less than 1 mm (0.042 inch) thick steel unless otherwise specified.
- c. Anchors set in masonry: Use adjustable anchors designed for friction fit against the frame and for extension into the masonry not less than 250 mm (10 inches). Use one of following type:
 - 1) Wire loop type of 5 mm (3/16 inch) diameter wire.
 - 2) T-shape or strap and stirrup type of corrugated or perforated sheet steel.

- d. Anchors for stud partitions: Either weld to frame or use lock-in snap-in type. Provide tabs for securing anchor to the sides of the studs.
- e. Anchors for frames set in prepared openings:
 - 1) Steel pipe spacers with 6 mm (1/4 inch) inside diameter welded to plate reinforcing at jamb stops or hat shaped formed strap spacers, 50 mm (2 inches) wide, welded to jamb near stop.
 - 2) Drill jamb stop and strap spacers for 6 mm (1/4 inch) flat head bolts to pass thru frame and spacers.
 - 3) Two piece frames: Subframe or rough buck drilled for 6 mm (1/4 inch) bolts.

2.4 SHOP PAINTING

SDI A250.8.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Plumb, align and brace frames securely until permanent anchors are set.
 - 1. Use triangular bracing near each corner on both sides of frames with temporary wood spreaders at midpoint.
 - 2. Use wood spreaders at bottom of frame if the shipping spreader is removed.
 - 3. Protect frame from accidental abuse.
 - 4. Where construction will permit concealment, leave the shipping spreaders in place after installation, otherwise remove the spreaders after the frames are set and anchored.
 - 5. Remove wood spreaders and braces only after the walls are built and jamb anchors are secured.
- B. Jamb Anchors:
 - 1. Anchors in masonry walls: Embed anchors in mortar. Fill space between frame and masonry wall with grout or mortar as walls are built.
 - 2. Coat frame back with a bituminous coating prior to lining of grout filling in masonry walls.
 - 3. Secure anchors to sides of studs with two fasteners through anchor tabs. Use steel drill screws to steel studs.
 - 4. Frames set in prepared openings of masonry or concrete: Expansion bolt to wall with 6 mm (1/4 inch) expansion bolts through spacers. Where subframes or rough bucks are used, 6 mm (1/4 inch) expansion

SOL 663-01-05
VA Seattle Building 100
Ambulatory Clinic Expansion

bolts on 600 mm (24 inch) centers or power activated drive pins 600 mm (24 inches) on centers. Secure two piece frames to subframe or rough buck with machine screws on both faces.

C. Install anchors for labeled fire rated doors to provide rating as required.

3.2 INSTALLATION OF DOORS AND APPLICATION OF HARDWARE

Install doors and hardware as specified in Section 08750, INSTALLATION OF DOORS AND HARDWARE.

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SECTION 08210
WOOD DOORS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies flush wood doors.
- B. Section includes fire rated doors.

1.2 RELATED WORK

- A. Metal door frames: Section 08110, STEEL DOORS AND FRAMES.
- B. Door hardware including hardware location (height): Section 08710, BUILDERS HARDWARE.
- C. Installation of doors and hardware: Section 08750, INSTALLATION OF DOORS AND HARDWARE.
- D. Glazing: Section 08810, GLASS AND GLAZING.
- E. Finish: Section 09050, INTERIOR/EXTERIOR FINISHES, MATERIALS, AND FINISH SCHEDULE.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01340, SAMPLES AND SHOP DRAWINGS.
- B. Samples:
 - 1. Corner section of flush veneered door 300 mm (12 inches) square, showing details of construction, labeled to show grade and type number and conformance to specified standard.
 - 2. Veneer sample 200 mm (8 inch) by 275 mm (11 inch) by 6 mm (1/4 inch) showing specified wood species sanded to receive a transparent finish. Factory finish veneer sample where the prefinished option is accepted.
- C. Shop Drawings:
 - 1. Show every door in project and schedule location in building.
 - 2. Indicate type, grade, finish and size; include detail of glazing and pertinent details.
 - 3. Provide information concerning specific requirements not included in the manufacturer's literature and data submittal.
- D. Manufacturer's Literature and Data:
 - Labeled fire rated doors showing conformance with NFPA 80.
- E. Laboratory Test Reports:
 - 1. Direct screw withdrawal test report in accordance with MWWDA TM-10.
 - 2. Split resistance test report in accordance with NWWDA TM-5.
 - 3. Cycle/Swing test report in accordance with NWWDA TM-7.

4. Door Finish Test report in accordance with NWWDA TM-9.

F. Certificate required with identification mark.

1.4 GUARANTEE

A. Doors are subject to terms of Article titled "GUARANTY" of Section, GENERAL CONDITIONS, except that guaranty is in accordance with NWWDA I.S.1-A.

1. For interior doors, manufacturer's guarantee (warranty) for lifetime of original installation.

2. For exterior doors two years against no delamination, and permissible warp tolerance not exceeding 6 mm (1/4 inch) as specified in NWWDA I.S.1-A.

1.5 DELIVERY AND STORAGE

A. Factory seal doors and accessories in minimum of 6 mill polyethylene bags or cardboard packages which shall remain unbroken during delivery and storage.

B. Store in accordance with NWWDA I.S.1-A, G-20 Care and installation at job site.

C. Label package for door opening where used.

1.6 APPLICABLE PUBLICATIONS

A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.

B. National Wood Window and Door Association (NWWDA):

I.S.1-A-00.....Architectural Wood Flush Doors

I.S.4-81.....Water-Repellent Preservative Non-Pressure
Treatment for Millwork

TM-5-90.....Test Method to Determine the Split Resistance
of Stile Edges of Wood Doors

TM-7-90.....Cycle-Slam Test Method

TM-9-90.....Test Method

TM-10-90.....Screw Holding Test Method

C. National Fire Protection Association (NFPA):

80-99.....Fire Doors and Windows

PART 2 - PRODUCTS

2.1 FLUSH DOORS

A. General:

1. Meet requirements of NWWDA I.S.1-A.

2. Solid Core types S-5 or S-9 and for fire rated door Type S-13.
 3. Adhesive:
 - Type II for interior doors.
 4. Thickness: 45 mm (1-3/4 inches) unless otherwise shown or specified.
- B. Face Veneer:
1. In accordance with NWWDA I.S.1-A.
 2. One species throughout the project unless scheduled or otherwise shown.
 3. For all locations: white maple.
 - a. AA grade face veneer, sawn. Rotary cut not acceptable.
 - b. Match face veneers for doors for uniform effect of color and grain at joints.
 - c. Stile face veneer same species as door face veneer.
 4. Factory sand doors for finishing.
- C. Wood for stops and moldings of flush doors required to have transparent finish:
1. Solid Wood of same species as face veneer.
 2. Glazing:

On non-labeled doors use applied wood stops nailed tight on room side and attached on opposite side with flathead, countersunk wood screws, spaced approximately 125 mm (5 inches) on centers.
- D. Stiles and Rails:
1. Option for wood stiles and rails.
 - a. Laminated Standard Lumber having screw withdrawal force greater than solid wood species when tested in accordance with TM-10.
 - b. Bonded to solid wood face veneer not less than 6 mm (1/4 inch) thick.
 2. Bonded to core.
 3. Provide 75 mm (3 inch) face width by full core thickness. Bottom rail of doors having mechanically operated door bottom seal.

2.2 PREFINISH

- A. Flush doors to be factory machined to receive hardware, bevels, undercuts, cutouts, accessories and fitting for frame.
- B. Factory fitting to conform to specification for shop and field fitting, including factory application of sealer to edge and routings.
- C. Flush doors to receive transparent finish (in addition to being prefit) may be factory finished as follows:

1. AWI Section 1500 specification for System TR-4, Conversion Varnish or System TR-5, Catalyzed Vinyl.
2. Clear finish - no stain required.

2.3 IDENTIFICATION MARK:

- A. On top edge of door.
- B. Either a stamp, brand or other indelible mark, giving manufacturer's name, door's trade name, construction of door, code date of manufacture and quality.
- C. Accompanied by either of the following additional requirements:
 1. An identification mark or a separate certification including name of inspection organization.
 2. Identification of standards for door, including glue type.
 3. Identification of veneer and quality certification.
 4. The National Wood Window and Door Association Registered Hallmark edge stamp and glue bond mark plug.

2.4 SEALING:

- A. Give top and bottom edge of doors two coats of catalyzed polyurethane or water resistant sealer before sealing in shipping containers.

PART 3 - EXECUTION

3.1 DOOR PREPARATION

- A. Field, shop or factory preparation: Do not violate the qualified testing and inspection agency label requirements for fire rated doors.
- B. Clearances between Doors and Frames and Floors:
 1. Maximum 3 mm (1/8 inch) clearance at the jambs, heads, and meeting stiles, and a 19 mm (3/4 inch) clearance at bottom, except as otherwise specified.
 2. Maximum clearance at bottom of sound rated doors, light-proofed doors, doors to operating rooms, and doors designated to be fitted with mechanical seal: 10 mm (3/8 inch).
- C. Provide cutouts for special details required and specified.
- D. Rout doors for hardware using templates and location heights specified in Section, BUILDER'S HARDWARE.
- E. Fit doors to frame, bevel lock edge of doors 3 mm (1/8 inch) for each 50 mm (two inches) of door.
- F. Immediately after fitting and cutting of doors for hardware, seal cut edges of doors with two coats of water resistant sealer.

- G. Finish surfaces, including both faces, top and bottom and edges of the doors smooth to touch.
- H. Apply a steel astragal on the opposite side of active door on pairs of fire rated doors.
- I. Apply a steel astragal to meeting style of active leaf of pair of doors or double egress smoke doors.

3.2 INSTALLATION OF DOORS APPLICATION OF HARDWARE

Install doors and hardware as specified in Section, INSTALLATION OF DOORS AND HARDWARE.

3.3 DOOR PROTECTION

- A. As door installation is completed, place polyethylene bag or cardboard shipping container over door and tape in place.
- B. Provide protective covering over knobs and handles in addition to covering door.
- C. Maintain covering in good condition until removal is approved by COTR.

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**SECTION 08305
ACCESS DOORS**

PART 1 - GENERAL

1.1 DESCRIPTION:

Section specifies access doors or panels.

1.2 RELATED WORK:

- A. Lock Cylinders: Section 08710, BUILDERS HARDWARE.
- C. Access doors in acoustical ceilings: Section 09510, ACOUSTICAL CEILING.
- D. Locations of access doors for duct work cleanouts: Section 15840, DUCTWORK AND ACCESSORIES.

1.3 SUBMITTALS:

- A. Submit in accordance with Section 01340, SAMPLES AND SHOP DRAWINGS.
- B. Shop Drawings: Access doors, each type, showing construction, location and installation details.
- C. Manufacturer's Literature and Data: Access doors, each type.

1.4 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in the text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
 - A167-99.....Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip
 - A1008-03.....Steel Sheet, Cold-Rolled, Carbon, Structural, High Strength Low-Alloy
- C. American Welding Society (AWS):
 - D1.3-98.....Structural Welding Code Sheet Steel
- D. National Fire Protection Association (NFPA):
 - 80-99.....Fire Doors and Windows
- E. The National Association of Architectural Metal Manufacturers (NAAMM):
 - AMP 500 Series.....Metal Finishes Manual
- F. Underwriters Laboratories, Inc. (UL):
 - Fire Resistance Directory

PART 2 - PRODUCTS

2.1 FABRICATION, GENERAL

- A. Fabricate components to be straight, square, flat and in same plane where required.

1. Slightly round exposed edges and without burrs, snags and sharp edges.
 2. Exposed welds continuous and ground smooth.
 3. Weld in accordance with AWS D1.3.
- B. Number of locks and non-continuous hinges as required to maintain alignment of panel with frame. For fire rated doors, use hinges and locks as required by fire test.
- C. Provide anchors or make provisions in frame for anchoring to adjacent construction. Provide size, number and location of anchors on four sides to secure access door in opening. Provide anchors as required by fire test.
- D. Fabricate panels of stainless steel for toilet rooms and soiled utility room Painted steel for other locations.

2.2 ACCESS DOORS, FIRE RATED:

- A. Shall meet requirements for "B" label 1-1/2 hours with maximum temperature rise of 120 degree C (250 degrees F).
- B. Comply with NFPA 80 and have Underwriters Laboratories Inc., or other nationally recognized laboratory label for Class B opening.
- C. Door Panel: Form of 0.9 mm (0.0359 inch) thick steel or stainless steel sheet, insulated sandwich type construction.
- D. Frame: Form of 1.5 mm (0.0598 inch) thick steel sheet of depth and configuration to suit material and type of construction where installed. Provide frame flange at perimeter where installed in concrete masonry or gypsum board openings.
1. Weld exposed joints in flange and grind smooth.
 2. Provide frame flange at perimeter where installed in concrete masonry or gypsum board.
- E. Automatic Closing Device: Provide automatic closing device for door.
- F. Hinge: Continuous steel hinge with stainless steel pin.
- G. Lock:
1. Self-latching, with provision for fitting flush a standard screw-in type lock cylinder. Lock cylinder specified in Section, BUILDERS HARDWARE.
 2. Provide latch release device operable from inside of door. Mortise case in door.

2.3 ACCESS DOORS, FLUSH PANEL:

- A. Door Panel:

1. Form of 1.9 mm (0.0747 inch) thick steel or 1.5 mm (0.0598 inch) thick stainless steel sheet.
2. Reinforce to maintain flat surface.

B. Frame:

1. Form of 1.5 mm (0.0598 inch) thick steel or stainless steel sheet of depth and configuration to suit material and type of construction where installed.
2. Provide surface mounted units having frame flange at perimeter where installed in concrete, masonry, or gypsum board construction.
3. Weld exposed joints in flange and grind smooth.

C. Hinge:

1. Concealed spring hinge to allow panel to open 175 degrees.
2. Provide removable hinge pin to allow removal of panel from frame.

D. Lock:

Flush, screwdriver operated cam lock.

2.4 FINISH:

- A. Provide in accordance with NAAMM AMP 500 series on exposed surfaces.
- B. Steel Surfaces: Baked-on prime coat over a protective phosphate coating.
- C. Stainless Steel: No. 4 for exposed surfaces.

2.5 SIZE:

Minimum 600 mm (24 inches) square door unless otherwise shown // or required to suit opening in suspension system of ceiling. //

PART 3 - EXECUTION

3.1 LOCATION:

- A. Provide access panels or doors wherever any valves, traps, dampers, cleanouts, and other control items of mechanical, electrical and conveyor work are concealed in wall or partition, or are above ceiling of gypsum board or plaster.
- B. Use fire rated doors in fire rated partitions and ceilings.
- C. Use flush panels in partitions and gypsum board ceilings, except lay-in acoustical panel ceilings or upward access acoustical tile ceilings.

3.2 INSTALLATION, GENERAL:

- A. Install access doors in openings to have sides vertical in wall installations, and parallel to ceiling suspension grid or side walls when installed in ceiling.

- B. Set frames so that edge of frames without flanges will finish flush with surrounding finish surfaces.
- C. Set frames with flanges to overlap opening and so that face will be uniformly spaced from the finish surface.

3.3 ANCHORAGE:

- A. Secure frames to adjacent construction using anchors attached to frames or by use of bolts or screws through the frame members.
- B. Type, size and number of anchoring device suitable for the material surrounding the opening, maintain alignment, and resist displacement during normal use of access door.
- C. Anchors for fire rated access doors shall meet requirements of applicable fire test.

3.4 ADJUSTMENT:

- A. Adjust hardware so that door panel will open freely.
- B. Adjust door when closed so door panel is centered in the frame.

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**SECTION 08520
ALUMINUM WINDOWS**

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Fixed aluminum windows of type and size shown, complete with hardware, related components and accessories.
- B. The aluminum windows for this project are to be supplied as part of Section 07410, PREFORMED WALL AND ROOF PANELS.

1.2 DEFINITIONS

- A. Accessories: Mullions, casings, closures, trim, moldings, clips anchors, fasteners, weatherstripping, and other necessary components required for fabrication and installation of window units.
- B. Uncontrolled Water: Water not drained to the exterior, or water appearing on the room side of the window.

1.3 RELATED WORK

- A. Steel subframes: Section 05500, METAL FABRICATIONS.
- B. Glazing: Section 08810, GLASS AND GLAZING.
- C. Color of finish: Section 09050, INTERIOR/EXTERIOR FINISHES, MATERIALS, AND FINISH SCHEDULES.
- D. Building panel system: Section 07410, PREFORMED WALL PANELS.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Protect windows from damage during handling and construction operations before, during and after installation.
- B. Store windows under cover, setting upright.
- C. Do not stack windows flat.
- D. Do not lay building materials or equipment on windows.

1.5 QUALITY ASSURANCE

- A. Approval by contracting officer is required of products or service of proposed manufacturers and installers.
- B. Approval will be based on submission of certification by Contractor that:
 - 1. Manufacturer regularly and presently manufactures the specified windows as one of its principal products.
 - 2. Installer has technical qualifications, experience, trained personnel and facilities to install specified items.
- C. Provide each type of window produced from one source of manufacture.
- D. Quality Certified Labels or certificate:

1. Architectural Aluminum Manufacturers Association, "AAMA label" affixed to each window indicating compliance with specification.
2. Certificates in lieu of label with copy of recent test report (not more than 4 years old) from an independent testing laboratory and certificate signed by window manufacturer stating that windows provided comply with specified requirements and AAMA 101/I.S.2 for type of window specified.

E. Provide warranty as part of the preformed wall panel system.

1.6 SUBMITTAL

A. Submit in accordance with Section 01340, SAMPLE AND SHOP DRAWINGS.

B. Shop Drawings:

1. Minimum of 3"=1'0" scale.
2. Identifying parts of window units by name and kind of metal or material, show construction, trim, installation and anchorages, and adjacent panel system.
3. Include glazing details and standards for factory glazed units.
4. May be included as part of the preformed wall panel system shop drawings.

C. Manufacturer's Literature and Data:

Window

D. Certificates:

1. Certificates as specified in paragraph QUALITY ASSURANCE.
2. Indicating manufacturers and installers qualifications.
3. Manufacturer's Certification that windows delivered to project are identical to windows tested.

E. Test Reports:

Copies of test reports as specified in paragraph QUALITY ASSURANCE.

F. Samples:

Provide 150 mm (six-inch) length samples showing finishes, specified.

1.7 GUARANTEE

Guaranty windows against malfunctions due to defects in thermal breaks, hardware, materials and workmanship, subject to the terms of Article GUARANTY of Section 01001, GENERAL CONDITIONS, except provide 10 year guaranty period.

1.8 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Architectural Manufacturers Association (AAMA):
- 101/I.S.2-97.....Aluminum, Vinyl (PVC) and Wood Windows and Glass Doors
 - 505-98.....Dry Shrinkage and Composite Performance Thermal Cycling Test Procedures
 - 2605-98.....Superior Performing Organic Coatings on Architectural Aluminum Extrusions and Panels
 - TIR-A8-90.....Structural Performance of Poured and Debridged Framing Systems
- C. American Society for Testing and Materials (ASTM):
- A653/A653M-02.....Steel Sheet, Zinc Coated (Galvanized), Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-dip Process
 - E 90-02.....Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions
- D. National Association of Architectural Metal Manufacturers (NAAMM):
- AMP 500 Series.....Metal Finishes Manual

PART 2- PRODUCTS

2.1 MATERIALS

- A. Aluminum Extrusions; Sheet and Plate: AAMA 101/I.S.2.
- B. Sheet Steel, Galvanized: ASTM A653; G90 galvanized coating.
- C. Weatherstrips: AAMA 101/I.S.2; except leaf type weatherstripping is not permitted.
- D. Fasteners: AAMA 101/I.S.2. Screws, bolts, nuts, rivets and other fastening devices to be non-magnetic stainless steel.
 - 1. Fasteners to be concealed when window is closed. Where wall thickness is less than 3 mm (0.125 inch) thick, provide backup plates or similar reinforcements for fasteners.
 - 2. Stainless steel self tapping screws may be used to secure venetian blind hanger clips, vent guide blocks, friction adjuster, and limit opening device.

3. Attach locking and hold-open devices to windows with concealed fasteners. Provide reinforcing plates where wall thickness is less than 3 mm (0.125 inch) thick.

E. Weatherstrips: AAMA 101/I.S.2.

2.2 THERMAL AND CONDENSATION PERFORMANCE

A. Condensation Resistance Factor (CRF): Minimum CRF of C 55.

B. Thermal Transmittance:

Maximum U value class for dual glazed windows: U 70 (.70
W/Hr/SqM/Degrees C). (or 0.335 BTUH/Hr/Sq.Ft./degrees F)

2.3 FABRICATION

A. Fabrication to exceed or meet requirements of Physical Load Tests, Air Infiltration Test, and Water Resistance Test of AAMA 101/I.S.2.

B. Glazing:

1. Factory or field glazing optional.
2. Glaze in accordance with Section 08810, GLASS AND GLAZING.
3. Windows reglazable without dismantling sash framing.
4. Design rabbet to suit glass thickness and glazing method specified. Increase rabbet depths for plastic glazing when used; minimum, depth of 25 mm (1-inch).
5. Glaze from interior.

C. Trim:

1. Trim includes casings, closures, and panning.
2. Fabricate to shapes shown of aluminum not less than 1.6 mm (0.062 inch) thick
3. Extruded or formed sections, straight, true, and smooth on exposed surfaces.
4. Exposed external corners mitered and internal corners coped; fitted with hairline joints.
5. Reinforce 1.6 mm (0.062 inch) thick members with not less than 3 mm (1/8-inch) thick aluminum.
6. Except for strap anchors, provide reinforcing for fastening near ends and at intervals not more than 305 mm (12 inches) between ends.
7. Design to allow unrestricted expansion and contraction of members and window frames.
8. Secure to window frames with machine screws or expansion rivets.
9. Exposed screws, fasteners or pop rivets are not acceptable on exterior of the casing or trim cover system.

D. Thermal-Break Construction:

1. Manufacturer's Standard.
2. Low conductance thermal barrier.
3. Capable of structurally holding sash in position and together.
4. All Thermal Break Assemblies shall be tested as per AAMA TIR A8 and AAMA 505 for Dry Shrinkage and Composite Performance.
5. Location of thermal barrier and design of window shall be such that outside air shall not come in direct contact with interior frame of the window.

E. Mullions: AAMA 101.

2.4 FIXED WINDOWS

AAMA 101/I.S.2

2.5 FINISH

- A. In accordance with NAAMM AMP 500 series.
- B. Finish exposed aluminum surfaces as follows:
 1. Anodized Aluminum:
 - a. Finish in accordance with AMP 501 letters and numbers.
 - b. Clear anodized Finish: AA-C22A41 Medium matte, clear anodic coating, Class 1 Architectural, 0.7 mils thick.
 - c. Match color of existing aluminum windows.

PART 3 - EXECUTION

3.1 PROTECTION (DISSIMILAR MATERIALS): AAMA 101/I.S.2.

3.2 INSTALLATION, GENERAL

- A. Install window units in accordance with manufacturer's specifications and recommendations for installation of window units, hardware, operators and other components of work.
- B. Where type, size or spacing of fastenings for securing window accessories or equipment to building construction is not shown or specified, use expansion or toggle bolts or screws, as best suited to construction material.
 1. Provide bolts or screws minimum 6 mm (1/4-inch) in diameter.
 2. Sized and spaced to resist the tensile and shear loads imposed.
 3. Do not use exposed fasteners on exterior, except when unavoidable for application of hardware.
 4. Provide non-magnetic stainless steel Phillips flat-head machine screws for exposed fasteners, where required, or special tamper-proof fasteners.

5. Locate fasteners to not disturb the thermal break construction of windows.
- C. Set windows plumb, level, true, and in alignment; without warp or rack of frames or sash.
- D. Anchor windows on four sides with anchor clips or fin trim.
 1. Do not allow anchor clips to bridge thermal breaks.
 2. Use separate clips for each side of thermal breaks.
 3. Make connections to allow for thermal and other movements.
 4. Do not allow building load to bear on windows.
 5. Use manufacturer's standard clips at corners and not over 600 mm (24 inches) on center.
 6. Where fin trim anchorage is shown build into adjacent construction, anchoring at corners and not over 600 mm (24 inches) on center.

3.3 MULLIONS CLOSURES, TRIM, AND PANNING

- A. Cut mullion full height of opening and anchor directly to window frame on each side.
- B. Closures, Trim, and Panning: External corners mitered and internal corners coped, fitted with hairline, tightly closed joints.
- C. Secure to concrete or solid masonry with expansion bolts, expansion rivets, split shank drive bolts, or powder actuated drive pins.
- D. Toggle bolt to hollow masonry units. Screwed to wood or metal.
- E. Fasten except for strap anchors, near ends and corners and at intervals not more than 300 mm (12 inches) between.
- F. Seal units following installation to provide weathertight system.

3.4 ADJUST AND CLEAN

- A. Adjust ventilating sash and hardware to provide tight fit at contact points, and at weatherstripping for smooth operation and weathertight closure.
- B. Clean aluminum surfaces promptly after installation of windows, exercising care to avoid damage to protective coatings and finishes.
- C. Remove excess glazing and sealant compounds, dirt, and other substances.
- D. Lubricate hardware and moving parts.
- E. Clean glass promptly after installation of windows. Remove glazing and sealant compound, dirt and other substances.
- F. Except when a window is being adjusted or tested, keep locked in the closed position during the progress of work on the project.

3.5 OPERATION DEVICES

- A. Provide wrenches, keys, or removable locking operating handles, as specified to operate windows.
- B. Provide one emergency ventilating operating handle for every four windows.

- - - E N D - - -

**SECTION 08710
FINISH HARDWARE**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Work under this section includes the complete finish hardware requirements for the project. Quantities listed are for the Contractor's convenience only and are not guaranteed. Items not specifically mentioned, but necessary to complete the work shall be furnished, matching the items specified in quality and finish.

B. Related Sections:

1. Steel Doors and Frames - Section 08100
2. Wood Doors - Section 08200
3. Electrical - Division 16

1.03 REFERENCES

A. Standards:

1. ANSI/BHMA A156.18 - 2000 Materials and Finishes
2. ICC A117.1 - 1998 - Accessible and Usable Buildings and Facilities
3. NFPA 80 - 1999 - Standard for Fire Doors and Windows
4. NFPA 252 - 1995 - Standard of Fire Tests of Door Assemblies
5. Underwriters Laboratories - Building Materials Directory
6. Underwriters Laboratories Test Standard UL 10C-98 - Positive Pressure Fire Tests of Door Assemblies

B. Codes:

1. 2003 International Building Code.
2. ADAAG - Americans with Disabilities Act, "Accessibility Guidelines for Buildings and Facilities".

1.04 SUBMITTALS

A. General Requirements: All Submittals shall be in accordance with Section 01300, Submittals.

B. Product Data: Submit Six (6) copies of manufacturer's data for each item of finish hardware

C. Hardware Schedule: Submit Six (6) copies of a detailed Finish Hardware Schedule.

1. The submitted Finish Hardware Schedule shall indicate the complete designation of every item required for each door or opening.
2. List each opening individually under separate headings in the same order as the door schedule. Do not continue headings on separate pages.
3. Each heading shall indicate opening location, handing, degree of opening, door size, type, fire rating, Door and Frame material.
4. Indicate product manufacturer and incorporate cross-reference to symbols used in Article 2.15 Hardware Schedule.
5. A Key Schedule and index shall be included in the Finish Hardware submittals indicating door number, heading, page number, and locking function of each Opening.
6. Include a cross reference for any abbreviations or symbols used shall be included.
7. Schedules in coded or horizontal format are unacceptable.
8. Submittals not conforming to these requirements will be returned without review, for re-submittal. Following is an example of the required format:

1 Sgl. Door #205A - Vestibule 201 from Custodial 205 RHR 180°
 HW-3 3-0 x 7-0 x 1-3/4" x 20 Minute x Type A SC WD x HMF

3	Each Butts	MC	TA2714 US26D (652)	4.5 x 4.5 x 1/2MS
1	Lockset	SC	D70HD Rhodes 626	x 2-3/4" BS x 10-025
1	Permanent Core	BE	1C7A4	626
1	Door Closer	LCN	4041-EDA 689/Alum	x STB
1	Kick Plate	TI	B4EKP - 10 x 34.5	- US32D x B4E x CTSK
1	Wall Stop	TR	1270CX-CP US26D	(626)
1	Set Smoke Gasket		PE S88D - 17'	per Set

- D. Processing: Hardware schedules will not be reviewed by the Architect until they have been reviewed and approved by Contractor.
- E. Modifications: The Finish Hardware Submittal shall be kept current throughout the project duration. All revisions incorporated shall be submitted in accordance with the above requirements. Submit only cover sheet and revised pages. All revisions shall clearly identify changes from previous submittal content.
- F. Samples: If requested by the Architect, submit one (1) sample of each exposed hardware category, finished as required, and tagged with full description for coordination with the hardware schedule. Samples will be reviewed, by the Architect, for design and finish only, compliance with other requirements is the responsibility of the Contractor. Units

which are acceptable and remain undamaged through submittal procedures may be used on the project.

- G. Color Samples: Submit Six (6) set of color charts and physical samples of each product requiring color selection.
- H. Key Schedule: Upon completion of the Key meeting indicated under Paragraph 2.14 C., submit Four (4) copies of a key schedule indicating the complete project key system for approval.
- I. Wiring Diagrams: Wiring Diagrams. Submit with Finish Hardware Schedule, Six (6) copies a separate list of all Electronic Hardware, cross-referenced to the Finish Hardware Submittal and Door Schedule. Include Voltage requirements and along with Product Data and Installation instructions. Where "System Wiring Diagrams" are specified under Part 2, Products, provide terminal-to-terminal wiring diagrams of the system along with riser diagrams and description of system function. Indicate connection points to products provided under Division 16.
- J Operations and Maintenance Data.
 - 1. Submittals: Submit Maintenance and Operations Manuals under provisions of Section 01700, Project Close Out
 - 2. Content: Manuals shall contain final copy of the Finish Hardware Submittal, Product Data, Templates, Key Schedule, Installation and Maintenance Instructions, and Wiring Diagrams.

1.05 QUALITY ASSURANCE

- A. Supplier: Finish hardware shall be supplied by a recognized builders' hardware supplier who has been furnishing hardware in the same area as the project for a period of not less than five (5) years. They shall be a factory direct, authorized distributor of the Locksets and Door Closers. The supplier's organization shall include a Architectural Hardware Consultant, certified by the Door and Hardware Institute, who is available at all reasonable times during the course of the work to meet with the Owner, Architect or Contractor for project hardware consultation.
- B. Source: Obtain each kind of Hardware (Butts, Locksets, Door Closers, etc.) from only one manufacturer.
- C. Installer: Finish hardware shall be installed only by experienced tradesmen in compliance with trade union jurisdictions, either at the door and frame fabrication plant or at the project site.

D. Templates: Furnish hardware templates for each fabricator of doors, frames and other work to be factory prepared for the installation of hardware. Upon request, check the shop drawings of such other work to confirm that provisions will be made for the proper installation of hardware.

E. Regulatory Requirements:

1. Code Compliance: All finish hardware shall comply with applicable local and state building codes.
2. All finish hardware shall meet the requirements of ICC/ANSI A117.1 - 1998, Accessible and Usable Building and Facilities.
3. Product Compliance: Provide only hardware which has been tested and listed by a recognized testing agency for the types and sizes of doors required, and which complies with the requirements of the door and door frame labels. Provide Door Closers, Automatic self latching bolts, coordinators, gasketing, and astragals if required to conform to label requirements.

1.06 PRODUCT HANDLING AND STORAGE

- A. Packaging: Each item or package is to be separately tagged with identification related to the final hardware schedule. Basic installation instructions shall be included in the packages.
- B. Storage: Provide a locked room at the jobsite for the storage of the hardware.

1.07 WARRANTY

Coverage: Finish hardware shall be guaranteed against defects in workmanship and operation for a period of one (1) year from substantial completion, backed by a factory guarantee of the hardware manufacturer. The following products shall be guaranteed for periods beyond One (1) Year:

1. Door Closers: Ten (10) Years.
2. Exit Devices: Three (3) Years.

1.08 MAINTENANCE

Furnish One (1) Set of Special Tools required for installation and adjustment, which shall be delivered directly to the Owner prior to substantial completion, in accordance with Section 01770, Close-Out Procedures.

PART 2 PRODUCTS

2.01 MANUFACTURERS AND SUBSTITUTIONS

Manufacturers: Products may be furnished by the manufacturers listed under "As Specified" below, or equivalent products of type, grade, design, and function from manufacturers listed under "Acceptable Substitutions". Requests for products not listed must be made in accordance with Section 01600, Product Substitutions.

<u>Product</u>	<u>As Specified</u>	<u>Acceptable</u>
<u>Substitutions</u>		
Butt Hinges	McKinney (MC)	Bommer, Hager
Continuous Hinges	Markar (MA)	McKinney
Lockset and Cylinders	Schlage (SC)	Best 93K Series
Permanent Cores	Best (BE)	None
Push Button Locksets	ILCO Unican (IL)	None
Exit Devices	Von Duprin (VO)	None
Door Pulls, Push Pulls Sets Rockwood		Trimco (TR) Tice,
Door Closers	LCN	None
Kick & Mop Plates	Tice Industries (TI)	Rockwood, Trimco
Wall and Floor Stops	Trimco (TR)	Rockwood
Overhead Stop and Holders	Rixson, ABH	Glynn-Johnson (GJ)
Weatherstrip & Thresholds Guard, Reese		Pemko (PE) National

2.02 HARDWARE MATERIALS AND FABRICATION

- A. Fasteners: Provide fasteners for installation with each hardware item. Provide Phillips head fasteners, countersunk oval, flat head, or undercut head as appropriate for material to be installed. Provide Door Closers, Exit Devices, and surface type Overhead Stops applied to Wood Composite or Mineral Core Doors with Sex Bolts sized to the thickness of the Door.
- B. Compatibility: Provide fasteners which are compatible with both unit fastened and substrate, and which will not cause corrosion or deterioration of hardware, base material, or fastener.

2.03 HARDWARE FINISHES

General: Unless specifically indicated otherwise, provide architectural hardware in the following finishes.

1. Finish in general shall be: US26D, Satin Chrome Plated, except:
2. Exit Devices, Push Plates, Door Pulls, Overhead Stops, and Exterior Butts: US32D, Satin Stainless Steel.
3. Hinges: Satin Chrome Plated over Steel Base (BHMA 652).
4. Door Closers: 689/Sprayed Aluminum
5. Kick Plates: US32D, Satin Stainless Steel.
6. Smoke Gasketing: As Selected.
7. Threshold, Weatherstrip & Door Bottoms: As listed

2.04 BUTTS AND CONTINUOUS HINGES

- A. Quantity (per Leaf):
 1. Door openings up to 60": 2 each.
 2. Door openings 60 to 90": 3 each.
 3. Doors over 90": Furnish one (1) additional for each 30" increment or fraction thereof.
- B. Sizes:
 1. 1-3/4" Exterior & Vestibule Doors: 5 x 4-1/2"
 2. 1-3/4" Interior Doors up to and including 36": 4-1/2 x 4-1/2"
 3. 1-3/4" Interior Doors over 36": 5 x 4-1/2"
- C. Width: Width of Hinges shall be as required to clear projecting trim or other conditions to allow maximum degree of opening
- D. Non-Standard Sizes: For unusual size or weight doors, furnish type, size and quantity recommended by the hinge manufacturer.
- E. Pins: Hinges shall have non-removable pins (NRP - Set Screw in Barrel)
- F. Tips: Hinges shall have Flat Button Tips.

2.05 LOCKSETS

- A. Lock Design: Furnish all Lever Handle Locksets and Latchsets in Rhodes design.
- B. Backset: 2-3/4"
- C. All Locksets and Cylinder shall be capable of accepting "Small Format" type key removable interchangeable cores.
- D. Ratings: All Locksets and Latchsets shall be listed with Underwriters Laboratories for A label and lesser class doors.

- E. Strikes: Provide Curved Lip Strikes with adequate projection to protect door trim. Provide flat, flush lip strikes for pairs of doors with overlapping Astragals.
- F. Strike Boxes: Provide manufacturers standard wrought or plastic strike boxes.

2.06 MORTISE AND RIM CYLINDERS

Provide Cams, Tail Pieces, Cylinder Collars, and Blocking Rings as required for each application.

2.07 EXIT DEVICES

- A. Wood Doors: Furnish Sex Nuts and Bolts at all Wood Doors.
- B. Rated Openings: Provide UL listed Fire Exit Devices at rated openings.
- C. Size Exit Devices in accordance with manufacturer's recommendations.
- D. Vision Frames: Provide Glass Bead Kits where interference with Door Vision Frames occurs.
- E. Lever Handles: Lever Handle Trim shall design listed under 2.5 A., Locksets

2.08 DOOR CLOSERS

- A. Drop Plates: Furnish drop plates where doors have insufficient height top rails, or where Regular Arm Door Closers are used in conjunction with Concealed Overhead Stops.
- B. Fluid: Furnish cold weather fluid, at exterior & vestibule doors. Furnish special non-flammable fluid at fire rated openings in conformance with UL Test Standard 10C.
- C. Special Mounting: Provide special closer mounting as required where interference with weatherstrip or sound seals occurs.
- D. Wood Doors: Furnish Shoulder Through Bolts for Wood Doors.
- E. Spacers and Supports: Furnish Fifth Hole Spacers or Shoe Supports where required by frame configuration.

2.09 KICK, MOP, AND ARMOR PLATES

- A. General: Kick Plates shall be applied to the Push Side of the Door, Mop Plate applied to the Pull Side.
- B. Fasteners: Provide stainless steel Phillips oval/undercut head, full tread type sheet metal screws for fastening not more than 5 inches on center.
- C. Material: Plates shall be .050 304 Stainless Steel, beveled four edges (B4E) with Satin (#4) finish.
- D. Heights: Kick Plates: 10", Mop Plates: 6", Armor Plates: 34".

- E. Width: All plates shall be furnished with width as required to provide 1/4" clearance at sides of doors, frame stops, stop applied seals, or other surface applied components.

2.10 STOPS AND HOLDERS

- A. Size: Furnish Overhead Stop and Holders sized as recommended by the manufacturer.
- B. Special Applications: Furnish Overhead Stop and Holders with Special Shims, Brackets, or Special Template mounting where required.
- C. Site Conditions: Where wall stops are not applicable, furnish floor stops 1211 Series, or Overhead Stops if required.

2.11 THRESHOLDS

Fasteners: Furnish all Thresholds with 1/4"-20 x 2" Zinc Plated Flat Head Sleeve Anchors.

2.12 WEATHERSTRIP AND SMOKE GASKETING

General: Furnish weatherstrip and gaskets for complete perimeter of opening, including mullions, and astragals.

2.13 DOOR SILENCERS

General: Furnish Rubber Door Silencers for all openings.

- 1. Quantity: Furnish three (3) for each single door frame, and four (4) for each pair of door frames.
- 2. Type: 1229A.

2.14 KEYING

- A. All key operated products specified under this section shall be keyed to the existing system for the Veterans Administration Seattle Campus.
- B. Construction Key System: Provide temporary brass construction cores and cylinders during the construction period. Plastic construction cores are unacceptable.
- C. The Finish Hardware Supplier shall meet with the Owner to prepare the permanent keying schedule. Submit key schedule for approval in accordance with 1.4 H.
- D. All permanent cores, cylinders, change keys, and master keys, prepared according to the approved keying schedule, shall be transmitted directly to the Owner, prior to substantial completion. The General Contractor shall replace the construction cores with the permanent cores under the supervision of the Owner's authorized representative. Demonstrate proper keying and lock operation. All temporary cores shall be returned to the Finish Hardware Supplier.

- E. Transmittal: All permanent keys shall be sent direct from the lock manufacturer via registered mail, return receipt requested, to the Owner.
- F. Stamping: Stamp all keys and with system number and sub number designations as directed.
- G. Key Quantities: Furnish the following Key quantities:
 - Six (6) Master Keys per Set
 - Four (4) change keys per Lockset or Cylinder
 - Two (2) Construction Control Keys
 - Two (2) Permanent Core Control Keys
 - Six (6) Construction Keys

2.15 HARDWARE SCHEDULE

A. HW-1

Offices A00, A02, A07, A801, A09, B08, B10, C02, C07, C09, C23, C24,
D00, D01, D03, D10, D12, F04

3	Each Butts	MC	TA2714
1	Lockset	SC	D53HD
1	Permanent Core	BE	1C7A4
1	Wall Stop	TR	1270CV-CP
1	Set Gasket	PE	S88D

B. HW-2

Triage A01, B02, C01, D002

3	Each Butts	MC	TA2714
1	Lockset	SC	D70HD
1	Permanent Core	BE	1C7A4
1	Wall Stop	TR	1270CX-CP
3	Silencers		

C. HW-3

Housekeeping A03, F03

3	Each Butts	MC	TA2714
1	Latchset	SC	D80HD
1	Permanent Core	BE	1C7A4
1	Wall Stop	TR	1270CX-CP
3	Silencers		

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D. HW-4

Exam A04, A05, A10, A11, A12, A13, A14, A15, A16, A17, A18, A19, A20,
A21, A22, A23, B03, B04, B06, B09, B11, B13, B15, B16, B17, B18,
B19, B20, B21, B22, C03, C04, C05, C10, C12, C14, C15, C16, C17,
C18, C19, C20, C21, C22, D04, D05, D06, D08, D11, D13, D14, D15,
D16, D17, D18, D19, D20, D21, D22, D23, D24

Treatment B24

3	Each Butts	MC	TA2714
1	Latchset	SC	D10S
1	Wall Stop	TR	1270CX-CP
3	Silencers		

E. HW-5

Soiled Utility A06, D07

Clean Utility B05, C06

3	Each Butts	MC	T4A3795
1	Push Button Lockset	IL	L1021B
1	Permanent Core	BE	1C7A4
1	Door Closer LCN		4041DA-RA
1	Kick Plate	TI	B4EKP
1	Wall Stop	TR	1298
1	Set Smoke Gasket	PE	S88D

F. HW-6

Med. Room A08

3	Each Butts	MC	TA2714
1	Lockset	SC	D80HD
1	Permanent Core	BE	1C7A4
1	Overhead Stop	GJ	410S Series
3	Silencers		

G. HW-7

Staff Toilet B07, F06, F07

3	Each Butts	MC	TA2714
1	Lockset	SC	D73HD
1	Permanent Core	BE	1C7A4

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1	Door Closer	LCN	4041-RA
1	Kick Plate	TI	B4EKP
1	Mop Plate	TI	B4EMP
1	Wall Stop	TR	1270CV-CP
3	Silencers		

H. HW-8

Phlebotomy C000

3	Each Butts	MC	T4A3796
1	Latchset	SC	D10S
1	Overhead Stop	GJ	90S Series
3	Silencers		

I. HW-9

Treatment D25

3	Each Butts	MC	T4A3796
1	Latchset	SC	D10S
1	Wall Stop	TR	1270CX-CP
3	Silencers		

J. HW-10

Patient Toilet D26

1	Set Pivots	RI	128-3/4
1	Lockset	SC	D73PD
1	Permanent Core	BE	1C7A4
1	Rescue Door Stop and Two Way Strike	HA	457
1	Overhead Stop	GJ	410S Series
1	Wall Stop	TR	1270CV-CP
2	Door Seals	PE	354CP x Mortise into Vertical Edges

K. HW-11

Staff Lounge D28

3	Each Butts	MC	TA2714
1	Lockset	SC	D70HD
1	Permanent Core	BE	1C7A4

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1	Door Closer	LCN	4041 Spring-H-CUSH
1	Kick Plate	TI	B4EKP
3	Silencers		

L. HW-12

Electrical F01

3	Each Butts	MC	TA2714
1	Lockset	SC	D80HD x Knurled Insert Outside
1	Permanent Core	BE	1C7A4
1	Door Closer	LCN	4041-RA
1	Kick Plate	TI	B4EKP
1	Wall Stop	TR	1270CX-CP
3	Silencers		

M. HW-13

Mechanical F02

3	Each Butts	MC	T4A3786
1	Lockset	SC	D80HD x Knurled Insert Outside
1	Permanent Core	BE	1C7A4
1	Door Closer	LCN	4041-RA
1	Kick Plate	TI	B4EKP
1	Wall Stop	TR	1270CX-CP
1	Set Gasket	PE	S88D

N. HW-14

Mailroom F05

3	Each Butts	MC	TA2714
1	Lockset	SC	D70HD
1	Permanent Core	BE	1C7A4
1	Overhead Stop	GJ	410S Series
3	Silencers		

O. HW-15

Staff Locker F08

3	Each Butts	MC	T4A3786
1	Push Button Lockset	IL	L1021B

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1	Permanent Core	BE	1C7A4
1	Door Closer LCN		4041-RA
1	Kick Plate	TI	B4EKP
1	Wall Stop	TR	1270CX-CP
3	Silencers		

P. HW-16

Conference G02

3	Each Butts	MC	TA2714
1	Lockset	SC	D70HD
1	Permanent Core	BE	1C7A4
1	Overhead Stop	GJ	410S Series
1	Set Gasket	PE	S88D

Q. HW-17

Men's Room

Women's Room

3	Each Butts	MC	T4A3786
1	Push Plate	TR	1001-11
1	Pull Plate	TR	1014-3
1	Door Closer LCN		4041-RA
1	Kick Plate	TI	B4EKP
1	Mop Plate	TI	B4EMP
1	Wall Stop	TR	1270CX-CP
3	Silencers		

R. HW-18

Stair

3	Each Butts	MC	T4A3786
1	Exit Device	VO	99L-F
1	Rim Cylinder	SC	80-159
1	Permanent Core	BE	1C7A4
1	Door Closer LCN		4041-EDA
1	Kick Plate	TI	B4EKP
1	Wall Stop	TR	1270CX-CP
1	Set Gasket	PE	S88D

S. HW-19

Corridor Pair

2	Continuous Hinges	MA	HG-305
2	Exit Devices	VO	9927EO-F
2	Door Closers	LCN	4041-DA-EDA
2	Kick Plates	TI	B4EKP
2	Mop Plates	TI	B4EMP - 10"
1	Door Edging	MA	EG-C-308
1	Door Edging	MA	EG-T-308
2	Floor Stops	TR	1215CKU
1	Set Gasket	PE	S88D

T. HW-20

Doors in Interstitial Space

3	Each Butts	MC	TA2714
1	Latchset	SC	D10S
1	Door Closer	LCN	4041-EDA
1	Kick Plate	TI	B4EKP
1	Floor Stop	TR	1215CKU
1	Set Gasket	PE	S88D

PART 3 EXECUTION

3.01 PREPARATION

- A. Examination: Examine Doors, Frames, and related items for conditions that would prevent the proper application of the Finish Hardware. Do not proceed until defects are corrected
- B. Blocking: Provide solid blocking for all wall stops.
- C. Fasteners: Check all conditions and use fastening devices as needed to securely anchor all hardware as per manufacturer's published templates. Self-tapping sheet metal screws are not acceptable. All Door Closers, Exit Devices, and Surface mounted Overhead Stops on wood doors shall be through-bolted.

3.02 INSTALLATION

- A. Mounting Heights: Mount units at heights as recommended in "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames (2001)" by Doors and Hardware Institute, except as

indicated below. Products not specifically covered shall be installed in accordance with the manufacturers templates and instructions.

1. Hinges:

- a. Top Hinge: 7-1/4", Top of frame rabbet to centerline of hinge.
- b. Bottom Hinge: 12-1/4", Bottom of Frame to centerline of hinge
- c. Intermediate Hinges: centered, equal spacing between top and bottom hinges.

2. Lock Strikes: 40", bottom of frame to centerline of Strike

3. Wall Stops: Locate Wall Stops intended for use with Lever Handle Locksets and Exit Devices at the Centerline of the Spindle or Door Pull.

B. Installation: Install each hardware item in compliance with manufacturer's instructions.

1. Cutting and Fitting: Wherever cutting and fitting are required to install hardware surfaces which will be painted or finished at a later time, install each item completely and then remove and store in a secure place. After completion of the finishes, re-install each item.

2. Door and Frame Finishes: Do not install surface-mounted items until finishes have been completed on the substrate.

3. Fire Rated Openings: Install in accordance with NFPA 80

4. Exit Devices: Trim Exit Devices to provide 1-1/2" clearance between Exit Device end cap and adjacent frame stops and stop applied weatherstrip where applicable.

5. Door Closers: Door Closer shall be located to allow maximum degree of opening that project conditions will allow. Door Closer shall not be used to stop the door, except for models equipped with an integral stop-on-the-arm feature.

6. Overhead Stops: Locate Overhead Stop and Holders with maximum degree of opening that project conditions will allow.

7. Floor Stops: Locate Floors Stops at maximum degree of opening that project conditions will allow. Do not locate Floor Stops where they create a hazardous condition. Stops should be located no more than 1/3 Door width from the latch edge of the Door.

C. Adjustment: Adjust and check each operating item of hardware and each door to insure proper operation or function of every unit. Replace units which cannot be adjusted to operate freely and smoothly.

3.03 FINAL ADJUSTMENT

- A. Final Adjustment: Wherever hardware installation is made more than one (1) month prior to acceptance or occupancy, make a final check and adjustment of all hardware items during the week prior to acceptance or occupancy. Clean and lubricate operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.
- B. Door Closer Adjustment: After mechanical systems have been balanced, adjust Door Closers to comply with following CABO/ANSI A117.1 - 1992 requirements.
 - 1. Closing Speed: With the door open 70 degrees, the door closer shall be adjusted so that the door will take at least three (3) seconds to move to a point where the leading edge of the door is three inches from latching.
 - 2. Opening Force: The maximum force for pushing or pulling a door open shall be as follows: (these forces do not apply to the force required to retract latch bolts or disengage other devices securing the door)
 - a. Fire Doors: The minimum opening force allowable by the appropriate administrative authority.
 - b. Exterior Doors: 8.5 lbf.
 - c. Interior Doors: 5.0 lbf.
- C. Door Closer Backcheck. Adjust Door Closer back check to provide protection for adjacent walls, stops, and magnetic holders.
- D. Instruct Owner's Personnel in proper adjustment and maintenance of hardware and hardware finishes.

- - - E N D - - -

**SECTION 08750
INSTALLATION OF DOORS AND HARDWARE**

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies the hanging of doors and installation of hardware.

1.2 RELATED WORK

- A. Sealants for Thresholds: Section 07920, SEALANTS AND CAULKING.
- B. Fitting and Preparation for hardware: Section 08110, STEEL DOORS AND FRAMES.
- C. Fitting and Preparation for Hardware of prefinished and prefit wood doors: Section 08210 PLASTIC-LAMINATE-FACED WOOD DOORS.
- D. Folding Doors: Section 10617, MOVEABLE METAL PARTITIONS.
- E. Door hardware, weatherstripping, seals, and location (height): Section 08710, BUILDER'S HARDWARE.

1.3 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in text by basic designation only.
- B. Door and Hardware Institute (DHI):
A115.1G-94.....Installation Guide for Doors and Hardware
- C. National Fire Protection Association (NFPA):
80-99.....Fire Doors and Windows
- D. American Society for Testing and Materials (ASTM):
A167-99.....Stainless and Heat-Resisting Chromium-Nickel
Steel Plate, Sheet and Strip

PART 2 - PRODUCTS

2.1 FASTENERS

- A. Use fasteners furnished with hardware for installation.
 - 1. Where fasteners are not furnished with item, use fasteners of suitable size and type to harmonize with item as to material and finish and to suit material to which fastened.
 - 2. Use machine screws and metal expansion shields to secure hardware to concrete, ceramic or quarry tile, or solid masonry. Do not use fiber, plastic, and lead plugs or adhesives.
- B. Use non-ferrous metal fastenings exposed to weather.

2.2 SHIMS

Stainless steel, type 302 or 304, thickness for conditions required.

PART 3 - EXECUTION

3.1 INSTALLATION GENERAL

- A. Hang doors and install hardware when concrete work, tile setting, and other operations have been completed which increase humidity and dust in building.
- B. Do not hang doors in areas where materials are not sufficiently dry so as to not affect the dimensional stability of the door.
- C. Install hardware, except hinges, after field painting or sealing, specified in Section 09900, PAINTING.
- D. Center doors in the opening or frame with contact surfaces fit tight and even without forcing or warping the components.
- E. Replace doors and frames that do not conform to hardware height requirements.

3.2 FITTING WOOD DOORS

- A. Do not alter pre-fit and pre-finished doors.
- B. Unless otherwise detailed, fit hinged doors with 3 mm (1/8 inch) clearance at hinge stiles, 3 mm (1/8 inch) at top and lock or meeting stiles, and 19 mm (3/4 inch) between bottom rail and floor.
- C. Bevel lock edge and meeting stile of single acting wood doors 3 mm (1/8 inch) for each 50 mm (2 inches) of door thickness.
- D. Immediately after fitting and cutting of wood doors for hardware, seal edges of doors as specified in Section 09900, PAINTING.
- E. Mortise wood doors for hardware using templates furnished under Section, BUILDER'S HARDWARE.
- F. Cut sinkages for lock fronts, strikes, hinges and similar items same size as item installed.

3.3 INSTALLING DOORS AND BUILDER'S HARDWARE

- A. Install hardware at the location (heights) specified.
- B. Install in accordance with the manufacturer's printed instructions and DHI A115.1G unless specified otherwise.
- C. Drill and tap screw holes in steel frames and doors for surface mounted hardware.
- D. Use shims only at hinges where required to provide uniform clearance and alignment of door. Cut shims from stainless steel sheet to same size as hinge.

- E. Do not drive screws in place.
- F. Carefully fit and securely attach hardware items to doors and frames.
- G. Closers including those with hold-open features:
 - 1. Where closers are mounted on doors, mount with hex nuts and bolts; fasten foot to frame with machine.
 - 2. Mount to provide maximum door opening permitted by building construction or equipment.
 - 3. Use regular arm mounting except where door swing is less than 90 degrees or closer is on interior of exterior door or door is equipped with roller latch.
- H. Thresholds:
 - 1. Install thresholds in a bed of sealant with machine screws and expansion shields. For sealant see section, SEALANT AD CAULKING.
 - 2. Cut thresholds to closely fit jambs.
 - 3. Drill and cut for door holders and bottom bolts where required.
- I. Install automatic door bottom so that gasket is automatically forced down to tightly seal instantly when the door is fully closed, and raised instantly when the door begins to open. Mount automatic door bottom to provide 5 mm (3/16 inch) clearance at door bottom.
- J. Install seals on door frames for lightproof doors. Secure seals to door frames at jamb and heads with contact adhesive to prevent infiltration of light.
- K. Install rain drips for heads of door frames not protected by canopy or soffit.
- L. Install key cabinet as directed by the COTR.

3.4 INSTALLING FIRE RATED DOORS

- A. Install fire rated doors in accordance with NFPA 80.
- B. Do not remove qualified testing and inspection agency label.

3.5 INSTALLING WEATHERSTRIPPING AND SEALS

- A. Accurately cut and fit weatherstrips and seals. Carefully aligned for full contact and tight seal and secure firmly to maintain weatherproof, waterproof, and lightproof seal without preventing smooth and easy operation of doors.
- B. Provide suitable blocking where necessary to clear hardware; and make adjustments as required to meet special conditions encountered.
- C. Prime paint wood surfaces which have been cut with wood sealer before weatherstrips are installed.

3.6 CLEANING AND ADJUSTING

- A. Adjust Doors, including hardware to operate as designed without binding or deformation of the members.
- B. After installation, clean surfaces, remove temporary labels, paint spots and other defacement.
- C. Clean prefinished and plated items and items fabricated from stainless steel, aluminum and copper alloys, as recommended by the manufacturer.

3.7 PROTECTION

- A. Protect doors and hardware from damage until completion of the project.
- B. Protective covering for wood doors is specified in Section 08210.

- - - E N D - -

**SECTION 08810
GLASS AND GLAZING**

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies glass, related glazing materials and accessories. Glazing products specified apply to factory or field glazed items.
- B. All exterior glazing is to be supplied as part of the exterior metal wall systems, specified under Section 07410, EXTERIOR METAL WALL SYSTEMS.

1.2 RELATED WORK

- A. Section 07410 EXTERIOR METAL WALL SYSTEMS.
- B. Steel doors and frames: Section 08110, STEEL DOORS AND FRAMES.
- C. Factory glazed by manufacturer in following units:
 - Mirrors: Section 10800, TOILET AND BATH ACCESSORIES
- D. Color of spandrel glass, tinted (heat absorbing or light reducing) glass, and reflective (metallic coated) glass: Section 09050, INTERIOR/EXTERIOR FINISHES.

1.3 LABELS

- A. Temporary labels:
 - 1. Provide temporary label on each light of glass identifying manufacturer or brand and glass type, quality and nominal thickness.
 - 2. Label in accordance with NFRC (National Fenestration Rating Council) label requirements.
 - 3. Temporary labels shall remain intact until glass is approved by COTR.
- B. Permanent labels:
 - 1. Locate in corner for each pane.
 - 2. Label in accordance with ANSI Z97.1 and SGCC (Safety Glass Certification Council) label requirements.
 - a. Tempered glass.
 - b. Laminated glass or have certificate for panes without permanent label.
 - c. Organic coated glass.

1.4 PERFORMANCE REQUIREMENTS

- A. Building Enclosure Vapor Retarder and Air Barrier:

1. Utilize the inner pane of multiple pane sealed units for the continuity of the air barrier and vapor retarder seal.
2. Maintain a continuous air barrier and vapor retarder throughout the glazed assembly from glass pane to heel bead of glazing sealant.

B. Glass Thickness:

1. Select thickness of exterior glass to withstand dead loads and wind loads acting normal to plane of glass at design pressures calculated in accordance with ASCE 7 and applicable codes.
2. Limit glass deflection to 1/200 or flexure limit of glass, whichever is less, with full recovery of glazing materials.
3. Test in accordance with ASTM E 330.
4. Thicknesses listed are minimum. Coordinate thicknesses with framing system manufacturers.

1.5 SUBMITTALS

- A. In accordance with Section 01340, SAMPLES AND SHOP DRAWINGS.
- B. Manufacturer's Certificates:
 1. Certificate on shading coefficient.
 2. Certificate on "R" value when value is specified.
- C. Guaranties: Submit written guaranty, conforming to General Condition requirements, and to "Guaranty" Article in this Section.
- D. Manufacturer's Literature and Data:
 1. Glass, each kind required.
 2. Insulating glass units.
 3. Elastic compound for metal sash glazing.
 4. Glazing cushion.
 5. Sealing compound.
- E. Samples:
 1. Size: 150 mm by 150 mm (6 inches by 6 inches).
 2. Tinted glass.
 3. Reflective glass.
- F. Preconstruction Adhesion and Compatibility Test Report: Submit glazing sealant manufacturer's test report indicating glazing sealants were tested for adhesion to glass and glazing channel substrates and for compatibility with glass and other glazing materials.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Delivery: Schedule delivery to coincide with glazing schedules so minimum handling of crates is required. Do not open crates except as required for inspection for shipping damage.
- B. Storage: Store cases according to printed instructions on case, in areas least subject to traffic or falling objects. Keep storage area clean and dry.
- C. Handling: Unpack cases following printed instructions on case. Stack individual windows on edge leaned slightly against upright supports with separators between each.

1.7 PROJECT CONDITIONS

Field Measurements: Field measure openings before ordering tempered glass products. Be responsible for proper fit of field measured products.

1.8 GUARANTY

- A. Guaranty: Conform to terms of "Guaranty" Article in Section 01001, GENERAL CONDITIONS, except extend guaranty period for the following:
Insulating glass units to remain sealed for 10 years.

1.9 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American National Standards Institute (ANSI):
Z97.1-94.....Safety Glazing Material Used in Building -
Safety Performance Specifications and Methods
of Test.
- C. American Society for Testing and Materials (ASTM):
C1363-97.....Thermal Performance of Building Assemblies, by
Means of A Hot Box Apparatus
C542-94 (R1999).....Lock-Strip Gaskets.
C716-00.....Installing Lock-Strip Gaskets and Infill
Glazing Materials.
C864-99.....Dense Elastomeric Compression Seal Gaskets,
Setting Blocks, and Spacers.
C920-02.....Elastomeric Joint Sealants.
C1036-01.....Flat Glass.

- C1048-97.....Heat-Treated Flat Glass-Kind HS, Kind FT Coated
and Uncoated Glass.
- C1172-96.....Laminated Architectural Flat Glass.
- C1349-96.....Architectural Flat Glass Clad Polycarbonate.
- D635-98.....Rate of Burning and/or Extent and Time of
Burning of Self-Supporting Plastic in a
Horizontal Position.
- D4802-02.....Poly (Methyl Methacrylate) Acrylic Plastic
Sheet.
- E84-01.....Surface Burning Characteristics of Building
Materials.
- E330-02.....Structural Performance of Exterior Windows,
Curtain Walls, and Doors by Uniform Static Air
Pressure Difference.
- E774-97.....Sealed Insulating Glass Units
- D. Code of Federal Regulations (CFR):
16 CFR 1201 - Safety Standard for Architectural Glazing Materials;
1977, with 1984 Revision.
- F. Glass Association of North America (GANA):
01.....Glazing Manual (1997 Edition).
02.....Sealant Manual (1990 Edition).
03.....Laminated Glass Design Guide (2000 Edition).
04.....Tempered Glass Engineering Standard Manual
(2001 Edition).
- G. National Fire Protection Association (NFPA):
80-(1999).....Fire Doors and Windows.
- H. National Fenestration Rating Council (NFRC):
Certified Products Directory (Latest Edition).
- I. Safety Glazing Certification Council (SGCC):
Certified Products Directory (Issued Semi-Annually).

PART 2 - PRODUCT

2.1 GLASS

- A. Use thickness stated unless specified otherwise in assemblies.
- B. Clear Glass:
 - 1. ASTM C1036, Type I, Class 1, Quality // q3 // // q4 //.
 - 2. Thickness, 6 mm (1/4 inch).
- C. Tinted and low emissivity coated glass:

1. ASTM C1036, Type I, Class 2, Quality q3.
2. Color: Gray.
3. Thickness, 6 mm.

D. Patterned and Wired Flat Glass:

1. ASTM C1036, Type II, Class 1, Form 1, Pattern Pl, Finish F1, Quality // Q5 // // Q6 //, Mesh // m1 // // m2 //.
2. Thickness, 6 mm.

2.2 HEAT-TREATED GLASS

Clear Tempered Glass.

1. ASTM C1048, Kind FT, Condition A, Type I, Class 1, Quality q3.
2. Thickness, 6 mm (1/4 inch).

2.3 COATED GLASS

Low-E Tempered Glass:

1. ASTM C1048, Kind FT, Condition C, Type I, Class 1, Quality q3 with low emissivity pyrolytic coating having an E of 0.15.
2. Apply coating to third surface of insulating glass units.
3. Thickness, 6 mm (1/4 inch).

2.4 INSULATING GLASS UNITS

- A. Provide factory fabricated, hermetically sealed glass unit consisting of two panes of glass separated by a dehydrated air space.
- B. Assemble units using glass types specified:
- C. Sealed Edge Units (SEU):
 1. Conform to ASTM E774, Class C performance requirements.
 2. Air Space not less than 13 mm (½ inch) wide.
 3. Winter "U" value: 0.35 BTU/Hr/Sq.Ft./degree F.
 4. Shading coefficient: .32 to .34
 5. Exterior pane: 11/4" cool gray color, low reflecting glass, heat strengthened.
 6. Interior Lite: Clear float Low-E coating on third surface. Safety glazing where required by code.
 7. Basis of Design: PPG "Gray" exterior glass with "Solarban" 60 solar control Low-E on third surface.

2.12 GLAZING ACCESSORIES

- A. As required to supplement the accessories provided with the items to be glazed and to provide a complete installation. Ferrous metal accessories exposed in the finished work shall have a finish that will not corrode or stain while in service.

B. Setting Blocks: ASTM C864:

1. Channel shape; having 6 mm (1/4 inch) internal depth.
2. Shore a hardness of 80 to 90 Durometer.
3. Block lengths: 50 mm (two inches) except 100 to 150 mm (four to six inches) for insulating glass.
4. Block width: Approximately 1.6 mm (1/16 inch) less than the full width of the rabbet.
5. Block thickness: Minimum 4.8 mm (3/16 inch). Thickness sized for rabbet depth as required.

C. Spacers: ASTM C864:

1. Channel shape having a 6 mm (1/4 inch) internal depth.
2. Flanges not less 2.4 mm (3/32 inch) thick and web 3 mm (1/8 inch) thick.
3. Lengths: One to 25 to 76 mm (one to three inches).
4. Shore a hardness of 40 to 50 Durometer.

D. Sealing Tapes:

1. Semi-solid polymeric based material exhibiting pressure-sensitive adhesion and withstanding exposure to sunlight, moisture, heat, cold, and aging.
2. Shape, size and degree of softness and strength suitable for use in glazing application to prevent water infiltration.

E. Spring Steel Spacer: Galvanized steel wire or strip designed to position glazing in channel or rabbeted sash with stops.

F. Glazing Gaskets: ASTM C864:

1. Firm dense wedge shape for locking in sash.
2. Soft, closed cell with locking key for sash key.
3. Flanges may terminate above the glazing-beads or terminate flush with top of beads.

I. Lock-Strip Glazing Gaskets: ASTM C542, shape, size, and mounting as indicated.

J. Glazing Sealants: ASTM C920, silicone neutral cure:

1. Type S.
2. Class 25
3. Grade NS.
4. Shore A hardness of 25 to 30 Durometer.

K. Color:

1. Color of glazing compounds, gaskets, and sealants used for aluminum color frames shall match color of the finished aluminum and be nonstaining.
2. Color of other glazing compounds, gaskets, and sealants which will be exposed in the finished work and unpainted shall be black, gray, or neutral color.

N. Smoke Removal Unit Targets: Adhesive targets affixed to glass to identify glass units intended for removal for smoke control. Comply with requirements of local Fire Department.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions:

1. Examine openings for glass and glazing units; determine they are proper size; plumb; square; and level before installation is started.
2. Verify that glazing openings conform with details, dimensions and tolerances indicated on manufacturer's approved shop drawings.

B. Advise Contractor of conditions which may adversely affect glass and glazing unit installation, prior to commencement of installation.

1. Do not proceed with installation until unsatisfactory conditions have been corrected.

C. Verify that wash down of adjacent masonry is completed prior to erection of glass and glazing units to prevent damage to glass and glazing units by cleaning materials.

3.2 PREPARATION

- A. For sealant glazing, prepare glazing surfaces in accordance with GANA-02 Sealant Manual.
- B. Determine glazing unit size and edge clearances by measuring the actual unit to receive the glazing.
- C. Shop fabricate and cut glass with smooth, straight edges of full size required by openings to provide GANA recommended edge clearances.
- D. Verify that components used are compatible.
- E. Clean and dry glazing surfaces.
- F. Prime surfaces scheduled to receive sealants, as determined by preconstruction sealant-substrate testing.

3.3 INSTALLATION - GENERAL

- A. Install in accordance with GANA-01 Glazing Manual and GANA-02 Sealant Manual unless specified otherwise.
- B. Glaze in accordance with recommendations of glazing and framing manufacturers, and as required to meet the Performance Test Requirements specified in other applicable sections of specifications.
- C. Set glazing without bending, twisting, or forcing of units.
- D. Do not allow glass to rest on or contact any framing member.
- E. Glaze doors and operable sash, in a securely fixed or closed and locked position, until sealant, glazing compound, or putty has thoroughly set.
- F. Tempered Glass: Install with roller distortions in horizontal position unless otherwise directed.
- G. Insulating Glass Units:
 - 1. Glaze in compliance with glass manufacturer's written instructions.
 - 2. When glazing gaskets are used, they shall be of sufficient size and depth to cover glass seal or metal channel frame completely.
 - 3. Do not use putty or glazing compounds.
 - 4. Do not grind, nip, cut, or otherwise alter edges and corners of fused glass units after shipping from factory.

3.4 INSTALLATION - DRY METHOD (TAPE AND GASKET SPLINE GLAZING)

- A. Cut glazing tape or spline to length; install on glazing pane. Seal corners by butting and sealing junctions with butyl sealant.
- B. Place setting blocks at 1/4 points with edge block no more than 150 mm (6 inches) from corners.
- C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure to attain full contact.
- D. Install removable stops without displacing glazing spline. Exert pressure for full continuous contact.
- E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- F. Trim protruding tape edge.

3.5 INSTALLATION - WET/DRY METHOD (PREFORMED TAPE AND SEALANT)

- A. Cut glazing tape to length and set against permanent stops, 5 mm (3/16 inch) below sight line. Seal corners by butting tape and dabbing with butyl sealant.

- B. Apply heel bead of butyl sealant along intersection of permanent stop with frame ensuring full perimeter seal between glass and frame to complete the continuity of the air and vapor seal.
- C. Place setting blocks at 1/4 points with edge block no more than 150 mm (6 inches) from corners.
- D. Rest glazing on setting blocks and push against tape and heel bead of sealant with sufficient pressure to achieve full contact at perimeter of pane or glass unit.
- E. Install removable stops, with spacer strips inserted between glazing and applied stops, 6 mm (1/4 inch) below sight line. Place glazing tape on glazing pane or unit with tape flush with sight line.
- F. Fill gap between glazing and stop with S-type sealant to depth equal to bite of frame on glazing, but not more than 9 mm (3/8 inch) below sight line.
- G. Apply cap bead of S-type sealant along void between the stop and the glazing, to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

3.6 INSTALLATION - WET METHOD (SEALANT AND SEALANT)

- A. Place setting blocks at 1/4 points and install glazing pane or unit.
- B. Install removable stops with glazing centered in space by inserting spacer shims both sides at 600 mm (24 inch) intervals, 6 mm (1/4 inch) below sight line.
- C. Fill gaps between glazing and stops with S-type sealant to depth of bite on glazing, but not more than 9 mm (3/8 inch) below sight line to ensure full contact with glazing and continue the air and vapor seal.
- D. Apply sealant to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

3.7 INSTALLATION - INTERIOR WET/DRY METHOD (TAPE AND SEALANT)

- A. Cut glazing tape to length and install against permanent stops, projecting 1.6 mm (1/16 inch) above sight line.
- B. Place setting blocks at 1/4 points with edge block no more than 150 mm (6 inches) from corners.
- C. Rest glazing on setting blocks and push against tape to ensure full contact at perimeter of pane or unit.
- D. Install removable stops, spacer shims inserted between glazing and applied stops at 600 mm (24 inch) intervals, 6 mm (1/4 inch) below sight line.

- E. Fill gaps between pane and applied stop with S-type sealant to depth equal to bite on glazing, to uniform and level line.
- F. Trim protruding tape edge.

3.9 INSTALLATION - INTERIOR WET METHOD (COMPOUND AND COMPOUND)

- A. Install glazing resting on setting blocks. Install applied stop and center pane by use of spacer shims at 600 mm (24 inch) centers, kept 6 mm (1/4 inch) below sight line.
- B. Locate and secure glazing pane using glazers' clips.
- C. Fill gaps between glazing and stops with glazing compound until flush with sight line. Tool surface to straight line.

3.10 REPLACEMENT AND CLEANING

- A. Clean new glass surfaces removing temporary labels, paint spots, and defacement after approval by COTR.
- B. Replace cracked, broken, and imperfect glass, or glass which has been installed improperly.
- C. Leave glass, putty, and other setting material in clean, whole, and acceptable condition.

3.11 PROTECTION

Protect finished surfaces from damage during erection, and after completion of work. Strippable plastic coatings on colored anodized finish are not acceptable.

3.12 GLAZING SCHEDULE

- A. Fire Resistant Glass:
 - Install clear wire glass in interior fire rated or labeled doors and windows.
- B. Tempered Glass:
 - 1. Install in door glazing unless otherwise indicated.
 - 2. Install in storefront, windows, and door sidelights adjacent to doors.
- C. Install SEU units in exterior windows. Temper interior glazing where required by code.

- - - E N D - - -

**SECTION 09050
INTERIOR / EXTERIOR FINISHES**

PART I - GENERAL

1.1 DESCRIPTION

This section contains a coordinated system in which requirements for materials specified in other sections shown are identified by abbreviated material names and finish codes in the room finish schedule or shown for other locations.

1.2 MANUFACTURERS

Manufacturer's trade names and numbers used herein are only to identify colors, finishes, textures and patterns. Products of other manufacturer's equivalent to colors, finishes, textures and patterns of manufacturers listed that meet requirements of technical specifications will be acceptable upon approval in writing by contracting officer for finish requirements.

1.3 SUBMITALS

Submit in accordance with Section 01340, Samples and Shop Drawings provide quadruplicate samples for color approval of materials and finishes specified in this section.

1. COLOR SLIDES-INTERIOR VIEWS:

Room Number and Name	Item/View to be Photographed
1.	
2.	
3.	
4.	

1.4 APPLICABLE PUBLICATIONS

A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in text by basic designation only.

B. MASTER PAINTING INSTITUTE: (MPI)
 2001.....Architectural Painting Specification Manual

PART 2- PRODUCTS

2.1 COLOR SLIDES

- A. Size 24 x 35 mm.
- B. Labeled for:
 - 1. Building name and Number.
 - 2. Room Name and Number.

2.2 DIVISION 5 - METALS

A. STRUCTURAL STEEL (05120)

Component	Finish	Color

B. STEEL DECKING (05311) OR (05321)

Finish	Color

D. COLD FORMED METAL FRAMING (05400)

Finish	Color

E. METAL FABRICATION (05500)

Item	Finish
Channel Door Frames	
Edge Guards Angles for Opening in Slabs	
Steel Plate Door Sill	
Cast Iron Safety Nosing	
Steel Ladders	
Steel Ladder Rungs	

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Steel Pipe Railings and Gates (not on Steel Stairs)	
Steel Counter or Bench Top Frame and Legs.	

F. METAL STAIRS (05510)

Component	Finish	Color
Newel Posts		
Guard Rails		
Handrails		
Stringers		
Risers		
Underside		

B. FINISH CARPENTRY AND MILLWORK (06200)

1. RECEPTION COUNTER PUBLIC OR PATIENT SIDE					
Room No. and Name	Component	Material	Species	Finish	Color
	Countertop				
	Vertical Surface(s)				
	Trim				
	Reveal				
	Handrail				
	Bumper guard				
	Base				

2. RECEPTION COUNTER STAFF SIDE				
Room No. and Name	Component	Material	Finish	Color
	Task Surface			
	Vertical Surface			

	Tackable Wall Covering			
	Shelving			
	Trim			
	Drawers			
	Misc. Items			

6. INTERVIEW BOOTH - STAFF SIDE				
Room No. and Name	Component	Material	Finish	Color
	Counter top surface			
	Vertical Surface Side Drawers (both sides)	Acoustical Panel		
	Trim			
	Base			
	Vertical Under Countertop Panel			
	Trim			
	Base			

10. MOUNTING STRIPS, SHELVES AND RODS		
Room No. and Name	Component	Finish/Color
	Strips	
	Shelf	
	Rod	

11. PEGBOARD (PERFORATED HARDBOARD)		
Room No. and Name	Component	Finish/Color
	Spacing Strip	
	Pegboard	

	Trim	
--	------	--

14. THROUGH - WALL COUNTER OR PASS THROUGH COUNTER (TYPE B)		
Room No. and Name	Component	Finish/Color
	Wood Edge	
	Countertop	
	Brackets	
20. WOOD HANDRAILS		
Room No. and Name	Finish	

2.7 DIVISION 7 - THERMAL AND MOISTURE PROTECTION

E. PREFORMED WALL AND ROOF PANELS (07410)

Type	Shape	Ext. Finish	Int. Finish	Manufacturer	Mfg. Color Name/No.

N. FLASHING AND SHEET METAL

Item	Material	Finish
Copings	Copper	
	Stainless steel	
	Aluminum	
Hanging Gutters and Downspouts	Copper	
	Stainless steel	
	Aluminum	
Roof Insulated Expansion Joint Covers	Vinyl sheet	
Scuppers		

Q. ROOF SPECIALITIES AND ACCESSORIES (07700)

Item	Material	Finish	Manufacturer	Manufacturer/Color Name/Number.
Equipment Support	Galv. Steel	Paint		

R. SEALANTS AND CAULKING (07920)

Location	Color	Manufacturer	Manufacturer Color
New to Existing Walls			
Building Expansion Joints			

2.8 DIVISION 8 - DOORS AND WINDOWS

A. STEEL DOORS AND FRAMES (08110)

Paint both sides of door and frames same color including ferrous metal louvers, and hardware attached to door	
Component	Color of Paint Type and Gloss
Door	
Frame	
Window frame	

B. PLASTIC LAMINATE FACED WOOD DOORS (09210)

Component	Finish/Color
Doors	
Frames	

C. ACCESS DOORS (08305)

Material	Finish/Color
Steel	
Stainless steel	

T. WINDOW STOOLS

Room No. and Name	Material	Finish
	Plastic Laminate	

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U. BUILDERS HARDWARE (08710)

Item	Material	Finish
Hinges		
Door Closers		
Floor Closers		
Floor Pivot Sets		
Closer/ Holder		
Floor Stops		
Door Holders		
Lock/ Latches		
Key Cabinet	Steel	
Armor Plates	Metal Plastic	
Kick Mop Plates	Metal Plastic	
Door Edging		
Exit Device		
Flush Bolts		
Door Pulls		
Push Plates		
Combination Push Pull Plate		
Coordinators		
Light Proof Seals		
Weather Strip		
Threshold		

V. GLASS AND GLAZING (08810)

Glazing Type	Manufacturer	Mfg. Color Name/No.
G-6		
G-7		
G-8		
G-9		
G-10		
G-11		
G-12		

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G-13		
G-14		
G-15		
G-16		
G-17		

2.9 DIVISION 9 - FINISHES

A. CERAMIC TILE (09310)

1. CERAMIC MOSAIC TILE (FT)					
Color	Size	Shape	Pattern	Manufacturer	Mfg. Color Name/No.

2. CERAMIC MOSAIC TILE GROUT (09310)		
Finish ode	Manufacturer	Mfg. Color Name/No

F. ACCOUSTICAL CEILING (AT) (09510)

Finish Code	Component	Color Pattern	Manufacturer	Mfg Name/No.
	Exposed Suspension System			
	Type III			
	Type III A			
	Type V			
	Type VI			
	Type VII			
	Type XX A			
	Type XX B			

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G. RESILIENT TILE FLOORING (09650)

Finish Code	Size	Material/Component	Manufacturer	Mfg Name/No.
		VCT		
		R		
		RT		

J. RESILIENT TILE FLOORING FEATURE STRIPS (FS) (09650)

Size	Manufacturer	Mfg. Color Name/No.

K. VINYL SHEET FLOORING, HEAT WELDED SEAMS (WSF) (09666)

Finish Code	Pattern name	Manufacturer	Mfg. Color Name/No.

1. WELDING RODS (WSF) (09666)			
Finish code	Manufacturer	Mfg. Color Name/No.	

2. CAP STRIPS (WSF) (09666)			
Finish Code	Manufacturer	Mfg. Color Name/No.	

M. RESILIENT BASE STAIR TREADS AND ACCESSORIES (09679)

Finish Code	Item	Height	Manufacturer	Mfg Name/No.
	Rubber Base (RB)			

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	Vinyl Base (VB)			
	Resilient Stair Treads (RST)			
	Sheet Rubber Flooring (SRF)			

N. CARPET (CP) (09680)

Finish Code	Pattern	Manufacture	Mfg. Color Name/No.

1. CARPET EDGE STRIP (09680)			
Finish Code	Material	Manufacturer	Mfg. Color Name/No.
	Metal		
	Vinyl		

2. CARPET BASE MOLDING (09680)		
Material	Manufacturer	Mfg. Color Name/No.

U. PAINT AND COATINGS (09900)

1. MPI Gloss and Sheen Standards

		Gloss @60
	Sheen @85	
Gloss Level 1	a traditional matte finish-flat	max 5
units, and	max 10 units	
Gloss Level 2	a high side sheen flat-"a velvet-like"	max 10
units, and		
	finish	
	10-35 units	

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Gloss Level 3 units, and	a traditional "egg-shell like" finish 10-35 units	10-25
Gloss Level 4 units, and	a "satin-like" finish min. 35 units	20-35
Gloss Level 5	a traditional semi-gloss	35-70 units
Gloss Level 6	a traditional gloss	70-85 units
Gloss level 7 85 units	a high gloss	more than

2. Paint code	Gloss	Manufacturer	Mfg. Color Name/No.
P			
P			
P			
P			
P			
P			
P			
P			
P			
P			
P			
P			
P			
P			
P			
P			
P			
P			
P			
P			
3. Stain Code (S)	Gloss and Transparency	Manufacturer	Mfg. Color Name/No.
	Semi		
S			
S			
S			

S			
S	Opaque		
S			
S			
S			
S			
4. Clear coatings Code (CC)	Gloss	Manufacturer	Mfg. Color Name/No.
CC			
CC			

V. VINYL COATED FABRIC WALLCOVERING (W) (09951)

Finish Code	Manufacturer	Mfg. Color Name/No.

W. EDGE GUARD OR TRIM (W) (09951)

Finish Code	Manufacturer	Mfg. Color Name/No.

X. POLYPROPYLENE FABRIC WALLCOVERING (PFW) (09952)

Finish Code	Manufacturer	Mfg. Color Name/No.

Y. EDGE GUARDS (PFW) (09952)

Finish Code	Manufacturer	Mfg. Color Name/No.

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Z. WAINSCOT CAP (PEW) (09952)

Manufacturer	Mfg. Color Name/No.

AA. ACCOUSTICAL WALL PANELLING (AWF) (09953)

Finish Code	Manufacturer	Mfg. Color Name/No.

2.10 DIVISION 10 - SPECIALITIES

A. CHALKBOARDS AND TRACKBOARDS (10100)

Room No. and Name	Component	Material	Manufacturer	Mfg. Color Name/No.

B. HOSPITAL CUBILCE CURTAINS AND INTRAVENOUS SUPPORT TRACKS (10152)

Finish Code	Manufacturer	Mfg. Color Name/No.

C. ACCORDION FOLDING PARTITION (AFP) (10623)

Component	Material	Manufacturer	Mfg. Color Name/No.
1. Panels			
Plasters			
Doors			
Urinal Screens			
2. Panels			
Plasters			
Doors			
3. Panels			
Plasters			
Doors			
4. Panels			

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Doors			
Plasters			
5. Panels			
Plasters			
Doors			

D. WALL GUARDS AND CORNER GUARDS (10260)

Item	Material	Manufacturer	Mfg. Color Name/No.
Corner Guards			
Wall Guards and Handrail			
Wall Guard			
Door Frame Protection			

H. MISCELLANEOUS SPECIALITIES (10360)

Room No. and Name	Item	Finish	Manufacturer	Mfg. Color Name/No.
	Mop racks			
	Package Transfer Box			
	Lobby Clock			

I. FIRE EXTINGUISHER CABINETS (10522)

Component	Material	Finish

P. FOLDING PANEL PARTITION (FP)

Room No. and Name	Component	Material	Manufacturer	Mfg. Color Name/No.
	Panel Face			
	Panel Edge			

Q. TOILET AND BATH ACCESSORIES (10800)

R. TOILET AND BATH ACCESSORIES (10800)

Item	Material	Manufacturer	Mfg. Color Name/No.

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 INTERIOR / EXTERIOR FINISHES

2.11 DIVISION II - EQUIPMENT

A. PROJECTION SCREENS

Component	Material	Finish	Manufacturer	Mfg. Color Name/No.
	Face			
	Frame			
	Face			
	Frame			

K. BIOHAZARD SAFETY CABINETS (11604)

Type	Manufacturer	Mfg. Color Name/No.
H 12 A		
H 12 B1		
H 12 B 2		
H 12 B 3		
H 20		

2.12 DIVISION 12-FURNISHINGS

A. METAL CASEWORK (12301)

Item/ Type	Finish	Manufacturer	Mfg. Color Name/No.
1. SHELVES			
2. LOCKERS			
3. CABINETS			
4. COUNTERS			

B. COUNTERTOPS AND ACCESSORIES (12303)

Type	Finish/Color
------	--------------

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Plastic Laminate	
Chemical Resistant Plastic Laminate	
Molded Resin	
Maple Tops	
Methyl Methacrylate	

D. DRAPERY HARDWARE (12501)

Material	Finish
Aluminum	
Steel	

G. WINDOW SHADES (12513)

Component	Material	Manufacturer	Mfg. Color Name/No.
Shade Cloth			
Vertical Blinds			
Venetian Blinds			
Support Hardware			

H. LIGHTPROOF SHADES (12514)

Component	Material	Manufacturer	Mfg. Color Name/No.
Shade Cloth			
Framing			

2.15 DIVISION 15 - MECHANICAL

A. PLUMBING FIXTURES AND TRIM (15450)

Item	Color
Water Closet	
Urinal	
Lavatories	
Service Sink Corner	
Service Sink	
Clinic Service Sink	

2.16 DIVISION 16 - ELECTRICAL

SECTION 09050
 INTERIOR / EXTERIOR FINISHES

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A. BUILDING LIGHTING INTERIOR (16510)

Fixture Type	Exterior Finish	Color

PART III EXECUTION

3.1 FINISH SCHEDULES & MISCELLANEOUS ABBREVIATIONS

FINISH SCHEDULE & MISCELLANEOUS ABBREVIATIONS	
Term	Abbreviation
Accordion Folding Partition	AFP
Acoustical Ceiling	AT
Acoustical Ceiling, Special Faced	AT (SP)
Acoustical Metal Pan Ceiling	AMP
Acoustical Wall Panel	AWP
Acoustical Wall Treatment	AWT
Acoustical Wallcovering	AWF
Anodized Aluminum Colored	AAC
Anodized Aluminum Natural Finish	AA
Baked On Enamel	BE
Brick Face	BR
Brick Flooring	BF
Brick Paving	BP
Carpet	CP
Carpet Athletic Flooring	CAF
Carpet Module Tile	CPT

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Ceramic Glazed Facing Brick	CGFB
Ceramic Mosaic Tile	FTCT
Concrete	C
Concrete Masonry Unit	CMU
Divider Strips Marble	DS MB
Epoxy Coating	EC
Epoxy Resin Flooring	ERF
Existing	E
Exposed Divider Strips	EXP
Exterior	EXT
Exterior Finish System	EFS
Exterior Paint	EXT-P
Exterior Stain	EXT-ST
Fabric Wallcovering	WF
Facing Tile	SCT
Feature Strips	FS
Floor Mats & Frames	FM
Floor Tile, Mosaic	FT
Fluorocarbon	FC
Folding Panel Partition	FP
Foot Grille	FG
Glass Masonry Unit	GUMU
Glazed Face CMU	GCMU
Glazed Structural Facing Tile	SFTU
Granite	GT
Gypsum Wallboard	GWB
High Glazed Coating	SC
Latex Mastic Flooring	LM
Linear Metal Ceiling	LMC
Linear Wood Ceiling	LWC
Marble	MB
Material	MAT
Mortar	M
Multi-Color Coating	MC

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Natural Finish	NF
Paint	P
Paver Tile	PVT
Perforated Metal Facing (Tile or Panels)	PMF
Plaster	PL
Plaster High Strength	HSPL
Plaster Keene Cement	KC
Plastic Laminate	HPDL
Polypropylene Fabric Wallcovering	PFW
Porcelain Paver Tile	PPT
Quarry Tile	QT
Radiant Ceiling Panel System	RCP
Resilient Stair Tread	RST
Rubber Base	RB
Rubber Tile Flooring	RT
Spandrel Glass	SLG
Stain	ST
Stone Flooring	SF
Structural Clay	SC
Suspension Decorative Grids Grids	SDG
Terrazzo Portland Cement	PCT
Terrazzo Tile	TT
Terrazzo, Thin Set	
Textured Gypsum Ceiling Panel	TGC
Textured Metal Ceiling Panel	TMC
Thin set Terrazzo	TST
Veneer Plaster	VP
Vinyl Base	VB
Vinyl Coated Fabric Wallcovering	W

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Vinyl Composition Tile	VCT
Vinyl Sheet Flooring	VSF
Vinyl Sheet Flooring (Welded Seams)	WSF
Wall Border	WB
Wood	WD

3.2 FINISH SCHEDULE SYMBOLS

Symbol Definition

- ** Same finish as adjoining walls
- No color required
- E Existing
- XX To match existing
- EFTR Existing finish to remain
- RM Remove

3.3 ROOM FINISH SCHEDULE

DESIGNER NOTE: Copy as stated for projects requiring alterations.

- A. Match adjoining or existing similar surfaces colors, textures or patterns where disturbed or damaged by alterations or new work when not scheduled.

B. ROOM FINISH SCHEDULE

Room No. and Name		FLOOR			BASE		WALL		WAINSCOT		CEILING		REMARKS
		MAT	FC		MAT	FCC	MAT	FCC	MAT	FC	MAT	FCC	
E X I S				N									
				E									
				S									

	T			W									
				C									
	N			N									
	E			E									
	W			S									
				W									
				C									
	E			N									
	X			E									
	I			S									
	S			W									
	T			C									
	N			N									
	E			E									
	W			S									
				W									
				C									
	EXIST			N									
				E									
				S									
				W									
				C									
	N			N									
	E			E									
	W			S									
				W									
				C									

- - - E N D - - -

**SECTION 09100
NON-LOAD BEARING FRAMING SYSTEMS**

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies steel studs wall systems, backing in walls, shaft wall systems, ceiling or soffit suspended or furred framing, wall furring, fasteners, and accessories for the screw attachment of gypsum board or other building boards.

1.2 RELATED WORK

Section 09260, GYPSUM BOARD SYSTEM.

1.3 TERMINOLOGY

- A. Description of terms shall be in accordance with ASTM C754, ASTM C11, ASTM C841 and as specified.
- B. Underside of Structure Overhead: In interstitial spaces with walk-on floors the underside of the walk-on floor is the underside of structure overhead. Where no interstitial floor is present, the underside of the roof deck is the underside of structure.
- C. Thickness of steel specified is the minimum bare (uncoated) steel thickness.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01340, SAMPLES AND SHOP DRAWINGS.
- B. Manufacturer's Literature and Data:
 - 1. Studs, runners and accessories.
 - 2. Hanger inserts.
 - 3. Channels (Rolled steel).
 - 4. Furring channels.
 - 5. Screws, clips and other fasteners.
- C. Shop Drawings:
 - 1. Typical ceiling suspension system.
 - 2. Typical metal stud and furring construction system including details around openings and corner details.
 - 3. Typical shaft wall assembly
 - 4. Typical fire rated assembly and column fireproofing showing details of construction same as that used in fire rating test.
- D. Test Results: Fire rating test designation, each fire rating required for each assembly.

1.5 DELIVERY, IDENTIFICATION, HANDLING AND STORAGE

In accordance with the requirements of ASTM C754.

1.6 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society For Testing And Materials (ASTM)
- A123-02.....Zinc (Hot-dip Galvanized) Coatings on Iron and Steel Products
 - A653/A653M-03.....Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process
 - A641-98.....Zinc-Coated (Galvanized) Carbon Steel Wire
 - C11-03.....Terminology Relating to Gypsum and Related Building Materials and Systems
 - C635-00.....Manufacture, Performance, and Testing of Metal Suspension System for Acoustical Tile and Lay-in Panel Ceilings
 - C636-03.....Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels
 - C645-03.....Non-Structural Steel Framing Members
 - C754-00.....Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products
 - C954-00.....Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness
 - C1002-00.....Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs
 - E580-02.....Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Requiring Moderate Seismic Restraint.
- C. Federal Specification (Fed. Spec.):
- FF-P-395B.....Pin, Drive, Guided And Pin Drive, Power Actuated (Fasteners For Powder Actuated And Hand Actuated Fastening Tools)

PART 2 - PRODUCTS

2.1 PROTECTIVE COATING

Galvanize steel studs, runners (track), rigid (hat section) furring channels, "Z" shaped furring channels, and resilient furring channels, with coating designation of G-60 minimum, per ASTM 123.

2.2 STEEL STUDS AND RUNNERS (TRACK)

- A. ASTM C645, modified for thickness specified and sizes and shown.
 - 1. Use ASTM A525 steel, 0.9 mm (0.0359-inch) thick bare metal (20 gauge).
 - 2. Runners same thickness as studs.
- B. Provide not less than two cutouts in web of each stud, approximately 300 mm (12 inches) from each end, and intermediate cutouts on approximately 600 mm (24-inch) centers.
- C. Doubled studs for openings and studs for supporting concrete backer-board.
- D. Studs 3600 mm (12 feet) or less in length shall be in one piece.
- E. Shaft Wall Framing:
 - 1. Conform to rated wall construction.
 - 2. C-H Studs.
 - 3. E Studs.
 - 4. J Runners.
 - 5. Steel Jamb-Strut.

2.3 FURRING CHANNELS

- A. Rigid furring channels (hat shape): ASTM C645.
- B. Resilient furring channels:
 - 1. Not less than 0.45 mm (0.0179-inch) thick bare metal.
 - 2. Semi-hat shape, only one flange for anchorage with channel web leg slotted on anchorage side, channel web leg on other side stiffens fastener surface but shall not contact anchorage surface other channel leg is attached to.
- C. Rolled Steel Channels: ASTM C754, cold rolled; or, ASTM C841, cold rolled.

2.4 COMPENSATION TRACK

Fire Trak runner and Fire Trak slip clip

- 1. Configure to allow for 1-1/2" movement in either direction.
- 2. At rated walls, meet requirements of UL Listing HW-D-1011.
- 3. System as manufactured by Fire Trak Corporation.

2.5 FASTENERS, CLIPS, AND OTHER METAL ACCESSORIES

- A. ASTM C754, except as otherwise specified.
- B. For fire rated construction: Type and size same as used in fire rating test.
- C. Fasteners for steel studs thicker than 0.84 mm (0.033-inch) thick. Use ASTM C954 steel drill screws of size and type recommended by the manufacturer of the material being fastened.
- D. Clips: ASTM C841 (paragraph 6.11), manufacturer's standard items. Clips used in lieu of tie wire shall have holding power equivalent to that provided by the tie wire for the specific application.
- E. Tie Wire and Hanger Wire:
 - 1. ASTM A641, soft temper, Class 1 coating.
 - 2. Gage (diameter) as specified in ASTM C754 or ASTM C841.
- G. Attachments for Wall Furring:
 - 1. Manufacturers standard items fabricated from zinc-coated (galvanized) steel sheet.
 - 2. For concrete or masonry walls: Metal slots with adjustable inserts or adjustable wall furring brackets. Spacers may be fabricated from 1 mm (0.0396-inch) thick galvanized steel with corrugated edges.
- H. Power Actuated Fasteners:
 - 1. Fed. Spec. FF-P-395.
 - 2. Fastener length and Class as required to resist twice the imposed loads; style suitable for type of hanger or bracket used.
 - 3. Eye Pin: Type I, Class 4, Style EP.
 - 4. Threaded Stud: Style SC for concrete; Style SS for steel.
 - 5. Drive Pins: Style PC for concrete, Style PS for steel.
 - 6. For applications not specified, type and size as recommended by the manufacturer of the material being fastened.

2.5 SUSPENDED CEILING SYSTEM FOR GYPSUM BOARD

- A. Conform to ASTM C635, heavy duty, with not less than 35 mm (1-3/8 inch) wide knurled capped flange face designed for screw attachment of gypsum board.
- B. Wall track channel with 35 mm (1-3/8 inch) wide flange.

PART 3 - EXECUTION

3.1 INSTALLATION CRITERIA

- A. Where fire rated construction is required for walls, partitions, columns, beams and floor-ceiling assemblies, the construction shall be same as that used in fire rating test.
- B. Construction requirements for fire rated assemblies and materials shall be as shown and specified, the provisions of the Scope paragraph (1.2) of ASTM C754 and ASTM C841 regarding details of construction shall not apply.

3.2 INSTALLING STUDS

- A. Install studs in accordance with ASTM C754, except as otherwise shown or specified.
- B. Space studs not more than 610 mm (24 inches) on center.
- C. Cut studs 6 mm to 9 mm (1/4 to 3/8-inch) less than floor to underside of structure overhead when extended to underside of structure overhead.
- D. Extend studs to underside of structure overhead for all partitions and insulated exterior wall furring.
- F. Openings:
 - 1. Frame jambs of openings in stud partitions and furring with two studs placed back to back or as shown.
 - 2. Fasten back to back studs together with 9 mm (3/8-inch) long Type S pan head screws at not less than 600 mm (two feet) on center, staggered along webs.
 - 3. Studs fastened flange to flange shall have splice plates on both sides approximately 50 X 75 mm (2 by 3 inches) screwed to each stud with two screws in each stud. Locate splice plates at 600 mm (24 inches) on center between runner tracks.
- H. Fastening Studs:
 - 1. Fasten studs located adjacent to partition intersections, corners and studs at jambs of openings to flange of runner tracks with two screws through each end of each stud and flange of runner.
 - 2. Do not fasten studs to top runner track when studs extend to underside of structure overhead.
- I. Chase Wall Partitions:
 - 1. Locate cross braces for chase wall partitions to permit the installation of pipes, conduits, carriers and similar items.

2. Use studs or runners as cross bracing not less than 63 mm (2-1/2 inches wide).

J. Form control joint, with double studs spaced 13 mm (1/2-inch) apart.

3.3 INSTALLING WALL FURRING FOR FINISH APPLIED TO ONE SIDE ONLY

A. In accordance with ASTM C754, or ASTM C841 except as otherwise specified or shown.

B. Wall furring-Stud System:

1. Framed with 63 mm (2-1/2 inch) or narrower studs, 600 mm (24 inches) on center.

2. Brace as specified in ASTM C754 for Wall Furring-Stud System or brace with sections or runners or studs placed horizontally at not less than three foot vertical intervals on side without finish.

3. Securely fasten braces to each stud with two Type S pan head screws at each bearing.

C. Installing Wall Furring-Bracket System: Space furring channels not more than 400 mm (16 inches) on center.

3.4 INSTALLING SUPPORTS REQUIRED BY OTHER TRADES

A. Provide for attachment and support of electrical outlets, plumbing, heating fixtures, recessed type plumbing fixture accessories, access panel frames, wall bumpers, toilet stall partitions, urinal screens, chalkboards, tackboards, wall-hung casework, handrail brackets, recessed fire extinguisher cabinets and other items supported by stud construction.

B. Provide additional studs where required. Install metal backing plates, or special metal shapes as required, securely fastened to metal studs.

3.5 INSTALLING SHAFT WALL SYSTEM

A. Conform to UL Design No. U438 for two-hour fire rating where indicated on the drawings.

B. Position J runners at floor and ceiling with the short leg toward finish side of wall. Securely attach runners to structural supports with power driven fasteners at both ends and 600 mm (24 inches) on center.

C. After liner panels have been erected, cut C-H studs and E studs, from 9 mm (3/8-inch) to not more than 13 mm (1/2-inch) less than floor-to-ceiling height. Install C-H studs between liner panels with liner panels inserted in the groove.

- D. Install full-length steel E studs over shaft wall line at intersections, corners, hinged door jambs, columns, and both sides of closure panels.
- E. Suitably frame all openings to maintain structural support for wall:
 - 1. Provide necessary liner fillers and shims to conform to label frame requirements.
 - 2. Frame openings cut within a liner panel with E studs around perimeter.
 - 3. Frame openings with vertical E studs at jambs, horizontal J runner at head and sill.

3.6 INSTALLING FURRED AND SUSPENDED CEILINGS OR SOFFITS

- A. Install furred and suspended ceilings or soffits in accordance with ASTM C754 or ASTM C841 except as otherwise specified or shown for screw attached gypsum board ceilings and for plaster ceilings or soffits.
 - 1. Space framing at 400 mm (16-inch) centers for metal lath anchorage.
 - 2. Space framing at 600 mm (24-inch) centers for gypsum board anchorage.
- B. Concrete slabs on steel decking composite construction:
 - 1. Use pull down tabs when available.
 - 2. Use power activated fasteners when direct attachment to structural framing can not be accomplished.
- D. Where beams are more than 1200 mm (48 inches) apart, provide intermediate hangers so that spacing between supports does not exceed 1200 mm (48 inches). Use clips, bolts, or wire ties for direct attachment to steel framing.
- E. Existing concrete construction exposed or concrete on steel decking:
 - 1. Use power actuated fasteners either eye pin, threaded studs or drive pins for type of hanger attachment required.
 - 2. Install fasteners at approximate mid height of concrete beams or joists. Do not install in bottom of beams or joists.
- F. Steel decking without concrete topping:
 - 1. Do not fasten to steel decking 0.76 mm (0.0299-inch) or thinner.
 - 2. Toggle bolt to decking 0.9 mm (0.0359-inch) or thicker only where anchorage to steel framing is not possible.
- G. Installing suspended ceiling system for gypsum board (ASTM C635 Option):
 - 1. Install only for ceilings to receive screw attached gypsum board.

2. Install in accordance with ASTM C636.
 - a. Install main runners spaced 1200 mm (48 inches) on center.
 - b. Install 1200 mm (four foot) tees not over 600 mm (24 inches) on center; locate for edge support of gypsum board.
 - c. Install wall track channel at perimeter.

H. Installing Ceiling Bracing System:

1. Construct bracing of 38 mm (1-1/2 inch) channels for lengths up to 2400 mm (8 feet) and 50 mm (2 inch) channels for lengths over 2400 mm (8 feet) with ends bent to form surfaces for anchorage to carrying channels and over head construction. Lap channels not less than 600 mm (2 feet) at midpoint back to back. Screw or bolt lap together with two fasteners.
2. Install bracing at an approximate 45 degree angle to carrying channels and structure overhead; secure as specified to structure overhead with two fasteners and to carrying channels with two fasteners or wire ties.
3. Brace suspended ceiling or soffit framing for seismic zone in accordance with ASTM E580.

3.7 TOLERANCES

- A. Fastening surface for application of subsequent materials shall not vary more than 3 mm (1/8-inch) from the layout line.
- B. Plumb and align vertical members within 3 mm (1/8-inch.)
- C. Level or align ceilings within 3 mm (1/8-inch.)

- - - E N D - - -

**SECTION 09260
GYPSUM BOARD SYSTEM**

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies installation and finishing of gypsum board.

1.2 RELATED WORK

- A. Installation of steel framing members for walls, partitions, furring, soffits, and ceilings: Section 09100, NON-LOAD BEARING FRAMING SYSTEMS.
- B. Acoustical Sealants: Section 07920, SEALANTS AND CAULKING.
- C. Sealing of rated assemblies: Section 07270, FIRESTOPPING SYSTEMS.
- D. Ceramic tile walls: Section 09310, CERAMIC TILE.

1.3 TERMINOLOGY

- A. Definitions and description of terms shall be in accordance with ASTM C11, C840, and as specified.
- B. "Yoked": Gypsum board cut out for opening with no joint at the opening.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01340, SAMPLES AND SHOP DRAWINGS.
- B. Manufacturer's Literature and Data:
 - 1. Cornerbead and edge trim.
 - 2. Finishing materials.
 - 3. Laminating adhesive.
 - 4. Gypsum board, each type.
- C. Shop Drawings:
 - 1. Typical gypsum board installation, showing corner details, edge trim details and the like.
 - 2. Typical sound rated assembly, showing treatment at perimeter of partitions and penetrations at gypsum board.
 - 3. Typical shaft wall assembly.
 - 4. Typical fire rated assembly and column fireproofing, indicating details of construction same as that used in fire rating test.
- D. Samples:
 - 1. Cornerbead.
 - 2. Edge trim.
 - 3. Control joints.
- E. Test Results:
 - 1. Fire rating test, each fire rating required for each assembly.
 - 2. Sound rating test.

1.5 DELIVERY, IDENTIFICATION, HANDLING AND STORAGE

In accordance with the requirements of ASTM C840.

1.6 ENVIRONMENTAL CONDITIONS

In accordance with the requirements of ASTM C840.

1.7 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society For Testing And Materials (ASTM):
 - C11-02.....Terminology Relating to Gypsum and Related Building Materials and Systems
 - C36-01.....Gypsum Wallboard
 - C79-01.....Treated Core and Nontreated Core Gypsum Sheathing Board
 - C442-01.....Gypsum Backing Board and Coreboard
 - C475-01.....Joint Compound and Joint Tape for Finishing Gypsum Board
 - C630-01.....Water Resistant Gypsum Backing Board
 - C840-01.....Application and Finishing of Gypsum Board
 - C954-00.....Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases to Steel Stud from 0.033 in. (0.84mm) to 0.112 in. (2.84mm) in thickness
 - C1002-01.....Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs
 - C1047-99.....Accessories for Gypsum Wallboard and Gypsum Veneer Base
 - E84-01.....Surface Burning Characteristics of Building Materials
 - E497-99.....Installing Sound Isolating Lightweight Partitions
- C. Underwriters Laboratories Inc. (UL):
 - Latest Edition.....Fire Resistance Directory
- D. Inchcape Testing Services (ITS):
 - Latest Editions.....Certification Listings

PART 2 - PRODUCTS

2.1 GYPSUM BOARD

- A. Gypsum Board: ASTM C36, Type X, 16 mm (5/8 inch) thick unless shown otherwise.
- B. Coreboard or Shaft Wall Liner Panels.
 - 1. ASTM C442, Type X.
 - 2. Coreboard for shaft walls 300, 400, 600 mm (12, 16, or 24 inches) wide by required lengths 25 mm (one inch) thick with paper faces treated to resist moisture.
- C. Water Resistant Gypsum Board: ASTM C620, Type X, 16 mm (5/8 inch) thick.

2.2 ACCESSORIES

- A. ASTM C1047, except form of 0.39 mm (0.015 inch) thick zinc coated steel sheet or rigid PVC plastic.
- B. Flanges not less than 22 mm (7/8 inch) wide with punchouts or deformations as required to provide compound bond.
- C. Partition Closure:
 - 1. Mullion/Mate II 4-1/2 to 6-1/2 opening as manufactured by Gordon, Inc.
 - 2. Clear anodized aluminum finish.
- D. Reveal Trim
 - 1. Series B300 trim as manufactured by Gordon, Inc.
 - 2. "Z" configuration.
- E. Light Cove
 - 1. 6"x8" light cove with recess for fluorescent fixtures: Profile #1106T as manufactured by Gordon, Inc.
 - 2. 6" radius for inside corners of light cover: Profile #1026 as manufactured by Gordon, Inc.

2.4 FASTENERS

- A. ASTM C1002 and ASTM C840, except as otherwise specified.
- B. ASTM C954, for steel studs thicker than 0.04 mm (0.33 inch).
- C. Select screws of size and type recommended by the manufacturer of the material being fastened.
- D. For fire rated construction, type and size same as used in fire rating test.
- E. Clips: Zinc-coated (galvanized) steel; gypsum board manufacturer's standard items.

2.5 FINISHING MATERIALS AND LAMINATING ADHESIVE

ASTM C475 and ASTM C840.

PART 3 - EXECUTION

3.1 GYPSUM BOARD HEIGHTS

- A. Extend all layers of gypsum board from floor to underside of structure overhead on following partitions and furring:
 - 1. Two sides of partitions:
 - All partitions
 - 2. One side of partitions or furring:
 - a. Inside of exterior wall furring or stud construction.
 - b. Column furring.
- B. At suspended interior soffits or ceiling, extend gypsum board to 4" above adjacent ceilings.

3.2 INSTALLING GYPSUM BOARD

- A. Coordinate installation of gypsum board with other trades and related work.
- B. Install water resistant drywall on toilet room walls above tile wainscot. (At locations to receive tile wainscot, install cementitious backer board per Section 09310, CERAMIC TILE..)
- C. Install gypsum board in accordance with ASTM C840, except as otherwise specified.
- D. Use gypsum boards in maximum practical lengths to minimize number of end joints.
- E. Bring gypsum board into contact, but do not force into place.
- F. Ceilings:
 - For single-ply construction, use perpendicular application.
- G. Walls (Except Shaft Walls):
 - 1. When gypsum board is installed parallel to framing members, space fasteners 300 mm (12 inches) on center in field of the board, and 200 mm (8 inches) on center along edges.
 - 2. When gypsum board is installed perpendicular to framing members, space fasteners 300 mm (12 inches) on center in field and along edges.
 - 3. Stagger screws on abutting edges or ends.
 - 4. For single-ply construction, apply gypsum board with long dimension either parallel or perpendicular to framing members as required to

- minimize number of joints except gypsum board shall be applied vertically over "Z" furring channels.
5. For two-ply gypsum board assemblies, apply base ply of gypsum board to assure minimum number of joints in face layer. Apply face ply of wallboard to base ply so that joints of face ply do not occur at joints of base ply with joints over framing members.
 6. No offset in exposed face of walls and partitions will be permitted because of single-ply and two-ply application requirements.
 7. Control Joints ASTM C840 and as follows:
 - a. Locate at both side jambs of openings if gypsum board is not "yoked". Use one system throughout.
 - b. Not required for wall lengths less than 9000 mm (30 feet).
 - c. Extend control joints the full height of the wall or length of soffit/ceiling membrane.
- H. Acoustical or Sound Rated Partitions, Fire and Smoke Partitions:
1. Cut gypsum board for a space approximately 3 mm to 6 mm (1/8 to 1/4 inch) wide around partition perimeter.
 2. Coordinate for application of caulking or sealants to space prior to taping and finishing.
- I. Accessories:
1. Set accessories plumb, level and true to line, neatly mitered at corners and intersections, and securely attach to supporting surfaces as specified.
 2. Install in one piece, without the limits of the longest commercially available lengths.
 3. Corner Beads:
 - a. Install at all vertical and horizontal external corners and where shown.
 - b. Use screws only. Do not use crimping tool.
 4. Edge Trim (casings Beads):
 - a. At both sides of expansion and control joints unless shown otherwise.
 - b. Where gypsum board terminates against dissimilar materials and at perimeter of openings, except where covered by flanges, casings or permanently built-in equipment.
 - c. Where gypsum board surfaces of non-load bearing assemblies abut load bearing members.

- d. Where shown.
- 5. Cove accessories:
 - a. Install with tight butt joints with splice plates.
 - b. Fasten within 3" of ends and 8" on center.
 - c. Install with fiberglass tape and standard drywall finish compound.

3.3 SHAFT WALL

- A. Coordinate assembly with Section, NON-LOAD BEARING FRAMING SYSTEMS for erection of framing and gypsum board.
- B. Conform to UL Design No. U438 or FM WALL CONSTRUCTION 12-2/HR (Nonbearing for two-hour fire rating).
- C. Cut coreboard (liner) panels 25 mm (one inch) less than floor-to-ceiling height, and erect vertically between J-runners on shaft side.
 - 1. Where shaft walls exceed 4300 mm (14 feet) in height, position panel end joints within upper and lower third points of wall.
 - 2. Stagger joints top and bottom in adjacent panels.
 - 3. After erection of J-struts of opening frames, fasten panels to J-struts with screws of sufficient length to secure to framing staggered from those in base, spaced 300 mm (12 inches) on center.
- D. Gypsum Board:
 - 1. Two hour wall:
 - a. Erect base layer (backing board) vertically on finish side of wall with end joints staggered. Fasten base layer panels to studs with 25 mm (one inch) long screws, spaced 600 mm (24 inches) on center.
 - b. Use laminating adhesive between plies in accordance with UL or FM if required by fire test.
 - c. Apply face layer of gypsum board required by fire test vertically over base layer with joints staggered and attach with screws of sufficient length to secure to framing staggered from those in base, spaced 300 mm (12 inches) on center.
 - 2. One hour wall with one layer on finish side of wall: Apply face layer of gypsum board vertically. Attach to studs with screws of sufficient length to secure to framing, spaced 300 mm (12 inches) on center in field and along edges.
 - 3. Where coreboard is covered with face layer of gypsum board, stagger joints of face layer from those in the coreboard base.

- E. Treat joints, corners, and fasteners in face layer as specified for finishing of gypsum board.

3.5 FINISHING OF GYPSUM BOARD

- A. Finish joints, edges, corners, and fastener heads in accordance with ASTM C840.
- B. Before proceeding with installation of finishing materials, assure the following:
 - 1. Gypsum board is fastened and held close to framing or furring.
 - 2. Fastening heads in gypsum board are slightly below surface in dimple formed by driving tool.
- C. Finish joints, fasteners, and all openings, including openings around penetrations, on that part of the gypsum board extending above suspended ceilings to seal surface of gypsum board construction. After the installation of hanger rods, hanger wires, supports, equipment, conduits, piping and similar work, seal remaining openings and maintain the integrity of the smoke barrier, fire rated or sound rated construction/ Sanding is not required of non decorated surfaces.

3.6 REPAIRS

- A. After taping and finishing has been completed, and before decoration, repair all damaged and defective work, including nondecorated surfaces.
- B. Patch holes or openings 13 mm (1/2 inch) or less in diameter, or equivalent size, with a setting type finishing compound or patching plaster.
- C. Repair holes or openings over 13 mm (1/2 inch) diameter, or equivalent size, with 16 mm (5/8 inch) thick gypsum board secured in such a manner as to provide solid substrate equivalent to undamaged surface.
- D. Tape and refinish scratched, abraded or damaged finish surfaces including cracks and joints in non decorated surface to provide smoke fire protection equivalent to the fire rated construction and STC equivalent to the sound rated construction.

- - - E N D - - -

SECTION 09310
CERAMIC TILE

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies ceramic tile, waterproofing membranes for thin-set applications, crack isolation membranes, and tile backer board.

1.2 RELATED WORK

- A. Sealing of joints where specified: Section 07920 SEALANTS AND CAULKING.
- B. Color, texture and pattern of field tile and trim shapes, size of field tile, trim shapes, and color of grout specified: Section 09050 INTERIOR/EXTERIOR FINISHES.
- C. Section 09260, GYPSUM BOARD SYSTEMS.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01340, SAMPLES AND SHOP DRAWINGS.
- B. Samples:
 - 1. Base tile, each type, each color, each size.
 - 2. Mosaic floor tile panels, 225 mm by 225 mm (9 inches by 9 inches), each type, color, size and pattern.
 - 3. Wall tile, each color, size and pattern.
 - 4. Trim shapes, bullnose cap and cove including bullnose cap and base pieces at internal and external corners of vertical surfaces, each type, color, and size.
- C. Product Data:
 - 1. Ceramic tile, marked to show each type, size, and shape required.
 - 2. Divider strip.
 - 3. Elastomeric membrane and bond coat.
 - 4. Reinforcing tape.
 - 5. Leveling compound.
 - 6. Latex-Portland cement mortar and grout.
 - 7. Commercial Portland cement grout.
 - 8. Slip resistant tile.
 - 9. Waterproofing isolation membrane.
 - 10. Fasteners.
 - 11. Cementitious backer units.
- D. Certification:
 - 1. Master grade, ANSI A137.1.

2. Manufacturer's certificates indicating that the following materials comply with specification requirements:
 - a. Modified epoxy emulsion.
 - b. Reinforcing tape.
 - c. Latex-Portland cement mortar and grout.
 - d. Leveling compound.
 - e. Waterproof isolation membrane.
 - f. Cementitious backer units.

1.4 DELIVERY AND STORAGE

- A. Deliver materials in containers with labels legible and intact and grade-seals unbroken.
- B. Store material to prevent damage or contamination.

1.5 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in text by basic designation only.
- B. American National Standards Institute (ANSI):
 - A10.20-1988.....Safety Requirements for Ceramic Tile, Terrazzo, and Marble Works
 - A108.1B-1999.....Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with dry-Set or latex-Portland Cement Mortar
 - A108.4-1999.....Installation of Ceramic Tile with Organic Adhesives or Water Cleanable Tile Setting Epoxy Adhesives
 - A108.5-1999.....Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar
 - A108.10-1999.....Installation of Grout in Tilework
 - A118.1-1999.....Dry-Set Portland Cement Mortar
 - A118.4-1999.....Latex-Portland Cement Mortar
 - A118.6-1999.....Standard Cement Grouts for Tile Installation
 - A118.7-1999.....Polymer Modified Tile Gouts for Tile Installation
 - A118.8-1999.....Modified Epoxy Emulsion Mortar/Grout
 - A118.9-1999.....Cementitious Backer Units

- A118.10-1999.....Load Bearing, Bonded, Waterproof Membranes for
Thin-Set Ceramic Tile and Dimension Stone
- A136.1-1999.....Organic Adhesives for Installation of Ceramic
Tile
- A137.1-1988.....Ceramic Tile
- C. American Society For Testing And Materials (ASTM):
 - A185-97.....Steel Welded Wire Fabric, Plain, for Concrete
Reinforcing
 - C627-93(1999).....Evaluating Ceramic Floor Tile Installation
Systems Using the Robinson-Type Floor Tester
 - C954-00.....Steel Drill Screws for the Application of
Gypsum Board on Metal Plaster Base to Steel
Studs from 0.033 in (0.84 mm) to 0.112 in (2.84
mm) in thickness
 - C979-99.....Pigments for Integrally Colored Concrete
 - C1002-01.....Steel Self-Piercing Tapping Screws for the
Application of Panel Products
 - C1027-99.....Determining "Visible Abrasion Resistance on
Glazed Ceramic Tile"
 - C1028-96.....Determining the Static Coefficient of Friction
of Ceramic Tile and Other Like Surfaces by the
Horizontal Dynamometer Pull Meter Method
- D. Tile Council of America, Inc. (TCA):
 - 2003-04.....Handbook for Ceramic Tile Installation

PART 2 - PRODUCTS

2.1 TILE

- A. Comply with ANSI A137.1, Standard Grade, except as modified:
 - 1. Inspection procedures listed under the Appendix of ANSI A137.1.
 - 2. Slip Resistant Tile for Floors:
 - a. Coefficient of friction, when tested in accordance with ASTM
C1028, required for level of performance:
 - 1) Not less than 0.7 (wet condition) for bathing areas.
 - 2) Not less than 0.8 on ramps for wet and dry conditions.
 - 3) Not less than 0.6, except 0.8 on ramps as stated above, for
wet and dry conditions for other areas.
 - b. Tile Having Abrasive Grains:

1. Unglazed Ceramic Mosaic Tile: Abrasive grains throughout body of the tile.
4. Mosaic tile may be mounted or joined together by a resinous bonding material along tile edges.
6. Factory Blending: For tile with color variations, within the ranges selected during sample submittals blend tile in the factory and package so tile units taken from one package show the same range in colors as those taken from other packages and match approved samples.
7. Factory-Applied Temporary Protective Coating:
 - a. Protect exposed face surfaces (top surface) of tile against adherence of mortar and grout by pre-coating with a continuous film of petroleum paraffin wax, applied hot.
 - b. Do not coat unexposed tile surfaces.
 - c. Pre-wax tiles set or grouted with latex modified mortars.
- B. Unglazed Ceramic Mosaic Tile: Nominal 6 mm (1/4 inch) thick with cushion edges.
- C. Glazed Wall Tile: Cushion edges, glazing, as specified in Section 09050, INTERIOR/ EXTERIOR FINISHES.
- D. Trim Shapes:
 1. Conform to applicable requirements of adjoining floor and wall tile.
 2. Use trim shapes sizes conforming to size of adjoining field wall tile unless detailed or specified otherwise in Section 09050, INTERIOR/ EXTERIOR FINISHES.
 3. Internal and External Corners:
 - a. Square internal and external corner joints are not acceptable.
 - b. External corners including edges: Use bullnose shapes.
 - c. Internal corners: Use cove shapes.
 - d. Base to floor internal corners: Use special shapes providing integral cove vertical and horizontal joint.
 - e. Base to floor external corners: Use special shapes providing bullnose vertical edge with integral cove horizontal joint. Use stop at bottom of openings having bullnose return to wall.
 - f. Wall top edge internal corners: Use special shapes providing integral cove vertical joint with bullnose top edge.
 - g. Wall top edge external corners: Use special shapes providing bullnose vertical and horizontal joint edge.

- h. For unglazed ceramic mosaic and glazed wall tile installed in dry-set Portland cement mortar, latex-Portland cement mortar, and organic adhesive (thin set methods), use cove and surface bullnose shapes as applicable.
- i. Provide cove and bullnose shapes where shown and required to complete tile work.

2.2 CEMENTITIOUS BACKER UNITS

- A. ANSI A118.9.
- B. Use cementitious backer units in maximum available lengths.
- C. Backer unit meet or exceed the following additional physical properties:
ASTM C948, water absorption less than 20%

2.3 JOINT MATERIALS FOR CEMENTITIOUS BACKER UNITS

- A. Reinforcing Tape: Vinyl coated woven glass fiber mesh tape, open weave, 50 mm (2 inches) wide. Tape with pressure sensitive adhesive backing will not be permitted.
- B. Tape Embedding Material: Latex-Portland cement mortar complying with ANSI A118.4.
- C. Joint material, including reinforcing tape, and tape embedding material, shall be as specifically recommended by the backer unit manufacturer.

2.4 FASTENERS

- A. Screws for Cementitious Backer Units
 - 1. Standard screws for gypsum board are not acceptable.
 - 2. Minimum 11 mm (7/16 inch) diameter head, corrosion resistant coated, with washers.
 - 3. ASTM C954 for steel 1 mm (0.033 inch) thick.
- B. Washers: Galvanized steel, 13 mm (1/2 inch) minimum diameter.

2.5 SETTING MATERIALS OR BOND COATS

- A. Conform to TCA Handbook for Ceramic Tile Installation.
- B. Portland Cement Mortar: ANSI A108.1.
- C. Latex-Portland Cement Mortar: ANSI A118.4.
 - 1. For wall applications, provide non-sagging, latex-Portland cement mortar complying with ANSI A118.4.
 - 2. Prepackaged Dry-Mortar Mix: Factory-prepared mixture of Portland cement; dry, redispersible, ethylene vinyl acetate additive; and

other ingredients to which only water needs to be added at Project site.

D. Waterproofing Isolation Membrane:

1. Sheet System TCA F122-03.
2. Optional System to elastomeric waterproof membrane.
3. Composite sheet consisting of ASTM D5109, Type II, Grade I Chlorinated Polyethylene (CM) sheet reinforced on both sides with a non-woven polyester fiber.
4. Designed for use in wet areas as an isolation and positive waterproofing membranes for thin-set bonding of sheet to substrate and thin-set bonding of ceramic tile or marble to sheet. Suited for both horizontal and vertical applications.
5. Conform to the following additional physical properties:

Property	Units	Results	Test Method
Hardness Shore A	Points	70-80	ASTM D2240 (10 Second Reading)
Shrinkage	Percent	5 maximum	ASTM D1204
Brittleness		No crack remains flexible at temperature-37 degrees C (-25 degrees F)	ASTM D2497 13 mm (1/2- inch) Mandrel Bend
Retention of Properties after Heat Aging	Percent of original	80 Tensile 80 Breaking 80 Elongation	ASTM D3045, 90 degrees C (194 degrees F) for 168 hours

6. Manufacturer's standard sheet size with prefabricated or preformed inside and outside corners.
7. Sheet manufacturer's solvent welding liquid or xylene and edge sealant.

2.7 GROUTING MATERIALS

A. Coloring Pigments:

1. Pure mineral pigments, limeproof and nonfading, complying with ASTM C979.
2. Add coloring pigments to grout by the manufacturer.

3. Job colored grout is not acceptable.
4. Use is required in Latex-Portland Cement Grout.

B. Latex-Portland Cement Grout: ANSI A118.6 color as specified.

1. Unsanded grout mixture for joints 3.2 mm (1/8 inch) and narrower.
2. Sanded grout mixture for joints 3.2 mm (1/8 inch) and wider.

2.8 PATCHING AND LEVELING COMPOUND

- A. Portland cement base, polymer-modified, self-leveling compound, manufactured specifically for resurfacing and leveling concrete floors. Products containing gypsum are not acceptable.
- B. Shall have minimum following physical properties:
 1. Compressive strength - 25 MPa (3500 psig) per ASTM C109/C109M.
 2. Flexural strength - 7 MPa (1000 psig) per ASTM C348 (28 day value).
- C. Capable of being applied in layers up to 38 mm (1-1/2 inches) thick without fillers and up to 100 mm (four inches) thick with fillers, being brought to a feather edge, and being trowelled to a smooth finish.
- D. Primers, fillers, and reinforcement as required by manufacturer for application and substrate condition.
- E. Ready for use in 48 hours after application.

2.9 WATER

Clean, potable and free from salts and other injurious elements to mortar and grout materials.

2.12 CLEANING COMPOUNDS

- A. Specifically designed for cleaning masonry and concrete and which will not prevent bond of subsequent tile setting materials including patching and leveling compounds and elastomeric waterproofing membrane and coat.
- B. Materials containing acid or caustic material not acceptable.

PART 3 - EXECUTION

3.1 ENVIRONMENTAL REQUIREMENTS

- A. Maintain ambient temperature of work areas at not less than 16 degree C (60 degrees F), without interruption, for not less than 24 hours before installation and not less than three days after installation.
- B. Maintain higher temperatures for a longer period of time where required by manufacturer's recommendation and ANSI Specifications for installation.

- C. Do not install tile when the temperature is above 38 degrees C (100 degrees F).
- D. Do not install materials when the temperature of the substrate is below 16 degrees C (60 degrees F).
- E. Do not allow temperature to fall below 10 degrees C (50 degrees F) after fourth day of completion of tile work.

3.2 ALLOWABLE TOLERANCE

- A. Variation in plane of sub-floor, including concrete fills leveling compounds and mortar beds:
 - 1. Not more than 1 in 500 (1/4 inch in 10 feet) from required elevation where Portland cement mortar setting bed is used.
 - 2. Not more than 1 in 1000 (1/8 inch in 10 feet) where dry-set Portland cement, and latex-Portland cement mortar setting beds and chemical-resistant bond coats are used.
- B. Variation in Plane of Wall Surfaces:
 - 1. Not more than 1 in 400 (1/4 inch in eight feet) from required plane where Portland cement mortar setting bed is used.
 - 2. Not more than 1 in 800 (1/8 inch in eight feet) where dry-set or latex-Portland cement mortar or organic adhesive setting materials is used.

3.3 CEMENTITIOUS BACKER UNITS

- A. Remove polyethylene wrapping from cementitious backer units and separate to allow for air circulation. Allow moisture content of backer units to dry down to a maximum of 335 percent before applying joint treatment and tile.
- B. Install in accordance with ANSI A108.11 except as specified otherwise.
- C. Install units horizontally or vertically to minimize joints with and joints over framing members. Units with rounded edges; face rounded edge away from studs to form a V joint for joint treatment.
- D. Install with shims where necessary to match level of adjacent GWB surfaces.
- E. Secure cementitious backer units to each framing member with screws spaced not more than 200 mm (eight inches) on center and not closer than 13 mm (1/2 inch) from the edge of the backer unit or as recommended by backer unit manufacturer. Install screws so that the screw heads are flush with the surface of the backer unit..

- F. Where backer unit joins shower pans or waterproofing, lap backer unit over turned-up waterproof system. Install fasteners only through top one inch of turned-up waterproof systems.
- G. Do not install joint treatment for seven days after installation of cementitious backer unit.
- H. Joint treatment:
 - 1. Fill horizontal and vertical joints and corners with latex-Portland cement mortar. Apply fiberglass tape over joints and corners and embed with same mortar.
 - 2. Leave 6 mm (1/4 inch) space for sealant at lips of tubs, sinks or other plumbing receptors.

3.4 SURFACE PREPARATION

- A. Patching and Leveling:
 - 1. Mix and apply patching and leveling compound in accordance with manufacturer's instructions.
 - 2. Fill holes and cracks and align concrete floors that are out of required plane with patching and leveling compound.
 - a. Thickness of compound as required to bring finish tile system to elevation shown.
 - b. Float finish.
 - c. At substrate expansion, isolation, and other moving joints, allow joint of same width to continue through underlayment.
 - 3. Apply patching and leveling compound to concrete and masonry wall surfaces that are out of required plane.
 - 4. Apply leveling coats of material compatible with wall surface and tile setting material to wall surfaces, other than concrete and masonry that are out of required plane.
- C. Existing Floors:
 - 1. Remove existing composition floor finishes and adhesive. Prepare surface by grinding, chipping, self-contained power blast cleaning or other suitable mechanical methods to completely expose uncontaminated concrete or masonry surfaces. Follow safety requirements of ANSI A10.20.
 - 2. Remove existing concrete fill or topping to structural slab. Clean and level the substrate for new setting bed and waterproof membrane or cleavage membrane.

3. Where new tile bases are required to finish flush with plaster above or where they are extensions of similar bases in conjunction with existing floor tiles cut channel in floor slab and expose rough wall construction sufficiently to accommodate new tile base and setting material.

3.4 CERAMIC TILE - GENERAL

- A. Comply with ANSI A108 series of tile installation standards in "Specifications for Installation of Ceramic Tile" applicable to methods of installation.
- B. Comply with TCA Installation Guidelines
- C. Workmanship:
 1. Lay out tile work so that no tile less than one-half full size is used. Make all cuts on the outer edge of the field. Align new tile work scheduled for existing spaces to the existing tile work unless specified otherwise.
 2. Set tile firmly in place with finish surfaces in true planes. Align tile flush with adjacent tile unless shown otherwise.
 3. Form intersections and returns accurately.
 4. Cut and drill tile neatly without marring surface.
 5. Cut edges of tile abutting penetrations, finish, or built-in items:
 - a. Fit tile closely around electrical outlets, piping, fixtures and fittings, so that plates, escutcheons, collars and flanges will overlap cut edge of tile.
 - b. Seal tile joints water tight as specified in Section 07920, SEALANTS AND CAULKING, around electrical outlets, piping fixtures and fittings before cover plates and escutcheons are set in place.
 6. Completed work shall be free from hollow sounding areas and loose, cracked or defective tile.
 7. Remove and reset tiles that are out of plane or misaligned.
 8. Floors:
 - a. Extend floor tile beneath casework and equipment, except those units mounted in wall recesses.
 - b. Align finish surface of new tile work flush with other and existing adjoining floor finish where shown.
 - c. In areas where floor drains occur, slope to drains where shown.

- d. Shove and vibrate tiles over 200 mm (8 inches) square to achieve full support of bond coat.
9. Walls:
- a. Cover walls and partitions, including pilasters, furred areas, and freestanding columns from floor to ceiling, or from floor to nominal wainscot heights shown with tile.
 - b. Finish reveals of openings with tile, except where other finish materials are shown or specified.
 - c. Finish wall surfaces behind and at sides of casework and equipment, except those units mounted in wall recesses, with same tile as scheduled for room proper.
 - d. Set a strip of tile around toilet accessories which intersect the top of the wainscot.
 - e. Set wall tile installed over concrete backer board in latex-Portland cement mortar, ANSI A108.1B.
10. Joints:
- a. Keep all joints in line, straight, level, perpendicular and of even width unless shown otherwise.
 - b. Make joints 2 mm (1/16 inch) wide for glazed wall tile and mosaic tile work.
 - c. Make joints in quarry tile work not less than 6 mm (1/4 inch) nor more than 9 mm (3/8 inch) wide. Finish joints flush with surface of tile.
 - d. Make joints in Paver tile, porcelain type; maximum 3 mm (1/8 inch) wide.

3.9 THIN SET CERAMIC FLOOR TILE INSTALLED WITH LATEX-PORTLAND CEMENT MORTAR

- A. Installation of Tile: ANSI A108.5, except as specified otherwise.
- B. Install with waterproof isolation membrane per ASTM D5109, TCA System F122-03.

3.11 THIN SET CERAMIC WALL TILE INSTALLED WITH LATEX-PORTLAND CEMENT MORTAR.

- A. Install backerboard per ANSI A108.11, Tile per ANSI A108.5 and grout per ANSI A108.10.
- B. Install per TCA #244.03.

3.12 GROUTING

- A. Grout Type and Location:
 - 1. Grout for glazed wall and base tile, unglazed mosaic tile, latex-Portland cement grout.

B. Workmanship:

1. Install and cure grout in accordance with the applicable standard.
2. Portland Cement grout: ANSI A108.10.
3. Dry-set grout: ANSI A108.5.

3.13 CLEANING

- A. Thoroughly sponge and wash tile. Polish glazed surfaces with clean dry cloths.
- B. Methods and materials used shall not damage or impair appearance of tile surfaces.
- C. The use of acid or acid cleaners on glazed tile surfaces is prohibited.
- D. Clean tile grouted with commercial Portland cement grout and tile set in elastomeric bond coat as recommended by the manufacturer of the grout and bond coat.

3.14 PROTECTION

- A. Keep traffic off tile floor, until grout and setting material is firmly set and cured.
- B. Where traffic occurs over tile floor, cover tile floor with not less than 9 mm (3/8 inch) thick plywood, wood particle board, or hardboard securely taped in place. Do not remove protective cover until time for final inspection. Clean tile of any tape, adhesive and stains.

3.15 TESTING FINISH FLOOR

Test floors in accordance with ASTM C627 to show compliance with codes 1 through 10.

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**SECTION 09510
ACOUSTICAL CEILING**

PART 1- GENERAL

1.1 DESCRIPTION

- A. Metal ceiling suspension system for acoustical ceilings.
- B. Acoustical units.

1.2 RELATED WORK

Color, pattern, and location of each type of acoustical unit:
Section 09050, INTERIOR/EXTERIOR FINISHES, MATERIALS, AND FINISH

1.3 SUBMITTAL

- A. Submit in accordance with Section 01340, SAMPLES AND SHOP DRAWINGS.
- B. Samples:
 - 1. Acoustical units, each type, with label indicating conformance to specification requirements, including units specified to match existing.
 - 2. Colored markers for units providing access.
- C. Manufacturer's Literature and Data:
 - 1. Ceiling suspension system, each type, showing complete details of installation, including suspension system specified to match existing.
 - 2. Acoustical units, each type
- D. Manufacturer's Certificates: Acoustical units, each type, in accordance with specification requirements.

1.4 DEFINITIONS

- A. Standard definitions as defined in ASTM C634.
- B. Terminology as defined in ASTM E1264.

1.5 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in the text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
 - A641/A641M-98.....Zinc-coated (Galvanized) Carbon Steel Wire
 - A653/A653M-01.....Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-coated (Galvannealed) by the Hot-Dip Process
 - C423-01.....Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method

C634-01.....	Standard Terminology Relating to Environmental Acoustics
C635-00.....	Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings
C636-96.....	Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels
E84-01.....	Surface Burning Characteristics of Building Materials
E119-00.....	Fire Tests of Building Construction and Materials
E413-87 (R1999).....	Classification for Rating Sound Insulation.
E580-00.....	Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Requiring Seismic Restraint
E1264-98.....	Classification for Acoustical Ceiling Products

PART 2- PRODUCTS

2.1 METAL SUSPENSION SYSTEM

- A. ASTM C635, heavy-duty system, except as otherwise specified.
 - 1. Ceiling suspension system members may be fabricated from either of the following unless specified otherwise.
 - a. Galvanized cold-rolled steel, bonderized.
 - b. Extruded aluminum.
 - c. Fire resistant plastic (glass fiber) having a flame spread and smoke developed rating of not more than 25 when tested in accordance with ASTM E84.
 - 2. Use same construction for cross runners as main runners. Use of lighter-duty sections for cross runners is not acceptable.
- B. Exposed grid suspension system for support of lay-in panels:
 - 1. Exposed grid width not less than 22 mm (7/8 inch) with not less than 8 mm (5/16 inch) panel bearing surface.
 - 2. Fabricate wall molding and other special molding from the same material with same exposed width and finish as the exposed grid members.
 - 3. On exposed metal surfaces apply baked-on enamel flat texture finish in color to match adjacent acoustical units unless specified otherwise in Section 09050, INTERIOR/EXTERIOR FINISHES.

C. Concealed grid suspension system for support of mineral base acoustical tile:

1. Concealed grid upward access suspension system to provide an initial opening of 300 mm by 600 mm (12 by 24 inches) and for removal of adjacent runners and tile without the use of special tools, and without damage to suspension system and acoustical tile.
2. Minimum flange width of 22 mm (7/8 inch) except for access hook and angle.
3. Minimum flange width of 11 mm (7/16 inch) for access hook and angle.

D. Suspension system for support of Metal Type V, VI, and VII tiles:

Concealed grid type having runners designed for the snap-in attachment of metal tile (pans).

2.2 PERIMETER SEAL

- A. Vinyl, polyethylene or polyurethane open cell sponge material having density of 1.3 plus or minus 10 percent, compression set less than 10 percent with pressure sensitive adhesive coating on one side.
- B. Thickness as required to fill voids between back of wall molding and finish wall.
- C. Not less than 9 mm (3/8 inch) wide strip.

2.3 WIRE

- A. ASTM A641.
- B. For wire hangers: Minimum diameter 2.68 mm (0.1055 inch).
- C. For bracing wires: Minimum diameter 3.43 mm (0.1350 inch).

2.4 ANCHORS AND INSERTS

- A. Use anchors or inserts to support twice the loads imposed by hangers attached thereto.
- B. Hanger Inserts:
 1. Fabricate inserts from steel, zinc-coated (galvanized after fabrication).
 2. Nailing type option for wood forms:
 - a. Upper portion designed for anchorage in concrete and positioning lower portion below surface of concrete approximately 25 mm (one inch).
 - b. Lower portion provided with not less than 8 mm (5/16 inch) hole to permit attachment of hangers.
 3. Flush ceiling insert type:

- a. Designed to provide a shell covered opening over a wire loop to permit attachment of hangers and keep concrete out of insert recess.
- b. Insert opening inside shell approximately 16 mm (5/8 inch) wide by 9 mm (3/8 inch) high over top of wire.
- c. Wire 5 mm (3/16 inch) diameter with length to provide positive hooked anchorage in concrete.

C. Clips:

1. Galvanized steel.
2. Designed to clamp to steel beam or bar joists, or secure framing member together.
3. Designed to rigidly secure framing members together.
4. Designed to sustain twice the loads imposed by hangers or items supported.

D. Tile Splines: ASTM C635.

2.5 CARRYING CHANNELS FOR SECONDARY FRAMING

- A. Fabricate from cold-rolled or hot-rolled steel, black asphaltic paint finish, free of rust.
- B. Weighing not less than the following, per 300 m (per thousand linear feet):

Size mm	Size Inches	Cold-rolled		Hot-rolled	
		Kg	Pound	Kg	Pound
38	1 1/2	215.4	475	508	1120
50	2	267.6	590	571.5	1260

2.6 ADHESIVE

- A. ASTM D1779, having flame spread index of 25 or less when tested in accordance with ASTM E84.
- B. Developing minimum strength of 7 kg/m² (one psi) of contact surface 48 hours after installation in temperature of 21 °C (70 °F).

2.7 ACOUSTICAL UNITS

A. General:

1. ASTM E1264, weighing 3.6 kg/m² (3/4 psf) minimum for mineral fiber panels or tile.
2. Class A Flame Spread: ASTM 84

3. Minimum NRC (Noise Reduction Coefficient): 0.55 unless specified otherwise: ASTM C423.
 4. Minimum CAC (Ceiling Attenuation Class): 40-44 range unless specified otherwise: ASTM E413.
- B. Lay In Units indicated on drawings. Provide equal as approved by the Contracting Officer.
1. ACT-1 Lay-in panels: Sizes as show, with square cut edges.
 - a. "Fine Fissured" Design, Washable Vinyl Latex Paint Finish, 2' x 4' with 2' x 2' scoring pattern 3/4" mineral fiber, angled tegular edge.
 - b. Armstrong Fine Fissured "Second Look II", #1761 establishes minimum quality standards.
 2. ACT-2 Lay-in panels: Sizes as shown, with angled tegular edges and decorative elements at ceiling grid intersection.
 - a. Class A, Fine Texture, Vinyl Latex Paint Finish, Humidity-resistant, 2' x 2' x 3/4" Mineral Fiber, Angled Tegular edge lay-in panels
 - b. Armstrong Cirrus Open Plan establishes quality standards.
 3. ACT-3 lay-in panels:
 - a. Class A. Nonperforated, 2'x2' 5/8" mineral fiber, with square edge and soil-resistant polyester film.
 - b. Armstrong CleanRoom VL #868 establishes quality standards.

2.9 ACCESS IDENTIFICATION

- A. Markers:
1. Use colored markers with pressure sensitive adhesive on one side.
 2. Make colored markers of paper or plastic, 6 to 9 mm (1/4 to 3/8 inch) in diameter.
- B. Use markers of the same diameter throughout building.
- C. Color Code: Use following color markers for service identification:
- | | |
|-------------|--|
| Color..... | Service |
| Red..... | Sprinkler System: Valves and Controls |
| Green..... | Domestic Water: Valves and Controls |
| Yellow..... | Chilled Water and Heating Water |
| Orange..... | Ductwork: Fire Dampers |
| Blue..... | Ductwork: Dampers and Controls |
| Black..... | Gas: Laboratory, Medical, Air and Vacuum |

PART 3 EXECUTION

3.1 CEILING TREATMENT

- A. Treatment of ceilings shall include sides and soffits of ceiling beams, furred work 600 mm (24 inches) wide and over, and vertical surfaces at changes in ceiling heights unless otherwise shown.
- B. Lay out acoustical units symmetrically about center lines of each room or space unless shown otherwise on reflected ceiling plan.
- C. Moldings:
 - 1. Install metal wall molding at perimeter of room, column, or edge at vertical surfaces.
 - 2. Install special shaped molding at changes in ceiling heights and at other breaks in ceiling construction to support acoustical units and to conceal their edges.
 - 3. Do not install spacers under the grid at wall angles. (Trim all tegular tiles to lay flat against the grid and wall angles.)
- D. Perimeter Seal:
 - 1. Install perimeter seal between vertical leg of wall molding and finish wall, partition, and other vertical surfaces.
 - 2. Install perimeter seal to finish flush with exposed faces of horizontal legs of wall molding.
- E. Existing ceiling:
 - 1. Where extension of existing ceilings occur, match existing.
 - 2. Where acoustical units are salvaged and reinstalled or joined, use salvaged units within a space. Do not mix new and salvaged units within a space which results in contrast between old and new acoustic units.
 - 3. Comply with specifications for new acoustical units for new units required to match appearance of existing units.

3.2 CEILING SUSPENSION SYSTEM INSTALLATION

- A. General:
 - 1. Install metal suspension system for acoustical tile and lay-in panels in accordance with ASTM C636, except as specified otherwise.
 - 2. Use direct or indirect hung suspension system or combination thereof as defined in ASTM C635.
 - 3. Support a maximum area of 1.48 m² (16 sf) of ceiling per hanger.
 - 4. Prevent deflection in excess of 1/360 of span of cross runner and main runner.

5. Provide extra hangers, minimum of one hanger at each corner of each item of mechanical, electrical and miscellaneous equipment supported by ceiling suspension system not having separate support or hangers.
6. Provide not less than 100 mm (4 inch) clearance from the exposed face of the acoustical units to the underside of ducts, pipe, conduit, secondary suspension channels, concrete beams or joists; and steel beam or bar joist unless furred system is shown,
7. Use main runners not less than 1200 mm (48 inches) in length.
8. Install hanger wires vertically. Angled wires are not acceptable except for seismic restraint bracing wires.

B. Anchorage to Structure:

1. Concrete:

- a. Install hanger inserts and wire loops required for support of hanger and bracing wire in concrete forms before concrete is placed. Install hanger wires with looped ends through steel deck if steel deck does not have attachment device.
- b. Use eye pins or threaded studs with screw-on eyes in existing or already placed concrete structures to support hanger and bracing wire. Install in sides of concrete beams or joists at mid height.

2. Steel:

- a. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels for attachment of hanger wires.
 - (1) Size and space carrying channels to insure that the maximum deflection specified will not be exceeded.
 - (2) Attach hangers to steel carrying channels, spaced four feet on center, unless area supported or deflection exceeds the amount specified.
- b. Attach carrying channels to the bottom flange of steel beams spaced not 1200 mm (4 feet) on center before fire proofing is installed. Weld or use steel clips to attach to beam to develop full strength of carrying channel.
- c. Attach hangers to bottom chord of bar joists or to carrying channels installed between the bar joists when hanger spacing prevents anchorage to joist. Rest carrying channels on top of the bottom chord of the bar joists, and securely wire tie or clip to joist.

B. Direct Hung Suspension System:

1. As illustrated in ASTM C635.
2. Support main runners by hanger wires attached directly to the structure overhead.
3. Maximum spacing of hangers, 1200 mm (4 feet) on centers unless interference occurs by mechanical systems. Use indirect hung suspension system where not possible to maintain hanger spacing.

C. Indirect Hung Suspension System:

1. As illustrated in ASTM C635.
2. Space carrying channels for indirect hung suspension system not more than 1200 mm (4 feet) on center. Space hangers for carrying channels not more than 2400 mm (8 feet) on center or for carrying channels less than 1200 mm (4 feet) on center so as to insure that specified requirements are not exceeded.
3. Support main runners by specially designed clips attached to carrying channels.

D. Seismic Ceiling Bracing System:

1. Construct system in accordance with ASTM E580.
2. Connect bracing wires to structure above as specified for anchorage to structure and to main runner or carrying channels of suspended ceiling at bottom.

3.3 ACOUSTICAL UNIT INSTALLATION

A. Cut acoustic units for perimeter borders and penetrations to fit tight against penetration for joint not concealed by molding.

B. Install lay-in acoustic panels in exposed grid with not less than 6 mm (1/4 inch) bearing at edges on supports.

1. Install tile to lay level and in full contact with exposed grid.
2. Notch edges of tegular tiles so that the tile makes full contact with the grid and with perimeter wall molding. Do not use spacers under runners.

3. Replace cracked, broken, stained, dirty, or tile not cut for minimum bearing.

C. Tile in concealed grid upward access suspension system:

1. Install acoustical tile with joints close, straight and true to line, and with exposed surfaces level and flush at joints.
2. Make corners and arises full, and without worn or broken places.

3. Locate acoustical units providing access as specified under Article, ACCESS.

D. Markers:

1. Install markers of color code specified to identify the various concealed piping, mechanical, and plumbing systems.
2. Attach colored markers to exposed grid on opposite sides of the units providing access.
3. Attach marker on exposed ceiling surface of upward access acoustical unit.

3.5 CLEAN-UP AND COMPLETION

- A. Replace damaged, discolored, dirty, cracked and broken acoustical units.
- B. Leave finished work free from defects.

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**SECTION 09540
SPECIAL SURFACES**

PART 1 - GENERAL

1.1 DESCRIPTION:

Work includes countertops with sinks and transaction counters fabricated from solid polymer materials.

1.2 RELATED WORK

- A. Casework: Section 12302, WOOD CASEWORK.
- B. Plumbing for integral sinks: Section 15450, PLUMBING FIXTURES AND TRIM.
- C. Finishes and colors: Section 09050, INTERIOR/EXTERIOR FINISHES.

1.3 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 basic designation only.

- A. American National Standards Institute (ANSI) Publications:
 - A136.1-1967 Organic Adhesives for Installation of Ceramic Tile
 - Z124-1980 Plumbing
- B. American Society for Testing and Materials (ASTM) Publications:
 - D256-84 Test Methods for Impact Resistance of Plastics and Electrical Insulating Materials
 - D570-81 Test Method for Water Absorption of Plastics
 - D638-84 Test Method for Tensile Properties of Plastics
 - D696-79 Test Method for Coefficient of Linear Thermal Expansion of Plastics
 - D1499-84 Recommended Practice for Operating Light-and-Water Exposure Apparatus (Carbon-Arc Type) for Exposure of Plastics
 - E84-84a Test Method for Surface Burning Characteristics of Building Materials
- C. Federal Specifications (FS):
 - WW-P-541E/GEN (GS-FSS) August 1, 1980, Plumbing Fixtures (Lavatories)

1.4 SUBMITTALS:

- A. Shop Drawings: Shop Drawings shall be submitted for approval in accordance with the Section 01340, SAMPLES AND SHOP DRAWINGS. Shop Drawings shall indicate dimensions, component sizes, fabrication details attachment provisions and coordination requirements with adjacent work.
- B. Samples: Samples, minimum 2-inch by 2-inch, shall be submitted for approval in accordance with the Section 01340, SAMPLES AND SHOP DRAWINGS. Samples shall indicate full range of color and pattern variation. Approved samples will be retained as a standard for this work.
- C. Product Data: Product data shall be submitted in accordance with the Section 01340, SAMPLES AND SHOP DRAWINGS. Product data shall indicate product description, fabrication information and compliance with specified performance requirement.
- D. Maintenance Data: Maintenance data shall be submitted indicating manufacturer's care, repair and cleaning instructions and maintenance video. Maintenance kit for semigloss finishes shall be submitted.
- E. DELIVERY, STORAGE AND HANDLING: Materials shall not be delivered to project site until areas are ready for installation. Materials shall be stored indoors and handled to prevent damage to finished surfaces. Protective coverings shall be provided to prevent physical damage or staining following installation, for duration of project.
- F. WARRANTY: Manufacturer's standard warranty against defects in materials, excluding damages caused by physical or chemical abuse or excessive heat, shall be provided. Warranty shall provide for material and labor for replacement or repair of defective material for a period of ten years after component installation.
- G. Identity: Fabrications shall be supplied by manufacturer approved fabricators and shall be marked with the fabricator's approval label affixed in an inconspicuous location.

PART 2 - PRODUCTS

2.1 POLYMER SURFACES

- A. Components shall be cast, filled acrylic, not coated, laminated or of composite construction, meeting ANSI Z124-1980 and FS WW-P-541E/GEN. Material shall have minimum physical and performance properties

specified. Superficial damage to a depth of 1/32 inch shall be repairable by sanding or polishing.

- B. Material shall be thickness as indicated on the Drawings. Color specified in Section 09050, INTERIOR/EXTERIOR FINISHES.
- C. Lavatories shall be seamed undermount style. 20" interior width x 13-3/8" interior, front to back, x 6-1/4" deep, with back-mounted overflow. Basis of design is Corian #831. Color as indicated in Section 09050, INTERIOR/EXTERIOR FINISHES. Fabricated vanities shall be pre-assembled from solid polymer sinks and countertops with integral backsplashes and side splashes.
- D. Countertops with stainless steel sinks shall be fabricated with integral back and side splashes
- E. Transaction surfaces at the Reception Stations shall be shop fabricated in one piece and installed without joints.
- F. Performance Characteristics:

PROPERTY	REQUIREMENT (min or max)	TEST PROCEDURE
Tensile Strength	5000 psi min	ASTM D638
Tensile Modulus	1.0×10^6 psi min	ASTM D638
Flexural Strength	7000 psi min	ASTM D790
Flexural Modulus	1.0×10^6 psi min	ASTM D790
Elongation	0.3% min.	ASTM D638
Hardness	90-Rockwell "M" scale min.	ASTM D758
	52-Barcol Impressor min.	ASTM D2583
Thermal Expansion	3.5×10^{-6} in/in/deg C. max.	ASTM D696

	1.95 x 10 ⁻⁶ in/in/deg F. max.	
Color Stability	No change, 100 hours min.	NEMA LD3-3.10
Wear and Cleanability	Passes	ANSI Z124.3
Abrasion Resistance	No loss of pattern max. weight loss (1000cycles)=0.9g.	NEMA LD3-3.01 ANSI Z124.3
Boiling water Surface Resistance	No Change	NEMA LD3-3.05
High Temperature Resistance	No Change	NEMA LD3-3.06
Impact Resistance		ASTM D256, Method A
Notched Izod	0.24 ft.-lbs.min.	ASTM D3029
Gardner	9.0 ft-lbs min.	
Ball drop		NEMA LD3-303
1/4" sheet	36" min, 1/2 lb ball, no failure	
1/2" sheet	140" min, 1/2 lb ball, no failure	
3/4" sheet	200" min, 1/2 lb ball, no failure	
Bowls (point impact)	No cracks or chips	ANSI Z124.3 and 124.6
Stain Resistance	Passes	ANSI Z124.3
Weatherability	No change, min. 1000 hours	ASTM D1499

SOL 663-01-05
 VA Seattle Building 100
 Ambulatory Clinic Expansion

Fungi and Bacteria No Attack ASTM G21, ASTM G22

Specific Gravity 1.6 min

Water
 Absorption 24 hrs. Long Term ASTM D570

Weight 0.05 0.50 (1/4")

(% max.) 0.10 0.90 (3/4")

Flammability ASTM E84

solid colors

1/4" 1/2" 3/4"

Flame
 spread 25 max 25 max 25 max

Smoke
 Developed 30 max 30 max 30 max

Class 1 1 1

particulate patterns

1/4" 1/2" 3/4"

Flame
 spread 25 max 25 max 25 max

Smoke
 Developed 30 max 30 max 30 max

Class 1 1 1

Pittsburgh Protocol Toxicity (as used by NY state)	solids-80 grams minimum rating particulate patterns- 65gms minimum	"LC50" Test
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2.2 ACCESSORY PRODUCTS:

- A. Joint Adhesive: Joint adhesive shall be two-part adhesive kit to create inconspicuous, non-porous joints by chemical bond.
- B. Sealant: Sealant shall be mildew-resistant, FDA and UL listed silicone sealant in colors matching components.
- C. Sink/Bowl Mounting Hardware: Hardware shall include bowl clips, and fasteners for attachment of undermount sinks or lavatories.

2.3 FABRICATION:

- A. Components shall be factory fabricated to the greatest extent practical to sizes and shapes indicated, in accordance with approved Shop Drawings. Joints shall be formed between components using manufacturer's standard joint adhesive. Joints shall be reinforced with 2-inch wide strips of solid polymer material. Factory cutouts shall be provided for plumbing fittings and bath accessories as indicated on the Drawings. Component edges shall be cut and finished with clean, sharp returns. Contours and radii shall be routed to template, with edges smooth. Defective and inaccurate work shall be rejected. Inlay work shall be performed in accordance with manufacturer's product data, using acrylic or methacrylate inlay material and color indicated on the Drawings.
- B. Finished surfaces shall receive a uniform semi-gloss finish with a gloss range of 20-50.
- C. Thermoforming shall comply with manufacturer's product data. Molds shall be constructed of plywood in "male/female" sections matching component shapes. Component parts shall be shaped prior to joining and finishing. Pieces shall be cut to finished dimensions with edges sanded and nicks and scratches removed. Heat the entire component uniformly between 275-325 degrees Fahrenheit during forming. Prevent blistering, whitening and cracking of solid polymer material during forming. Defective material shall be rejected.

- D. Coved backsplashes shall be shop fabricated with 1/2-inch radius cove at intersection of counters and backsplashes and intersection of backsplash and endsplashes.
- E. Counter tops with stainless steel sinks shall 3/4-inch thick polymer material overhanging specified sinks. Edge details shall be as indicated on the Drawings. Counter tops shall be complete with backsplash and endsplashes. Manufacturer's standard sink mounting hardware shall be provided. Seam between sink and counter top shall be sealed with silicone sealant. Color of counter tops and splashes shall be as indicated in Section 09050, SHOP DRAWINGS AND SUBMITTALS.
- F. Counter tops with undermount lavatories shall be 3/4-inch thick polymer material with lavatory bowl. Edge details shall be as indicated on the Drawings. Countertops shall be complete with integral backsplash and endsplashes. Manufacturer's standard lavatory mounting hardware shall be provided. Seam between lavatory and counter top shall be sealed with joint adhesive. Counter tops and splashes and lavatory shall be as indicated in Section 09050, INTERIOR/EXTERIOR FINISHES.

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. Components shall be installed plumb, level and rigid. Field joints shall be made using specified adhesives, with joints inconspicuous in the finished work. Sinks and lavatory bowls shall be attached to counter tops using manufacturer's recommended sealant, adhesive and mounting hardware.
- B. Back and end splashes shall be mounted as indicated on the Drawings. Splashes shall be adhered using joint adhesive.
- C. Components shall be cleaned after installation and covered to protect against damage during completion of the remaining project items. Components damaged after installation by other trades will be repaired or replaced at the General Contractor's cost. Component supplier will provide a repair/replace cost estimate to the General Contractor who shall approve estimate before repairs are made.
- D. Plumbing connections to sinks and lavatories shall be made in accordance with Division 15, Mechanical.

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**SECTION 09660
RESILIENT TILE FLOORING**

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies the installation of vinyl composition tile flooring and accessories.

1.2 RELATED WORK

- A. Color and pattern and location in room finish schedule: Section 09050, INTERIOR/EXTERIOR FINISHES.
- B. Resilient Base: Section 09679, RESILIENT BASE AND ACCESSORIES.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01340, SAMPLES AND SHOP DRAWINGS.
- B. Manufacturer's Literature and Data:
 - 1. Description of each product.
 - 2. Resilient material manufacturers recommendations for adhesives, underlayment, primers and polish.
 - 3. Application and installation instructions.
- C. Samples:
 - 1. Tile: 300 mm by 300 mm (12 inches by 12 inches) for each type, pattern and color.
 - 2. Edge Strips: 150 mm (6 inches) long, each type.
 - 3. Feature Strips: 150 mm (6 inches) long.
- D. Shop Drawings:
 - 1. Layout of patterns shown on the drawings and in Section 09050, INTERIOR/EXTERIOR FINISHES.
 - 2. Edge strip locations showing types and detail cross sections.
- E. Test Reports:
 - 1. Abrasion resistance: Depth of wear for each tile type and color and volume loss of tile, certified by independent laboratory.
 - 2. Tested per ASTM F510.

1.4 DELIVERY

- A. Deliver materials to the site in original sealed packages or containers, clearly marked with the manufacturer's name or brand, type and color, production run number and date of manufacture.
- B. Materials from containers which have been distorted, damaged or opened prior to installation will be rejected.

1.5 STORAGE

- A. Store materials in weathertight and dry storage facility.
- B. Protect from damage from handling, water, and temperature.

1.6 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
 - D4078-02.....Water Emulsion Floor Finish
 - D3564-95 R (2002).....Application of Floor Polishes to Maintain Vinyl Composition Tile or Flooring
 - E648-03.....Critical Radiant Flux of Floor Covering Systems Using a Radiant Energy Source
 - E662-03.....Specific Optical Density of Smoke Generated by Solid Materials
 - F510-93 (R1999).....Resistance to Abrasion of Resilient Floor Coverings Using an Abrader with a Grit Feed Method
 - F710-03.....Preparing Concrete Floors to Receive Resilient Flooring
 - F1066-99.....Vinyl Composition Floor Tile
- C. Resilient Floor Covering Institute (RFCI):
 - ADH-1.....Vinyl Composition Tile Adhesive
 - MRP.....Moisture Related Problems Relevant to Resilient Floor Coverings Installed over Concrete
 - CL-1.....Cleaners for Use on Resilient Floor
 - TM-6.....Determination of Quality of Cut (Joint Tightness and Corner Openings) of Resilient Tile

PART 2 - PRODUCTS

2.1 GENERAL

- A. Furnish product type, materials of the same production run and meeting following criteria.
- B. Use adhesives, underlayment, primers and polish recommended by the floor resilient material manufacturer.
- C. Critical Radiant Flux: 0.45 watts per sq. cm or more, Class I, per ASTM E 648.

D. Smoke density: Less than 450 per ASTM E662.

2.2 VINYL COMPOSITION TILE

- A. ASTM F1066, Composition 1, Class I (solid color) or Class 2 (through pattern), 300 mm (12 inches) square, 3 mm (1/8 inch) thick.
- B. Color and pattern uniformly distributed throughout thickness.

2.3 ADHESIVES

Latex type adhesives RFC ADH-1, Type III, Water based latex as recommended by tile manufacturer.

2.4 PRIMER (FOR CONCRETE SUBFLOORS)

As recommended by the adhesive and tile manufacturer.

2.5 LEVELING COMPOUND (FOR CONCRETE FLOORS)

- A. Provide cementitious products with latex or polyvinyl acetate resins in the mix.
- B. Determine the type of underlayment selected for use by the condition to be corrected.

2.6 POLISH AND CLEANERS

- A. Cleaners RFCI CL-1.
- B. Polish: ASTM D4078.

2.7 EDGE STRIPS

- A. 28 mm (1-1/8 inch) wide unless shown otherwise.
- B. Bevel from maximum thickness to minimum thickness for flush joint unless shown otherwise.
- C. Resilient Edge Strip or Reducer Strip: Fed. Specs. SS-T-312, Solid vinyl.

2.8 FEATURE STRIPS

- A. Use same material as floor tile.
- B. Sizes and shapes as shown.

PART 3 - EXECUTION

3.1 PROJECT CONDITIONS

- A. Maintain temperature of materials a minimum of 22 °C (70 °F,) for 48 hours before installation.
- B. Maintain temperature of rooms where work occurs between 21 °C and 27 °C (70 °F and 80 °F), for at least 48 hours, before, during and after installation.

- C. Do not install flooring until building is permanently enclosed and wet construction in or near areas to receive tile materials is complete, dry and cured.

3.2 SUBFLOOR PREPARATION

- A. Verify that concrete slabs comply with ASTM F710.
- B. Correct conditions which will impair proper installation.
- C. The existing slab was specified to be float finished and was covered with a lightweight concrete fill. Remove all traces of the lightweight concrete fill and apply a thin skim coat of leveling compound over the whole floor area.
- D. Fill cracks, joints and other irregularities in concrete with leveling compound:
 - 1. Do not use adhesive for filling or leveling purposes.
 - 2. Do not use leveling compound to correct imperfections which can be corrected by spot grinding.
 - 3. Trowel to smooth surface free of trowel marks, pits, dents, protrusions, cracks or joints.
- E. Clean floor of oil, paint, dust, and deleterious substances: Leave floor dry and cured free of residue from existing curing or cleaning agents.
- F. Concrete Subfloor Testing:
Determine Adhesion and dryness of the floor by bond and moisture tests as recommended by RFCI manual MRP.
- G. Perform additional subfloor preparation to obtain satisfactory adherence of flooring if subfloor test patches allows easy removal of tile.
- H. Prime the concrete subfloor if the primer will seal slab conditions that would inhibit bonding, or if priming is recommended by the tile or adhesive manufacturers.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions for application and installation unless specified otherwise.
- B. Mix tile from at least two containers. An apparent line either of shades or pattern variance will not be accepted.
- C. Tile Layout:
 - 1. If layout is not shown on drawings, lay tile symmetrically about center of room or space with joints aligned.

2. No tile shall be less than 150 mm (6 inches) and of equal width at walls.
3. Place tile pattern in the same direction; do not alternate tiles.
- D. Trim tiles to touch for the length of intersections at pipes and vertical projections, seal joints at pipes with waterproof cement.
- E. Application:
 1. Apply adhesive uniformly with no bare spots.
 - a. Conform to RFC1-TM-6 for joint tightness and for corner intersection unless layout pattern shows random corner intersection.
 - b. More than 5 percent of the joints not touching will not be accepted.
 2. Roll tile floor with a minimum 45 kg (100 pound) roller. No exceptions.
 3. The COTR may have test tiles removed to check for non-uniform adhesion, spotty adhesive coverage, and ease of removal. Install new tile for broken removed tile.
- F. Installation of Edge Strips:
 1. Locate edge strips under center line of doors unless otherwise shown.
 2. Set resilient edge strips in adhesive. Anchor metal edge strips with anchors and screws specified.
 3. Where tile edge is exposed, butt edge strip to touch along tile edge.
 4. Where thin set ceramic tile abuts resilient tile, set edge strip against floor file and against the ceramic tile edge.

3.4 CLEANING AND PROTECTION

- A. Clean adhesive marks on exposed surfaces during the application of resilient materials before the adhesive sets. Exposed adhesive is not acceptable.
- B. Keep traffic off resilient material for a minimum 72 hours after installation.
- C. Clean and polish materials in the following order:
 1. For the first two weeks sweep and damp mopped only.
 2. After two weeks, scrub resilient materials with a minimum amount of water and a mild detergent. Leave surface clean and free of detergent residue.

3. Apply polish to the floors in accordance with the polish manufacturer's instructions.
- D. When construction traffic occurs over tile, cover resilient materials with reinforced kraft paper properly secured and maintained until removal is directed by COTR. At entrances and where wheeled vehicles or carts are used, cover tile with plywood, hardboard, or particle board over paper, secured and maintained until removal is directed by COTR.
- E. When protective materials are removed and immediately prior to acceptance, replace any damage tile, re-clean resilient materials, lightly re-apply polish and buff floors.

3.6 LOCATION

- A. Unless otherwise specified or shown, install tile flooring, on floor under areas where casework, laboratory and pharmacy furniture and other equipment occurs, except where mounted in wall recesses.
- B. Extend tile flooring for room into adjacent closets and alcoves.

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**SECTION 09679
RESILIENT BASE AND ACCESSORIES**

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies the installation of rubber base.

1.2 RELATED WORK

- A. Color and texture: Section 09050, INTERIOR/EXTERIOR FINISHES.
- B. Carpets: Section 09680, CARPET.
- C. Base at resilient tile flooring: Section 09660, RESILIENT TILE FLOORING.
- D. Base at resilient flooring: Section 09665, RESILIENT SHEET FLOORING.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01340, SAMPLES AND SHOP DRAWINGS.
- B. Manufacturer's Literature and Data:
 - 1. Description of each product.
 - 2. Base and stair material manufacturer's recommendations for adhesives.
 - 3. Application and installation instructions.
- C. Samples:
 - 1. Base: 150 mm (6 inches) long, each type and color.
 - 2. Resilient Stair Treads: 150 mm (6 inches) long.
 - 3. Sheet Rubber Flooring: 300 mm (12 inches) square.
 - 4. Adhesive: Literature indicating each type.

1.4 DELIVERY

- A. Deliver materials to the site in original sealed packages or containers, clearly marked with the manufacturer's name or brand, type and color, production run number and date of manufacture.
- B. Materials from containers which have been distorted, damaged or opened prior to installation will be rejected.

1.5 STORAGE

- A. Store materials in weather tight and dry storage facility.
- B. Protect material from damage by handling and construction operations before, during, and after installation.

1.6 APPLICABLE PUBLICATIONS

- A. The publication listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

- B. American Society for Testing and Materials (ASTM):
 - F1344-00.....Rubber Tile
 - F1859-00.....Rubber Sheet Flooring without Backing
 - F1860-00.....Rubber Sheet Flooring with Backing
 - F1861-00.....Resilient Wall Base
- C. Federal Specifications (Fed. Spec.):
 - RR-T-650E.....Treads, Metallic and Non-Metallic, Nonskid

PART 2 - PRODUCTS

2.1 GENERAL

Use only products by the same manufacturer and from the same production run.

2.2 RESILIENT BASE

- A. ASTM F1861, 3 mm (1/8 inch) thick, 100 mm (4 inches) high, Type TP Rubber, Thermoplastics, Group 2-layered with molded top. Style B-cove.
- B. Where carpet occurs, use Style A-straight.
- C. Use only one type of base throughout.

2.3 ADHESIVES

Use products recommended by the material manufacturer for the conditions of use.

PART 3 - EXECUTION

3.1 PROJECT CONDITIONS

- A. Maintain temperature of materials above 21° C (70 °F), for 48 hours before installation.
- B. Maintain temperature of rooms where work occurs, between 21° C and 27° C (70°F and 80°F) for at least 48 hours, before, during, and after installation.
- C. Do not install materials until building is permanently enclosed and wet construction is complete, dry, and cured.

3.2 INSTALLATION REQUIREMENTS

- A. The respective manufacturer's instructions for application and installation will be considered for use when approved by the COTR.
- B. Submit proposed installation deviation from this specification to the COTR indicating the differences in the method of installation.
- C. The COTR reserves the right to have test portions of material installation removed to check for non-uniform adhesion and spotty adhesive coverage.

3.3 PREPARATION

- A. Examine surfaces on which material is to be installed.
- B. Fill cracks, pits, and dents with leveling compound.
- C. Level to 3 mm (1/8 inch) maximum variations.
- D. Do not use adhesive for leveling or filling.
- E. Grind, sand, or cut away protrusions; grind high spots.
- F. Clean substrate area of oil, grease, dust, paint, and deleterious substances.
- G. Substrate area dry and cured. Perform manufacturer's recommended bond and moisture test.
- H. Preparation of existing installation:
 - 1. Remove existing base and stair treads including adhesive.
 - 2. Do not use solvents to remove adhesives.
 - 3. Prepare substrate as specified.

3.4 BASE INSTALLATION

- A. Location:
 - 1. Unless otherwise specified or shown, where base is scheduled, install base over toe space of base of casework, lockers, pharmacy furniture island cabinets and where other equipment occurs.
 - 2. Extend base scheduled for room into adjacent closet, alcoves, and around columns.
- B. Application:
 - 1. Apply adhesive uniformly with no bare spots.
 - 2. Set base with joints aligned and butted to touch for entire height.
 - 3. Before starting installation, layout base material to provide the minimum number of joints with no strip less than 600 mm (24 inches) length.
 - a. Short pieces to save material will not be permitted.
 - b. Locate joints as remote from corners as the material lengths or the wall configuration will permit.
- C. Form corners and end stops as follows:
 - 1. Score back of outside corner.
 - 2. Score face of inside corner and notch cove.
- D. Roll base for complete adhesion.

3.5 CLEANING AND PROTECTION

- A. Clean all exposed surfaces of base and adjoining areas of adhesive spatter before it sets.

- B. Keep traffic off resilient material for at least 72 hours after installation.
- C. Clean and polish materials in the following order:
 - 1. After two weeks, scrub resilient base, sheet rubber and treads materials with a minimum amount of water and a mild detergent. Leave surfaces clean and free of detergent residue. Polish resilient base to a gloss finish.
 - 2. Do not polish tread and sheet rubber materials.
- D. When construction traffic is anticipated, cover tread materials with reinforced kraft paper and plywood or hardboard properly secured and maintained until removal is directed by the COTR.
- E. Where protective materials are removed and immediately prior to acceptance, replace damaged materials and re-clean resilient materials. Damaged materials are defined as having cuts, gouges, scrapes or tears and not fully adhered.

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SECTION 09680
CARPET

PART 1 - GENERAL

1.1 DESCRIPTION

Section specifies carpet, edge strips, adhesives, and other items required for complete installation.

1.2 RELATED WORK

- A. Color and texture of carpet and edge strip: Section 09050, INTERIOR/EXTERIOR FINISHES, MATERIALS AND FINISH SCHEDULES.
- B. Resilient wall base: Section 09679, RESILIENT BASE, STAIR TREADS AND ACCESSORIES.

1.3 QUALITY ASSURANCE

- 1. Carpet installed by mechanics certified by the Floor Covering Installation Board.
- 2. Certify and label the carpet that it has been tested and meets criteria of CRI IAQ Carpet Testing Program for indoor air quality.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01340, SAMPLES AND SHOP DRAWINGS.
- B. Product Data:
 - 1. Manufacturer's catalog data and printed documentation stating physical characteristics, durability, resistance to fading and flame resistance characteristics for each type of carpet material and installation accessory.
 - 2. Manufacturer's printed installation instructions for the carpet, including preparation of installation substrate, seaming techniques and recommended adhesives and tapes.
 - 3. Manufacturer's certificate verifying carpet containing recycled materials include percentage of recycled materials as specified.
- C. Samples:
 - 1. Carpet: "Production Quality" samples 300 x 300 mm (12 x 12 inches) of carpets, showing quality, pattern and color specified in Section 09050, INTERIOR/EXTERIOR FINISHES, MATERIALS AND FINISH SCHEDULES..
 - 2. Floor Edge Strip (Molding): 150 mm (6 inches) long of each color and type specified.
 - 3. Base Edge Strip (Molding): 150 mm (6 inches) long of each color specified.

- D. Shop Drawings: Installers layout plan showing seams and cuts for sheet carpet and carpet module.
- E. Maintenance Data: Carpet manufacturer's maintenance instructions describing recommended type of cleaning equipment and material, spotting and cleaning methods and cleaning cycles.

1.5 DELIVERY AND STORAGE

- A. Deliver carpet in manufacturer's original wrappings and packages clearly labeled with manufacturer's name, brand, name, size, dye lot number and related information.
- B. Deliver adhesives in containers clearly labeled with manufacturer's name, brand name, number, installation instructions, safety instructions and flash points.
- C. Store in a clean, dry, well ventilated area, protected from damage and soiling. Maintain storage space at a temperature above 16 degrees C (60 degrees F) for 2 days prior to installation.

1.6 ENVIRONMENTAL REQUIREMENTS

Areas in which carpeting is to be installed shall be maintained at a temperature above 16 degrees C (60 degrees F) for 2 days before installation, during installation and for 2 days after installation. A minimum temperature of 13 degrees C (55 degrees F) shall be maintained thereafter for the duration of the contract. Traffic or movement of furniture or equipment in carpeted area shall not be permitted for 24 hours after installation. Other work which would damage the carpet shall be completed prior to installation of carpet.

1.7 GUARANTY

Carpet and installation subject to terms of "Guaranty" article in Section 01001, GENERAL CONDITIONS except that guaranty period is extended to two years.

1.8 APPLICABLE PUBLICATIONS

- A. Publication listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Association of Textile Chemists and Colorists (AATCC):
 - AATCC 16-98.....Colorfastness to Light
 - AATCC 129-01.....Colorfastness to Ozone in the Atmosphere under High Humidities
 - AATCC 134-01.....Electric Static Propensity of Carpets

AATCC 165-99.....Colorfastness to Crocking: Carpets-AATCC
Crockmeter Method

C. American Society for Testing and Materials (ASTM):

ASTM D1335-98.....Tuft Bind of Pile Yarn Floor Coverings

ASTM D3278-97.....Flash Point of Liquids by Small Scale Closed-
Cup Apparatus

ASTM D5252-98.....Operation of the Hexapod Tumble Drum Tester

ASTM D5417-99.....Operation of the Vettermann Drum Tester

ASTM E648-00.....Critical Radiant Flux of Floor-Covering Systems
Using a Radiant Heat Energy Source

D. The Carpet and Rug Institute (CRI):

CRI 104-96.....Installation of Commercial Carpet

PART 2 - PRODUCTS

2.1 CARPET

A. Physical Characteristics:

1. Carpet free of visual blemishes, streaks, poorly dyed areas, fuzzing
of pile yarn, spots or stains and other physical and manufacturing
defects.

2. Manufacturers standard construction commercial carpet:
Broadloom; maximum width to minimum use

3. Provide static control to permanently control static build upto less
than 2.0 kV when tested at 20 percent relative humidity and 21
degrees C (70 degrees F) in accordance with AATCC 134.

B. Color, Texture, and Pattern: As specified in Section 09050,
INTERIOR/EXTERIOR FINISHES, MATERIALS AND FINISH SCHEDULES.

C. Performance Specifications:

Radiant Panel: Passes Class 1 (ASTM E-648) Critical Radiant Flux

Smoke Density: Dm corrected 450 (ASTM E-662)

Static: <3.5 kV (AATCC-134)

Flaammability: Passes Methenamine Pill Test (DOC-FF1-70)

Backing: LIFESPAN D

Construction: Tufted Tip-Sheared

Soil/Stain Protection: Protpekt

Antimicrobial Treatment: Intersept

Yarn System: Antron Legacy (SPA is Antron Lumena solution-dyed
Nylon)

Size: 12'-6" wide.

- D. Manufacturer: Bentley Prince Street
1. Cadogan Tip: Product No. 8CD30. 30 oz/yard
 2. Cassim Bazar: Product No. 8CY32. 32 oz/yard
 3. SPA: Product No. 85D26. 26 ozz/yard

2.2 ADHESIVE AND CONCRETE PRIMER

- A. Waterproof, resistant to cleaning solutions, steam and water, nonflammable, complies with air-quality standards as well as carpet manufacturer requirements. Adhesives flashpoint minimum 60 degrees C (140 degrees F), complies with ASTM D 3278.
- B. Seam Adhesives: Waterproof, non-flammable and non-staining as recommended by the carpet manufacturer.
- C. Release adhesives for modular tile carpet in accordance with written instructions by carpet manufacturer.

2.3 SEAMING TAPE

- A. Permanently resistant to carpet cleaning solutions, steam, and water.
- B. Recommended by carpet manufacturer.

2.4 EDGE STRIPS (MOLDING)

Vinyl Edge Strip:

1. Beveled floor flange minimum 50 mm (2 inches) wide.
2. Beveled surface to finish flush with carpet for tight joint and other side to floor finish.
3. Color as specified in Section 09050, INTERIOR/EXTERIOR FINISHES, MATERIALS AND FINISH SCHEDULES.

2.5 LEVELING COMPOUND (FOR CONCRETE FLOORS)

- A. Provide Portland cement bases polymer modifier with latex or polyvinyl acetate resin manufactured specifically for resurfacing and leveling concrete floors. Products containing gypsum are not acceptable.
- B. Determine the type of underlayment selected for use by condition to be corrected.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

- A. Examine surfaces on which carpeting is to be installed.
- B. Clean floor of oil, waxy films, paint, dust and deleterious substances that prevent adhesion, leave floor dry and cured, free of residue from curing or cleaning agents.
- C. Correct conditions which will impair proper installation, including trowel marks, pits, dents, protrusions, cracks or joints.

- D. Fill cracks, joints depressions, and other irregularities in concrete with leveling compound.
 - 1. Do not use adhesive for filling or leveling purposes.
 - 2. Do not use leveling compound to correct imperfections which can be corrected by spot grinding.
 - 3. Trowel to smooth surface free of trowel marks, pits, dents, protrusions, cracks or joint lines.
- E. Test new concrete subfloor prior to adhesive application for moisture and surface alkalinity per CRI 104 Section 6.3.1 or per ASTM E1907.

3.2 CARPET INSTALLTION

- A. Do not install carpet until work of other trades including painting is complete and dry.
- B. Install in accordance with CRI 104 direct glue down installation.
 - 1. Relax carpet in accordance with Section 6.4.
 - 2. Comply with indoor air quality recommendations noted in Section 6.5.
 - 3. Maintain temperature in accordance with Section 15.3.
- C. Secure carpet to subfloor of spaces with adhesive applied as recommended by carpet manufacturer.
- D. Follow carpet manufacturer's recommendations for matching pattern and texture directions.
- E. Cut openings in carpet where required for installing equipment, pipes, outlets, and penetrations.
 - 1. Bind or seal cut edge of sheet carpet and replace flanges or plates.
 - 2. Use additional adhesive to secure carpets around pipes and other vertical projections.
- G. Broadloom Carpet:
 - 1. Install per CRI 104, Section 8.
 - 2. Lay broadloom carpet lengthwise in longest dimension of space, with minimum seams, uniformly spaced to provide a tight smooth finish, free from movement when subjected to traffic.
 - 3. Use tape-seaming method to join sheet carpet edges. Do not leave visible seams.

3.3 EDGE STRIPS INSTALLATION

- A. Install edge strips over exposed carpet edges adjacent to uncarpeted finish flooring.
- B. Anchor metal strips to floor with suitable fasteners. Apply adhesive to edge strips, insert carpet into lip and press it down over carpet.

- C. Anchor vinyl edge strip to floor with adhesive apply adhesive to edge strip and insert carpet into lip and press lip down over carpet.

3.4 PROTECTION AND CLEANING

- A. Remove waste, fasteners and other cuttings from carpet floors.
- B. Vacuum carpet and provide suitable protection. Do not use polyethylene film.
- C. Do not permit traffic on carpeted surfaces for at least 48 hours after installation. Protect the carpet in accordance with CRI 104.
- D. Do not move furniture or equipment on unprotected carpeted surfaces.
- E. Just before final acceptance of work, remove protection and vacuum carpet clean.

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**SECTION 09900
PAINTING**

PART 1-GENERAL

1.1 DESCRIPTION

- A. Section specifies field painting.
- B. Section specifies prime coats which may be applied in shop under other sections.
- C. Painting includes shellacs, stains, varnishes, coatings specified, and striping or markers and identity markings.
- D. Includes sealing of concrete floors, landings and stair treads.

1.2 RELATED WORK

- A. Shop prime painting of steel and ferrous metals: Divisions 5, 8, 10, 11, 12, 13, 14, 15 and 16 sections.
- B. Type of Finish, Color, and Gloss Level of Finish Coat: Section 09050, INTERIOR EXTERIOR FINISHES.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01340, SAMPLES AND SHOP DRAWINGS.
- B. Manufacturer's Literature and Data:
Before work is started, or sample panels are prepared, submit manufacturer's literature, the current Master Painters Institute (MPI) "Approved Product List" indicating brand label, product name and product code as of the date of contract award, will be used to determine compliance with the submittal requirements of this specification. The Contractor may choose to use subsequent MPI "Approved Product List", however, only one list may be used for the entire contract and each coating system is to be from a single manufacturer. All coats on a particular substrate must be from a single manufacturer. No variation from the MPI "Approved Product List" where applicable is acceptable.
- C. Sample Panels:
 - 1. After painters' materials have been approved and before work is started submit sample panels showing each type of finish and color specified.
 - 2. Panels to show color: Composition board, 100 by 250 by 3 mm (4 inch by 10 inch by 1/8 inch).
 - 3. Panel to show transparent finishes: Wood of same species and grain pattern as wood approved for use, 100 by 250 by 3 mm (4 inch by 10

inch face by 1/4 inch) thick minimum, and where both flat and edge grain will be exposed, 250 mm (10 inches) long by sufficient size, 50 by 50 mm (2 by 2 inch) minimum or actual wood member to show complete finish.

4. Attach labels to panel stating the following:
 - a. Federal Specification Number or manufacturers name and product number of paints used.
 - b. Specification code number specified in Section, 09050 INTERIOR EXTERIOR FINISHES.
 - c. Product type and color.
 - d. Name of project.

5. Strips showing not less than 50 mm (2 inch) wide strips of undercoats and 100 mm (4 inch) wide strip of finish coat.

D. Sample of identity markers if used.

E. Manufacturers' Certificates indicating compliance with specified requirements:

Manufacturer's paint substituted for Federal Specification paints meets or exceeds performance of paint specified.

1.4 DELIVERY AND STORAGE

- A. Deliver materials to site in manufacturer's sealed container marked to show following:
 1. Name of manufacturer.
 2. Product type.
 3. Batch number.
 4. Instructions for use.
 5. Safety precautions.
- B. In addition to manufacturer's label, provide a label legibly printed as following:
 1. Federal Specification Number, where applicable, and name of material.
 2. Surface upon which material is to be applied.
 3. If paint or other coating, state coat types; prime, body or finish.
- C. Maintain space for storage, and handling of painting materials and equipment in a neat and orderly condition to prevent spontaneous combustion from occurring or igniting adjacent items.
- D. Store materials at site at least 24 hours before using, at a temperature between 18 and 30 degrees C (65 and 85 degrees F).

1.5 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by basic designation only.
- B. American Conference Of Governmental Industrial Hygienists (ACGIH):
 - ACGIH TLV-BKLT-1992.....Threshold Limit Values (TLV) for Chemical Substances and Physical Agents and Biological Exposure Indices (BEIs)
 - ACGIH TLV-DOC.....Documentation of Threshold Limit Values and Biological Exposure Indices, (Sixth Edition)
- C. American National Standards Institute (ANSI):
 - A13.1-96.....Scheme for the Identification of Piping Systems
- D. American Society for Testing and Materials (ASTM):
 - D260-86.....Boiled Linseed Oil
- E. Commercial Item Description (CID):
 - A-A-378.....Putty, Linseed Oil Type (For Wood Sash Glazing) (cancelled)
 - A-A-1272.....Plaster, Gypsum (Spackling Compound)
 - A-A-1555.....Water Paint, Powder (Cementitious, White and Colors) (WPC) (cancelled)
 - A-A-2335.....Sealer, Surface (Varnish Type, Wood and Cork Floors) (cancelled)
 - A-A-3120.....Paint, For Swimming Pools (RF) (cancelled)
- F. Federal Specifications (Fed Spec):
 - P-W-155C.....Wax Floor, Water-Emulsion INT AMD 1
 - TT-F-322D.....Filler, Two-Component Type, For Dents, Cracks INT AMD 1.....Small-Hole and Blow-Holes
 - TT-F-340C.....Filler, Wood, Plastic
 - TT-P-1411A.....Paint, Copolymer-Resin, Cementitious (For Waterproofing Concrete and Masonry Walls) (CEP)
- G. Master Painters Institute (MPI):
 - No. 8-02.....Exterior Alkyd, Flat (EO)
 - No. 9-02.....Exterior Alkyd Enamel (EO)
 - No. 10-02.....Exterior Latex, Flat (AE)
 - No. 11-02.....Exterior Latex, Semi-Gloss (AE)
 - No. 18-02.....Organic Zinc Rich Coating
 - No. 22-02.....High Heat Resistant Coating (HR)

- No. 26-02.....Cementitious Galvanized Metal Primer
- No. 27-02.....Exterior / Interior Alkyd Floor Enamel, Gloss
(FE)
- No. 31-02.....Polyurethane, Moisture Cured, Clear Gloss (PV)
- No. 43-02.....Interior Satin Latex
- No. 44-02.....Interior Low Sheen Latex
- No. 45-02.....Interior Primer Sealer
- No. 46-02.....Interior Enamel Undercoat
- No. 47-02.....Interior Alkyd, Semi-Gloss (AK)
- No. 50-02.....Interior Latex Primer Sealer
- No. 52-02.....Interior Latex, MPI Gloss Level 3 (LE)
- No. 53-02.....Interior Latex, Flat, MPI Gloss Level 1 (LE)
- No. 54-02.....Interior Latex, Semi-Gloss, MPI Gloss Level 5
(LE)
- No. 59-02.....Interior/Exterior Alkyd Porch & Floor Enamel,
Low Gloss (FE)
- No. 60-02.....Interior/Exterior Latex Porch & Floor Paint,
Low Gloss
- No. 66-02.....Interior Alkyd Fire Retardant, Clear Top-Coat
(ULC Approved) (FC)
- No. 71-02.....Polyurethane, Moisture Cured, Clear, Flat (PV)
- No. 90-02.....Interior Wood Stain, Semi-Transparent (WS)
- No. 91-02.....Wood Filler Paste
- No. 94-02.....Exterior Alkyd, Semi-Gloss (EO)
- No. 95-02.....Fast Drying Metal Primer
- No. MPI 135-02.....Non-Cementitious Galvanized Primer
- No. 138-02.....Interior High Performance Latex, MPI Gloss
Level 2 (LF)
- No. 139-02.....Interior High Performance Latex, MPI Gloss
Level 3 (LL)
- No. 140-02.....Interior High Performance Latex, MPI Gloss
Level 4
- No. 141-02.....Interior High Performance Latex (SG) MPI Gloss
Level 5

H. Steel Structures Painting Council (SSPC):

- SSPC SP 1-00.....Solvent Cleaning
- SSPC SP 2-00.....Hand Tool Cleaning

SSPC SP 3-00.....Power Tool Cleaning

PART 2 - PRODUCTS

SPEC WRITER NOTE:

1. Coordinate material requirements to agree with applicable requirements specified in the referenced Applicable Publications.
2. Update and specify only that which applies to the project in paragraphs 1.5 and 2.1 with paint schedule and Section 09050, INTERIOR/EXTERIOR FINISHES, MATERIALS AND FINISH SCHEDULES for abbreviations and terminology. See appendix at the end of section.

2.1 MATERIALS

- A. Putty: Fed Spec A-A-378, Type II (Putty, Linseed Oil Type).
- B. Wood Sealer: MPI 31 (gloss) or MPI 71 (flat) thinned with thinner recommended by manufacturer at rate of about one part of thinner to four parts of varnish.
- C. Identity markers options:
 1. Pressure sensitive vinyl markers.
 2. Snap-on coil plastic markers.
- D. Exterior Alkyd Enamel (EO): MPI 9.
- E. Interior Satin Latex: MPI 43.
- F. Interior Low Sheen Latex: MPI 44.
- G. Interior Primer Sealer: MPI 45.
- H. Interior Enamel Undercoat: MPI 47.
- I. Interior Alkyd, Semi-Gloss (AK): MPI 47.
- J. Interior Latex Primer Sealer: MPI 50.
- K. Interior Latex, MPI Gloss Level 3 (LE): MPI 52.
- L. Interior Latex, Flat, MPI Gloss Level 1 (LE): MPI 53.
- M. Interior Latex, Semi-Gloss, MPI Gloss Level 5 (LE): MPI 54.
- N. Interior / Exterior Alkyd Porch & Floor Enamel, Low Gloss (FE): MPI 59.
- O. Interior/ Exterior Latex Porch & Floor Paint, Low Gloss: MPI 60.
- P. Interior Latex Fire Retardant, Top-Coat (ULC Approved) (FR): MPI 67.
- Q. Interior Wood Stain, Semi-Transparent (WS): MPI 90.
- R. Wood Filler Paste: MPI 91.
- S. Exterior Alkyd, Semi-Gloss (EO): MPI 94.
- T. Fast Drying Metal Primer: MPI 95.

- U. Interior latex, Gloss (LE) and (LG): MPI 114.
- V. Exterior Latex, High Gloss (acrylic) (AE): MPI 119.
- W. Waterborne Galvanized Primer: MPI 134.
- X. Interior High Performance Latex, MPI Gloss Level 2 (LF): MPI 138.
- Y. Interior High Performance Latex, MPI Gloss Level 3 (LL): MPI 139.
- Z. Interior High Performance Latex, MPI Gloss Level 4: MPI 140.
- AA. Interior High Performance Latex (SG), MPI Gloss Level 5: MPI 141.
- BB. Concrete Sealer, Water-Based Concrete Sealer. Thoro Concrete and Masonry Sealer is the standard for quality.

2.2 PAINT PROPERTIES

- A. Use ready-mixed (including colors).
- B. Where no requirements are given in the referenced specifications for primers, use primers with pigment and vehicle, compatible with substrate and finish coats specified.

2.3 REGULATORY REQUIREMENTS

- A. Paint materials shall conform to the restrictions of the local Environmental and Toxic Control jurisdiction.
 - 1. Volatile Organic Compounds (VOC): VOC content of paint materials shall not exceed local, state or district requirements.
 - 2. Lead-Base Paint:
 - a. Comply with Section 410 of the Lead-Based Paint Poisoning Prevention Act, as amended, and with implementing regulations promulgated by Secretary of Housing and Urban Development.
 - b. Regulations concerning prohibition against use of lead-based paint in federal and federally assisted construction, or rehabilitation of residential structures are set forth in Subpart F, Title 24, Code of Federal Regulations, Department of Housing and Urban Development.
 - 3. Asbestos: Materials shall not contain asbestos.
 - 4. Chromate, Cadmium, Mercury, and Silica: Materials shall not contain zinc-chromate, strontium-chromate, Cadmium, mercury or mercury compounds or free crystalline silica.
 - 5. Human Carcinogens: Materials shall not contain any of the ACGIH-BKLT and ACGHI-DOC confirmed or suspected human carcinogens.

PART 3 - EXECUTION

3.1 JOB CONDITIONS

- A. Safety: Observe required safety regulations and manufacturer's warning and instructions for storage, handling and application of painting materials.
1. Take necessary precautions to protect personnel and property from hazards due to falls, injuries, toxic fumes, fire, explosion, or other harm.
 2. Deposit soiled cleaning rags and waste materials in metal containers approved for that purpose. Dispose of such items off the site at end of each days work.
- B. Atmospheric and Surface Conditions:
1. Do not apply coating when air or substrate conditions are:
 - a. Less than 3 degrees C (5 degrees F) above dew point.
 - b. Below 10 degrees C (50 degrees F) or over 35 degrees C (95 degrees F), unless specifically pre-approved by the Contracting Officer and the product manufacturer. Under no circumstances shall application conditions exceed manufacturer recommendations.
 2. Maintain interior temperatures until paint dries hard.
 3. Do no exterior painting when it is windy and dusty.
 4. Do not paint in direct sunlight or on surfaces that the sun will soon warm.
 5. Apply only on clean, dry and frost free surfaces except as follows:
 - a. Apply water thinned acrylic and cementitious paints to damp (not wet) surfaces where allowed by manufacturer's printed instructions.
 - b. Dampened with a fine mist of water on hot dry days concrete and masonry surfaces to which water thinned acrylic and cementitious paints are applied to prevent excessive suction and to cool surface.
 6. Varnishing:
 - a. Apply in clean areas and in still air.
 - b. Before varnishing vacuum and dust area.
 - c. Immediately before varnishing wipe down surfaces with a tack rag.

3.2 SURFACE PREPARATION

- A. Method of surface preparation is optional, provided results of finish painting produce solid even color and texture specified with no overlays.
- B. General:
1. Remove prefinished items not to be painted such as lighting fixtures, escutcheon plates, hardware, trim, and similar items for reinstallation after paint is dried.
 2. Remove items for reinstallation and complete painting of such items and adjacent areas when item or adjacent surface is not accessible or finish is different.
 3. See other sections of specifications for specified surface conditions and prime coat.
 4. Clean surfaces for painting with materials and methods compatible with substrate and specified finish. Remove any residue remaining from cleaning agents used. Do not use solvents, acid, or steam on concrete and masonry.
- C. Wood:
1. Sand to a smooth even surface and then dust off.
 2. Sand surfaces showing raised grain smooth between each coat.
 3. Wipe surface with a tack rag prior to applying finish.
 4. Surface painted with an opaque finish:
 - a. Coat knots, sap and pitch streaks with MPI 36 (Knot Sealer) before applying paint.
 - b. Apply two coats of MPI 36 (Knot Sealer) over large knots.
 5. After application of prime or first coat of stain, fill cracks, nail and screw holes, depressions and similar defects with TT-F-340C (Filler, Wood, Plastic) or A-A-378 (Putty, Linseed Oil Type). Use TT-F-340C (Filler, Wood, Plastic) for transparent finish, to match wood. Sand the surface to make smooth and finish flush with adjacent surface.
 6. Before applying finish coat, reapply TT-340C (Filler, Wood, Plastic) or A-A-378 (Putty, Linseed Oil Type) if required, and sand surface to remove surface blemishes. Finish flush with adjacent surfaces.
 7. Fill open grained wood such as oak, walnut, ash and mahogany with MPI 91 (Wood Filler Paste), colored to match wood color.

- a. Thin filler in accordance with manufacturer's instructions for application.
 - b. Remove excess filler, wipe as clean as possible, dry, and sand as specified.
- D. Ferrous Metals:
1. Remove oil, grease, soil, drawing and cutting compounds, flux and other detrimental foreign matter in accordance with SSPC-SP 1 (Solvent Cleaning).
 2. Remove loose mill scale, rust, and paint, by hand or power tool cleaning, as defined in SSPC-SP 2 (Hand Tool Cleaning) and SSPC-SP 3 (Power Tool Cleaning). Exception: where high temperature aluminum paint is used, prepare surface in accordance with paint manufacturer's instructions.
 3. Fill dents, holes and similar voids and depressions in flat exposed surfaces of hollow steel doors and frames, access panels and similar items specified to have semi-gloss or gloss finish with TT-F-322D (Filler, Two-Component Type, For Dents, Small Holes and Blow-Holes). Finish flush with adjacent surfaces.
 - a. This includes flat head countersunk screws used for permanent anchors.
 - b. Do not fill screws of item intended for removal such as glazing beads.
 4. Spot prime abraded and damaged areas in shop prime coat which expose bare metal with same type of paint used for prime coat. Feather edge of spot prime to produce smooth finish coat.
 5. Spot prime abraded and damaged areas which expose bare metal of factory finished items with paint as recommended by manufacturer of item.
- E. Gypsum Board:
1. Remove efflorescence, loose and chalking plaster or finishing materials.
 2. Remove dust, dirt, and other deterrents to paint adhesion.
 3. Fill holes, cracks, and other depressions with CID-A-A-1272A [Plaster, Gypsum (Spackling Compound) finished flush with adjacent surface, with texture to match texture of adjacent surface. Patch holes over 25 mm (1-inch) in diameter as specified in Section for plaster or gypsum board.

F. Aluminum. Surfaces Specified Painted:

Clean surfaces to remove grease, oil and other deterrents to paint adhesion in accordance with SSPC-SP 1 (Solvent Cleaning).

G. Concrete Floors, Landings and Stair Treads:

Remove all debris, paint, dirt, traces of lightweight concrete fill and other material.

3.3 PAINT PREPARATION

A. Thoroughly mix painting materials to ensure uniformity of color, complete dispersion of pigment and uniform composition.

B. Do not thin unless necessary for application and when finish paint is used for body and prime coats. Use materials and quantities for thinning as specified in manufacturer's printed instructions.

C. Remove paint skins, then strain paint through commercial paint strainer to remove lumps and other particles.

D. Mix two component and two part paint and those requiring additives in such a manner as to uniformly blend as specified in manufacturer's printed instructions unless specified otherwise.

E. For tinting required to produce exact shades specified, use color pigment recommended by the paint manufacturer.

3.4 APPLICATION

A. Start of surface preparation or painting will be construed as acceptance of the surface as satisfactory for the application of materials.

B. Unless otherwise specified, apply paint in three coats; prime, body, and finish. When two coats applied to prime coat are the same, first coat applied over primer is body coat and second coat is finish coat.

C. Apply each coat evenly and cover substrate completely.

D. Allow not less than 48 hours between application of succeeding coats, except as allowed by manufacturer's printed instructions, and approved by COTR.

E. Finish surfaces to show solid even color, free from runs, lumps, brushmarks, laps, holidays, or other defects.

F. Apply by brush, roller or spray, except as otherwise specified.

G. Do not spray paint in existing occupied spaces unless approved by COTR, except in spaces sealed from existing occupied spaces.

H. Do not paint in closed position operable items such as access doors and panels and similar items.

3.5 PRIME PAINTING

- A. After surface preparation prime surfaces before application of body and finish coats, except as otherwise specified.
- B. Spot prime and apply body coat to damaged and abraded painted surfaces before applying succeeding coats.
- C. Additional field applied prime coats over shop or factory applied prime coats are not required except for exterior exposed steel apply an additional prime coat.
- D. Prime rebates for stop and face glazing of wood, and for face glazing of steel.
- E. Metals except boilers, incinerator stacks, and engine exhaust pipes:
 - 1. Steel and iron: MPI 79 (Marine Alkyd Metal Primer) or MPI 95 (Fast Drying Metal Primer)
 - 2. Zinc-coated steel and iron: MPI 134 (Waterborne Galvanized Primer) or MPI 135 (Non-Cementitious Galvanized Primer).
- F. Gypsum Board:
 - 1. Primer: MPI 50 (Interior Latex Primer Sealer) except use MPI 45 (Interior Primer Sealer) in toilet rooms.
 - 3. Surfaces scheduled to receive wall coverings or wall protection: Use MPI 45 (Interior Primer Sealer).

3.6 EXTERIOR FINISHES

- A. Apply following finish coats where specified in Section 09050 INTERIOR EXTERIOR FINISHES.
- B. Steel and Ferrous Metal:
 - Two coats of MPI 94 (Exterior Alkyd, Semi-Gloss (EO)) on exposed surfaces, except on surfaces over 94 degrees C (200 degrees F).
- D. Machinery without factory finish except for primer: One coat MPI 94 (Exterior Alkyd, Semi-Gloss (EO)).

3.7 INTERIOR FINISHES

- A. Apply following finish coats over prime coats in spaces or on surfaces specified in Section, 09050 INTERIOR EXTERIOR FINISHES.
- B. Metal Work:
 - 1. Apply to exposed surfaces.
 - 2. Omit body and finish coats on surfaces concealed after installation except electrical conduit containing conductors over 600 volts.
 - 3. Ferrous Metal, Galvanized Metal, and Other Metals Scheduled:

- a. Apply two coats of MPI 47 (Interior Alkyd, Semi-Gloss (AK))
unless specified otherwise.
- b. Machinery: One coat MPI 9 (Exterior Alkyd Enamel (EO)).
- C. Gypsum Board:
Two coats of MPI 138 (Interior High Performance Latex, MPI Gloss
Level 2 (LF)) over prime coat.
- D. Wood:
 1. Sanding:
 - a. Use 220-grit sandpaper.
 - b. Sand sealers and varnish between coats.
 - c. Sand enough to scarify surface to assure good adhesion of
subsequent coats, to level roughly applied sealer and varnish,
and to knock off "whiskers" of any raised grain as well as dust
particles.
 2. Sealers:
 - a. Apply sealers specified except sealer may be omitted where
pigmented, penetrating, or wiping stains containing resins are
used.
 - b. Allow manufacturer's recommended drying time before sanding, but
not less than 24 hours or 36 hours in damp or muggy weather.
 - c. Sand as specified.
 3. Transparent Finishes on Wood.
 - a. Natural Finish:
 - 1) One coat of sealer as written in 2.1 E.
 - 2) Two coats of MPI 71 (Polyurethane, Moisture Cured, Clear Flat
(PV) or MPI 31 (Polyurethane, Moisture Cured, Clear Gloss (PV)),
as scheduled.
- E. Concrete Floors: Two coat of water-based concrete sealer.
- F. Miscellaneous:
Apply where specified in Section 09050, INTERIOR EXTERIOR FINISHES.

3.8 REFINISHING EXISTING PAINTED SURFACES

- A. Clean, patch and repair existing surfaces as specified under surface
preparation.
- B. Remove and reinstall items as specified under surface preparation.
- C. Remove existing finishes or apply separation coats to prevent non
compatible coatings from having contact.

- D. Patched or Replaced Areas in Surfaces and Components: Apply spot prime and body coats as specified for new work to repaired areas or replaced components.
- E. Except where scheduled for complete painting apply finish coat over plane surface to nearest break in plane, such as corner, reveal, or frame.
- F. Refinish areas as specified for new work to match adjoining work unless specified or scheduled otherwise.
- G. Coat knots and pitch streaks showing through old finish with MPI 36 (Knot Sealer) before refinishing.
- H. Sand or dull glossy surfaces prior to painting.
- I. Sand existing coatings to a feather edge so that transition between new and existing finish will not show in finished work.

3.9 PAINT COLOR

- A. Color and gloss of finish coats is specified in Section 09050, INTERIOR EXTERIOR FINISHES.
- B. For additional requirements regarding color see Articles, REFINISHING EXISTING PAINTED SURFACE and MECHANICAL AND ELECTRICAL FIELD PAINTING SCHEDULE.
- C. Coat Colors:
 - 1. Color of priming coat: Lighter than body coat.
 - 2. Color of body coat: Lighter than finish coat.
 - 3. Color prime and body coats to not show through the finish coat and to mask surface imperfections or contrasts.
- D. Painting, Caulking, Closures, and Fillers Adjacent to Casework:
 - 1. Paint to match color of casework where casework has a paint finish.
 - 2. Paint to match color of wall where casework is stainless steel, plastic laminate, or varnished wood.

3.10 MECHANICAL AND ELECTRICAL WORK FIELD PAINTING SCHEDULE

- A. Field painting of mechanical and electrical consists of cleaning, touching-up abraded shop prime coats, and applying prime, body and finish coats to materials and equipment if not factory finished in space scheduled to be finished.
- B. In spaces not scheduled to be finish painted in Section 09050, INTERIOR EXTERIOR FINISHES, MATERIALS AND FINISH SCHEDULES paint as specified under paragraph H, colors.
- C. Paint various systems specified in Divisions 2, 15, and 16.

- D. Paint after tests have been completed.
- E. Omit prime coat from factory prime-coated items.
- F. Finish painting of mechanical and electrical equipment is not required when located in interstitial spaces, above suspended ceilings, in concealed areas such as pipe and electric closets, pipe basements, pipe tunnels, trenches, attics, roof spaces, shafts and furred spaces except on electrical conduit containing feeders 600 volts or more.
- G. Omit field painting of items specified in paragraph, Building and Structural WORK NOT PAINTED.
- H. Color:
 - 1. Paint items having no color specified in Section 09050, INTERIOR/ EXTERIOR FINISHES, to match surrounding surfaces.
 - 2. Paint colors as specified in Section 09050, INTERIOR/EXTERIOR FINISHES.
 - a. WhiteExterior unfinished surfaces of enameled plumbing fixtures. Insulation coverings on breeching and uptake inside boiler house, drums and drum-heads, oil heaters, condensate tanks and condensate piping.
 - b. Gray:Heating, ventilating, air conditioning and refrigeration equipment (except as required to match surrounding surfaces), and water and sewage treatment equipment and sewage ejection equipment.
 - c. Aluminum Color:. Ferrous metal on outside of boilers and in connection with boiler settings including supporting doors and door frames and fuel oil burning equipment, and steam generation system (bare piping, fittings, hangers, supports, valves, traps and miscellaneous iron work in contact with pipe).
 - d. Federal Safety Red: Exposed fire protection piping hydrants, post indicators, electrical conducts containing fire alarm control wiring, and fire alarm equipment.
 - e. Federal Safety Orange: .Entire lengths of electrical conduits containing feeders 600 volts or more.
 - f. Color to match brickwork sheet metal covering on breeching outside of exterior wall of boiler house.
- I. Apply paint systems on properly prepared and primed surface as follows:
 - 1. Exterior Locations:

- a. Apply two coats of MPI 94 (Exterior Alkyd, Semi-gloss (EO)) to the following ferrous metal items:
Vent and exhaust pipes with temperatures under 94 degrees C (200 degrees F), roof drains, fire hydrants, post indicators, yard hydrants, exposed piping and similar items.
 - b. Apply two coats of MPI 11 (Exterior Latex, Semi Gloss (AE)) to the following metal items:
Galvanized and zinc-copper alloy metal.
2. Interior Locations:
- a. Apply two coats of MPI 47 (Interior Alkyd, Semi-Gloss (AK)) to following items:
 - 1) Metal under 94 degrees C (200 degrees F) of items such as bare piping, fittings, hangers and supports.
 - 2) Equipment and systems such as hinged covers and frames for control cabinets and boxes, cast-iron radiators, electric conduits and panel boards.
 - 3) Heating, ventilating, air conditioning, plumbing equipment, and machinery having shop prime coat and not factory finished.
 - b. Paint electrical conduits containing cables rated 600 volts or more using two coats of MPI 94 (Exterior Alkyd, Semi-gloss (EO)) in the Federal Safety Orange color in exposed and concealed spaces full length of conduit.
3. Other exposed locations:
- Cloth jackets of insulation of ducts and pipes in connection with plumbing, air conditioning, ventilating refrigeration and heating systems: One coat of MPI 50 (Interior Latex Primer Sealer) and one coat of MPI 11 (Exterior Latex Semi-Gloss (AE)).

3.11 BUILDING AND STRUCTURAL WORK FIELD PAINTING

- A. Painting and finishing of interior and exterior work except as specified under paragraph 3.11 B.
1. Painting and finishing of new and existing work including colors and gloss of finish selected is specified in Finish Schedule, Section 09050, INTERIOR EXTERIOR FINISHES.
 2. Painting of disturbed, damaged and repaired or patched surfaces when entire space is not scheduled for complete repainting or refinishing.
 3. Painting of ferrous metal and galvanized metal.

4. Identity painting and safety painting.

B. Building and Structural Work not Painted:

1. Prefinished items:

- a. Prefinished casework, prefinished doors, metal panels, wall covering, and similar items specified factory finished under other sections.
- b. Factory finished equipment and pre-engineered metal building components such as metal roof and wall panels.

2. Finished surfaces:

- a. Hardware except ferrous metal.
- b. Anodized aluminum, stainless steel, chromium plating, copper, and brass, except as otherwise specified.
- c. Signs, fixtures, and other similar items integrally finished.

3. Concealed surfaces:

- a. Inside dumbwaiter interstitial spaces, pipe basements, crawl spaces, pipe tunnels, above ceilings, attics, except as otherwise specified.
- b. Inside walls or other spaces behind access doors or panels.
- c. Surfaces concealed behind permanently installed casework and equipment.

4. Moving and operating parts:

- a. Shafts, chains, gears, mechanical and electrical operators, linkages, and sprinkler heads, and sensing devices.
- b. Tracks for overhead or coiling doors, shutters, and grilles.

5. Labels:

- a. Code required label, such as Underwriters Laboratories Inc., Inchcape Testing Services, Inc., or Factory Mutual Research Corporation.
- b. Identification plates, instruction plates, performance rating, and nomenclature.

6. Galvanized metal:

- a. Exterior chain link fence and gates, corrugated metal areaways, and gratings.
- b. Gas Storage Racks.
- c. Except where specifically specified to be painted.

7. Metal safety treads and nosings.

8. Gaskets.

9. Concrete curbs, gutters, pavements, retaining walls, exterior exposed foundations walls and interior walls in pipe basements.
10. Structural steel encased in concrete, masonry, or other enclosure.
11. Structural steel to receive sprayed-on fire proofing.
12. Ceilings, walls, columns in interstitial spaces.
13. Ceilings, walls, and columns in pipe basements.

3.12 IDENTITY PAINTING SCHEDULE

- A. Identify designated service in accordance with ANSI A13.1, unless specified otherwise, on exposed piping, piping above removable ceilings, piping in accessible pipe spaces, interstitial spaces, and piping behind access panels.
 1. Legend may be identified using 2.1 G options or by stencil applications.
 2. Apply legends adjacent to changes in direction, on branches, where pipes pass through walls or floors, adjacent to operating accessories such as valves, regulators, strainers and cleanouts a minimum of 12 000 mm (40 feet) apart on straight runs of piping. Identification next to plumbing fixtures is not required.
 3. Locate Legends clearly visible from operating position.
 4. Use arrow to indicate direction of flow.
 5. Identify pipe contents with sufficient additional details such as temperature, pressure, and contents to identify possible hazard. Insert working pressure shown on drawings where asterisk appears for High, Medium, and Low Pressure designations as follows:
 - a. High Pressure - 414 kPa (60 psig) and above.
 - b. Medium Pressure - 104 to 413 Kpa (15 to 59 psig).
 - c. Low Pressure - 103 kPa (14 psig) and below.
 - d. Add Fuel oil grade numbers.
 6. Legend name in full or in abbreviated form as follows:

PIPING	COLOR OF EXPOSED PIPING	COLOR OF BACKGROUND	COLOR OF LETTERS	LEGEND BBREVIATIONS
Blow-off		Yellow	Black	Blow-off
Boiler Feedwater		Yellow	Black	Blr Feed
A/C Condenser Water Supply		Green	White	A/C Cond Wtr Sup
A/C Condenser Water Return		Green	White	A/C Cond Wtr Ret
Chilled Water Supply		Green	White	Ch. Wtr Sup
Chilled Water Return		Green	White	Ch. Wtr Ret

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SOL 663-01-05
 VA Seattle Building 100
 Ambulatory Clinic Expansion

Shop Compressed Air		Yellow	Black	Shop Air
Air-Instrument Controls		Green	White	Air-Inst Cont
Drain Line		Green	White	Drain
Emergency Shower		Green	White	Emg Shower
High Pressure Steam		Yellow	Black	H.P. _____*
High Pressure Condensate Return		Yellow	Black	H.P. Ret _____*
Medium Pressure Steam		Yellow	Black	M. P. Stm _____*
Medium Pressure Condensate Return		Yellow	Black	M.P. Ret _____*
Low Pressure Steam		Yellow	Black	L.P. Stm _____*
Low Pressure Condensate Return		Yellow	Black	L.P. Ret _____*
High Temperature Water Supply		Yellow	Black	H. Temp Wtr Sup
High Temperature Water Return		Yellow	Black	H. Temp Wtr Ret
Hot Water Heating Supply		Yellow	Black	H. W. Htg Sup
Hot Water Heating Return		Yellow	Black	H. W. Htg Ret
Gravity Condensate Return		Yellow	Black	Gravity Cond Ret
Pumped Condensate Return		Yellow	Black	Pumped Cond Ret
Vacuum Condensate Return		Yellow	Black	Vac Cond Ret
Fuel Oil - Grade		Green	White	Fuel Oil-Grade ____*
Boiler Water Sampling		Yellow	Black	Sample
Chemical Feed		Yellow	Black	Chem Feed
Continuous Blow-Down		Yellow	Black	Cont. B D
Pumped Condensate		Black		Pump Cond
Pump Recirculating		Yellow	Black	Pump-Recirc.
Vent Line		Yellow	Black	Vent
Alkali		Yellow	Black	Alk
Bleach		Yellow	Black	Bleach
Detergent		Yellow	Black	Det
Liquid Supply		Yellow	Black	Liq Sup
Reuse Water		Yellow	Black	Reuse Wtr
Cold Water (Domestic)	White	Green	White	C.W. Dom
Hot Water (Domestic)				
Supply	White	Yellow	Black	H.W. Dom
Return	White	Yellow	Black	H.W. Dom Ret
Tempered Water	White	Yellow	Black	Temp. Wtr
Ice Water				
Supply	White	Green	White	Ice Wtr
Return	White	Green	White	Ice Wtr Ret
Reagent Grade Water		Green	White	RG
Reverse Osmosis		Green	White	RO
Sanitary Waste		Green	White	San Waste
Sanitary Vent		Green	White	San Vent
Storm Drainage		Green	White	St Drain
Pump Drainage		Green	White	Pump Disch
Chemical Resistant Pipe				

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Waste	Yellow	Black	Acid Waste
Vent	Yellow	Black	Acid Vent
Atmospheric Vent	Green	White	ATV
Silver Recovery	Green	White	Silver Rec
Oral Evacuation	Green	White	Oral Evac
Fuel Gas	Yellow	Black	Gas
Fire Protection Water			
Sprinkler	Red	White	Auto Spr
Standpipe	Red	White	Stand
Sprinkler	Red	White	Drain

7. Electrical Conduits containing feeders over 600 volts, paint legends using 50 mm (2 inch) high black numbers and letters, showing the voltage class rating. Provide legends where conduits pass through walls and floors and at maximum 6100 mm (20 foot) intervals in between. Use labels with yellow background with black border and words Danger High Voltage Class, 5000, 15000 or 25000.

8. See Sections for methods of identification, legends, and abbreviations of the following:

- a. Regular compressed air lines: Section 15319, COMPRESSED AIR SYSTEMS, SHOP AND LAUNDRY.
- b. Dental compressed air lines: Section, 15481, DENTAL COMPRESSED AIR.
- c. Laboratory gas and vacuum lines: Section 15488, LABORATORY (NONFLAMMABLE) GAS AND VACUUM SYSTEMS.
- d. Oral evacuation lines: Section 15489, ORAL EVACUATION SYSTEM.
- e. Medical Gases and vacuum lines: Section 15491, MEDICAL GAS AND VACUUM SYSTEMS.
- f. Conduits containing high voltage feeders over 600 volts: Section 16111, CONDUIT SYSTEMS.

B. Fire and Smoke Partitions:

1. Identify partitions above ceilings on both sides of partitions except within shafts in letters not less than 64 mm (2 1/2 inches) high.
2. Stenciled message: "SMOKE PARTITION" or, "FIRE PARTITION" as applicable.
3. Locate not more than 6100 mm (20 feet) on center on corridor sides of partitions, and with a least one message per room on room side of partition.

4. Use semigloss paint of color that contrasts with color of substrate.
- C. Identify columns in pipe basements and interstitial space:
 1. Apply stenciled number and letters to correspond with grid numbering and lettering shown.
 2. Paint numbers and letters 100 mm (4 inches) high, locate 450 mm (18 inches) below overhead structural slab.
 3. Apply on four sides of interior columns and on inside face only of exterior wall columns.
 4. Color:
 - a. Use black on concrete columns.
 - b. Use white or contrasting color on steel columns.

3.14 PROTECTION CLEAN UP, AND TOUCH-UP

- A. Protect work from paint droppings and spattering by use of masking, drop cloths, removal of items or by other approved methods.
- B. Upon completion, clean paint from hardware, glass and other surfaces and items not required to be painted of paint drops or smears.
- C. Before final inspection, touch-up or refinished in a manner to produce solid even color and finish texture, free from defects in work which was damaged or discolored.

- - - E N D - - -

SECTION 09952
FABRIC WALL COVERING

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies fabric wall covering of polyolefin fiber with acrylic backing and Teflon finish.

1.2 RELATED WORK

Color, pattern, type and location of wall fabric: Section 09050, INTERIOR/EXTERIOR FINISHES, MATERIALS, AND FINISH SCHEDULE.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01340, SAMPLES AND SHOP DRAWINGS.
- B. Samples:
 - 1. Fabric wall covering, each type and pattern as specified in Section, INTERIOR/EXTERIOR FINISHES, MATERIALS, AND FINISH SCHEDULE, size, 450 mm (18 inch) long, full width of mill run, each color.
 - 2. Molding, each type.
- C. Manufacturer's Literature and Data:
 - 1. Primer and adhesive.
 - 2. Complete instructions for installation of wall covering.
 - 3. Maintenance instructions for each type of wall covering.
- D. Certificate: Flame spread, and smoke density factors.

1.4 QUALITY ASSURANCE

- A. Before proceeding with the work under this Section, and in coordination with other trades, finish one complete space of each type (color and pattern) of wall covering showing selected colors, textures, materials and workmanship.
- B. After approval, the sample spaces or items shall serve as a standard for similar work throughout the building.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver wall coverings, sealers, adhesive and accessories specified, to the job site in sealed, labeled containers, each bearing the manufacturer's names, brand names and color designations.
- B. Store wall covering materials laid flat, not upright, in a dry area with heat maintained at 16 °C (60 °F) minimum with humidity normal to the space or area where wall covering is to be installed.

1.6 JOB CONDITIONS

- A. Temperatures:

1. Do not start wall covering work until surfaces and materials have been maintained at 16 °C (60 °F) minimum, or higher if recommended by wall covering manufacturer, for three days before work begins.
 2. Maintain minimum temperature of 16 °C (60 °F) during the work and until primers and adhesives have fully dried or cured.
- B. Ventilation: Provide continuous ventilation as required to rid the spaces in which the wall coverings are being installed of volatile compounds given off by the wall coverings, sealers and adhesives and as recommended by the product manufacturer for full drying or curing.
- C. Protect other surfaces from damage which may be caused by this work. Provide drop cloths, shields and protective equipment to prevent primers, adhesives or wall covering from fouling adjacent surfaces and in particular, storage and preparation areas.
- D. Store flammable rubbish, waste, cloths and materials which may constitute a fire hazard, in closed metal containers. Daily remove and properly dispose of flammable wastes from the site.

1.7 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extend referenced. The publications are referenced in text by the basic designation only.
- B. Federal Specifications (Fed. Spec):
MMM-A-130B.....Adhesive, Contact
- C. National Association of Architectural Metal Manufacturers (NAAMM):
AMP 500 Series.....Metal Finishes Manual
- D. American Society for Testing and Materials (ASTM):
E84-98.....Surface Burning Characteristics of Building
Materials

PART 2 - PRODUCTS

2.1 FABRIC WALL COVERING

- A. Facing of polyolefin, with acrylic backing and Teflon finish. Maharam
TEK-WALL 1000 300801
- B. Class A rating, passing NFPA 286
- C. Weight: 16.7 oz.
- D. Width 54"

2.2 PRIMER AND ADHESIVE

Mildew resistant type recommended by the wall covering manufacturer for use on substrate to receive the fabric wall covering.

2.3 EDGE GUARDS

Edge guards shall be 2 mm (3/32 inch) thick and shall cover 19 mm (3/4 inch) each side of corner at right angles. Edge guards shall be clear polycarbonate.

PART 3 - EXECUTION

3.1 SURFACE CONDITION

1. Do not apply wall covering to rough surfaces or which have stains that will bleed through the wall covering. Fill cracks and holes and sand rough spots smooth. Masonry and concrete walls shall have flush joints. Coat these walls with cement plaster or wall/liner as substrate preparation.
2. Surfaces to receive wall covering shall be thoroughly dry. Test moisture content of plaster, concrete, and masonry walls with an electric moisture meter. The moisture shall not be more than 5 percent.
3. Prime surfaces of walls as required by manufacturer's instructions. Primer shall be completely dry before adhesive is applied.
4. Existing surfaces should be clean; free of mildew or loose or flakey paint; and, smooth before the application of primer, and adhesive.

3.2 INSTALLATION

- A. Install according to manufacturer's installation instructions. Clean up adhesive spillage with recommended cleaners. Install edge guards and wainscot cap where shown.
- B. When installation is complete, vacuum wall covering with a ceiling to floor motion.

3.3 CLEAN-UP

Upon completion of work, leave wall covering free of dirt or soil.

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**SECTION 10152
HOSPITAL CUBICLE CURTAIN TRACKS**

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies cubicle curtain track (C.C.T).

1.2 RELATED WORK

Steel shapes for suspending track assembly: Section 05500, METAL FABRICATIONS and Section 09500, ACOUSTICAL CEILING.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01340, SAMPLES AND SHOP DRAWINGS.
- B. Samples:
 - One 300 mm (12 inch) long piece of cubicle curtain track with carrier access and end stop.
 - One clip anchor for fastening track to grid system of acoustical ceilings. One curtain carrier.
- C. Shop Drawings: Showing layout of tracks and method of anchorage.
- D. Manufacturer's Literature and Data:
 - Cubicle curtain track.
 - Intravenous support assembly.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Deliver material in original package marked to identify the contents, brand name, and the name of the manufacturer or supplier.
- B. Store in dry and protected location. Store so as to not bend or warp the tracks.
- C. Do not open packages until contents are needed for installation, unless verification inspection is required.

1.5 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
 - B221-00.....Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.
 - B456-95.....Electrodeposited Coatings for Copper Plus Nickel Plus Chromium and Nickel Plus Chromium
- C. The National Association of Architectural Metal Manufacturers (NAAMM):
 - AMP 500 Series.....Metal Finishes Manual

PART 2 - PRODUCTS

2.1 CUBICLE CURTAIN TRACKS

- A. Surface mounted:
 - 1. Channel Tracks (Surface Mounted Type): Extruded aluminum, ASTM B221, alloy 6063, temper T5 or T6, channel shaped, with smooth inside raceway for curtain carriers.
- B. Curtain Carriers: Nylon or delrin carriers, with either nylon or delrin wheels on metal, delrin, or nylon axles. Equip each carrier with either stainless steel, chromium plated brass or steel hooks with swivel, or nickel chromium plated brass or stainless steel bead chain and hook assembly, or delrin carriers may have molded on delrin hooks. Hook for bead chain may be the same material and finish as the bead chain or may be chromium plated steel. Provide 2.2 carriers for every 300 mm (one foot) of each section of each track length, plus one additional carrier.
- C. End Stop Connectors, Ceiling Flanges and Other Accessories: Fabricate from the same material with the same finish as the tracks or from nylon.
- E. At end of each section of track, make provision for insertion and removal of carriers. Design to prevent accidental removal of carrier. Any operating mechanism shall be removable with common tools.

2.3 FASTENERS

- A. Exposed Fasteners, Screws and Bolts: Stainless steel or chromium/nickel plated brass.
- B. Concealed Fasteners, Screws and Bolts: Hot-dip galvanized (except in high moisture areas use stainless steel).
- C. Metal Clips: Anchor curtain tracks to exposed grid of lay-in acoustical tile ceilings, with concealed metal (butterfly) type or two piece snap locking type of high strength spring steel.

2.4 FINISHES

Aluminum: Finish numbers for aluminum specified are in accordance with The Aluminum Association's Designation System. AA-C22A31 finish, chemically etched medium matte, with clear anodic coating, Class II Architectural, 0.4 mils thick.

2.5 FABRICATION

- A. All tracks to be formed as a single piece with curves as indicated on the Drawings. No splices or joints allowed.

- B. Provide steel anchor plates, supports, and anchors for securing components to building construction.
- C. Form flat surface without distortion.
- D. Shop assemble components and package complete with anchors and fittings.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install tracks after finish painting and ceiling finishing operations are complete.
- B. Install track level and securely anchor to the ceiling to form a rigid installation.
- C. Anchor surface mounted curtain tracks directly to exposed grid of lay-in acoustical tile ceilings with suitable fasteners, spaced approximately 600 mm (24 inches) on center.
- D. Anchor surface mounted curtain tracks to concrete, plaster and gypsum board ceilings with a minimum of 3 mm (1/8-inch) diameter fastenings or concealed clips spaced not more than 900 mm (three feet) on center.
- E. Securely fasten end stop caps to prevent their being forced out by the striking weight of carriers.
- G. Remove damaged or defective components and replace with new components or repair to the original condition.

3.2 ACCEPTANCE

- A. Track shall be installed neat, rigid, plumb, level and true, and securely anchored to the overhead construction.
- B. Carrier units shall operate smoothly and easily over the full range of travel.

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**SECTION 10162
TOILET PARTITIONS AND URINAL SCREENS**

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies metal toilet partitions, and urinal screens.

1.2 RELATED WORK

- A. Overhead structural steel supports for ceiling hung plasters: Section 05500, METAL FABRICATIONS.
- B. Color of baked enamel finish: Section 09050, INTERIOR/EXTERIOR FINISHES.
- C. Grab bars and toilet tissue holders: Section 10800, TOILET AND BATH ACCESSORIES.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01340, SAMPLES AND SHOP DRAWINGS.
- B. Samples: Prime coat of paint on 150 mm (six-inch) square of metal panel with baked enamel finish coat over half of panel.
- C. Manufacturer's Literature and Data: Specified items indicating all hardware and fittings, material, finish, and latching.
- D. Shop Drawings: Construction details at 1/2 scale, showing installation details, anchoring and leveling devices.
- E. Manufacturer's certificate, attesting that zinc-coatings conform to specified requirements.

1.4 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. Federal Specifications (Fed. Spec.):
FF-B-575C.....Bolt, Hexagon and Square
- C. Commercial Item Descriptions (CID):
A-A-1925.....Shield, Expansion (Nail Anchors)
A-A-60003.....Partitions, Toilet, Complete

PART 2 - PRODUCTS

2.1 FABRICATION

- A. Conform to Fed. CID A-A-60003, except as modified herein.
- B. Fabricate to dimensions shown or specified.
- C. Toilet Enclosures:
 - 1. Type 1, Style B (Ceiling hung).

2. Reinforce panels shown to receive toilet tissue holders or grab bars.
3. Upper pivots and lower hinges adjustable to hold doors open 30 degrees.
4. Latching devices and hinges for handicap compartments shall comply with ADA requirements.
5. Keeper:
 - a. U-slot to engage bar of throw latch.
 - b. Combined with rubber bumper stop.
6. Wheelchair Toilets:
 - a. Upper pivots and lower hinges to hold out swinging doors in closed position.
 - b. Provide U-type doors pulls, approximately 100 mm (four inches) long on pull side.
7. Finish:

Finish 1 (baked enamel) on doors, pilasters, and enclosure panels except those adjacent to urinals and as specified.

D. Urinal Screens:

1. Type III, Style D (wall hung), finish 3, (stainless steel).
 - a. With integral flanges and continuous, full height wall anchor plate.
 - b. Option: Full height U-Type bracket.
 - c. Wall anchor plate drilled for 4 anchors on both sides of screen.
2. Screen 600 mm (24 inches) wide and 1060 mm (42 inches high).

2.2 FASTENERS

- A. Partition Fasteners: CID A-A-60003.
- B. Use toggle bolts, CID A-A-60003, for anchoring to hollow masonry or stud framed walls.
- C. Use steel bolts FS-B-575, for anchoring pilasters to overhead steel supports.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General:
 1. Install in rigid manner, straight, plumb and with all horizontal lines level.
 2. Conceal evidence of drilling, cutting and fitting in finish work.
 3. Use hex-bolts for through-bolting.

4. Adjust hardware and leave in freely working order.
5. Clean finished surfaces and leave free of imperfections.

B. Panels and Pilasters:

1. Support panels, except urinal screens, and pilaster abutting building walls near top and bottom by stirrup supports secured to partitions with through-bolts.
2. Secure stirrups to walls with two suitable anchoring devices for each stirrup.
3. Secure panels to faces of pilaster near top and bottom with stirrup supports, through-bolted to panels and machine screwed to each pilaster.
4. Secure edges of panels to edges of pilasters near top and bottom with "U" shaped brackets.

C. Urinal Screens:

1. Anchor urinal screen flange to walls with minimum of four bolts both side of panel.
2. Space anchors at top and bottom and equally in between.

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**SECTION 10200
LOUVERS AND WALL VENTS**

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies a fixed wall louver. The louver is to be provided as part of the preformed wall panel system.

1.2 RELATED WORK

Exterior wall panel system: Section 07410, PREFORMED WALL PANELS.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01340, SAMPLES AND SHOP DRAWINGS.
- B. Shop Drawings:
Each type, showing material, finish, size of members, method of assembly, and installation and anchorage details.
- C. Manufacturer's Literature and Data:
Each type of louver and vent.

1.4 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. The Master Painters Institute (MPI):
Approved Product List - February 2002
- C. American Society for Testing and Materials (ASTM):
A167-99.....Stainless and Heat-Resisting Chromium - Nickel
Steel Plate, Sheet, and Strip
A1008-02.....Steel, Sheet, Carbon, Cold Rolled, Structural,
and High Strength Low-Alloy with Improved
Formability
B209/B209M-02.....Aluminum and Aluminum Alloy, Sheet and Plate
B221/B221M-00.....Aluminum and Aluminum Alloy Extruded Bars,
Rods, Wire, Shapes, and Tubes
- D. National Association of Architectural Metal Manufacturers (NAAMM):
Metal Finishes Manual (1988 Edition)
AMP 500.....Metal Finishes Manual
- E. National Fire Protection Association (NFPA):
90A-99.....Installation of Air Conditioning and
Ventilating Systems
- G. American Architectural Manufacturers Association (AAMA):

605-98.....High Performance Organic Coatings on
Architectural Extrusions and Panels

H. Air Movement and Control Association, Inc. (AMCA):

500-89.....Test Methods for Louvers, Dampers and Shutters

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Aluminum, Extruded: ASTM B221/B221M.
- B. Aluminum, Plate and Sheet: ASTM B209/B209M.
- C. Fasteners: Fasteners for securing louvers and wall vents to adjoining construction, except as otherwise specified or shown, shall be toggle or expansion bolts, of size and type as required for each specific type of installation and service condition.
 - 1. Where type, size, or spacing of fasteners is not shown or specified, submit shop drawings showing proposed fasteners, and method of installation.
 - 2. Fasteners for louvers, louver frames, and wire guards shall be of stainless steel or aluminum.

2.2 EXTERIOR WALL LOUVER

- A. General:
 - 1. Provide a fixed type louver of 61 square feet, 4" thick.
 - 2. Heads, sills and jamb sections shall have formed caulking slots or be designed to retain caulking. Head sections shall have exterior drip lip, and sill sections an integral water stop.
 - 3. Furnish louvers with sill extension or separate sill as shown.
 - 4. Frame shall be mechanically fastened or welded construction with welds dressed smooth and flush.
- B. Performance Characteristics:
 - 1. Weather louvers shall have a minimum of 45 percent free area and shall pass 360 fpm free area velocity at a pressure drop not exceeding 0.1 inch water gage and carry not more than // ____ g // (ounces) of water per m² (square foot) of free area for 15 minutes when tested per AMCA Standard 500.
 - 2. Louvers shall bear AMCA certified rating seals for air performance and water penetration ratings.
- C. Aluminum Louvers:

1. General: Frames, blades, sills and mullions (sliding interlocking type); 2 mm (0.081-inch) thick extruded aluminum. Blades shall be drainable type and have reinforcing bosses.
2. Louvers, fixed: Make frame sizes 13 mm (1/2-inch) smaller than openings. Single louvers frames shall not exceed 1700 mm (66 inches) wide. When openings exceed 1700 mm (66 inches), provide twin louvers separated by mullion members.

2.3 CLOSURE ANGLES AND CLOSURE PLATES

- A. Fabricate from 2 mm (0.074-inch) thick stainless steel or aluminum.
- B. Provide continuous closure angles and closure plates on inside head, jambs and sill of exterior wall louvers.
- C. Secure angles and plates to louver frames with screws, and to masonry or concrete with fasteners as specified.

2.4 FINISH

In accordance with NAAMM Metal Finishes Manual:

Aluminum Louvers:

Anodized finish

AA-C22A41 Chemically etched medium matte, with clear anodic coating, Class I Architectural, 0.7 mils thick. Finish to match extrusions provided as part of the preformed wall panel system.

2.11 PROTECTION

- A. Provide protection for aluminum against galvanic action wherever dissimilar materials are in contact, by painting the contact surfaces of the dissimilar material with a heavy coat of bituminous paint (complete coverage), or by separating the contact surfaces with a preformed synthetic rubber tape having pressure sensitive adhesive coating on one side.
- B. Isolate the aluminum from plaster, concrete and masonry by coating aluminum with zinc-chromate primer.
- C. Protect finished surfaces from damage during fabrication, erection, and after completion of the work.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Set work accurately, in alignment and where shown. Items shall be plumb, level, free of rack and twist, and set parallel or perpendicular as required to line and plane of surface.

- B. Furnish setting drawings and instructions for installation of anchors and for the positioning of items having anchors to be built into masonry construction. Provide temporary bracing for such items until masonry is set.
- C. Provide anchoring devices and fasteners as shown and as necessary for securing louvers to building construction as specified. Power actuated drive pins may be used, except for removal items and where members would be deformed or substrate damaged by their use.

3.2 CLEANING AND ADJUSTING

After installation, all exposed prefinished and plated items and all items fabricated from stainless steel and aluminum shall be cleaned as recommended by the manufacturer and protected from damage until completion of the project.

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**SECTION 10260
CORNER GUARDS AND WALL PROTECTION**

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies rigid vinyl acrylic corner guards with aluminum frame.

1.2 RELATED WORK

Color and texture of aluminum and resilient material: Section 09050, INTERIOR/EXTERIOR FINISHES.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01340, SAMPLES AND SHOP DRAWINGS.
- B. Shop Drawings: Show design and installation details.
- C. Manufacturer's Literature and Data:
 - 1. Corner Guards
 - 2. Wall Protection
- D. Test Report: Showing that resilient material complies with specified fire and safety code requirements.
- E. Samples:
 - 1. Corner guard extrusion with cover and end caps 4" minimum section
 - 2. Wall protection: 6" x 6" piece with (2) sets of available colors.

1.4 DELIVERY AND STORAGE

- A. Deliver materials to the site in original sealed packages or containers marked with the name and brand, or trademark of the manufacturer.
- B. Protect from damage from handling and construction operations before, during and after installation.
- C. Store in a dry environment of approximately 21° C (70 degrees F) for at least 48 hours prior to installation.

1.5 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
 - A167-99.....Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
 - B221-02.....Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
 - D256-02.....Impact Resistance of Plastics

- D635-98.....Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position
- D1729-96.....Visual Appraisal of Color and Color Differences of Diffusely-Illuminated Opaque Materials
- E84-03.....Surface Burning Characteristics of Building Materials

- C. The National Association of Architectural Metal Manufacturers (NAAMM):
AMP 500 Series.....Metal Finishes Manual
- D. National Fire Protection Association (NFPA):
80-99.....Standard for Fire Doors and Windows
- E. Society of American Automotive Engineers (SAE):
J 1545-86.....Instrumental Color Difference Measurement for Exterior Finishes.
- F. Underwriters Laboratories Inc. (UL):
Annual Issue.....Building Materials Directory

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Aluminum Extruded: ASTM B221, Alloy 6063, Temper T5 or T6.
- B. Resilient Material:
 - Extruded and injection molded acrylic vinyl or extruded polyvinyl chloride meeting following requirements:
 - a. Minimum impact resistance of 1197 ps (25 ft lbs per sq.ft) when tested in accordance with ASTM D256 (Izod impact, ft.lbs. per inch notch).
 - b. Class 1 fire rating when tested in accordance with ASTM E84, having a maximum flame spread of 25 and a smoke developed rating of 450 or less.
 - c. Rated self extinguishing when tested in accordance with ASTM D635.
 - d. Material shall be labeled and tested by Underwriters Laboratories or other approved independent testing laboratory.
 - e. Integral color with all colored components matched in accordance with SAE J 1545 to within plus or minus 1.0 on the CIE-LCH scales.
 - f. Same finish on exposed surfaces.

2.2 CORNER GUARDS

Resilient, Shock-Absorbing Corner Guards: Surface mounted 2"x 2"x4' with ¼" radius. Height 4"0" unless noted otherwise.

1. Snap-on corner guard formed from resilient material, minimum 2 mm (0.078-inch) thick, free floating on a continuous 1.6 mm (0.063-inch) thick extruded aluminum retainer. 2. Provide factory fabricated end closure caps at top and bottom of surface mounted corner guards.
2. Flush mounted corner guards installed on any fire rated wall shall maintain the fire rating of the wall. Provide fire test of proposed corner guard system to verify compliance.
 - a. Where insulating materials are an integral part of the corner guard system, the insulating materials shall be provided by the manufacturer of the corner guard system.
 - b. All exposed metal in fire rated assemblies shall have a paintable finish.

2.3 FASTENERS AND ANCHORS

- A. Provide fasteners and anchors as required for each specific type of installation.
- B. Where type, size, spacing or method of fastening is not shown or specified, submit shop drawings showing proposed installation details.

2.4 FINISH

- A. In accordance with NAAMM AMP 500 series.
- B. Aluminum

Concealed aluminum: Mill finish as fabricated, uniform in color and free from surface blemishes.
- C. Resilient Material: Embossed texture and color in accordance with SAE J 1545 and as specified in Section 09050, INTERIOR/EXTERIOR FINISHES. Color as selected from manufacturer's solid colors.

PART 3 - INSTALLATION

3.1 RESILIENT CORNER GUARDS

Install corner guards on walls in accordance with manufacturer's instructions.

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**SECTION 10505
METAL LOCKERS**

PART 1 - GENERAL

1.02 SUMMARY

- A. Provide materials, fabrication and installation of locker types specified herein and other associated accessories.

1.03 SUBMITTALS

- A. Comply with provisions of Section 01300 - SUBMITTALS.
- B. Submit manufacturer's literature describing products.
- C. Shop Drawings: Provide layout, dimensions, details of construction, fitting of closures, locker numbering system, and attachment to adjacent surfaces.
- D. Samples: Submit manufacturer's metal finish samples in colors as shown on Finish Schedule.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of Section 01600 - MATERIALS AND EQUIPMENT.
- B. Identify type, size, and location of lockers before site delivery in manner not to damage finish.
- C. Deliver products only after proper storage facilities are available.
- D. Handle carefully to prevent damage and store on clean concrete surface or raised platform in safe, dry area. Do not dump onto ground.

1.04 QUALITY ASSURANCE

MRI Safety: Keys provided for MRI Department Patient Lockers shall be of non-ferrous, non-magnetic composition to allow patients to keep the locker key with them while undergoing MRI procedures.

PART 1 - PRODUCTS

2.01 MANUFACTURERS

Provide products of one of the following:

- 1. De Bourgh Manufactory Co.
- 2. Lyon Metal Products, Inc.
- 3. Medart, Inc.
- 4. Penco Products.
- 5. Republic Storage Systems Co., Inc.
- 6. Or approved equivalent.

2.02 LOCKER TYPES

- A. Six-Tier:
 - 1. Size: 12 inches wide by 18 inches deep by 12 inches high.

2. Ventilation: Minimum 2 louvers at top and bottom of doors.
3. Locks: Built-in master-keyed flat key lock.
4. Seismic Reinforcing: Two 2-inch-wide by 20-gauge steel plates full width of each locker, welded at top and bottom of locker tier anchorage points.
5. Base: 4-inch built-in concrete with finish base, as indicated.

B. Double Tier:

1. Size: 15 inches wide by 18 inches deep by 72 inches high.
2. Ventilation: Minimum 6 louvers at top and bottom of doors.
3. Hooks: One double-prong ceiling hook and single-prong hooks at side walls of each locker.
4. Locks: Built-in master keyed flat key lock.
5. Seismic Reinforcing: Two 2-inch-wide by 20-gauge steel plates full width of each locker, welded at top and bottom of locker tier anchorage points.
6. Closed.

C. Two Person:

1. Size: 15 inches wide by 18 inches deep by 72 inches high.
2. Ventilation: Minimum 6 louvers at top and bottom of bottom doors and at each side of top doors.
3. Hooks: One double-prong ceiling hook and single-prong hooks at side walls of both bottom units.
4. Locks: Built-in master keyed flat key lock for each bottom unit with interlock to respective top unit.
5. Seismic Reinforcing: Two 2-inch-wide by 20-gauge steel plates full width of each locker, welded at top and bottom of locker tier anchorage points.
6. Base: Closed.

D. Triple Tier - Type One:

1. Size: 12 inches wide by 18 inches deep by 72 inches high.
2. Ventilation: Minimum six louvers at top and bottom of doors.
3. Locks: Built-in master keyed flat key lock.
4. Seismic Reinforcing: Two 2-inch-wide by 20-gauge steel plates full width of each locker, welded at top and bottom of locker tier anchorage points.
5. Base: 4-inch built-in concrete with finish base as indicated.

2.03 BASIC MATERIALS AND COMPONENTS

- A. Sheet Steel:
 - 1. For Doors, Door Frames, Shelves, Bases, Fillers, Closures, and Trim:
Cold-rolled and stretcher-leveled sheet steel, minimum 16 gauge.
 - 2. For Bodies and Dust Covers: Mild cold-rolled sheet steel, minimum 24 gauge.
- B. Lock Bars: Channel-formed steel with latching fingers to operate independently of bar such that lock bar drops into locked position immediately after door is opened and handle released.
 - 1. Provide typically except at box lockers.
 - 2. Provide at least 2 locking points for lockers 48 inches high or less.
 - 3. Provide at least 3 locking points for lockers greater than 48 inches high.
- C. Handles: Die-Cast zinc alloy, chromium-plated; with provision for padlock such that handle case serves as protective strike.
- D. Locks: Flat key lever tumbler type for flush mounting; spring bolt action with master key.
 - 1. National Lock Co., No. 68-2600.
 - 2. Or approved equivalent.
- E. Hinges: 2-inch, tight pin, five knuckle butt type fabricated from heavy gauge cold-rolled steel. Provide minimum 2 hinges per door typically and minimum 3 on doors greater than 40 inches high.
- F. Silencers: Rubber. Provide to minimize noise wherever metal strikes against metal.
- G. Number Plates: Polished aluminum with black numbers 1/2-inch high.
- H. Hooks: Steel with ball points.
- I. Exposed Fasteners: Rustproof. Where bolts are exposed, provide slotless head type with shakeproof washers.
- J. Seismic Anchors: Provide two 1/4 inch diameter "Tek" screws at top and bottom of each full height locker, or tier of lockers.

2.04 FABRICATION

- A. Preparation: Verify dimensions at job site.
- B. Frames:
 - 1. Make faces flush without overlapping cross-members; weld joints.
 - 2. Provide door strike and silencers where necessary to curtail noise of closing.

C. Bodies:

1. Form sheets as necessary for tight joints and rigid body.
2. Rivet or bolt sheets to each other and frames.

D. Doors:

1. Form at least 1 right angle flange continuous on 4 sides.
2. Provide integral louvers where noted; louver profile as standard with approved manufacturer.

E. Hinges:

Expose only pin portion to exterior.

F. Dust Covers: Provide where noted; minimize joints; reinforce where required; and provide closures for open ends where occurring.]

G. Seismic Reinforcing: Weld each end of a plate 2 inches by 20 gauge by full width of locker to interior of each locker, or tier of lockers, at top and bottom anchorage points.

H. Number Plates: Rivet on in approved order starting from No. [1] at each room containing lockers.

2.05 FINISHES

A. Steel: After forming and welding, thoroughly clean, phosphatize, electrostatically apply heavy coat high quality enamel, baked-on; color as shown on Color Schedule.

B. Exposed Fasteners: Same as steel or noncorrosive white metal finish.

PART 2 - EXECUTION

3.01 EXAMINATION

A. Examine areas to receive lockers and benches and verify that:

1. Concrete bases not included in work of this section have been properly prepared.
2. Seismic backing plates in stud partitions which are not included in work of this section are correct.

B. Do not start work until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Assemble and install lockers and benches in accordance with approved manufacturer's specifications and approved shop Drawings.

B. Set lockers in place such that they are accurately aligned, level, plumb, and flush with planes of adjacent surfaces.

C. Anchor lockers to floors and walls as recommended by manufacturer and specified herein.

1. Install seismic anchors through seismic reinforcing plates.

- 2. Provide seismic anchorage as indicated on Drawings.
- D. Install recess trim to recessed lockers using concealed fasteners. Provide hairline joints and concealed splice plates.
- E. Install sloping top units (dust covers) to lockers using concealed fasteners. Provide hairline joints and concealed splice plates.
- F. Install finished end panels to conceal exposed ends of non-recessed lockers.

3.03 CLEANING AND ADJUSTMENT

- A. Comply with requirements of Section 01710 - CLEANING.
- B. Adjust locker doors and latches to assure proper operation.
- C. Protect lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit use of during construction.

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SECTION 10522
FIRE EXTINGUISHER CABINETS

PART 1 - GENERAL

1.1 DESCRIPTION

This section covers recessed fire extinguisher cabinets.

1.2 RELATED WORK

Acrylic glazing: Section 08810, GLASS AND GLAZING.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01340, SAMPLES AND SHOP DRAWINGS.
- B. Manufacturer's Literature and Data: Fire extinguisher cabinet including installation instruction and rough opening required.

PART 2 - PRODUCTS

2.1 FIRE EXTINGUISHER CABINET

- A. Fully recessed type with flat trim with full window.
- B. Interior dimensions 24" high x 9-1/2" wide x 6" deep.

2.2 FABRICATION

- A. Form body of cabinet from 0.9 mm (0.0359 inch) thick sheet steel.
- B. Fabricate door and trim from extruded aluminum with mitered corners.
 - 1. Glaze doors with 6 mm (1/4 inch) thick G-19, clear acrylic sheet.
 - 2. Design doors to open 180 degrees.
 - 3. Provide continuous hinge, pull handle, and adjustable roller catch.

2.3 FINISH

- A. Finish interior of cabinet body with baked-on semigloss white enamel.
- B. Finish door, factory clear anodized.

PART 3 - EXECUTION

- A. Install fire extinguisher cabinets in prepared openings and secure in accordance with manufacturer's instructions.
- B. Install cabinet so that bottom of cabinet is 975 mm (39 inches) above finished floor.

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SECTION 10617
MOVABLE METAL PARTITIONS

PART 1 - GENERAL

1.1 DESCRIPTION

This Section specifies manually operated, paired panel operable partitions.

1.2 RELATED WORK

- A. Related Sections include the following:
 - 1. Division 3 Sections for concrete tolerance required.
 - 2. Primary structural support: Section 05500, METAL FABRICATIONS.
 - 3. Division 9 Sections for wall and ceiling framing at head and jambs
- B. Color of Finish: Section 09050, INTERIOR/EXTERIOR FINISHES.

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who is certified in writing by the operable partition manufacturer, as qualified to install the manufacturer's partition system for work similar in material, design, and extent to that indicated for this Project.
- B. Acoustical performance: Test operable partitions in an independent acoustical laboratory in accordance with ASTM E90 test procedure to attain no less than the STC rating specified. Provide a complete and unedited written test report by testing laboratory upon request.
- C. Preparation of the opening shall confirm to the criteria set forth per ASTM E557 "Standard Practice for Architectural Application and Installation of Operable Partitions."

1.4 SUBMITTALS

- A. Product Data: Material descriptions, construction details, finishes, installation details, and operating instructions for each type of operable partition, component, and accessory specified.
- B. Shop Drawings: Show location and extent of operable partitions. Include plans, elevations, sections, details, attachments to other construction, and accessories. Indicate dimensions, weights, conditions at openings, and at storage areas, and required installation, storage, and operating clearances. Indicate location and installation requirements for hardware and track, including floor tolerances required and direction of travel. Indicate blocking to be provided by others.

- C. Setting Drawings: Show imbedded items and cutouts required in other work, including support beam punching template.
- D. Samples: Color samples demonstrating full range of finishes available by architect. Verification samples will be available in same thickness and material indicated for the work.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Clearly mark packages and panels with numbering system used on Shop Drawings. Do not use permanent markings on panels.
- B. Protect panels during delivery, storage, and handling to comply with manufacturer's direction and as required to prevent damage.

1.6 WARRANTY

- A. Provide written warranty by manufacturer of operable partitions agreeing to repair or replace any components with manufacturing defects.
- B. Warranty period: One (1) year from date of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS, PRODUCTS, AND OPERATION

- A. Manufacturers: Modernfold, Inc. provides the basis of design, approved equal products by other manufacturers are acceptable.
- B. Products: Subject to compliance with the requirements, provide one of the following products: Acousti-Seal 932S manually operated paired panel operable partition.

2.2 OPERATION

- A. Series of flat panels, hinged in pairs, manually operated, top supported with automatic, auto-deploy operable floor seals.
- B. Final Closure: Hinged final closure panel.

2.3 PANEL CONSTRUCTION

- A. Nominal 3 inch (76mm) thick panels in manufacturer's standard 48 inch (1220mm) widths. All panel horizontal and vertical framing members fabricated from minimum 18-gage formed steel with overlapped and welded corners for rigidity. Top channel is reinforced to support suspension system components. Frame is designed so that full vertical edges of panels are of formed steel and provide concealed protection of the edges of the panel skin.
- B. Panel skin options: 0.50" (13mm) tackable fire core "C" gypsum board, class "A" rated single material or composite layers continuously bonded

to panel frame. Acoustical ratings of panels with this construction:
47 STC.

- C. Hinges: Full leaf butt hinges, attached directly to panel frame with welded hinge anchor plates within panel to further support hinge mounting to frame. Hinges mounted into panel edge or vertical astragals are not acceptable.
- D. Panel Trim: No vertical trim required or allowed on edges of panels; minimal groove appearance at panel joints.
- E. Panel Weights: 7 lbs. /square foot

2.4 PANEL FINISHES

- A. Panel Finish: Factory applied, Class A rated reinforced vinyl with woven backing weighing not less than 15 ounces per lineal yard. Color as selected by Architect from standard options.
- B. Panel trim: Exposed panel trim of one consistent color: Smoke Gray.

2.5 SOUND SEALS

- A. Vertical Interlocking Sound Seals between panels: Roll-formed steel astragals, with reversible tongue and groove configuration in each panel edge for universal panel operation. Rigid plastic astragals or astragals in only one panel edge are not acceptable.
- B. Horizontal Top Seals: Continuous contact extruded vinyl bulb seal shape with pairs of non-contacting vinyl fingers to prevent distortion without the need for mechanically operated parts.
- C. Horizontal Bottom Seals: Modernfold IA2 Bottom seal. Automatic operable seals providing nominal 2 inch (51mm) operating clearance with an operating range of +0.50 inch (13mm) to -1.50 inch (38mm) which automatically drops as panels are positioned, without the need for tools or cranks.

2.6 SUSPENSION SYSTEM

- A. Modernfold #17 Suspension: Minimum 11-gage, 0.12 inch (3.04mm) roll-formed steel track, suitable for support by adjustable steel hanger brackets, supporting the load-bearing surface of the track, connected to structural support by pairs of 0.38 inch (10mm) diameter threaded rods.
- B. Carriers: Acousti-Seal 932S - One all-steel trolley with (4) steel-tired ball-bearing wheels on all panels except hinged closure panels. Non-steel tires are not acceptable

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Comply with ASTM E557, #2 operable partition manufacturer's written installation instructions, Drawings and approved Shop Drawings
- B. Install operable partitions and accessories after other finishing operations, including painting have been completed.
- C. Match operable partitions by installing panels from marked packages in number sequence indicated on Shop Drawings
- D. Broken, cracked, chipped, deformed or unmatched panels are not acceptable.
- E. Punch support members as required for installation.
- F. Adjust hangar assembly as needed for installation.

3.2 CLEANING AND PROTECTING

- A. Clean partition surfaces upon completing installation of operable partitions to remove dust, dirt, adhesives, and other foreign materials according to manufacturer's written instructions.
- B. Provide final inspection and maintain conditions in a manner acceptable to manufacturer and installer that insure operable partitions are without damage or deterioration at time of Substantial Completion.

3.3 ADJUSTING

Adjust operable partitions to operate smoothly, easily, and quietly, free from binding, warp excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Lubricate hardware and other moving parts.

3.4 EXAMINATION

Examine flooring, structural support, and opening, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of operable partitions. Proceed with installation only after unsatisfactory conditions have been corrected.

3.5 DEMONSTRATION

- A. Demonstrate proper operation and maintenance procedures to Owner's representative.
- B. Provide Operation and Maintenance Manual to Owner's representative.

- - - E N D - - -

**SECTION 10800
TOILET ACCESSORIES**

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies manufactured items for use in toilet rooms, housekeeping closets and at sinks in other spaces.
- B. Items Specified:
 - 1. Paper towel dispenser.
 - 2. Combination paper towel dispenser and disposal unit.
 - 3. Waste receptacles, disposals.
 - 4. Toilet tissue dispensers.
 - 5. Grab Bars.
 - 6. Clothes hooks, robe or coat.
 - 7. Metal framed mirrors.
 - 8. Paper cup dispenser.
 - 9. Seat cover dispensers
 - 10. Shelves

1.2 RELATED WORK

- A. Color Section 10162, TOILET PARTITIONS AND URINAL SCREENS.
- B. Ceramic toilet and bath accessories: Section 09310, CERAMIC TILE.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01340, SAMPLES AND SHOP DRAWINGS.
- B. Shop Drawings:
 - 1. Paper towel dispenser and combination dispenser and disposal units.
 - 2. Metal framed mirrors, showing shelf where required, fillers, and design and installation of units when installed on ceramic tile wainscots and offset surfaces.
 - 3. Grab bars, showing design and each different type of anchorage.
- C. Samples:
 - 1. One of each type of accessory specified.
 - 2. After approval, samples may be used in the work.
- D. Manufacturer's Literature and Data:
 - 1. All accessories specified.
 - 2. Show type of material, gages or metal thickness in inches, finishes, and when required, capacity of accessories.
 - 3. Show working operations of spindle for toilet tissue dispensers.

1.4 QUALITY ASSURANCE

- A. Each product shall meet, as a minimum, the requirements specified, and shall be a standard commercial product of a manufacturer regularly presently manufacturing items of type specified.
- B. Each accessory type shall be the same and be made by same manufacturer.
- C. Each accessory shall be assembled to the greatest extent possible before delivery to the site.
- D. Include additional features, which are not specifically prohibited by this specification, but which are a part of the manufacturer's standard commercial product.

1.5 PACKAGING AND DELIVERY

- A. Pack accessories individually to protect finish.
- B. Deliver accessories to the project only when installation work in rooms is ready to receive them.
- C. Deliver inserts and rough-in frames to site at appropriate time for building-in.

1.6 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
 - A167-99.....Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip.
 - A176-99.....Stainless and Heat-Resisting Chromium Steel Plate, Sheet, and Strip
 - A269-02.....Seamless and Welded Austenitic Stainless Steel Tubing for General Service
 - A312/A312M-02.....Seamless and Welded Austenitic Stainless Steel Pipes
 - A653/A653M-02.....Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - B221-02.....Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
 - B456-95.....Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium
 - C1036-01.....Flat Glass

- C1048-97.....Heat-Treated Flat Glass-Kind HS, Kind FT Coated
and Uncoated Glass
- D635-98.....Rate of Burning and/or Extent and Time of
Burning of Self Supporting Plastics in a
Horizontal Position
- F446-85 (R1999).....Consumer Safety Specification for Grab Bars and
Accessories Installed in the Bathing Area.
- C. The National Association of Architectural Metal Manufacturers (NAAMM):
AMP 500 Series.....Metal Finishes Manual
- D. American Welding Society (AWS):
D10.4-86 (R2000).....Welding Austenitic Chromium-Nickel Stainless
Steel Piping and Tubing
- E. Federal Specifications (Fed. Specs.):
A-A-3002.....Mirrors, Glass
FF-S-107C (2).....Screw, Tapping and Drive
WW-P-541/8B.....Plumbing Fixtures (Accessories, Land Use)
Detail Specification

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Aluminum: ASTM B221, alloy 6063-T5 and alloy 6463-T5.
- B. Stainless Steel: ASTM A167, Type 302, 304, or 304L, except ASTM A176
where Type 430 specified, 0.0299-inch thick unless otherwise specified.
- C. Stainless Steel Tubing: ASTM A269, Grade 304 or 304L, seamless or
welded.
- D. Stainless Steel Pipe: ASTM A312; Grade TP 304 or TP 304L.
- E. Steel Sheet: ASTM A653, zinc-coated (galvanized) coating designation
G90.
- F. Glass: ASTM C1036, Type 1, Class 1, Quality q2, for mirrors.

2.2 FASTENERS

- A. Exposed Fasteners: Stainless steel or chromium plated brass, finish to
match adjacent surface.
- B. Concealed Fasteners: Steel, hot-dip galvanized (except in high moisture
areas such as showers or bath tubs use stainless steel).
- C. Toggle Bolts: For use in hollow masonry or frame construction.
- D. Hex bolts: For through bolting on thin panels.

- E. Expansion Shields: Lead or plastic as recommended by accessory manufacturer for component and substrate for use in solid masonry or concrete.

2.3 FINISH

- A. In accordance with NAAMM AMP 500 series.
- B. Anodized Aluminum:
 - AA-C22A41 Chemically etched medium matte, with clear anodic coating, Class I Architectural, 0.7-mil thick.
- C. AA-M32 Mechanical finish, medium satin.
 - 1. Chromium Plating: ASTM B456, satin or bright as specified, Service Condition No. SC2.
 - 2. Stainless Steel: NAAMM AMP 503, finish number 4.
 - 3. Ferrous Metal:
 - a. Shop Prime: Clean, pretreat and apply one coat of primer and bake.
 - b. Finish: Over primer apply two coats of alkyd or phenolic resin enamel, and bake.

2.4 FABRICATION - GENERAL

- A. Welding, AWS D10.4.
- B. Grind, dress, and finish welded joints to match finish of adjacent surface.
- C. Form exposed surfaces from one sheet of stock, free of joints.
- D. Provide steel anchors and components required for secure installation.
- E. Form flat surfaces without distortion. Keep exposed surfaces free from scratches and dents. Reinforce doors to prevent warp or twist.
- F. Isolate aluminum from dissimilar metals and from contact with building materials as required to prevent electrolysis and corrosion.
- G. Hot-dip galvanized steel, except stainless steel, anchors and fastening devices.
- H. Shop assemble accessories and package with all components, anchors, fittings, fasteners and keys.
- I. Key items alike.
- J. Provide templates and rough-in measurements as required.

2.5 PAPER TOWEL DISPENSERS

- A. Surface mounted type with sloping top.
- B. Dispensing capacity for 300 sheets of any type of paper toweling.
- C. Fabricate of stainless steel.

D. Provide door with continuous hinge at bottom, and either spring tension cam lock or tumbler lock, keyed alike, at top and a refill sight slot in front.

E. Basis of quality and design: Bobrick B-262 (E-45)

2.6 COMBINATION PAPER TOWEL DISPENSER AND DISPOSAL UNITS

A. Recessed type.

B. Dispensing capacity for 400 sheets of any type of paper toweling.

C. Fabricate of stainless steel.

D. Form face frames, from one piece.

E. Provide each door with continuous stainless steel piano hinge and tumbler lock, keyed alike.

F. Provide removable waste receptacle approximately 40 liter (10.5 gallon) capacity, fabricated of 0.45 mm (0.018-inch) thick stainless steel.

G. Basis of quality and design: Bobrick B-3944 (E-65)

2.7 WASTE RECEPTACLES, DISPOSALS

A. Semi-recessed type, without doors. Fed. Spec WW-P-541, Type II.

B. Fabricate of stainless steel.

C. Form face frame from one piece.

D. Provide removable waste receptacle of approximately (12 gallon) capacity, fabricated of stainless steel.

E. Waste receptacle key locked in place.

F. Basis of quality and design: Bobrick B-353 (E-75)

2.8 TOILET TISSUE DISPENSERS

A. Double roll surface mounted type.

B. Mount on continuous backplate.

C. Removable spindle ABS plastic or chrome plated plastic.

D. Wood rollers are not acceptable.

E. Basis of quality and design: Bobrick B-3888 (E-63) and Bobrick B-386 (E-66)

2.9 GRAB BARS

A. Fed. Spec WW-P-541/8B, Type IV, bars, surface mounted, Class 2, grab bars and ASTM F446.

B. Fabricate of either stainless steel or nylon coated steel, except use only one type throughout the project:

Stainless steel: Grab bars, flanges, mounting plates, supports, screws, bolts, and exposed nuts and washers.

C. Concealed mount.

D. Bars:

1. Fabricate from 38 mm (1-1/2 inch) outside diameter tubing.
 - a. Stainless steel, minimum 1.2 mm (0.0478 inch) thick.
 - b. Nylon coated bars, minimum 1.5 mm (0.0598 inch) thick.
2. Fabricate in one continuous piece with ends turned toward walls, except swing up and where grab bars are shown continuous around three sides of showers, bars may be fabricated in two sections, with concealed slip joint between.
3. Continuous weld intermediate support to the grab bar.
4. Swing up bars manually operated. Designed to prevent bar from falling when in raised position.

E. Flange for Concealed Mounting:

1. Minimum of 2.65 mm (0.1046 inch) thick, approximately 75 mm (3 inch) diameter by 13 mm (1/2 inch) deep, with provisions for not less than three set screws for securing flange to back plate.
2. Insert grab bar through center of the flange and continuously weld perimeter of grab bar flush to back side of flange.

F. Flange for Exposed Mounting:

1. Minimum 5 mm (3/16 inch) thick, approximately 75 mm (3 inch) diameter.
2. Insert grab bar through flange and continuously weld perimeter of grab bar flush to backside of flange.
3. Where mounted on metal toilet partitions, provide three equally spaced, countersunk holes, sized to accommodate 5 mm (3/16 inch) diameter bolts.
4. Where mounted on floor, provide four equally spaced holes, sized to accommodate 5 mm (3/8 inch) diameter bolts, not more than 5 mm (3/8 inch) from edge of flange.

G. In lieu of providing flange for concealed mounting, and back plate as specified, grab rail may be secured by being welded to a back plate and be covered with flange.

H. Back Plates:

1. Minimum 2.65 mm (0.1046 inch) thick metal.
2. Fabricate in one piece, approximately 6 mm (1/4 inch) deep, with diameter sized to fit flange. Provide slotted holes to accommodate anchor bolts.

3. Furnish spreaders, through bolt fasteners, and cap nuts, where grab bars are mounted on metal partitions.

2.10 CLOTHES HOOKS-ROBE OR COAT

- A. Fabricate hook units either of chromium plated brass with a satin finish, or stainless steel, using 6 mm (1/4 inch) minimum thick stock, with edges and corners rounded smooth to the thickness of the metal, or 3 mm (1/8 inch) minimum radius.
- B. Fabricate each unit as a double hook on a single shaft, integral with or permanently fastened to the wall flange, provided with concealed fastenings.
- C. Basis of design and quality: Bobrick B-76717 (E-13)

2.11 METAL FRAMED MIRRORS

- A. Fed. Spec. A-A-3002 metal frame; stainless steel, type 302 or 304.
- B. Mirror Glass:
 1. Minimum 6 mm (1/4 inch) thick.
 2. Set mirror in a protective vinyl glazing tape.
- C. Frames:
 1. Channel or angle shaped section with face of frame not less than 18 mm (3/4 inch) wide. Fabricate with square corners.
 2. Use either 0.9 mm (0.0359 inch) thick stainless steel.
 3. Filler:
 - a. Where mirrors are mounted on walls having ceramic tile wainscots not flush with wall above, provide fillers at void between back of mirror and wall surface.
 - b. Fabricate fillers from same material and finish as the mirror frame, contoured to conceal void behind mirror at sides and top.
 4. Attached Shelf for Mirrors:
 - a. Fabricate shelf of same material and finish as mirror frame.
 - b. Make shelf approximately 125 mm (five inches) in depth, and extend full width of the mirror.
 - c. Close the ends and the front edge of the shelf to the same thickness as the mirror frame width.
 - d. Form shelf for aluminum framed mirror as an integral part of the bottom frame member. Form stainless steel shelf with concealed brackets to attach to mirror frame.
- D. Back Plate:

1. Fabricate backplate for concealed wall hanging of either zinc-coated, or cadmium plated 0.9 mm (0.036 inch) thick sheet steel, die cut to fit face of mirror frame, and furnish with theft resistant concealed wall fastenings.
2. Use set screw type theft resistant concealed fastening system for mounting mirrors.

E. Mounting Bracket:

1. Designed to support mirror tight to wall.
2. Designed to retain mirror with concealed set screw fastenings.
3. Basis of quality and design:
 - a. Bobrick B-290-7236 (72"W x 36" H) (E-19)
 - b. Bobrick B-2292-22436 (29"W x 36" H) (E-41)
 - c. Bobrick B-294-22436 (24"W x 36"H) (E-42)

2.12 PAPER CUP DISPENSER

- A. Fabricate of stainless steel.
- B. Provide door with either concealed stainless steel pivoting rod or piano hinge, and either spring tension cam lock, or tumbler lock, keyed alike when more than one accessory unit is provided and with a cup level refill sight slot in the door front.
- C. Fabricate for flat bottom cups.
- D. Dispenser unit:
 1. Surface mounted single stack dispenser unit having a capacity of approximately one hundred cups.
 2. Form door from one piece to cover front and sides warp free.
 3. Adjustable for cups 3 to 6 oz.
- E. Basis of quality and design: Bobrick B-235 (E-71)

2.13 SHELVES

- A. 18 ga. Type 304 Stainless Steel, satin finish, front edges hemmed.
- B. Mop holders anti-slip with spring-loaded rubber cams.
- C. Integral brackets for mounting.
- D. Basis of quality and design:
 1. Shelf: Bobrick B-295 16" wide (E-73)
 2. Shelf, mop holder and hooks: Bobrick B-224x30 (E-58)

2.14 SEAT COVER DISPENSERS

- A. Satin finished stainless steel, seamless beveled flange.
- B. Recessed installation.
- C. Basis of quality and design: Bobrick B-301 (E-22)

PART 3 - EXECUTION

3.1 PREPARATION

- A. Before starting work notify COTR in writing of any conflicts detrimental to installation or operation of units.
- B. Verify with the COTR the exact location of accessories.

3.2 INSTALLATION

- A. Install accessories in accordance with the manufacturer's printed instructions and ASTM F446.
- B. Install accessories plumb and level and securely anchor to substrate.
- C. Install accessories in a manner that will permit the accessory to function as designed and allow for servicing as required without hampering or hindering the performance of other devices.
- D. Position and install dispensers, and other devices in countertops, clear of drawers, permitting ample clearance below countertop between devices, and ready access for maintenance as needed.
- E. Align mirrors, dispensers and other accessories even and level, when installed in battery.
- F. Install accessories to prevent striking by other moving, items or interference with accessibility.

3.3 SCHEDULE OF ACCESSORIES

Equipment List No. Sheet A4.00	Name	Basis of Design
E-13	Coat Hooks	B-76717
E-19	Large Mirror	B-290-7236 (72"Wx36"H)
E-33	Seat Cover Dispenser, Recessed	B-301
E-441	Mirror w/shelf	B-292-2436 (24"Wx36H)
E-42	Mirror - tilt	B-294-22436 (24"Wx36"H)
E-45	Paper Towel Dispenser	B-262
E-58	Shelf, mop holder, hooks	B-224x30
E-63	Recessed Toilet Paper Dispenser	B-3888
E-65	T.P. Dispenser, Trash Container, Recessed	B-3944
E-66	Partition-Mounted T.P Dispenser	B-386
E-71	Cup Dispenser	B-2235
E-73	Shelf	B-296-16" wide
E-72	Sanitary Napkin Disposal	B-353

Note: Grab Bars are not designated on equipment schedule; supply and install per plans and interior elevations.

SECTION 11132
MANUAL PROJECTION SCREEN

PART 1 - GENERAL

1.1 SUMMARY

Section includes: Manually operated projection screen and accessories.

1.2 REFERENCES

Society of Motion Picture and Television Engineers (SMPTE):

SMPTE RP 94-2000 - Gain Determination of Front Projection Screens.

1.3 DEFINITIONS

- A. Gain: Indication of screen's luminance or brightness measured perpendicular of screen center and measured relative to a block of magnesium carbonate which serves as the standard for 1.0 gain. Higher numbers indicate greater brightness. Gain shall be determined in accordance with SMPTE RP 94-2000.
- B. Viewing angle: Angle from perpendicular center of screen at which the gain or brightness is decreased by 50 percent.
- C. Keystone: Distortion of projected image when screen is not perpendicular to center line of projected image.

1.4 SUBMITTALS

Provide in accordance with Section 01330 - Submittal Procedures:

- 1. Product data for projection screens and accessories.
- 2. Shop drawings: Indicate dimensions, fabrication, and installation details.
- 3. Samples:

Viewing surface: 6 inches by 6 inches minimum size.

- 4. Manufacturer's installation, maintenance, and cleaning instructions.

1.5 QUALITY ASSURANCE

Manufacturer qualifications: Firm with 30 years minimum successful experience manufacturing projection screens.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver projection screens after building is enclosed and construction where screens will be installed is substantially complete.
- B. Deliver screens in manufacturer's undamaged, labeled packaging.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

Da-Lite Screen Company, Inc. is used as the basis of design. Approved equal products by other manufacturers may be used.

2.2 ROLLERS

Provide rigid metal spring rollers for operation of manual screens. Fabricate from either steel or aluminum. Material and roller diameter determined by manufacturer as required by type and size of manual screen.

2.3 VIEWING SURFACE

- A. High Power as manufactured by Da-Lite Screen Company, Inc.: Flame retardant, mildew resistant, vinyl coated fiberglass screen with impregnated glass beads and smooth surface that can be rolled and cleaned with mild soap and water solution.
 - 1. Gain: 2.8.
 - 2. Viewing angle: 30 degrees.
- B. Seams: No seams allowed.

2.4 MANUALLY OPERATED PROJECTION SCREENS

- A. Type: Manually operated, retractable projection screen with rigid steel, spring roller and mechanism to ensure quiet, controlled screen return (CSR); Advantage Manual with CSR as manufactured by Da-Lite Screen Company, Inc.
 - 1. Installation method: Recessed in acoustical panel ceiling.
 - 2. Case: Extruded aluminum with steel end caps designed to receive mounting hardware. Fabricate case with bottom flange to accommodate adjacent ceiling finish.
 - a. Case length: 89-1/2 inches
 - b. Finish: White paint.
 - 3. Controlled screen return (CSR): Provide mechanism to control screen return speed into case ensuring quiet, even movement.
 - 4. Roller mounting brackets: Adjustable to allowing centering or offsetting screen within case.
 - 5. Permanently attach screen fabric to roller with clips at 3 inches maximum. Provide bottom of screen with metal slat in pocket. Screw attach aluminum saddle and zinc plated pull to slat.
 - 6. Provide padded bumper stops to prevent slat wedging inside case.
 - 7. Viewing surface: High Power
 - a. Size: 60 inches high by 80 inches wide.
 - b. Provide with black masking borders and 13 inches (330 mm) black extra drop.

2.5 ACCESSORIES

- A. Installation hardware: Provide attachment hardware, fasteners, and other components of type, size, and spacing recommended by manufacturer for complete, functional, secure installation of manual screens.
- B. Pull rods: Provide manual screens with zinc-plated rod with black plastic handle grip to access and operate out of reach screens. Rod shall be suitable for use as pointer.

PART 3 - EXECUTION

3.1 COORDINATION

- A. Coordinate provision of manual screens with locations of other wall and ceiling mounted components such as visual display boards, casework, structural framing, light fixtures, air diffusers, ducts, and fire sprinklers to eliminate potential conflicts.
- B. Coordinate requirements for blocking, construction of recesses, and auxiliary structural supports to ensure adequate means for installation of screens.
- C. Coordinate installation of recessed mounted screens with construction of suspended acoustical panel ceilings specified in Section 09510 - Acoustical Ceilings

3.2 INSTALLATION

- A. Install screens in accordance with approved shop drawings and manufacturer's installation instructions.
- B. Install projection screens at locations and heights indicated on Drawings. Verify locations in field with Architect.
- C. Install screens securely to supporting substrate so that screens are level and back of case is plumb.

3.3 TESTING AND PROTECTING

- A. Operate each screen ten times minimum. Ensure screens properly extend and retract and that screen is level and viewing surface plumb when extended. Adjust to correct deficiencies.
- B. Protect projection screens from damage resulting from subsequent construction activities. Remove and replace damaged screens.

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**SECTION 12302
WOOD CASEWORK**

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies wood veneer casework, plastic laminate casework, countertops and work surfaces as detailed on the drawings, including related components and accessories required to form integral units. Wood casework items shown on the drawings, but not specified below shall be included as part of the work under this section, and applicable portions of the specification shall apply to these items. Each like item of casework shall be of the same design and by one manufacturer.
- B. Where shown, provide plastic laminate casework items as follows:
1. Work surfaces in exam rooms, phlebotomy and medication rooms.
 2. Base and upper cabinets in soiled utility rooms, treatment room and staff lounge.
 3. Counters and upper cabinets in corridors.
 4. Reception desks and casework.
 5. Countertop and upper cabinets behind reception stations.
- C. Where shown, provide wood veneer casework items as follows:
- At reception desks and on the upper cabinets behind the reception desks.

1.2 RELATED WORK

- A. Custom Casework: Section 06200, FINISH CARPENTRY AND MILLWORK.
- B. Color and Finish of Plastic Laminate: Section 09050, INTERIOR/EXTERIOR FINISHES.
- C. Lavatories and Plumbing in Casework: Section 15450, PLUMBING FIXTURES AND TRIM.
- D. Solid surface countertop and transaction tops: Section 09540, SPECIAL SURFACES.
- E. Cove base installed on cabinet bases: Section 09679, BASE AND ACCESSORIES.
- F. Work surface or countertop supports: Section 0550, METAL FABRICATIONS.

1.3 MANUFACTURER'S QUALIFICATIONS

The fabrication of casework shall be by a manufacturer who produces casework similar to the casework specified and shown.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01340, SAMPLES AND SHOP DRAWINGS.
 - 1. Locks for doors and drawers
 - 2. Hardware
- B. Samples:
 - 1. Counter top, plastic laminate, 150 mm (six inch) square
 - 2. Wood Face Veneer or Hardwood Plywood
 - 3. Edge bonding samples
- D. Shop Drawings:
 - 1. All casework, showing details of construction, including materials, hardware and accessories.
 - 2. Cabinets and counters showing faucets in connection with sink bowls, and electrical fixtures and receptacles which are mounted on cabinets and counters.
 - 3. Fastenings and method of installation.

1.5 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
 - A167-99.....Stainless and Heat-Resisting chromium-Nickel Steel Plate, Sheet and Strip
 - A366-97.....Steel Sheet, and Strip, Carbon, Cold Rolled, Commercial Quality
 - C1036-91 (R97).....Flat Glass
- C. National Particleboard Association (NPA):
 - A208.1-93.....Wood Particleboard
- D. U.S. Department of Commerce Product Standards (Prod. Std):
 - PS1-95.....Construction And Industrial Plywood
- E. Hardwood, Plywood and Veneer Association (HPVA):
 - HP.1-93.....Hardwood and Decorative Plywood
- F. Architectural Woodwork Institute (AWI):
 - Architectural Woodwork Quality Standards, Guide Specifications Quality Certification Program - 1997
- G. American Society of Mechanical Engineers (ASME):
 - A112.18.1M-00.....Plumbing Fixture Fittings

- H. National Electrical Manufacturers Association (NEMA):
 - LD3-00.....High Pressure Decorative Laminates
 - LD3.1-95.....Performance, Application Fabrication and
Installations of High-Pressure Decorative
Laminates

PART 2 - PRODUCTS

2.1 PLYWOOD, HARDWOOD FACE VENEER

ANSI HP.1, Premium Grade plain sliced Select White Birch.

2.2 PLYWOOD, MARINE GRADE

½" OR ¾" plywood meeting the APA requirements for Marine Grade.

2.3 PLASTIC LAMINATE:

- A. NEMA LD-3.
- B. Exposed decorative surfaces including countertops, both sides of cabinet doors, and for items having plastic laminate finish. General purpose Type HGL.
- C. Cabinet Interiors Including Shelving: Both of following options to comply with NEMA, CL20 as a minimum.
 - 1. Plastic laminate clad plywood or particle board.
 - 2. Resin impregnated decorative paper thermally fused to particle board.
- D. Backing sheet on bottom of plastic laminate covered wood tops. Backer Type BKL.
- E. Post Forming Fabrication, Decorative Surface: Post forming Type HGP.

2.4 PLYWOOD, SOFTWOOD

Prod. Std. PS1, five ply construction from 13 mm to 28 mm (1/2 inch to 1-1/8 inch) thickness, and seven ply for 31 mm (1-1/4 inch) thickness.

2.5 PARTICLEBOARD

ANSI A208.1, Type 1, Grade 1-M-3.

2.6 SOLID WOOD

Wood required for edge banding at moldings.

2.7 SHEET STEEL

ASTM A366.

2.8 STAINLESS STEEL

ASTM A167, with No. 4 finish.

2.9 EDGE BANDING

3mm PVC edgeband, colors as selected by COTR.

2.10 HARDWARE

- A. Where pin tumbler locks are specified, disc tumbler lock "Duo A", with brass working parts and case, as manufactured by the Illinois Lock Company will be an acceptable substitute. Locks shall be keyed as directed by the COTR. Provide two keys for each lock. Exposed hardware, except as otherwise specified, shall be satin finished chromium plated brass or nickel plated brass.
- B. Marking of Locks and Keys:
1. The name of the manufacturer, or trademark by which manufacturer can readily be identified, legibly marked on each lock.
 2. The key change number marked on the exposed face of lock, and also stamped on each key.
 3. Key change numbers shall provide sufficient information for replacement of the key by the manufacturer.
- C. Hinged Doors:
1. Doors 900 mm (36 inches) and more in height shall have three hinges and doors less than 900 mm (36 inches) in height shall have two hinges. Each door shall close against two rubber bumpers.
 2. Hinges: Hinges to be concealed, adjustable European-type hinges.
- D. Locks:
1. Cylinder type pin tumbler.
 2. Equip doors and drawers where shown with locks.
- E. Drawer and Door Pulls:
- Doors and drawers shall have 4" wire pulls, fabricated of either chromium plated brass.
- F. Drawer Slides:
1. Full extension steel slides with nylon ball-bearing rollers.
 2. Slides shall have positive stop.
 3. Equip drawers with rubber bumpers.
- G. Shelf Standards (Except For Fixed Shelves):
- Bright zinc-plated steel for recessed mounting with screws, 16 mm (5/8 inch) wide by 5 mm (3/16 inch) high providing 13 mm (1/2 inch) adjustment, complete with shelf supports.

2.11 KEYBOARD TRAYS

- A. Provide a keyboard tray where indicated on the drawings at 12302 desks, counters and reception desks. The Contractor is not required to

provide or install keyboard trays at owner-furnished, owner-installed furniture.

B. Manufacturer:

Humanscale, Inc.
c/or MRG
10 Inverness Drive East
Englewood, CO 80112
800.440.0625

C. Item: Keyboard Platform w/slide and adjustment mechanism, #4G9001RF.

D. Platform:

Dimensions: 19" W x 10-5/8" D
Platform Color: Graphite Spektrum
Palm Support: Synthetic Leather Palm Support (Gel), Black

E. Slide and Adjustment Mechanism:

Dial-a-tilt keyboard angle: adjustable 0-15 degrees
Height adjustment: 6-1/4" (1-1/4" above track to 5" below track)
Base swivel: 360 degrees
Track length: 16"
End of track to beginning of platform: 6"
Maximum depth below bottom of keyboard: 1/2"

2.12 COUNTERTOP SUPPORTS

- A. Fabricate countertop supports as indicated on the drawings.
- B. Construct of 1" x 3" x 1/8" steel tubes, welded all around at all joints and with a gusset plate.
- C. Close exposed ends with an angled closure plate welded all around and welds ground smooth.
- D. Power-coat paint to match PT-1.

2.13 FABRIC COVERED TACK SURFACES

- A. Sizes as indicated on the drawings.
- B. Thickness: 3/4" nominal
- C. Woven Panel Fabric: Guilford of Main Pattern 3516 Hieroglyphics. 100% polyester 11.5 ounces per linear yard, 66" width; 200 pounds tensile strength, 15 pounds tear strength. Color as indicated on Section 09050, INTERIOR/EXTERIOR FINISHES or as directed by COTR.
- D. Fabric covering shall be stretch free of wrinkles and then bonded to the edges and back or bonded directly to the panel face, edges and back of panel a minimum distance standard with the manufacturer. Light

fastness (fadeometer) shall be approximately 40 hours in accordance with AATCC TMM 16.

- E. Fire rating for the complete composite system: Class A, 200 or less smoke density and flame spread less than 25, when tested in accordance with ASTM E 84.
- F. Substrate: "Homasote" or equal.

2.14 FABRICATION

- A. Casework shall be of the flush overlay design and, except as otherwise specified, be of premium grade construction and of component thickness in conformance with AWI Quality Standards.
- B. Fabricate casework of plastic laminated covered plywood or particleboard factory finished wood veneer as follows:
 - 1. Where shown, doors, drawers, shelves and all semi-concealed surfaces shall be plastic laminated.
 - 2. Horizontal and vertical reveals between doors and drawer for reveal overlay design shall be 19 mm (3/4 inch) unless otherwise shown.
- C. Electrical fixtures, receptacles, wiring and junction boxes required for fixtures and receptacles:
 - 1. Factory installed in casework.
 - 2. For electrical lighting fixtures, see drawings.
 - 3. For electric receptacles and lighting fixtures installed below or adjacent to wall cabinets or above counter tops, see electrical sections or specifications.
 - 4. Install wiring in built-in raceways and terminate at junction box mounted on rear of cabinet and counter.
 - 5. For final hook-up at junction box see electrical sections of specifications.
- D. Countertops:
 - 1. Countertops, splashbacks and shelves shall be plastic laminate factory glued to either a plywood (PS1), or particleboard (ANSI A208.1) core.
 - 2. Countertop supports under Section 09540, SPECIAL SURFACES, shall be Marine Grade plywood.
 - 3. Countertops shall be 32 mm (1-1/4 inches) thick.
 - 4. Splashbacks and reagent type shelves shall be finished 19 mm (3/4 inch) thick and be secured to countertops with concealed metal fastenings and with contact surfaces set in waterproof adhesive.

5. Provide cut-outs for plumbing trim where shown.
6. Cover exposed edges of countertops, splashbacks and reagent type shelves with 3mm PVC edgebanding.

E. Tack Surfaces

1. Fabricate to fit in the spaces as indicated on the plans and interior elevations.
2. Install with concealed fasteners.
3. Cut tightly around junction boxes to allow cover plate to conceal edges of tack surface.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Set casework in place; level, plumb and accurately scribe and secure to walls, and/or floors.
- B. The installation shall be complete including all trim and hardware. Leave the casework clean and free from defects.

3.2 FASTENINGS

- A. Fastenings for securing casework to adjoining construction shall be as detailed on the drawings or approved shop drawings.
- B. See section 05500, METAL FABRICATIONS for reinforcement of walls and partitions for casework anchorage.

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**SECTION 12336
MEDICATION CABINET**

PART 1 - GENERAL

1.1 DESCRIPTION

This section covers Medication Cabinet consisting of a stainless steel cabinet equipped with a self-contained refrigerator, sink and fixtures and other facilities for the storage of medicines and drugs.

1.2 RELATED WORK

- A. For electrical connections and available voltages see electrical sections of the specifications and the drawings.
- B. For plumbing connections see the plumbing sections of the specifications and the drawings.

1.3 MANUFACTURER'S QUALIFICATIONS

Medication cabinet shall be product of manufacturers regularly engaged in manufacturing cabinets of type specified.

1.4 ELECTRICAL STANDARDS

- A. Cabinet shall have been tested for conformance with NFPA Pamphlet No. 70.
- B. Body of cabinet shall have an Underwriters Laboratories, Inc., label as evidence that the NFPA requirements have been met.

1.5 SUBMITTALS

- A. In accordance with Section 01340, SAMPLES AND SHOP DRAWINGS, furnish the following:
- B. Shop Drawings: Medication cabinet, showing design, materials, construction and installation.
- C. Manufacturers' Certificates: Certificate signed by manufacturer that servicing of component parts can be made from the front of the cabinet.

1.6 EQUIPMENT MANUAL

The supplier shall furnish with each cabinet two copies of the manufacturers' equipment manual containing installation, operation and maintenance instructions, parts list showing part number and source of supply and electrical data and connection diagrams for all utilities.

1.7 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. Federal Specifications (Fed. Spec.):

- AA-R-211G(3).....Refrigerators, Mechanical, Household
(Electrical Self-contained)
- C. American Society for Testing and Materials (ASTM):
 - A167-99.....Stainless and Heat-resisting Chromium-Nickel
Steel Plate, Sheet and Strip
 - D4802-94.....Acrylic Plastic Sheet
- D. American Society of Mechanical Engineers (ASME):
 - A112.18.1-00.....Plumbing Fixture Fittings
- E. The National Association of Architectural Metal Manufacturers (NAAMM):
Finishes Manual
- F. National Fire Protection Association (NFPA):
 - 70-98.....National Electrical Code

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Stainless Steel: ASTM A167
- B. Acrylic Plastic: ASTM D4802.
- C. Plumbing Fixtures: ASME A112 Series, except die-cast zinc alloy is not acceptable.

2.2 FABRICATION

- A. The medication cabinet shall be of the following sizes as specified:
 - Size 4, width: 1800 mm (72 inch)
 - 1. Depth: Not more than 750 mm (25 inches).
 - 2. Height: Not more than 2400 (80 inches) excluding sloping top.
- B. General Requirements: The cabinet shall be open mounted and provided with refrigerator, countertop with sink, shelves, narcotics locker, doors, drawers, storage compartment, waste compartment and accessories as shown.
- C. Cabinet Fabrication:
 - 1. The cabinet shall be either single unit or sectional fabrication, constructed of steel angles or formed sheet metal panels and structural members welded into a unitized assembly.
 - 2. Enclose open mounted cabinets on the sides with stainless steel panels 1 mm (0.0359 inch) thick. Enclose backs and concealed sides with either stainless steel or aluminized steel, 1 mm (0.0359 inch) thick.
 - 3. Recess the base of the cabinet on the front to provide not less than a 75 mm (3 inch) toe space.

4. Provide sloping top fabricated from 1 mm (0.0359 inch) thick stainless steel.
- D. Refrigerator: Provide size 1 cabinet with a 0.07 cu m (2.5 cfm) refrigerator and sized 2, 3 and 4 cabinets with a 1.0 cu m (3.5 cfm). refrigerator self-defrosting type meeting the fabrication and performance requirements of Fed. Spec. AA-R-211, except that it shall not be equipped with an ice-making compartment.
1. Provide the refrigerator with either an adjustable shelf or not less than two perforated stainless steel pans and provide either stainless steel or 19 mm (3/4 inch) clear plastic hinged or sliding doors equipped with magnetic catches.
 2. Provide refrigerator with air cooled condensing unit.
 3. Provide refrigerator with a temperature control switch to control the temperature within the range of 20° C to 80° C (36° F to 46° F). Equip refrigerator with a thermometer, that is accurate within 5% of the actual temperature.
- E. Countertop: Provide cabinet with a full width countertop having an inverted "V" curbing at the front edge and integral back splash fabricated from 1.2 mm (0.0478 inch) thick stainless steel.
- F. Sink: Form sink integral with countertop to the following dimensions:
Width:.....Not less than 200 mm (8 inches), not more than 250 mm 10 inches).
Length:.....Not less than 225 mm (9 inches), not more than 325 mm (13 inches).
Depth:.....Not less than 150 mm (6 inches), not more than 200 mm (8 inches).
- G. Plumbing Fittings and Trim:
1. Faucets, ASME A112.18, compression type, countertop mounted, chromium plated brass, having two valves and with gooseneck spout as shown, elevated to clear handles. Fittings shall have an elongated escutcheon for spout and handles, replaceable valve seats and four arm or lever style indexed chromium plated handles; handles either with or without hood.
 2. Faucets, ASME A112.18, compression type, splashback mounted, chromium plated brass, having two valves and with gooseneck spout as shown. Fittings shall have indexed chromium plated fore arm or lever

- handles and replaceable valve seats; handles either with or without hood.
3. Drain, ASME A112.18, either cast or wrought brass or stainless steel, with flat strainer, except for Cabinet Type 1B provided with a cup strainer. Surfaces of brass drains exposed from above shall have a chromium plated finish.
 4. Trap, ASME A112.18, cast brass.
- H. Shelves: In the upper section of the cabinet, provide at least two removable adjustable shelves, as shown, fabricated from not less than 1.2 mm (0.0478 inch) thick stainless steel and having a front to back dimension of 175 mm to 250 mm (7 to 10 inches).
- I. Narcotics Locker: Provide a narcotics locker with an adjustable or tiered shelf in the upper section of the cabinet, fabricated from not less than 1.2 mm (0.0478 inch) thick stainless steel.
1. Illuminate interior of the locker. Provide at least one warning light on front of the cabinet that shall remain lit until the locker is secured.
 2. Furnish locker doors with tamperproof wardrobe type locks. One door locker shall be equipped with two locks that are individually keyed. Only one key to the single door unit shall fit other locking cabinet facilities. Provide two door lockers with one lock on each door. The locks shall be individually keyed and only the outer door key shall fit other locking cabinet facilities.
- J. Doors: Provide upper section of the cabinet with either hinged or sliding double doors or roll-up type doors, equipped with wardrobe or cylindrical type locks. Key locks as specified for locker doors.
1. Fabricate frames for hinged doors, when furnished, from stainless steel and use 6 mm (1/4 inch) thick laminated glass for glazing.
 2. Fabricate sliding doors, when furnished, from 9 mm (3/8 inch) clear plastic and shall ride in stainless steel track or channel. Fabricate and install track in a manner that will prevent removal of the doors when they are in a locked position.
 3. Where roll-up type doors are required, they shall be of integral construction with cabinet, fabricated of aluminum and shall coil up into a head box at the top of the cabinet. Add-on, surface mounted roll-up doors are not acceptable.

- K. Storage Compartment: Provide at least one storage compartment in the lower section of the cabinet. Compartment shall have one adjustable, removable, stainless steel shelf and either hinged or sliding stainless steel doors.
- L. Waste Compartment: Provide a concealed stainless steel, aluminum or rigid plastic waste receptacle in the lower section of the cabinet. Refuse disposal shall be through an access opening on either the front of the cabinet or at the countertop level.
- M. Provide cabinet with the following accessories:
 - 1. Paper cup dispenser, designed to hold 200 g (7 ounce) cups
 - 2. Paper towel dispenser
 - 3. 24 card plastic medicine card rack

PART 3 - EXECUTION

3.1 FASTENINGS AND ANCHORAGE

- A. Fastenings and anchorage for securing medication cabinet, except as otherwise specified, to adjoining construction shall be by toggle or expansion bolts, approximately 6 mm (1/4 inch) in diameter or other appropriate size and type of fastenings as required for each specific type of installation. Space fastenings approximately 600 mm (24 inches) on center.
- B. Where type, size or spacing of fastening is not shown or specified, submit shop drawings for approval showing proposed fastenings and method of installation.
- C. The cabinets shall not be anchored to wood ground strips.
- D. Fastenings and anchorage for cabinets to metal stud partitions shall be as detailed on the drawings.

3.2 CLOSURES

- A. Close openings larger than 6 mm (1/4 inch) wide between cabinets and adjacent walls, and where shown, with either 18 gage flat steel closure strips, scribed to required contours or 20 gage machined formed fillers with returns and secured with sheet metal screws to tubular or channel members of units or with bolts where exposed on inside.
- B. Where ceilings interfere with installation of sloping tops, omit sloping tops and provide flat steel filler plates. Filler plates more than 150 mm (six inches) in width shall in addition, be secured to top edge and fastened by screws to a continuous 25 mm by 25 mm (one inch by one inch), 14 gage steel angle secured to ceiling with toggle bolts.

- C. Paint closure strips and fillers (except stainless steel fillers) same color as adjoining walls.

3.3 INSPECTION

- A. Upon completion of the installation, the manufacturer shall examine the anchorage, check the operation of the equipment and the hardware, and examine the finish for damage.
- B. Manufacturer shall report in writing that the installation is satisfactory and shall include information concerning minor adjustments and minor repairs which may be required for final acceptance by the COTR.

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**SECTION 13081
SEISMIC RESTRAINT REQUIREMENTS FOR
NONSTRUCTURAL COMPONENTS**

PART 1 - GENERAL

1.1 DESCRIPTION:

- A. Provide seismic restraint in accordance with the requirements of this section in order to maintain the integrity of nonstructural components of the building so that they remain safe and functional in case of seismic event.
- B. Definitions: Non-structural building components are components or systems that are not part of the building's structural system whether inside or outside, above or below grade. Non-structural components of buildings include:
 - 1. Architectural Elements: Facades or exterior metal panels that are not part of the structural system and its shear resistant elements; cornices and other architectural projections and parapets that do not function structurally; glazing; nonbearing partitions; suspended ceilings; stairs isolated from the basic structure; cabinets; bookshelves; medical equipment; and storage racks.
 - 2. Electrical Elements: Power and lighting systems; substations; switchgear and switchboards; auxiliary engine-generator sets; transfer switches; motor control centers; motor generators; selector and controller panels; fire protection and alarm systems; special life support systems; and telephone and communication systems.
 - 3. Mechanical Elements: Heating, ventilating, and air-conditioning systems; medical gas systems; plumbing systems; sprinkler systems; pneumatic systems; boiler equipment and components.
 - 4. Transportation Elements: Mechanical, electrical and structural elements for transport systems, i.e., elevators and dumbwaiters, including hoisting equipment and counterweights.

1.2 RELATED WORK:

- A. Section No.03300 CAST-IN-PLACE CONCRETE
- B. Section No.05120 STRUCTURAL STEEL
- C. Section No.05500 METAL FABRICATION

1.3 QUALITY CONTROL:

- A. Shop-Drawing Preparation:

1. Have seismic-force-restraint shop drawings and calculations prepared by a professional structural engineer experienced in the area of seismic force restraints. The professional structural engineer shall be registered in the State of Washington.
2. Submit design tables and information used for the design-force levels, stamped and signed by a professional structural engineer registered in the State of Washington.

B. Coordination:

1. Do not install seismic restraints until seismic restraint submittals are approved by the Resident Engineer or COTR.
2. Coordinate and install trapezes or other multi-pipe hanger systems prior to pipe installation.

1.4 SUBMITTALS:

- A. Submit a coordinated set of equipment anchorage drawings prior to installation including:
 1. Description, layout, and location of items to be anchored or braced with anchorage or brace points noted and dimensioned.
 2. Details of anchorage or bracing at large scale with all members, parts brackets shown, together with all connections, bolts, welds etc. clearly identified and specified.
 3. Numerical value of design seismic brace loads.
 4. For expansion bolts, include design load and capacity if different from those specified.
- B. Submit prior to installation, a coordinated set of bracing drawings for seismic protection of piping, with data identifying the various support-to-structure connections and seismic bracing structural connections, include:
 1. Single-line piping diagrams on a floor-by-floor basis. Show all suspended piping for a given floor on the same plain.
 2. Type of pipe (Copper, steel, cast iron, insulated, non-insulated, etc.).
 3. Pipe contents.
 4. Structural framing.
 5. Location of all gravity load pipe supports and spacing requirements.
 6. Numerical value of gravity load reactions.
 7. Location of all seismic bracing.

8. Numerical value of applied seismic brace loads.
 9. Type of connection (Vertical support, vertical support with seismic brace etc.).
 10. Seismic brace reaction type (tension only, tension and compression).
Details illustrating all support and bracing components, methods of connections, and specific anchors to be used.
- C. Submit prior to installation, bracing drawings for seismic protection of suspended ductwork and suspended electrical and communication cables, include:
1. Details illustrating all support and bracing components, methods of connection, and specific anchors to be used.
 2. Numerical value of applied gravity and seismic loads and seismic loads acting on support and bracing components.
 3. Maximum spacing of hangers and bracing.
 4. Seal of registered structural engineer responsible for design.
- D. Submit design calculations prepared and sealed by the registered structural engineer specified above in paragraph 1.3A.
- E. Submit for concrete anchors, the appropriate ICBC evaluation reports, OSHPD pre-approvals, or lab test reports verifying compliance with OSHPD Interpretation of Regulations 28-6.

1.5 APPLICABLE PUBLICATIONS:

- A. The Publications listed below (including amendments, addenda revisions, supplements and errata) form a part of this specification to the extent referenced. The publications are referenced in text by basic designation only.
- B. American Concrete Institute (ACI):
Building Code Requirements for Structural Concrete, ACI 318-02.
- C. American Institute of Steel Construction (AISC):
Load and Resistance Factor Design Specification for Structural Steel in Buildings, Third Edition, 2001.
- D. American Society for Testing and Materials (ASTM):
A36/A36M-00.....Standard Specification for Carbon Structural Steel.
A53/A53M-99.....Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

- A307-00.....Standard Specification for Carbon Steel Bolts and Studs; 60,000 PSI Tensile Strength.
 - A325-00.....Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 Ksi Minimum Tensile Strength.
 - A325M-00.....Standard Specification for High-Strength Bolts for Structural Steel Joints [Metric].
 - A490-00.....Standard Specification for Heat-Treated Steel Structural Bolts, 150 ksi Minimum Tensile Strength.
 - A490M-00.....Standard Specification for High-Strength Steel Bolts, Classes 10.9 and 10.9.3, for Structural Steel Joints [Metric].
 - A500-99.....Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
 - A501-98.....Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
 - A615/615M-00.....Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
 - A992/A992M-98.....Standard Specification for Steel for Structural Shapes for Use in Building Framing.
 - A996/996M-00.....Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement.
 - E488-96.....Standard Test Method for Strength of Anchors in Concrete and Masonry Elements.
- E. Department of Veteran Affairs:
H-18-8 Seismic Design Requirements, December 2003.
- F. International Conference of Building Officials (ICBO):
International Building Code (UBC), 2003 edition.
- G. National Uniform Seismic Installation Guidelines (NUSIG).
- H. National Institute of Standards and Technology (NIST):
Standards for Seismic Safety for Existing Federally Owned or Leased Buildings, ICSSC RP4, NISTIR 5382, 1994.

- I. Sheet Metal and Air Conditioning Contractors National Association
(SMACNA):
Seismic Restraint Manual - Guidelines for Mechanical Systems, 1998
Edition and Addendum.

1.6 SEISMIC FORCES AND RESTRAINTS:

- A. Provide seismic-force restraints for the items listed in Part 1 of this section. The seismic forces should be calculated based on Section 1621 of the 2003 International Building Code with the following parameters:

$$S_{DS} = 1.073$$

$$I_p = 1.50$$

- B. Exceptions: The attachments of the following items need not be considered.
1. Equipment weighing less than 400 pounds supported directly on the floor or roof.
 2. Equipment weighing less than 20 pounds suspended from a roof or floor or hung from a wall.
 3. Furniture; except storage racks, cabinets, and bookcases as specified in Part 3 of this Section.
 4. Temporary or moveable equipment.
 5. Gas and medical piping less than one inch inside diameter.
 6. Piping in boiler and mechanical equipment rooms less than 1 ¼ inch inside diameter.
 7. All other piping less than 2 ½ inch inside diameter except for automatic fire suppression systems.
 8. All piping suspended by individual hangers, 12 inches or less in length from the top of the pipe to the bottom of the support for the hanger.
 9. All electrical conduits, less than 2 ½ inch inside diameter.
 10. All rectangular air handling ducts less than six square feet in cross sectional area.
 11. All round air handling ducts less than 28 inches in diameter.
 12. All ducts suspended by hangers 12 inches or less in length from the top of the duct to the bottom of the support for the hanger.

PART 2 - PRODUCTS

2.1 STEEL:

- A. Structural Steel: ASTM A36.

- B. Structural Tubing: ASTM A500, Grade B.
- C. Steel Pipe: ASTM A53/A53M, Grade B.
- D. Bolts & Nuts: ASTM A307 or A325.

2.2 CAST-IN-PLACE CONCRETE:

- A. Concrete: 28 day strength, $f'c = 25$ MPa (3,000 psi).
- B. Reinforcing Steel: ASTM A615/615M or ASTM A996/A996M deformed.

PART 3 - EXECUTION

3.1 CONSTRUCTION, GENERAL:

- A. The magnitude of seismic forces to be resisted to be based on the requirements of Section 1621 of the 2003 International Building Code with the following parameters:
 $S_{DS} = 1.073$
 $I_p = 1.50$
- B. Provide equipment supports and anchoring devices to withstand the seismic design forces, so that when seismic design forces are applied, the equipment cannot displace, overturn, or become inoperable.
- C. Provide anchorages in conformance with recommendations of the equipment manufacturer and as shown on approved shop drawings and calculations.
- D. Construct seismic restraints and anchorage to allow for thermal expansion.
- E. Testing Before Final Inspection:
 - 1. Test 10-percent of anchors in masonry and concrete per ASTM E488 to determine that they meet the required load capacity. If any anchor fails to meet the required load, test the next 20 consecutive anchors, which are required to have zero failure, before resuming the 10-percent testing frequency.
 - 2. Before scheduling Final Inspection, submit a report on this testing indicating the number and location of testing, and what anchor-loads were obtained.

3.3 MECHANICAL DUCTWORK AND PIPING; BOILER PLANT STACKS AND BREACHING; ELECTRICAL BUSWAYS, CONDUITS, AND CABLE TRAYS; AND TELECOMMUNICATION WIRES AND CABLE TRAYS:

- A. Support and brace mechanical ductwork and piping; electrical busways, conduits and cable trays; and telecommunication wires and cable trays including boiler plant stacks and breeching to resist directional forces (lateral, longitudinal and vertical).

- B. Brace duct and breeching branches with a minimum of 1 brace per branch.
- C. Provide supports and anchoring so that, upon application of seismic forces, piping remains fully connected as operable systems which will not displace sufficiently to damage adjacent or connecting equipment, or building members.
- D. Seismic Restraint of Piping:
 - 1. Design criteria:
 - a. Piping resiliently supported: Restrain to support 120-percent of the weight of the systems and components and contents.
 - b. Piping not resiliently supported: Restrain to support 60-percent of the weight of the system components and contents.
 - c. Except as noted above, meet requirements of the International Building Code and VA H-18-8 Seismic Design Guidelines for determining seismic force F_p .
- E. Piping Connections: Provide flexible connections where pipes connect to equipment. Make the connections capable of accommodating relative differential movements between the pipe and equipment under conditions of earthquake shaking.

3.4 PARTITIONS:

- A. In buildings with flexible structural frames, anchor partitions to only 1 structural element, such as a floor slab, and separate such partition by a physical gap from all other structural elements.

3.5 CEILINGS AND LIGHTING FIXTURES:

- A. At regular intervals, laterally brace suspended ceilings against lateral and vertical movements, and provide with a physical separation at the walls.
- B. Independently support and laterally brace all lighting fixtures. Refer to applicable portion of lighting specification, Section 16510.

3.6 FACADES AND GLAZING:

- A. Install attachments to structure for all façade materials as shown on construction drawings to ensure strength against applicable seismic forces at the project location.

3.7 STORAGE RACKS, CABINETS, AND BOOKCASES:

- A. Install storage racks to withstand earthquake forces and anchored to the floor or laterally braced from the top to the structural elements.

- B. Anchor medical supply cabinets to the floor or walls and equip them with properly engaged, lockable latches.
- C. Anchor filing cabinets that are more than 2 drawers high to the floor or walls, and equip all drawers with properly engaged, lockable latches.
- D. Anchor bookcases that are more than 30 inches high to the floor or walls, and equip any doors with properly engaged, lockable latches.

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**SECTION 14580
PNEUMATIC TUBE SYSTEM**

PART 1 - GENERAL

1.1 DESCRIPTION:

An extension of the existing 4-inch diameter pneumatic tube system, including one new station, one new transfer unit, additional tubing, additional carriers, and engineering and design work.

1.2 RELATED WORK

Section 01320, COORDINATION DRAWINGS

Section 01340, SAMPLES AND SHOP DRAWINGS

Section 16050, BASIC METHODS AND REQUIREMENTS (ELECTRICAL)

Section 13081, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS

1.3 GENERAL REQUIREMENTS

- A. Verification of Dimensions: The contract drawings show the location of the new pneumatic tube station. The Contractor shall visit the premises to verify details of the work and working conditions, dimensions in the field and advise the COTR of any discrepancy before performing any work. He shall be specifically responsible for the conditions and proper relation of this work to the building structure and to the work of other trades.
- B. Welding: Structural and load bearing members shall not be field welded.
- C. Manufacturer: Work on this system shall be supplied and installed by Swisslog Translogic as an extension of the existing system.

1.4 PRODUCTS CRITERIA

- A. Assembled units: Manufacturers of equipment assemblies, which use components made by others, complete responsibility for the final assembled product.
 - 1. All components of an assembled unit need not be products of the same manufacturer but component parts which are alike are the product of a single manufacturer.
 - 2. Components are compatible with each other and with the total assembly for the intended service.
- B. System Requirement
 - 1. The general system configuration shall be made up of independent zones connected together via storage lines. Each zone shall be composed of a group of stations, each connected to the zone via a

single tube line through a transfer unit. Contract drawings show locations of each station, equipment rooms and designated space where piping can be run. Contractor shall design piping and equipment to suit available space.

2. Install in each sending and receiving line provisions to facilitate future additional stations, without modification of mechanical and electrical components at central control. Arrange wiring so that additional stations may be added by extending wiring from nearest station or transfer unit without running back to central control.
3. Operation: Shall be totally automatic requiring no intermediate manual handling of carriers.
 - a. Dispatched carriers shall not pass through the sender of another station.
 - b. Destination selection shall be by membrane keypad, dials or push buttons on the station control panel. No destination coding shall be on carriers.
 - c. Failure of one station shall not interfere with normal functioning of any other station on system.
 - d. A "carrier acceptance" signal on station control panel shall confirm that carrier can be delivered to selected station before system accepts a carrier.
 - e. After receipt of "carrier acceptance" signal dispatching sequence shall be controlled by system computer requiring no additional attention from operator.
 - f. Carriers shall be rejected at the source station if they cannot be delivered to the destination station. The route to the destination station is checked twice to insure that all sections of the system are operating properly before the carrier is dispatched. A "carrier rejection" signal on station control panel shall indicate carrier cannot be delivered to selected station for one of the following reasons:
 - 1) Non-existing station selection.
 - 2) Selected station filled to capacity.
 - 3) Selected station off-line.
 - 4) System malfunction.
 - g. Use no carrier impact valves in system. Carrier transfer from negative pressure or positive pressure sections of system to

- atmospheric shall be through electro-mechanical devices not dependent on carrier mass or velocity for proper operation.
- h. Carriers may be positioned in all senders simultaneously and designation selection dialed into station control panel.
 - i. Carriers already in transit at time of a power failure shall be delivered to selected destinations when power is restored.
 - j. Carriers already in transit when system is turned off at central control center shall be delivered to their selected destinations. Additional carriers shall not be accepted into system after off button is depressed.
 - k. Carriers already in transit when receiving station is turned off shall be returned to sending station or continue to intended receiving station.
 - l. If carrier has not entered transfer unit, make provisions in control circuits to return carrier to its originating station should its destination become inoperative.
 - m. If both sending and receiving stations should be turned off after carrier is in transit, carrier shall be sent to receiving station. Power at receiving station shall not shut off until carriers in route to receiving station have been received. Otherwise, there will be no reject station.
 - n. Each zone shall contain its own blower and function independently.
 - o. The dispatching routing, spacing and storage of carriers shall be directed by the control center to provide automatic, unattended transmission of carriers between all station.
 - p. Provide shortest route vacuum-pressure travel. Transactions between stations on the same zone shall process to the closet turnaround point to the destination.
 - q. To dispatch a carrier from a station the operator will place a latched carrier in the dispatcher, select the destination address and press the "send" pushbutton at the station.
 - r. Allow multiple carriers in transit within the system. Allow the station dispatchers to be simultaneously loaded and destinations selected. Automatically process all carriers until the system is clear.

- s. The modular construction of the system components shall permit changes and the addition of stations and/or zones as Owner requirements change.
- t. Provide automatic empty carrier redistribution. Allow any station with excess carriers to select automatic return which will direct empty carriers anywhere in the system on a most needed basis. The need will be determined by the ratio of assigned carriers to present carriers.
- u. Allow individual station or zone shutdown without affecting remainder of system.
- v. Carriers in process shall be delivered to either the source or destination station if a failure occurs in the route while they are in transit.
- w. Carriers in process or pending when any part of the system is signed off shall deliver to their destinations. Any new requests to send shall be rejected.
- x. Carrier in process shall be returned to the source station if the destination station becomes overloaded while they are in transit.
- y. When a power failure occurs at the control center, the system continues to process carriers for approximately one minute without interruption. If the power failure lasts more than one minute, as many in process transactions as possible are completed before the system is shut off. Any remaining in process transactions are stored in memory and delivered to their destinations when power is restored.
- z. Station send and receive and system priorities shall insure that carriers are processed to their destinations in the shortest time.
- aa. Closed loop control shall verify that commands to the system equipment were properly executed before the next segment of each transaction is started.
- bb. A 115V AC duplex receptacle and on/off switch shall be provided at each station, transfer unit, and blower package.
- cc. The destination selection capability of any station can be controlled from the Control Center.
- dd. An option can be selected to allow scheduled off stations to dispatch but no receive carriers.

- ee. Stations can be automatically assigned up to five on/off periods per day.
 - ff. Stations can be automatically assigned up to ten dispatch and receive priority levels with different time intervals.
 - gg. Component diagnostics can be performed at each station, transfer unit and blower using diagnostic capability in each unit.
- D. Employee Instructions: Provide a qualified representative possessing complete knowledge of system and equipment to train employees in operation and maintenance of system. Training period shall be as follows:
- Four hours instructing operating personnel in use of system.
- E. Inspection and Maintenance Service: Furnish inspection and maintenance service on equipment for a period of 1 year after system begins daily operation. This service shall consist of monthly examination by competent and qualified mechanics; cleaning, oiling greasing adjustments and replacement of any parts required to place equipment in proper working order (except parts made necessary by improper use, accident or negligence).

1.6 SUBMITTALS:

- A. Submit in accordance with Section 01340, SAMPLES AND SHOP DRAWINGS.
- B. Manufacturer's Literature and Data and Shop Drawings of Fabricated Equipment- Submit the following as one package:
 - 1. Stations
 - 2. Carriers
 - 3. Transfer Units
 - 4. Pneumatic Control Air
 - 5. Tubing
 - 6. Hangers
 - 7. Exhausters
- C. Complete layout shop drawings showing pneumatic tubes and adjacent ducts and pipes for possible interference. Provide complete dimensioned drawings that indicate tube track routing, right-of-way, methods of suspending and anchoring tube, station details, equipment locations and detailed dimensions of all major components. Include a riser or isometric diagram of track routing and electrical wiring detail.
- D. Submit computer run simulation. Base simulation on the following input:

1. Average carrier velocity shall be 25 feet per second.
 2. Requirements of this specification.
- E. Operating and Instruction Manual: Provide six manuals. Each manual shall be bound and indexed containing complete operation, maintenance and repair instructions including following:
1. Description of system and components.
 2. Starting and stopping procedures.
 3. Special operating instructions.
 4. Routine maintenance procedures.
 5. Cataloged list of spare parts.

1.7 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. Federal Specifications (Fed. Spec.):
- WW-H-171E.....Hangers, And Supports, Pipe
- WW-T-799E.....Tube, Copper, Seamless, Water And Refrigeration
(For Use With Solder-Flared Or Compression-Type
Fittings)

PART 2 - PRODUCTS

2.1 STATIONS

- A. Recessed wall type, 34-3/4" wide x 46-3/4" high x 17-3/8" deep, with face plate and doors flush with wall. Provide self-supporting "rough-in" frame to which various operating and decorative components are added. Provide switch with signal lights or written legends to indicate station "ON" or "OFF". In lieu of switch at station, provide control at computer.
- B. Doors, if provided for air cushioning or arriving carrier, shall have heavy spring loaded hinges and positive "self-closing" latches. Door handles shall be stainless steel.
- C. Sheet metal surfaces shall be factory painted with a polyurethane base or scuff resistant low gloss black, or be covered with molded decorative plastic. Finish frame for final mating to wall surface shall be stainless steel or same material as terminal surface.
- D. There shall be no in rush of air when send door is opened.
- E. Station shall be capable of receiving and storing not less than four carriers.

- F. Provide means to assure quite arrival of carriers.
- G. Carrier storage compartment shall be capable of storing four empty carriers and be integral with station.
- H. Furnish and mount station directories and station operating instructions at each station and central control center.
- I. Station Control Panel shall contain.
 - 1. Membrane keypad - for destination and special function selection.
 - 2. Display with 48 characters - for message display.
 - 3. Send/Enter key - to activate dispatch after destination selection or to enter data for special functions.
 - 4. Cancel/Clear Key - to allow for transaction cancellation or clearing of display during special function activation.
 - 5. Special Function Key- to request special features.
 - 6. Directory - listing station addresses.
 - 7. Instruction Compartment - for operating and special function instructions.
 - 8. Discreet rejection messages shall be provided for:
 - a. Dispatching station full.
 - b. Dispatching station off.
 - c. Dispatching station not in service.
 - d. Receiving station full.
 - e. Receiving station does not exist.
 - f. Receiving station off.
 - g. Receiving station not in service.
 - h. Selection not permitted.
 - i. Transaction aborted.
- J. Message will be displayed for the following conditions:
 - 1. Incoming carriers at the receiving station.
 - 2. To return surplus carriers when the receiving station has a specified surplus over its assigned number of carriers.
 - 3. To empty a station receiver when it is full.
 - 4. Receiving station not receiving - traffic forwarded to another station.
- K. The following special functions shall be selectable from each station.
 - 1. Transaction Tracking
 - 2. Secure Transaction
 - 3. Emergency Shutdown

4. State Transaction
5. Traffic Forwarding
6. Incoming Carrier Query
7. Station On/Off
8. Carriers Present
9. Station Diagnostics
10. Audible Full Station
11. Audible Carrier Arrival

2.2 CARRIERS

Transparent shatterproof plastic with side opening or double end opening. Carriers shall be bi-directional and have replaceable wear bands and latches. Open carriers shall not be accepted in system. Carrier shall have an interior diameter of approximately three inches and a minimum length of 11" or transporting 1000 ML IV bottle. Furnish four for each station. Mark station number on three carriers of each station. If automatic return of carrier to station in need is furnished as standard equipment, carriers need not be marked.

2.3 TUBING

- A. Air and conveying tubing and bends shall be 16 gauge cold rolled, electric welded steel with flash removed and zinc-coated after fabrication. Joints shall be bell-end tubing or sleeve couplings forming air tight connections.
- B. Form bends to minimum 48 radius. Use expanded bends only where carrier travel is down.
- C. Provide expansion joints where tubing passes through a construction expansion joint.

2.4 SOUND DAMPENING

Provide 1-1/2 inch thick insulation, one pound density flexible fiberglass with 0.0025 inch foil facing with joints taped.

2.5 HANGERS

- A. Fed. Spec. WW-H-171.
- B. Horizontal Tubing: Types 1, 4, 5, 6 and 11. Provide lock nuts on Type 1 hangers.
- C. Vertical Tubing: Riser Clamp Type 8.
- D. Trapeze Hangers: Structural channel, single irons or preformed channel shapes. May be used for groups of pipes close together and parallel.

2.6 TRANSFER UNITS

Sheet metal enclosure with access panels. Joints between transfer unit tubing segment and incoming/outgoing tubing lines shall be sealed with slip sleeve at each joint to minimize air leakage. Direction change through unit shall be gradual, using curved tube section.

2.7 EXHAUSTERS AND CONTROL

Revise and/or add as needed for the additional station.

2.8 PNEUMATIC CONTROL AIR SYSTEM

Revise and/or add as needed for the additional station.

2.9 CENTRAL CONTROL CENTER

Revise and/or add as needed for the additional station.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install vertical risers and horizontal trucks within designated spaces, where possible within interstitial spaces.
- B. Slots and openings in shear walls are in place and no new holes are allowed.
- C. Core holes in completed structural floors and interstitial space floors for tubing to stations.
- D. Vertical pipes or tubing passing through occupied floors other than designated risers are not permitted.
- E. Hangers shall be spaced not more than 10 feet on centers. Support each diverter, wye branch and bend by two hangers. Provide floor clamps for each tube at each floor on vertical runs. Install wye branches and diverters with split sleeves to facilitate system maintenance. Do not suspend hangers from piping above.
- F. Apply insulation only to bends and wyes not located in pipe shafts, equipment rooms and pipe basements.
- G. Close pipe openings with caps or plugs during installation. Tightly cover and protect fixtures and equipment against dirt, water and chemical or mechanical injury. At completion of all work thoroughly clean fixtures, exposed materials and equipment.
- H. Station frame shall be installed flush to wall.

3.2 PRE-TESTS AND TEST

- A. Pre-test as per specifications in the presence of the COTR, for proper operation before requesting final inspection. Final inspection shall be conducted at other than normal working hours, if required by the COTR's

Representative. The pneumatic tube system shall be tested as specified in the presence of, and under the direction of the COTR's Representative.

- B. General: Test shall be conducted by a competent factory trained engineer possessing complete knowledge of system and equipment.
- C. Test Procedure: Phase I - To determine that system meets functional, operational installation and hardware requirements of specifications:
 - 1. Inspect components to determine compliance with hardware and installation specifications.
 - 2. At a random station demonstrate the following:
 - a. Place carrier into send compartment. Do not close door. Make random destination selection. Depress dispatch button. Acceptable result: System shall ignore dispatch request.
 - b. Remove carrier from send compartment. Close dispatch door. Make random destination selection. Depress dispatch button. Acceptable result: System shall ignore dispatch request.
 - c. Place carrier into send compartment. Close dispatch door. Make random inter-zone (loop) destination selection. Depress dispatch button. Acceptable result: Carrier accepted light shall turn on, carrier shall be delivered to selected destination.
 - d. Place carrier into send compartment. Close dispatch door. Make intr-zone destination selection. Depress dispatch button. Acceptable result: Carrier accepted light shall turn on, carrier shall be delivered to selected destination.
 - 3. At random station, try to send under following listed conditions. Acceptable result in each case: Carrier rejected signal shall light and carrier will not be accepted into system. Following each test, depress cancel button which shall cancel the reject light.
 - a. Destined station filled to capacity.
 - b. Destined station turned off.
 - c. Power off at destined station.
 - d. Destined loop control switch off.
 - e. Dispatching loop control switch off.
 - f. Simulate a malfunction of a different zone and try to dispatch a carrier into that zone.
 - g. Simulate a malfunction of the same zone and try to dispatch carrier to a random station in the system.

- h. Simulate malfunction of inter-loop transfer and attempt to dispatch carrier to random station in the system.
- 4. At random station, dispatch carrier to another random station. Immediately after start of sending, remove power from the destined station. Acceptable result: Carrier will return to dispatching station.
- 5. One station per zone will be randomly selected to dispatch carrier into a different zone. Ten seconds after start of sending, remove power from main system control center. Restore power and depress system "on" switch. Acceptable result: Carrier shall be delivered to destined station.
- 6. Simulate any malfunction of the system. Acceptable result: computer shall generate specified printout, specific alarm light will activate at central control, master audio visual alarm shall activate. Operate reset switch or buttons. Acceptable result: All alarm indicators shall reset.
- 7. Demonstrate system has the capacity and power to discharge 60 carriers in one hour. An acceptable test would be the use of 6 people each discharging 10 carriers from a separate zone. Eighty percent of transactions by one tester may be intra-zones; 20 percent shall be inter-zone with half of these passing through exchangers, if used. Phase II - To test operation of maintenance program.
 - a. Turn random loop off through loop control switch on Central Control Center.
 - b. Through the keyboard input, components in turned-off loop shall be selectively set and reset.
 - c. Through keyboard input, devices in loop shall be cycled.
- D. Carriers: Carriers used for final tests shall be new.
 - 1. Inspect carriers used for tests for scratches on leather washers and skirts, or rubbing bands. Presence of deep scratches indicate rough spots in tubing and/or joints. Rough spots shall be corrected before acceptance of system.
 - 2. Carriers scratched, marred or damaged as a result of test shall be repaired or replaced.

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SECTION 15050
BASIC METHODS AND REQUIREMENTS (MECHANICAL)

PART 1 - GENERAL

1.1 DESCRIPTION:

- A. Basic Methods and Requirements (Mechanical) for Division 15, MECHANICAL, applies to all sections of Division 15.
- B. Definitions:
 - 1. Exposed: Piping, ductwork, and equipment exposed to view in finished rooms.
 - 2. Option or optional: Contractor's choice of an alternate material or method.

1.2 RELATED WORK:

- A. Section 01310, EXAM ROOM MOCK-UP
- B. Section 01320, COORDINATION DRAWINGS
- C. Section 01340, SAMPLES AND SHOP DRAWINGS
- D. Excavation and Backfill: Section 02200, EARTHWORK.
- E. Concrete and Grout: Section 03300, CAST-IN-PLACE CONCRETE.
- F. Building Components for Attachment of Hangers: Section 05311, Steel Decking.
- G. Section 05500, METAL FABRICATIONS.
- H. Section 07270, FIRESTOPPING, SYSTEMS.
- I. Flashing for Wall and Roof Penetrations: Section 07600, FLASHING AND SHEET METAL.
- J. Section 07920, SEALANTS AND CAULKING.
- K. Section 09900, PAINTING.
- L. Section 113081, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.
- M. Section 15200, NOISE AND VIBRATION CONTROL.
- N. Section 15250, INSULATION.
- O. Section 15980, TESTING, ADJUSTING, AND BALANCING.
- P. Section 16155, MOTOR STARTERS.

1.3 QUALITY ASSURANCE:

- A. Flow Rate Tolerance for HVAC Equipment: Section 15980, TESTING, ADJUSTING, AND BALANCING.
- B. Equipment Vibration Tolerance:

1. The allowable vibration tolerance is specified in Section 15200, NOISE AND VIBRATION CONTROL. Equipment specifications require factory balancing of equipment to this tolerance.
2. After air balance work is completed and permanent drive sheaves are in place, perform field mechanical balancing and adjustments required to meet the specified vibration tolerance.

C. Products Criteria:

1. Standard Products: Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products for at least 3 years. See other specification sections for any exceptions.
2. Equipment Service: Products shall be supported by a service organization which maintains a complete inventory of repair parts and is located reasonably close to the site.
3. Multiple Units: When two or more units of materials or equipment of the same type or class are required, these units shall be products of one manufacturer.
4. Assembled Units: Manufacturers of equipment assemblies, which use components made by others, assume complete responsibility for the final assembled product.
5. Nameplates: Nameplate bearing manufacturer's name or identifiable trademark shall be securely affixed in a conspicuous place on equipment, or name or trademark cast integrally with equipment, stamped or otherwise permanently marked on each item of equipment.
6. Asbestos products or equipment or materials containing asbestos shall not be used.

D. Welding: Before any welding is performed, contractor shall submit a certificate certifying that welders comply with the following requirements:

1. Qualify welding processes and operators for piping according to ASME "Boiler and Pressure Vessel Code", section IX, "Welding and Brazing Qualifications".
2. Comply with provisions of ASME B31 series "Code for Pressure Piping".
3. Certify that each welder has passed American Welding Society (AWS) qualification tests for the welding processes involved, and that certification is current.

- E. 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 Resident Engineer 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.
- F. Guaranty: Section 01001, GENERAL CONDITIONS.
- G. Plumbing Systems: NAPHCC National Standard Plumbing Code.
- H. Supports for sprinkler piping shall be in conformance with NFPA 13.

1.4 SUBMITTALS:

- A. Submit in accordance with Section 01340, SAMPLES AND SHOP DRAWINGS.
- B. Manufacturer's Literature and Data: Submit under the pertinent section rather than under this section.
 - 1. Equipment and materials identification.
 - 2. Fire-stopping materials.
 - 3. Hangers, inserts, supports and bracing. Provide load calculations for variable spring and constant support hangers.
 - 4. Wall, floor, and ceiling plates.
- C. Coordination Drawings: In accordance with Section 01001, GENERAL CONDITIONS, Article, SUBCONTRACTS AND WORK COORDINATION. Contractor shall prepare detail drawings to minimum scale 1/8" = 1'0", on tracing paper or AutoCAD, same size as Contract Drawings and with the following layouts, coordinate this work with the work of other trades. Such detail work shall be clearly identified on the drawings as to the area to which it applies. Submit these drawings to the Architect/Engineer for approval. At completion, include a set of such drawings with each set of As-Built Drawings for Owner's record purposes. Provide detailed layout drawings of all piping, fire alarm systems and duct systems. In addition provide details of the following:
 - 1. Interstitial space.
 - 2. Hangers, inserts, supports, and bracing.
 - 3. Pipe sleeves.
 - 4. Duct or equipment penetrations of floors, walls, ceilings, or roofs.
- D. Maintenance Data and Operating Instructions:

1. Maintenance and operating manuals in accordance with Section 01010, GENERAL REQUIREMENTS, Article, INSTRUCTIONS, for systems and equipment.
 2. Provide a listing of recommended replacement parts to keep in supply, including sources of supply, for equipment. Include in the listing belts for equipment: Belt manufacturer, model number, size and style, and distinguished whether of multiple belt sets.
- E. Provide copies of approved HVAC equipment submittals to the Testing, Adjusting and Balancing Subcontractor.

1.5 APPLICABLE PUBLICATIONS:

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. Federal Specifications (Fed. Spec.):
FF-S-325.....Shield, Expansion; Nail, Expansion; and Nail,
Drive Screw (Devices, Anchoring, Masonry)
- C. American National Standard Institute (ANSI):
B31.1-98.....Power Piping
- D. Air Movement and Control Association (AMCA):
Recommended Safety Practices for Air Moving Devices
- E. American Society of Mechanical Engineers (ASME):
- F. Boiler and Pressure Vessel Code (BPVC):
SEC IX-98.....Qualifications Standard for Welding and Brazing
Procedures, Welders, Brazers, and Welding and
Brazing Operators
- G. American Society for Testing and Materials (ASTM):
A36/A36M-97.....Carbon Structural Steel
A575-96.....Steel Bars, Carbon, Merchant Quality, M-Grades
E84-98Surface Burning Characteristics of Building
Materials
E119-98.....Fire Tests of Building Construction and
Materials
- H. Manufacturers Standardization Society (MSS) of the Valve and Fittings
Industry, Inc:
SP-58-93.....Pipe Hangers and Supports-Materials, Design and
Manufacturer

SOL 663-01-05
VA Seattle Building 100
Ambulatory Clinic Expansion

SP-69-96.....Pipe Hangers and Supports-Selection and
Application

I. National Association of Plumbing - Heating - Cooling Contractors
(NAPHCC):

1.6 NATIONAL STANDARD PLUMBING CODE:

National Fire Protection Association (NFPA):

90A-96.....Installation of Air Conditioning and
Ventilating Systems Life Safety Code

1.7 INTENT OF DRAWINGS:

Drawings show only approximate location of piping, fixtures, equipment and the general requirements as to size and location of pipes, etc. Take measurements from the buildings and check against the Mechanical Plans. Report conflicts to the Contracting Officer (COTR) for adjustment before proceeding with work. Failure to follow this instruction shall be considered sufficient cause for the Contractor to alter his work at his own expense, as directed by the Architect/Engineer. General layout is shown on plan views, detailed flow diagrams (P & ID's) indicated design intention. Contractor shall be responsible for a complete and functional system throughout.

1.8 RECORD (AS-BUILT) DRAWINGS:

This Contractor shall maintain a set of Contract Plans at the site on which the actual location of piping, ductwork, equipment, etc., as installed, shall be shown in a legible, neat manner. This set of Plans shall show actual dimensions (including depth of bury) of underground piping from construction lines so they can be readily found after covering. Upon completion of the project, the as-built information shall be transferred to a set of reproducible sepias or mylars. This set of Plans shall be presented to the Architect/Engineer for final approval and acceptance.

1.9 WORK IN OTHER SECTIONS:

Comply with all requirements of General Conditions and Divisions.

1.10 CODES:

Construction shall be in accordance with the latest edition of International Building Code, International Mechanical Code, International Fire Code, National Standard Plumbing Code, National Electrical Code, Washington State Energy Code, Washington State Vent & Indoor Air Quality Code, Washington State Water Conservation

Performance Standards, Barrier-Free Design-UBC, Chapter 11, and NFPA Codes and Local Amendments. Fire systems shall comply with NFPA Pamphlet 13. In the event of a conflict of codes, the more stringent code will apply in the following descending order: VA Standards, IBC, NEC, IMC, IFC, NFPA, NSPC, Washington State Energy Code, Washington State Ventilation Indoor Air Quality Code, Washington State Water Conservation Performance Standards, and Barrier-Free Design-IBC, Chapter 11.

1.11 ELECTRICAL WORK:

All electrical work, conduit, boxes and devices of any nature in connection with control wiring required to install the equipment as specified herein or shown on the Drawings shall be furnished and installed complete under this Section of the Specifications. All electrical work performed under this Section of the Specifications shall conform to all applicable portions of the Electrical Section of the Specifications, and shall conform to all applicable codes.

1.12 COORDINATION:

Examine the Architectural, Civil, Structural and Electrical Drawings; before work is started, consult with each of the other Contractors regarding locations and spaces required for the work and lay out work to avoid interference. Failure to coordinate shall be justification to require Contractor, at his own expense, to move his work to provide the necessary space for the other Contractors.

1.13 SCHEDULING:

Comply with requirements of General Specifications.

1.14 PRESSURE VESSELS:

At the completion of the project, this Contractor shall provide State of Washington certification of all pressure vessels installed on the project.

1.15 CUTTING AND PATCHING (NEW WORK):

Furnish dimensions and locations of openings to other Contractors doing the work. Provide ample time to avoid delays and unnecessary labor. Cutting and patching made necessary to admit work, repair defective material or workmanship, or by neglect to anticipate proper requirements shall be done.

1.16 CUTTING AND PATCHING (EXISTING STRUCTURE) :

- A. The Mechanical Contractor, as directed by the Architect shall do all necessary cutting and patching of existing structures necessary for the installation of mechanical work.
- B. All surfaces must be patched upon completion of work to the satisfaction of the Architect. Final finish of all patched surfaces shall be done per Architectural finish schedule by the General Contractor. All excavation necessary for the mechanical work shall be done by the Mechanical Contractor. Surfaces shall be patched as hereinbefore specified and all backfilling shall be done in accordance with requirements of this section and other related notes in the Contract Documents. If none specified, restore to original condition.

1.17 ACCESSIBILITY:

- A. Locate valves, traps, damper operators, access doors, etc., with easy accessibility, either accessible in mechanical spaces or through access panels specified hereinafter. Otherwise, obtain Architect's approval of location.
- B. Any equipment requiring maintenance clearances for servicing of filters, motors, compressors, etc. shall be carefully installed to avoid servicing problem. Failure of contractor to comply with this requirement shall be sufficient cause for contractor to make all necessary changes to comply at no cost to the Owner.

1.18 OPERATION OF EQUIPMENT AND SYSTEMS:

Contractor is responsible for operation of contractor supplied equipment during all periods of balancing and testing. Provide temporary utilities, as required.

1.19 ACCESS DOORS:

Provide access panels for all wall cleanouts on drainage piping and concealed valves for all piping. The locations of such panels shall be carefully selected on the job so as not to be located behind cabinets, etc. Coordinate closely with the General and Electrical Contract Plans before installing panels. Panels shall be J.R. Smith, or equal, prime-coated and painted, size as shown or approved. Install before surrounding surfaces have been painted. Doors shall have cylinder lock latch, all keyed alike. Provide Milcor, or approved equal, fire-rated access doors for one- or two-hour rated walls and ceilings; units shall be UL labeled. Provide access doors in ceiling or wall adjacent

to fire damper location. In areas such as toilet rooms, janitor rooms, etc., access panels may be J.R. Smith, or equal, and may be painted. In finished areas as on ceilings, all access panels shall have the same type of finished surface as that of the surrounding area. Verify with Architect location and finish of all such panels.

1.20 MECHANICAL ACCESSES:

- A. Provide suitable access to all mechanical equipment requiring servicing, maintenance, replacement, or repair. In concealed spaces where access has not been provided by the Architect by means of doors, hatchways, walkways or other means, provide wall or ceiling access doors of a type suitable to the Architect, sized to provide easy access to all equipment. Location of such doors shall be coordinated with the work of the other trades to avoid conflict therewith, and such locations shall be approved by the Engineer or Architect prior to installation of access panels.
- B. In addition to building access openings, provide access panels on ducts where required to service fire dampers, damper operators, and other associated equipment. All access doors to mechanically furnished panels, control boxes and filter compartments shall be provided with fully-hinged, easily-opened access doors.

1.21 EQUIPMENT:

- A. Specifications have been written around equipment and materials selected for this project based on quality, size capacity, and performance required to meet building design criteria.
- B. Supplier and/or Mechanical Contractor shall be responsible to ensure that material or equipment other than that listed, is of same size, quality, capacity, weight and electrical characteristics as that specified. Any changes and costs required during construction due to contractors/supplier neglect to properly select substituted equipment shall be paid by the Contractor/supplier.

1.22 TESTS, ADJUSTMENTS, AND INSPECTION:

- A. Test all work thoroughly and systematically, both during construction and after completion. Notify Engineer and Owner 48 hours in advance of all tests. Tests shall be maintained until approved. Tests shall be as hereinafter specified.
- B. Test the completed installation as in regular service.

- C. No systems, whether prescribed for testing or not, shall be covered or concealed below ground, in walls, in ceiling spaces, or generally from ease of viewing without first notifying Engineer. Failure to notify Engineer for inspection of concealed systems shall be cause to require this contractor to uncover such systems at no additional cost.
- D. Thoroughly review the project to determine when final inspection is appropriate and advise Engineer. Intent of this section is to require the Mechanical Contractor to complete his work before requiring final inspection.

1.23 DAMAGED OR REJECTED MATERIALS:

Remove from the site immediately.

1.24 RECORD DRAWINGS, OPERATING INSTRUCTIONS, OPERATION AND MAINTENANCE MANUALS:

- A. Record (As-Built) Drawings: Keep a set of drawings on site, with current changes marked in red pencil as they occur. This set shall be presented to Architect upon completion of project.
- B. Operating Instructions: Operate all systems through complete cycles in presence of designated Owner's representative, give instructions for operation, care and maintenance. All systems shall be operated through complete operating cycles for a minimum period of 7-days in conjunction with designated Owner's representative before acceptance by Owner.
- C. The Mechanical Contractor shall record on video tape all Owner training sessions. Training sessions shall be provided for all mechanical systems. Video tape shall be turned over to the Owner at the completion of the project.
- D. Operation and Maintenance Manuals (O&M):
 - 1. General: Provide one (1) preliminary bound set of Operation and Maintenance Manuals including maintenance information and parts list furnished by the manufacturer with the equipment, together with supplementary drawings where necessary to itemize serving and maintenance points. Include filter maintenance, methods of operation, seasonal requirements, manufacturer's data and warranty forms. Provide address and 24-hour phone number of firm responsible under warranty. Items requiring service or correction during the warranty period shall be serviced within 24-hours of notification by Owner. Data in manuals shall be neat, clean copies and posted on 8-1/2" x 11" sheets, typed, operation and maintenance instructions for

each item of equipment installed. Drawings shall be accordion folded. An index shall be provided with all contents listed in an orderly presentation according to specification section.

2. Number of Copies: The preliminary set of the O&M Manual shall be presented to the Architect for approval by the Engineer. After this set has been approved, two (2) additional sets shall be prepared and the three (3) sets shall be transmitted to the Architect.
3. Binding: Organize operating and maintenance data into suitable sets of manageable size. Copies shall be bound with black cloth-covered hardboard covers, three-hole punched, and secured with aluminum screw posts. Covers shall be gold embossed with the name of the Job, Owner, Architect, Engineer, Contractor, and the year of completion. The back edge shall be imprinted with the name of the Job, the Owner and the year of completion. Each copy shall have a typewritten index and tabbed dividers between equipment categories.

1.25 CERTIFICATIONS:

- A. Provide written certification that work has been fully completed in strict accordance with plans and specifications and requesting final inspection.
- B. Provide written certification that Contractor will replace materials and workmanship that prove defective for one year after date of acceptance.
- C. Provide written certification of inspection from the governing building authority, stating that all work has been inspected, accepted, and approved as complying with existing governing ordinances and codes.
- D. Provide written certification that Owner or appointed representative has been fully instructed in the operation and function of all mechanical systems.

1.26 WORKMANSHIP:

Furnish and install all equipment in a neat and finished appearance. If, in the judgment of the COTR, any portion of the work has not been installed in a workmanlike manner, or has been left in a rough, unfinished manner, Contractor will be required to remove the equipment, reinstall and patch and paint surrounding surfaces in a manner satisfactory to the Architect, without any increase in cost.

1.27 FINAL INSPECTION:

This contractor shall thoroughly review and inspect the project to determine when final inspection is required, and shall so advise the Architect and Owner. It shall be understood that the work is to be essentially complete. If such is not the case and more than one (1) final inspection and one (1) backcheck are necessary, this Contractor shall be billed for the additional backchecks at the then governing rate for the personnel involved. The final inspection punchlist shall be signed on a copy of the punch list by a person responsible for the trade involved before the backcheck is done.

1.28 PAINTING, TAGS, ETC.:

- A. Field painting of all mechanical equipment, piping etc., located in and exposed in occupied spaces, shall be the responsibility of the General Contractor. See Architectural Painting Specification and paragraph 1.28.C.1 of this section.
- B. Identification Tags: Provide identification tags for each valve throughout the building indicating the system served. Tags shall be black phenolic plastic with white engraved inscription attached with chrome chain.
- C. Stencil:
 - 1. Piping throughout the building shall be identified with W.H. Brady Co. B-946, M.S.I. No. MS-900, or equal, meeting or exceeding ANSI A13.1-1981. Pipe markers shall consist of an arrow in direction of flow, color, and wording as indicated in the schedule following. Stencils shall be visibly located and spaced on max. 20'-0" centers for long straight pipe runs. Use of appropriate colored stick-on labels may be used, if approved by the VA.
 - 2. Each major item of Mechanical Equipment shall be provided with the name of the item, i.e., Exhaust Fan No. 2, Hot-Water Heater No. 1, in labels of black phenolic plastic with white engraved inscription.
 - 3. Color Code Schedule: Per VA Standards.

1.29 DOCUMENTS:

- A. Present to the Architect prior to final acceptance of buildings the following documents. Final payment of the Contract will be contingent upon receiving these documents:
 - 1. Record (as-built) drawings.
 - 2. Operation and Maintenance Manuals (3 sets).

3. Final material submittal.
4. Warranties (other than the one year).
5. Balancing logs. (Air and Hydronic Systems) (3 sets).
6. At the completion of the project, provide State of Washington certification of all pressure vessels installed on the project.
7. Final certificates of inspection and code compliance.
8. All applicable filled-in forms, shall be made part of Operation & Maintenance Manuals and shall be included with final documents.

1.30 TEMPORARY HEAT:

- A. Heat units may be used as temporary heating units during construction provided the following conditions are met:
 1. Agreed upon by Architect, Engineer, and Owner.
 2. Building must be clean of all dust before starting units.
 3. General Contractor must provide temporary filter media (80-85% efficient) for all return air, fresh air, exhaust and relief air systems.
 4. All windows, doors or other openings in building must be closed off.
 5. Upon completion of the job, Mechanical Contractor shall furnish new filters for all units, size and type as specified hereinafter.
- B. Temporary throw-away filters shall be provided by this Contractor as required during construction phase. This Contractor shall remove and dispose of temporary filters after construction is complete, and install those specified for the completed project before final acceptance of the project.

1.31 TEST PLUGS AND GAUGES:

Pressure or temperature test plugs shall be installed on inlet and discharge of all pumps and coils. A minimum of six (6) compatible pressure gauges (including pressure gauge adapters) and six (6) compatible temperature gauges shall be provided.

1.32 EQUIPMENT LUBRICATION:

All exhaust fans, air handling units, and heat pumps shall have all lubrication fittings on the equipment exterior.

1.33 PRODUCT TESTING:

- A. Any piece of equipment used in this project and hereinafter specified which, by its nature, requires electrical hook-up, such as fans, pumps, hot water tanks, boosters, air handling equipment, etc., MUST be

provided with an approved label from one of the agencies hereinafter listed.

- B. Approval of agency must be for the total package (approval of individual components not acceptable) and all labels must be located outside of equipment and shall be visible to inspector. Comply with all requirements of R.C.W. 19.28.010 and N.E.C. Sections 90-7 and 110-3 (1993).
- C. It shall be the responsibility of the Mechanical Contractor or the equipment supplier to meet the requirements of this section. Any agency costs to provide appropriate label for a piece of equipment must be included in this bid. Failure by Mechanical Contractor or supplier to obtain approved labels prior to bid shall be sufficient cause for the Mechanical Contractor/supplier to obtain all such labels at no additional cost to Owner. The following is a list of approved testing laboratories:

Underwriters Laboratories, Inc.
1655 Scott Boulevard
Santa Clara, CA 95050
(408) 985-2400
(206) 632-6441

Underwriters Laboratories, Inc.
260 NW Lake Road
Camas, WA 98607
(360) 817-5500

Gayle Varner
Santa Clara, CA 95050
(408) 985-2400
(206) 632-6441

Factory Mutual Systems
1151 Boston-Providence Turnpike
Norwood, MA 02062
(781) 762-4300

SOL 663-01-05
VA Seattle Building 100
Ambulatory Clinic Expansion

Intertec Testing
Industrial Park
Courtland, NY 13045
(607) 753-6711

MET Electrical Testing Co., Inc.
69256 Oakland Mills Road
Columbia, MD 21045-4760
(410) 381-2200

Electrical Testing Laboratories
Route 11, Industrial Park
Cartland, NY 13045-0950
(607) 753-6711

1.34 WARRANTY:

- A. All mechanical equipment and systems including plumbing, fire sprinkling, heating, ventilating, and air conditioning systems including controls and all parts thereof shall be warranted for a period of one year after the date of substantial completion as determined by the VA Contracting Officer.
- B. Contractor shall repair or replace to the satisfaction of the Architect and/or VA any defective material, equipment, or poor workmanship which may show itself during this warranty period. All compressors used in HVAC equipment shall have an additional four-year warranty.

1.35 FIRE INTEGRITY:

All penetrations of fire-rated/smoke rated walls, ceilings, roof and floors by ductwork, piping and air terminals shall be protected by fire dampers and firestopping per Chapter 7 of the 1997 Uniform Building Code.

1.36 COMMISSIONING:

This contractor will be required to perform commissioning on all critical HVAC, hydronic and domestic water systems as described in Sections 15980. This contractor shall include in his bid all Division 15 costs associated with the commissioning process.

PART 2 - PRODUCTS

2.1 ELECTRIC MOTORS:

- A. Provide special energy efficient motors as scheduled. Unless otherwise specified for a particular application use electric motors with the following requirements (provide motor starters per section 16155 when required by the motor):
1. Single-phase Motors: Capacitor-start type for hard starting applications. Motors for centrifugal fans and pumps may be split phase or permanent split capacitor (PSC).
 2. Poly-phase Motors: NEMA Design B, Squirrel cage, induction type. Each two-speed motor shall have two separate windings. Provide a time- delay (20 seconds minimum) relay for switching from high to low speed.
 3. Rating: Continuous duty at 100 percent capacity in an ambient temperature of 40 degrees centigrade (104 degrees F); minimum horsepower as shown on drawings; maximum horsepower in normal operation not to exceed nameplate rating without service factor.
 4. Insulation Resistance: Not less than one-half meg-ohm between stator conductors and frame, to be determined at the time of final inspection.

2.2 VARIABLE SPEED MOTOR CONTROLLERS:

- A. Refer to Section 16050, BASIC METHODS AND REQUIREMENTS (ELECTRICAL) and Section 16155, MOTOR STARTERS for specifications.
- B. The combination of controller and motor shall be provided by the respective air handler, fan or pump manufacturer, and shall be rated for 100 percent output performance. Multiple units of the same class of equipment, i.e. air handlers, fans, pumps, shall be product of a single manufacturer.
- C. Motors shall be energy efficient type and be approved by the motor controller manufacturer. The controller-motor combination shall be guaranteed to provide full motor nameplate horsepower in variable frequency operation. Both driving and driven motor/fan sheaves shall be fixed pitch.
- D. Controller shall not add any current or voltage transients to the input AC power distribution system, DDC controls, sensitive medical equipment, etc., nor shall be affected from other devices on the AC power system.

2.3 EQUIPMENT AND MATERIALS IDENTIFICATION:

- A. Use symbols, nomenclature and equipment numbers specified, shown on the drawings and shown in the maintenance manuals. Identification for piping shall be per VA Standards.
- B. Control Items: Label all temperature and humidity sensors, controllers and control dampers. Identify and label each item as they appear on the control diagrams.
- C. Equipment: Provide a color coded thumbtack in the ceiling to identify the location of all above ceiling equipment. VA to color requirements.
- D. Valve Tags and Lists:
 - 1. Plumbing: Provide for all valves (Fixture stops not included).
 - 2. HVAC: Provide for all valves other than for equipment in Section 15740, AIR TERMINALS.
 - 3. Valve tags: Engraved black filled numbers and letters not less than 13 mm (1/2-inch) high for number designation, and not less than 6.4 mm (1/4-inch) for service designation on 19 gage 38 mm (1-1/2 inches) round brass disc, attached with brass "S" hook or brass chain.
 - 4. Valve lists: Typed or printed plastic coated card(s), sized 216 mm (8-1/2 inches) by 280 mm (11 inches) showing tag number, valve function and area of control, for each service or system. Punch sheets for a 3-ring notebook.
 - 5. Provide detailed plan for each floor of the building indicating the location and valve number for each valve. Identify location of each valve with a color-coded thumbtack in ceiling.

2.4 FIRESTOPPING:

Section 07270, FIRESTOPPING SYSTEMS, specifies an effective barrier against the spread of fire, smoke and gases where penetrations occur for piping and ductwork. Refer to Section 15250, INSULATION, for firestop pipe and duct insulation.

2.5 GALVANIZED REPAIR COMPOUND:

Mil. Spec. DOD-P-21035B, paint form.

2.6 PIPE AND EQUIPMENT SUPPORTS AND RESTRAINTS:

- A. Vibration Isolators: Refer to Section 15200, NOISE AND VIBRATION CONTROL.
- B. In lieu of the paragraphs, which follow, suspended equipment support and restraints may be designed and installed in accordance with the

National Uniform Seismic Installation Guidelines (NUSIG), most current edition. Submittals based on either the NUSIG guidelines or the following paragraphs of this Section shall be stamped and signed by a professional engineer registered in a state where the project is located. Support of suspended equipment over 227kg (500 pounds) shall be submitted for approval of the Resident Engineer in all cases.

- C. Type Numbers Specified: MSS SP-58. For selection and application refer to MSS SP-69. Refer to Section 05500, METAL FABRICATIONS, for miscellaneous metal support materials and prime coat painting.
- D. For Attachment to Concrete Construction:
Concrete insert: Type 18, MSS SP-58.
1. Self-drilling expansion shields and machine bolt expansion anchors: Fed. Spec. FF-S-325, permitted in concrete not less than 102 mm (four inches) thick. Applied load shall not exceed one-fourth the proof test load listed in Fed. Spec. FF-S-325.
 2. Power-driven fasteners: Permitted in existing concrete or masonry not less than 102 mm (four inches) thick when approved by the Resident Engineer for each job condition. Applied load shall not exceed one-fourth the proof test load listed in Fed. Spec. FF-S-325.
- E. For Attachment to Steel Construction: MSS SP-58.
1. Welded attachment: Type 22.
 2. Beam clamps: Types 20, 21, 28 or 29. Type 23 C-clamp may be used for individual copper tubing up to 23mm (7/8-inch) outside diameter.
 3. Attachment to Metal Pan or Deck: As required for materials specified in Section 05311, STEEL DECKING Section 05321, STEEL DECKING COMPOSITE.
 4. For Attachment to Wood Construction: Wood screws or lag bolts.
 5. Hanger Rods: Hot-rolled steel, ASTM A36 or A575 for allowable load listed in MSS SP-58. For piping, provide adjustment means for controlling level or slope. Types 13 or 15 turn-buckles shall provide 38 mm (1-1/2 inches) minimum of adjustment and incorporate locknuts. All-thread rods are acceptable.
 6. Multiple (Trapeze) Hangers: Galvanized, cold formed, lipped steel channel horizontal member, not less than 41mm by 41mm (1-5/8 inches by 1-5/8 inches), 2.7 mm (No. 12 gage), designed to accept special spring held, hardened steel nuts. Not permitted for steam supply and condensate piping.

- a. Allowable hanger load: Manufacturers rating less 91kg (200 pounds).
 - b. Guide individual pipes on the horizontal member of every other trapeze hanger with 6 mm (1/4-inch) U-bolt fabricated from steel rod. Provide Type 40 insulation shield, secured by two 13mm (1/2-inch) galvanized steel bands, or preinsulated calcium silicate shield for insulated piping at each hanger.
- F. Pipe Hangers and Supports: (MSS SP-58), use hangers sized to encircle insulation on insulated piping. Refer to Section 15250, INSULATION for insulation thickness. To protect insulation, provide Type 39 saddles for roller type supports or preinsulated calcium silicate shields. Provide Type 40 insulation shield or preinsulated calcium silicate shield at all other types of supports and hangers including those for preinsulated piping.
1. General Types (MSS SP-58):
 - a. Standard clevis hanger: Type 1; provide locknut.
 - b. Riser clamps: Type 8.
 - c. Wall brackets: Types 31, 32 or 33.
 - d. Roller supports: Type 41, 43, 44 and 46.
 - e. Saddle support: Type 36, 37 or 38.
 - f. Turnbuckle: Types 13 or 15. preinsulate
 - g. U-bolt clamp: Type 24.
 - h. Copper Tube:
 - 1) Hangers, clamps and other support material in contact with tubing shall be painted with copper colored epoxy paint, plastic coated or taped with non adhesive isolation tape to prevent electrolysis.
 - 2) For vertical runs use epoxy painted or plastic coated riser clamps.
 - 3) For supporting tube to strut: Provide epoxy painted pipe straps for copper tube or plastic inserted vibration isolation clamps.
 - 4) Insulated Lines: Provide pre-insulated calcium silicate shields sized for copper tube.
 - i. Supports for plastic or glass piping: As recommended by the pipe manufacturer with black rubber tape extending one inch beyond steel support or clamp.

- G. Spring Supports (Expansion and contraction of vertical piping):
1. Movement up to 20 mm (3/4-inch): Type 51 or 52 variable spring unit with integral turn buckle and load indicator.
 2. Movement more than 20 mm (3/4-inch): Type 54 or 55 constant support unit with integral adjusting nut, turn buckle and travel position indicator.
 3. Converter and Expansion Tank Hangers: May be Type 1 sized for the shell diameter. Insulation where required will cover the hangers.
 4. Plumbing Piping (Other Than General Types):
 - a. Horizontal piping: Type 1, 5, 7, 9, and 10.
 - b. Chrome plated piping: Chrome plated supports.
 - c. Hangers and supports in pipe chase: Prefabricated system ABS self-extinguishing material, not subject to electrolytic action, to hold piping, prevent vibration and compensate for all static and operational conditions.
 - d. Blocking, stays and bracing: Angle iron or preformed metal channel shapes, 1.3 mm (18 gage) minimum.
- H. Pre-insulated Calcium Silicate Shields:
1. Provide 360 degree water resistant high density 965 kPa (140 psi) compressive strength calcium silicate shields encased in galvanized metal.
 2. Pre-insulated calcium silicate shields to be installed at the point of support during erection.
 3. Shield thickness shall match the pipe insulation.
- I. The type of shield is selected by the temperature of the pipe, the load it must carry, and the type of support it will be used with.
1. Shields for supporting chilled or cold water shall have insulation that extends a minimum of 1 inch past the sheet metal. Provide for an adequate vapor barrier in chilled lines.
 2. The pre-insulated calcium silicate shield shall support the maximum allowable water filled span as indicated in MSS-SP 69. To support the load, the shields may have one or more of the following features: structural inserts 4138 kPa (600 psi) compressive strength, an extra bottom metal shield, or formed structural steel (ASTM A36) wear plates welded to the bottom sheet metal jacket.
 3. Shields may be used on steel clevis hanger type supports, roller supports or flat surfaces.

J. Seismic Restraint of Piping:

1. Design criteria is as follows:
 - a. Piping resiliently supported: 120 percent of the weight of the systems and components and contents.
 - b. Piping not resiliently supported: 60 percent of the weight of the system components and contents.
 - c. Except as noted above; meet the more severe requirements of the Local Code and the latest Uniform Building Code for determining seismic force F_p .
2. Provide one of the following options:
 - a. Design and installation to meet the criteria listed above, and meet requirements of the latest Sheet Metal and Air Conditioning Contractors National Association (SMACNA), Seismic Restraint Manual Guidelines for Mechanical Systems for the prescribed Seismic Hazard Level (SHL) A.
 - b. Design and installation to meet the criteria listed above, and meet the most current requirements of the National Uniform Seismic Installation Guidelines (NUSIG). Contractor shall submit all design tables and information for the design force levels, stamped and signed by a professional engineer registered in the State where project is located.
 - c. Where SMACNA or NUSIG requirements are not met completely submit proposed alternate details and calculations to completely address seismic bracing requirements. Such designs shall use more severe of the Local Code and the Uniform Building Code requirements for determining seismic forces, and be performed, stamped and signed by a professional engineer registered in the State where project is located. Revise if necessary any details shown on the contract drawings for vertical support and lateral bracing, and submit for the approval of the Resident Engineer to meet the design criteria listed above.

2.7 PIPE PENETRATIONS:

- A. Install sleeves during construction for other than blocked out floor openings for risers in mechanical bays.
- B. To prevent accidental liquid spills from passing to a lower level, provide the following:

1. For sleeves: Extend sleeve 25 mm (one inch) above finished floor and provide sealant for watertight joint.
 2. For blocked out floor openings: Provide 40 mm (1-1/2 inch) angle set in silicone adhesive around opening.
 3. For drilled penetrations: Provide 40 mm (1-1/2 inch) angle ring or square set in silicone adhesive around penetration.
- C. Penetrations are not allowed through beams or ribs, but may be installed in concrete beam flanges. Any deviation from this requirements must receive prior approval of Resident Engineer.
- D. Sheet Metal, Plastic, or Moisture-resistant Fiber Sleeves: Provide for pipe passing through floors, interior walls, and partitions, unless brass or steel pipe sleeves are specifically called for below.
- E. Cast Iron or Zinc Coated Pipe Sleeves: Provide for pipe passing through exterior walls below grade. Make space between sleeve and pipe watertight with a modular or link rubber seal. Seal shall be applied at both ends of sleeve.
- F. Galvanized Steel or an alternate Black Iron Pipe with asphalt coating Sleeves: Provide for pipe passing through concrete beam flanges, except where brass pipe sleeves are called for. Provide sleeve for pipe passing through floor of mechanical rooms, laundry work rooms, and animal rooms above basement. Except in mechanical rooms, connect sleeve with floor plate.
- G. Brass Pipe Sleeves: Provide for pipe passing through quarry tile, terrazzo or ceramic tile floors. Connect sleeve with floor plate.
- H. Sleeves are not required for wall hydrants for fire department connections or in drywall construction.
- I. Sleeve Clearance: Sleeve through floors, walls, partitions, and beam flanges shall be one inch greater in diameter than external diameter of pipe. Sleeve for pipe with insulation shall be large enough to accommodate the insulation. Interior openings shall be caulked tight with fire stopping material and sealant to prevent the spread of fire, smoke, and gases.
- J. Sealant and Adhesives: Shall be as specified in Section 07920, SEALANTS AND CAULKING.

2.8 TOOLS AND LUBRICANTS:

- A. Furnish, and turn over to the Resident Engineer, special tools not readily available commercially, that are required for disassembly or adjustment of equipment and machinery furnished.
- B. Grease Guns with Attachments for Applicable Fittings: One for each type of grease required for each motor or other equipment.
- C. Tool Containers: Hardwood or metal, permanently identified for intended service and mounted, or located, where directed by the Resident Engineer.
- D. Lubricants: A minimum of 0.95 L (one quart) of oil, and 0.45 kg (one pound) of grease, of equipment manufacturer's recommended grade and type, in unopened containers and properly identified as to use for each different application.

2.9 WALL, FLOOR, AND CEILING PLATES:

- A. Material and Type: Chrome plated brass or chrome plated steel, one piece or split type with concealed hinge, with set screw for fastening to pipe, or sleeve. Use plates that fit tight around pipes, cover openings around pipes and cover the entire pipe sleeve projection.
- B. Thickness: Not less than 2.4 mm (3/32-inch) for floor plates. For wall and ceiling plates, not less than 0.64 mm (0.025-inch) for up to 80 mm (3-inch pipe), 0.89 mm (0.035-inch) for larger pipe.
- C. Locations: Use where pipe penetrates floors, walls and ceilings in exposed locations, in finished areas only. Use also where insulation ends on exposed water supply pipe drop from overhead. Provide a watertight joint in spaces where brass or steel pipe sleeves are specified.

2.10 FILTERS:

Provide on complete set of spare filters for each mechanical unit utilizing them. Filters will be of the same quality as those specified within the division 15000 specifications. These filters are not to be used by the contractor as replacement filters required in section 01010 - Temporary Use of Mechanical and Electrical Equipment.

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. Coordinate location of piping, sleeves, inserts, hangers, ductwork and equipment. Locate piping, sleeves, inserts, hangers, ductwork and equipment clear of windows, doors, openings, light outlets, and other

services and utilities. Follow manufacturer's published recommendations for installation methods not otherwise specified.

B. Protection and Cleaning:

1. Equipment and materials shall be carefully handled, properly stored, and adequately protected to prevent damage before and during installation, in accordance with the manufacturer's recommendations and as approved by the Resident Engineer. Damaged or defective items in the opinion of the Resident Engineer, shall be replaced.
2. Protect all finished parts of equipment, such as shafts and bearings where accessible, from rust prior to operation by means of protective grease coating and wrapping. Close pipe openings with caps or plugs during installation. Tightly cover and protect fixtures and equipment against dirt, water chemical, or mechanical injury. At completion of all work thoroughly clean fixtures, exposed materials and equipment.

C. Concrete and Grout: Use concrete and shrink compensating grout 25 MPa (3000 psi) minimum, specified in Section 03301, CAST-IN-PLACE CONCRETE.

D. Install gages, thermometers, valves and other devices with due regard for ease in reading or operating and maintaining said devices. Locate and position thermometers and gages to be easily read by operator or staff standing on floor or walkway provided. Servicing shall not require dismantling adjacent equipment or pipe work.

E. Work in Existing Building:

1. Perform as specified in Article, OPERATIONS AND STORAGE AREAS, Article, ALTERATIONS, and Article, RESTORATION of the Section 01010, GENERAL REQUIREMENTS for relocation of existing equipment, alterations and restoration of existing building(s).
2. As specified in Section 01010, GENERAL REQUIREMENTS, Article, OPERATIONS AND STORAGE AREAS, make alterations to existing service piping at times that will least interfere with normal operation of the facility.
3. Cut required openings through existing masonry and reinforced concrete using diamond core drills. Use of pneumatic hammer type drills, impact type electric drills, and hand or manual hammer type drills, will be permitted only with approval of the Resident Engineer. Locate openings that will least effect structural slabs, columns, ribs or beams. Refer to the Resident Engineer for

determination of proper design for openings through structural sections and opening layouts approval, prior to cutting or drilling into structure. After Resident Engineer's approval, carefully cut opening through construction no larger than absolutely necessary for the required installation.

F. Switchgear Drip Protection: Every effort shall be made to eliminate the installation of pipe above electrical and telephone switchgear. If this is not possible, encase pipe in a second pipe with a minimum of joints.

G. Inaccessible Equipment:

1. Where the Government determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, equipment shall be removed and reinstalled or remedial action performed as directed at no additional cost to the Government.
2. The term "conveniently accessible" is defined as capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as motors, fans, pumps, belt guards, transformers, high voltage lines, piping, and ductwork.

3.2 PIPE AND EQUIPMENT SUPPORTS:

A. Where hanger spacing does not correspond with joist or rib spacing, use structural steel channels secured directly to joist and rib structure that will correspond to the required hanger spacing, and then suspend the equipment and piping from the channels. Drill or burn holes in structural steel only with the prior approval of the Resident Engineer.

B. Use of chain, wire or strap hangers; wood for blocking, stays and bracing; or, hangers suspended from piping above will not be permitted. Replace or thoroughly clean rusty products and paint with zinc primer.

C. Use hanger rods that are straight and vertical. Turnbuckles for vertical adjustments may be omitted where limited space prevents use. Provide a minimum of 15 mm (1/2-inch) clearance between pipe or piping covering and adjacent work.

D. HVAC Horizontal Pipe Support Spacing: Refer to MSS SP-69. Provide additional supports at valves, strainers, in-line pumps and other heavy components. Provide a support within one foot of each elbow.

E. HVAC Vertical Pipe Supports:

1. Up to 150 mm (6-inch pipe), 9 m (30 feet) long, bolt riser clamps to the pipe below couplings, or welded to the pipe and rests supports securely on the building structure.

2. Vertical pipe larger than the foregoing, support on base elbows or tees, or substantial pipe legs extending to the building structure.

F. Plumbing horizontal and vertical pipe supports, refer to the NAPHCC National Standard Plumbing Code.

3.3 MOTOR AND DRIVE ALIGNMENT:

A. Belt Drive: Set driving and driven shafts parallel and align so that the corresponding grooves are in the same plane.

B. Direct-connect Drive: Securely mount motor in accurate alignment so that shafts are free from both angular and parallel misalignment when both motor and driven machine are operating at normal temperatures.

3.4 LUBRICATION:

Field check and lubricate equipment requiring lubrication prior to initial operation.

3.5 STARTUP AND TEMPORARY OPERATION:

Start up equipment as described in equipment specifications. Verify that vibration is within specified tolerance prior to extended operation. Temporary use of equipment is specified in Section 01010, GENERAL REQUIREMENTS, Article, TEMPORARY USE OF MECHANICAL AND ELECTRICAL EQUIPMENT.

3.6 OPERATING AND PERFORMANCE TESTS:

A. Prior to the final inspection, perform required tests as specified in Section 01010, GENERAL REQUIREMENTS, Article, TESTS and submit the test reports and records to the Resident Engineer.

B. Should evidence of malfunction in any tested system, or piece of equipment or component part thereof, occur during or as a result of tests, make proper corrections, repairs or replacements, and repeat tests at no additional cost to the Government.

C. When completion of certain work or system occurs at a time when final control settings and adjustments cannot be properly made to make performance tests, then make performance tests for heating systems and for cooling systems respectively during first actual seasonal use of respective systems following completion of work.

3.7 INSTRUCTIONS TO VA PERSONNEL:

Provide in accordance with Article, INSTRUCTIONS, of Section 01010, GENERAL REQUIREMENTS or as required in the Division 15000 specifications.

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**SECTION 15139
PUMPS (PLUMBING)**

PART 1 - GENERAL

1.1 DESCRIPTION

Hot water circulating pump

1.2 RELATED WORK

- A. Section 15050, BASIC METHODS AND REQUIREMENTS (MECHANICAL).
- B. Section 16155, MOTOR STARTERS.
- C. Section 16150, MOTORS.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01340, SAMPLES AND SHOP DRAWINGS.
- B. Manufacturer's Literature and Data:
 - 1. Pump:
 - a. Manufacturer and model.
 - b. Operating speed.
 - c. Capacity.
 - d. Characteristic performance curves.
 - 2. Motor:
 - a. Manufacturer.
 - b. Speed.
 - c. Current Characteristics and W (HP).
 - d. Efficiency.
- C. Certified copies of all of the factory and construction site test data sheets and reports.
- D. Complete operating and maintenance manuals including wiring diagrams, technical data sheets and information for ordering replaceable parts:
 - 1. Include complete connection which indicate all components of the system.
 - 2. Include complete diagrams of the internal wiring for each item of equipment.
 - 3. Diagrams shall have their terminals identified to facilitate installation, operation and maintenance.

1.4 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. National Electrical Manufacturers Association (NEMA):

ICS-6-93.....Industrial Control and Systems Enclosures
250-91.....Enclosures for Electrical Equipment (1000
Maximum)

- C. American Society of Mechanical Engineers (ASME):
Boiler and Pressure Vessel Code: 1995
Section VIII.....Pressure Vessels, Division I and II.
- D. Underwriters' Laboratories, Inc. (UL):
508-94.....Safety Industrial Control Equipment

PART 2 - PRODUCTS

2.1 CIRCULATING PUMP

- A. Use for hot water systems. Pump for hot water system shall be designed for 65 degrees C (150 degrees F) water service. Centrifugal, single stage, constructed to prevent contact of water with metal other than nonferrous, except casing. Driver shall be electric motor, close coupled or connected by flexible coupling.
- B. Mounting shall be either of the following:
 - 1. In-line mounted.
 - 2. Floor mounted set on common bed plate with drip lip.
- C. Casings: Cast iron, vertically or horizontally split.
- D. Impeller: High grade, cast brass or bronze, accurately machined and properly balanced.
- E. Motors: Maximum 40 degrees C ambient temperature rise, dripproof, for operation with current of voltage, phase and cycle shown in schedule on Electrical drawings, conforming to NEMA 250-Type 4. Capacity to be such to operate pump without overloading. In-line pump motors shall not exceed 1800 rpm and be provided with spring mountings or other devices to assure quiet operation.
- F. Pump shall operate continuously with "on-off" switch for shut down.

PART 3 - EXECUTION

3.1 TEST

- A. Make tests under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.
- B. When any defects are detected, correct defects and repeat test.

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**SECTION 15140
PUMPS (HVAC)**

PART 1 - GENERAL

1.1 DESCRIPTION:

- A. Pumps for Heating, Ventilating, and Air Conditioning.
- B. Definitions:
 - 1. Capacity: Liters per second (L/s) (Gallons per minute (GPM)) of the fluid pumped.
 - 2. Head: Total dynamic head in kPa (feet) of the fluid pumped.
 - 3. Flat head-capacity curve: Where the shutoff head is less than 1.16 times the head at the best efficiency point.

1.2 RELATED WORK:

- A. Section 15050, BASIC METHODS AND REQUIREMENTS (MECHANICAL).
- B. Section 15200, NOISE AND VIBRATION CONTROL.
- C. Section 15705, HVAC PIPING SYSTEMS.
- D. Section 16155, MOTOR STARTERS.
- E. Section 16150, MOTORS.

1.3 QUALITY ASSURANCE:

- A. Refer to Paragraph, QUALITY ASSURANCE, in Section, BASIC METHODS AND REQUIREMENTS (MECHANICAL).
- B. Design Criteria:
 - 1. Head-capacity curves shall slope up to maximum head at shut-off. Curves shall be relatively flat for closed systems. Select pumps near the midrange of the curve, so the design capacity falls to the left of the best efficiency point, to allow a cushion for the usual drift to the right in operation, without approaching the pump curve end point and possible cavitation and unstable operation. Select pumps for open systems so that required net positive suction head (NPSHR) does not exceed the net positive head available (NPSHA).
 - 2. The head for pumps submitted for pumping through chilled water coils, evaporators and other equipment shall be increased, if necessary, to match the equipment approved for the project.
 - 3. Pump Driver: Furnish with pump. Size to be non-overloading at any point on the head-capacity curve including one pump operation in a parallel or series pumping installation.
- C. Allowable Vibration Tolerance for Pump Units: Section, NOISE AND VIBRATION CONTROL.

1.4 SUBMITTALS:

- A. Submit in accordance with Section 01340, SAMPLES AND SHOP DRAWINGS.
- B. Manufacturer's Literature and Data:
 - 1. Pumps and accessories.
 - 2. Motors and drives.
 - 3. Variable speed motor controllers.
- C. Manufacturer's installation, maintenance and operating instructions in accordance with Section, BASIC METHODS AND REQUIREMENTS (MECHANICAL).
- D. Characteristic Curves: Head-capacity, efficiency-capacity, brake horsepower-capacity, NPSHR-capacity for each pump and for combined pumps in parallel or series service. Identify pump and show fluid pumped, specific gravity, pump speed and curves plotted from zero flow to maximum for the impeller being furnished and at least the maximum diameter impeller that can be used with the casing.

1.5 APPLICABLE PUBLICATIONS:

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only:
- B. American Iron and Steel Institute (AISI):
 - AISI 1045.....Cold Drawn Carbon Steel Bar, Type 1045
 - AISI 416.....Stainless Steel, Type 416
- C. American National Standards Institute (ANSI):
 - ANSI B15.1-96.....Safety Standard for Mechanical Power
Transmission Apparatus
 - ANSI B16.1-98.....Cast Iron Pipe Flanges and Flanged Fittings,
Class 25, 125, 250 and 800
- D. American Society for Testing and Materials (ASTM):
 - A48-94a1.....Gray Iron Castings
 - B62-93.....Composition Bronze or Ounce Metal Castings

PART 2 - PRODUCTS

2.1 CENTRIFUGAL PUMPS, BRONZE FITTED:

- A. In-Line Type:
 - 1. Casing and Bearing Housing: Close-grained cast iron, ASTM A48.
 - 2. Casing Wear Rings: Bronze.
 - 3. Suction or Discharge 65 mm (2-1/2 inches) and Larger: Plain face flange, 850 kPa (125 psi), ANSI B16.1.
 - 4. Casing Vent: Manual brass cock at high point.

5. Casing Drain and Gage Taps: 15 mm (1/2-inch) plugged connections minimum size.
6. Bearings: Regreaseable ball or roller type. Provide lip seal and slinger outboard of each bearing.
7. Impeller: Bronze, ASTM B62, enclosed type, keyed to shaft.
8. Shaft: Steel, AISI Type 1045 or stainless steel.
9. Shaft Seal: Manufacturer's standard mechanical type to suit pressure and temperature and fluid pumped.
10. Shaft Sleeve: Bronze or stainless steel.
11. Motor: Furnish with pump. Refer to Section 16150, MOTORS.
12. Suction Diffuser:
 - a. Body: Cast iron with steel inlet vanes and combination diffuser-strainer-orifice cylinder with 5 mm (3/16-inch) diameter openings for pump protection. Provide taps for strainer blowdown and gage connections.
13. Provide adjustable foot support for suction piping.
14. Strainer free area: Not less than five times the suction piping.
15. Provide disposable start-up strainer.
16. Suction Strainer, "Y" Type: Section 15705, HVAC PIPING SYSTEMS.
 - a. May be furnished in lieu of a suction diffuser at the Contractor's option. Provide equivalent support of pump suction piping.

2.2 CONDENSATE PUMP, PAD-MOUNTED

- A. General: Factory assembled unit consisting of vented receiver tank, motor-driven pumps, interconnecting piping and wiring, motor controls (including starters, if necessary) and accessories, designed to receive, store, and pump steam condensate.
- B. Receiver Tank: Cast iron or galvanized steel, with threaded openings for connection of piping and accessories and facilities for mounting float switches. Receivers for simplex pumps shall include all facilities for future mounting of additional pump and controls.
- C. Centrifugal Pumps: Bronze fitted with mechanical shaft seals.
 1. Designed to allow removal of rotating elements without disturbing connecting piping or pump casing mounting.
 2. Shafts: Stainless steel or alloy steel with bronze shaft sleeves.
 3. Bearings: Regreaseable ball or roller type.
 4. Casing wearing rings: Bronze.

- D. Motors: Refer to Section 16150, MOTORS.
- E. Pump Operation:
 - 1. Float Switches: NEMA 1, mounted on receiver tank, to start and stop pumps in response to changes in the water level in the receiver and adjustable to permit the controlled water levels to be changed. Floats and connecting rods shall be copper, bronze or stainless steel.
 - 2. Alternator: Provide for duplex units to automatically start the second pump when the first pump fails in keeping the receiver water level from rising and to alternate the order of starting the pumps. For units 0.25 kW (1/3 horsepower) and smaller, the alternator may be the mechanical type for use in lieu of float switches.
- F. Control Cabinet for 3 Phase (0.37 kW (1/2 hp) and larger) Units: NEMA 1, UL approved, factory wired, enclosing all controls, with indicating lights, manual switches and resets mounted on the outside of the panel. Attach cabinet to the pump set with rigid steel framework, unless remote mounting is noted on the pump schedule.
 - 1. Motor starters: Magnetic contact type with circuit breakers or combination fusible disconnect switches. Provide low voltage control circuits (120 volt maximum) and "on-off-automatic" (H-O-A-) switches for each pump.
 - 2. Indicating lights for each pump: Green to show that power is on, red to show that the pump is running.
- G. Electric Wiring: Suitable for 93 degrees C (200 degrees F) service; enclosed in liquid-tight flexible metal conduit where located outside of control cabinet.
- H. Receiver Accessories:
 - 1. Thermometer: 4-216 degrees C (40 - 420 degrees F), mounted below minimum water level.
 - 2. Water level gage glass: Brass with gage cocks which automatically stop the flow of water when the glass is broken. Provide drain on the lower gage cock and protection rods for the glass.

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. Follow manufacturer's instructions for pump mounting and start-up.
- B. Permanently support in-line pumps by the connecting piping only, not from the casing or the motor eye bolt.

C. Sequence of installation for base-mounted pumps:

1. Level and shim the unit base and grout to the concrete pad.
2. Shim the driver and realign the pump and driver. Correct axial, angular or parallel misalignment of the shafts.
3. Connect properly aligned and independently supported piping.
4. Recheck alignment.

D. Pad-Mounted Condensate Pump: Level, shim, bolt, and grout the unit base onto the concrete pad.

3.2 START-UP:

- A. Verify that the piping system has been flushed, cleaned and filled.
- B. Prime the pump, vent all air from the casing and verify that the rotation is correct. To avoid damage to mechanical seals, never start or run the pump in dry condition.
- C. After several days operation, remove the disposable start-up strainer in the suction diffuser.
- D. Perform field mechanical balancing if necessary to meet specified vibration tolerance.

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**SECTION 15200
NOISE AND VIBRATION CONTROLS**

PART 1 - GENERAL

1.1 DESCRIPTION:

Noise criteria, seismic restraints for equipment, vibration tolerance, and vibration isolation for HVAC and plumbing work.

1.2 RELATED WORK:

- A. Section 15050, BASIC METHODS AND REQUIREMENTS (MECHANICAL).
- B. Flexible Pipe Connectors to Reciprocating and Rotating Mechanical Equipment: Section 15705, HVAC PIPING SYSTEMS.
- C. Air Handling Unit Internal Vibration Isolation: Section 15763, AIR HANDLING UNITS.
- D. Flexible Duct Connectors, Sound Attenuators and Sound Absorbing Duct Lining: Section 15840, DUCTWORK AND ACCESSORIES.
- E. Sound Tests and Vibration Tests: Section 15980, TESTING, ADJUSTING AND BALANCING.

1.3 QUALITY ASSURANCE:

- A. Refer to article, QUALITY ASSURANCE in Section 15050, BASIC METHODS AND REQUIREMENTS (MECHANICAL).
- B. Noise Criteria:
 - 1. Noise levels in all 8 octave bands due to equipment and duct systems shall not exceed NC 35 within the occupied room, except as follows:

TYPE OF ROOM	NC LEVEL
Patient Rooms	35
Conference Rooms	35
Offices, small private	35
Offices, large open	40
Lobbies, Waiting Areas	40
Corridors (Public)	40
Bath Rooms and Toilet Rooms	40

- 2. For equipment which has no sound power ratings scheduled on the plans, the contractor shall select equipment such that the foregoing noise criteria, local ordinance noise levels, and OSHA requirements are not exceeded. Selection procedure shall be in accordance with ASHRAE 2003 HVAC Applications Handbook, Chapter 47, SOUND AND VIBRATION CONTROL.

3. An allowance, not to exceed 5db, may be added to the measured value to compensate for the variation of the room attenuating effect between room test condition prior to occupancy and design condition after occupancy which may include the addition of sound absorbing material, such as, furniture. This allowance may not be taken after occupancy. The room attenuating effect is defined as the difference between sound power level emitted to room and sound pressure level in room.
4. In absence of specified measurement requirements, measure equipment noise levels three feet from equipment and at an elevation of maximum noise generation.

C. Seismic Restraint Requirements:

1. For equipment:

- a. All mechanical equipment not supported with isolators external to the unit shall be securely anchored to the structure. Such mechanical equipment, shall be properly supported to resist a horizontal force of 50 percent of the weight of the equipment furnished.
- b. All mechanical equipment mounted on vibration isolators shall be provided with seismic restraints capable of resisting a horizontal force of 100 percent of the weight of the equipment furnished.

2. For piping: Section 15050, BASIC METHODS AND REQUIREMENTS (MECHANICAL) (MECHANICAL) .

3. For ductwork: Section 15840, DUCTWORK AND ACCESSORIES.

- D. Allowable Vibration Tolerances for Rotating, Non-reciprocating Equipment: Not to exceed a self-excited vibration maximum velocity of 5 mm per second (0.20-inch per second) RMS, filter in, when measured with a vibration meter on bearing caps of machine in vertical, horizontal and axial directions or measured at equipment mounting feet if bearings are concealed. Measurements for internally isolated fans and motors may be made at the mounting feet.

- E. All suspended piping, ductwork, conduit and cable trays shall be provided with seismic sway braces in accordance with the Mason Industries Seismic Restraint Guidelines for Suspended Piping, Ductwork and Electrical Systems and the applicable codes. Seismic sway braces shall consist of galvanized steel aircraft cables or steel

angles/channels. Steel aircraft cables shall be prestretched to establish a certified minimum modulus of elasticity. Cable braces shall be designed to resist seismic tension loads and steel braces shall be designed to resist both tension and compression loads with a minimum safety factor of 2. Brace end connections shall be steel assemblies that swivel to the final installation angle. Do not mix cable and steel braces to brace the same system. Steel angles or strut channels, when required, shall be clamped to the threaded hanger rods at the seismic sway brace locations utilizing a minimum of two ductile iron clamps. The bracing system shall have an Anchorage Preapproval "OPA" number from OSHPD in the State of California verifying its capability to resist seismic forces. Cable brace assemblies shall be Type SCB, steel brace assemblies shall be Type SSB, rod clamps shall be either Type SRC or UC, pipe clevis braces shall be Type CCB and multiple anchor load distribution brackets shall be Type SLDB all as manufactured by Mason Industries, Inc.

1.4 SUBMITTALS:

- A. Submit in accordance with Section 01340, SAMPLES AND SHOP DRAWINGS.
- B. Manufacturer's Literature and Data:
 - 1. Vibration isolators:
 - a. Floor mountings.
 - b. Hangers.
 - c. Snubbers.
 - d. Thrust restraints.
 - 2. Bases.
 - 3. Seismic restraint provisions and bolting.
- C. Isolator manufacturer shall furnish with submittal load calculations for selection of isolators, including supplemental bases, based on lowest operating speed of equipment supported.
- D. Seismic Requirements: Submittals are required for all equipment anchors, supports and seismic restraints. Submittals shall include weights, dimensions, standard connections, manufacturer's recommendations, behavior problems (vibration, thermal, expansion etc.) associated with equipment or piping.

1.5 APPLICABLE PUBLICATIONS:

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE):
- C. Systems Handbook 2003, Chapter 47, Sound and Vibration Control.
- D. American Society for Testing and Materials (ASTM):
 - A123-89.....Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
 - A307-94.....Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
 - D2240-91.....Standard Test Method for Rubber Property - Durometer Hardness
- E. Manufacturers Standardization (MSS):
 - SP-58-93.....Pipe Hangers and Supports-Materials, Design and Manufacture
- F. Occupational Safety and Health Administration (OSHA):
 - 1910.....Occupational Noise Exposure

PART 2 - PRODUCTS

2.1 GENERAL:

Type of isolator, base, and minimum static deflection shall be as required for each specific equipment application as recommended by isolator or equipment manufacturer but subject to minimum requirements indicated in the schedule on the drawings.

2.2 VIBRATION ISOLATORS:

- A. Floor Mountings:
 - 1. Double Deflection Neoprene (Type N): Shall include neoprene covered steel support plated (top and bottom), friction pads, and necessary bolt holes.
 - 2. Spring Isolators (Type S): Shall be free-standing, laterally stable and include acoustical friction pads and leveling bolts. Isolators shall have a minimum ratio of spring diameter-to-operating spring height of 1.0 and an additional travel to solid equal to 50 percent of rated deflection.
 - 3. Captive Spring Mount for Seismic (Type SS):

- a. Design mounts to resiliently resist seismic forces in all directions. Snubbing shall take place in all modes with adjustment to limit upward, downward, and horizontal travel to a maximum of 6 mm (1/4-inch) before contacting snubbers. Mountings shall be have a minimum rating of one G as calculated and certified by a registered structural engineer.
 - b. All mountings shall have leveling bolts that must be rigidly bolted to the equipment. Spring diameters shall be no less than 0.8 of the compressed height of the spring at rated load. Springs shall have a minimum additional travel to solid equal to 50 percent of the rated deflection. Mountings shall have ports for spring inspection. Provide an all directional neoprene cushion collar around the equipment bolt.
4. Spring Isolators with Vertical Limit Stops (Type SP): Similar to spring isolators preceding, except include a vertical limit stop to limit upward travel if weight is removed and also to reduce movement due to wind loads. Provide clearance around restraining bolts to prevent mechanical short circuiting. Isolators shall have a minimum seismic rating of one G.
 5. Pads (Type D), Washers (Type W), and Bushings (Type L): Pads shall be felt, cork, neoprene waffle, neoprene and cork sandwich, neoprene and fiberglass, neoprene and steel waffle, or reinforced duck and neoprene. Washers and bushings shall be reinforced duck and neoprene. Size pads for a maximum load of 345 kPa (50 pounds per square inch).
 6. Seismic Pad (Type DS): Pads shall be felt, cork neoprene waffle, neoprene and cork sandwich, neoprene and fiberglass, neoprene and steel waffle, or reinforced duck and neoprene, with steel top plate and drilled for an anchor bolt. Washers and bushings shall be reinforced duck and neoprene. Size pads for a maximum load of 345 kPa (50 pounds per square inch).
- B. Hangers: Shall be combination neoprene and springs unless otherwise noted and shall allow for expansion of pipe.
1. Combination Neoprene and Spring (Type H): Vibration hanger shall contain a spring and double deflection neoprene element in series. Spring shall have a diameter not less than 0.8 of compressed operating spring height. Spring shall have a minimum additional travel

- of 50 percent between design height and solid height. Spring shall permit a 15 degree angular misalignment without rubbing on hanger box.
2. Spring Position Hanger (Type HP): Similar to combination neoprene and spring hanger except hanger shall hold piping at a fixed elevation during installation and include a secondary adjustment feature to transfer load to spring while maintaining same position.
 3. Neoprene (Type HN): Vibration hanger shall contain a double deflection type neoprene isolation element. Hanger rod shall be separated from contact with hanger bracket by a neoprene grommet.
 4. Spring (Type HS): Vibration hanger shall contain a coiled steel spring in series with a neoprene grommet. Spring shall have a diameter not less than 0.8 of compressed operating spring height. Spring shall have a minimum additional travel of 50 percent between design height and solid height. Spring shall permit a 15 degree angular misalignment without rubbing on hanger box.
 5. Hanger supports for piping 50 mm (2-inches) and larger shall have a pointer and scale deflection indicator.
- C. Snubbers: Each spring mounted base shall have a minimum of four all-directional or eight two directional (two per side) seismic snubbers that are double acting. Elastomeric materials shall be shock absorbent neoprene bridge quality bearing pads, maximum 60 durometer, replaceable and have a minimum thickness of 6 mm (1/4-inch). Air gap between hard and resilient material shall be not less than 3 mm (1/8-inch) nor more than 6 mm (1/4-inch). Restraints shall be capable of withstanding design load without permanent deformation.
- D. Thrust Restraints (Type THR): Restraints shall provide a spring element contained in a steel frame with neoprene pads at each end attachment. Restraints shall have factory preset thrust and be field adjustable to allow a maximum movement of 6 mm (1/4-inch) when the fan starts and stops. Restraint assemblies shall include rods, angle brackets and other hardware for field installation.

2.3 BASES:

- A. Rails (Type R): Design rails with isolator brackets to reduce mounting height of equipment and cradle machines having legs or bases that do not require a complete supplementary base. To assure adequate stiffness, height of members shall be a minimum of 1/12 of longest base

dimension but not less than 100 mm (four-inches). Where rails are used with neoprene mounts for small fans or close coupled pumps, extend rails to compensate overhang of housing.

- B. Integral Structural Steel Base (Type B): Design base with isolator brackets to reduce mounting height of equipment which require a complete supplementary rigid base. To assure adequate stiffness, height of members shall be a minimum of 1/12 of longest base dimension, but not less than 100 mm (four-inches).
- C. Inertia Base (Type I): Base shall be a reinforced concrete inertia base. Pour concrete into a welded steel channel frame, incorporating prelocated equipment anchor bolts and pipe sleeves. Level concrete to provide a smooth uniform bearing surface for equipment mounting. Provide grout under uneven supports. Channel depth shall be a minimum of 1/12 of longest dimension of base but not less than 150 mm (six inches). Form shall include 13 mm (1/2-inch) reinforcing bars welded in place on minimum of 203 mm (eight inch) centers running both ways in a layer 40 mm (1-1/2 inches) above bottom. Use height saving brackets in all mounting locations. Weight of inertia base shall be equal to or greater than weight of equipment supported to provide a maximum peak-to-peak displacement of 2 mm (1/16-inch).
- D. Curb Mounted Isolation Base (Type CB): Fabricate from aluminum to fit on top of standard curb with overlap to allow water run-off and have wind and water seals which shall not interfere with spring action. Provide resilient snubbers with 6 mm (1/4-inch) clearance for wind resistance. Top and bottom bearing surfaces shall have sponge type weather seals. Integral spring isolators shall comply with Spring Isolator (Type S) requirements.

2.4 GENERAL ISOLATOR REQUIREMENTS:

- A. Elastomeric isolators shall comply with ASTM D2240 and be oil resistant neoprene with a maximum stiffness of 60 durometer and have a straight-line deflection curve.
- B. Exposure to Weather: Isolators, including springs, exposed to weather shall be hot-dip galvanized after fabrication. Hot-dip zinc coating shall be not less than 609 grams per square meter (two ounces per square foot) by weight complying with ASTM A123. In addition, provide limit stops to resist wind velocity. Comply with the design wind velocity for hurricane areas as per VA Construction Standard CD-54.

- C. Uniform Loading: Select and locate isolators to produce uniform loading and deflection even when equipment weight is not evenly distributed.
- D. Color code isolator by type and size for easy identification of capacity.

2.5 SEISMIC RESTRAINT REQUIREMENTS FOR EQUIPMENT:

- A. Bolt pad mounted equipment, without vibration isolators, to the floor or other support using ASTM A307 standard bolting material; or, equal.
- B. Floor Mounted Equipment, With Vibration Isolators: Type SS. Where Type N isolators are used provide channel frame lease horizontal restraints bolted to the floor, or other support, on all sides of the equipment. Size and material required for the lease shall be as recommended by the isolator manufacturer.
- C. On all sides of suspended equipment, provide bracing for rigid supports and provide restraints for resiliently supported equipment. The slack cable restraint method, Mason Industries, or equal, is acceptable.

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. Vibration Isolation:
 - 1. No metal-to-metal contact will be permitted between fixed and floating parts.
 - 2. Connections to Equipment: Allow for deflections equal to or greater than equipment deflections. Electrical, drain, piping connections, and other items made to rotating or reciprocating equipment (pumps, compressors, etc.) which rests on vibration isolators, shall be isolated from building structure for first three hangers or supports.
 - 3. Common Foundation: Mount each electric motor on same foundation as driven machine. Hold driving motor and driven machine in positive rigid alignment with provision for adjusting motor alignment and belt tension. Bases shall be level throughout length and width. Provide shims to facilitate pipe connections, leveling, and bolting.
 - 4. Provide heat shields where elastomers are subject to temperatures over 38 degrees C (100 degrees F).
 - 5. Extend bases for pipe elbow supports at discharge and suction connections at pumps. Pipe elbow supports shall not short circuit pump vibration to structure.

6. Non-rotating equipment such as heat exchangers and convertors shall be mounted on isolation units having the same static deflection as the isolation hangers or support of the pipe connected to the equipment.

B. Inspection and Adjustments: Check for vibration and noise transmission through connections, piping, ductwork, foundations, and walls. Adjust, repair, or replace isolators as required to reduce vibration and noise transmissions to specified levels.

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SECTION 15250
INSULATION

PART 1 - GENERAL

1.1 DESCRIPTION:

- A. Field applied insulation for thermal efficiency and condensation control for HVAC and plumbing piping, ductwork and equipment. Re-insulate steam, HVAC and plumbing piping, and ductwork systems after asbestos abatement.
- B. Definitions
 - 1. ASJ: All service jacket, white finish facing or jacket.
 - 2. Air conditioned space: Space directly supplied with heated or cooled air.
 - 3. Cold: Equipment, ductwork or piping handling media at design temperature of 16 °C (60 °F) or below.
 - 4. Concealed: Ductwork and piping above ceilings and in chases, interstitial space, and pipe spaces.
 - 5. Exposed: Piping, ductwork, and equipment exposed to view in finished areas including mechanical and electrical equipment rooms or exposed to outdoor weather. Attics and crawl spaces where air handling units are located are considered to be mechanical rooms. Shafts, chases, interstitial spaces, unfinished attics, crawl spaces and pipe basements are not considered finished areas.
 - 6. FSK: Foil-scrim-kraft facing.
 - 7. Hot: Ductwork handling air at design temperature above 16 °C (60 °F); equipment or piping handling media above 41 °C (105 °F).
 - 8. Kcm: Density, kilograms per cubic meter (Pcf: Density, pounds per cubic foot).
 - 9. Runout: Branch pipe connection up to 25 mm (one inch) nominal size to a floor mounted fan coil unit.
 - 10. Thermal conductance: Heat flow rate through materials.
 - a. Flat surface: Watt per square meter (BTU per hour per square foot).
 - b. Pipe or cylinder: Watt per square meter (BTU per hour per linear foot).

11. Thermal conductivity (k): Watt per meter, per °C (BTU per inch thickness, per hour, per square foot, per °Fahrenheit temperature difference).
12. HPS: High pressure steam (414 kPa [60 psi] gage and above).
13. HPR: High pressure steam condensate return.
14. MPS: Medium pressure steam (110 kPa [16 psi] gage thru 415 kPa [59 psi] gage).
15. MCR: Medium pressure steam condensate return.
16. LPS: Low pressure steam (103 kPa [15 psi] gage and below).
17. LCR: Low pressure steam condensate return.
18. PC: Pumped condensate.
19. HWS: Hot water heating supply.
20. HWR: Hot water heating return.
21. GH: Hot glycol-water heating supply.
22. GHR: Hot glycol-water heating return.
23. CWS: Chilled water supply.
24. CWR: Chilled water return.
25. GC: Chilled glycol-water supply.
26. GCR: Chilled glycol-water return.
27. RS: Refrigerant suction.

1.2 RELATED WORK:

- A. Section 07250, FIRESTOPPING.
- B. Section 15050, BASIC METHODS AND REQUIREMENTS (MECHANICAL).
- C. Section 15400, PLUMBING SYSTEMS.
- D. Section 15705, HVAC PIPING SYSTEMS.
- E. Factory Insulated Flexible Duct: Section 15840, DUCTWORK AND ACCESSORIES.
- F. Section 01569: ASBESTOS ABATEMENT

1.3 QUALITY ASSURANCE:

- A. Refer to article QUALITY ASSURANCE, in Section 15050, BASIC METHODS AND REQUIREMENTS (MECHANICAL).
- B. Criteria:
 1. Comply with NFPA 90A, particularly paragraphs 2-3.3.1 through 2-3.3.6; 2-3.10.1(a); and 3-4.6.4, parts of which are quoted as follows:
 - a. "2-3.3.1 Supplementary materials such as duct coverings, duct linings, vapor barrier facings, adhesives, fasteners, tapes, and

core materials added to air ducts, plenums, panels, and duct silencers used in duct systems shall have a flame spread rating not over 25 without evidence of continued progressive combustion and a smoke developed rating no higher than 50. If air duct coverings and linings are to be applied with adhesives, they shall be tested as applied with such adhesives, or the adhesives used shall have a flame spread rating not over 25 and a smoke developed rating no higher than 50 when in the final dry state.....".

- b. "2-3.3.2 Air duct, panel, and plenum coverings and linings shall not flame, glow, smolder, or smoke when tested in accordance with similar test for pipe covering, ASTM C411, Standard Test Method for Heat-Surface Performance of High Temperature Thermal Insulation, at the temperature to which they are exposed in service. In no case shall the test temperature be below 250 °F (121 °C)".
- c. "2-3.3.3 Air duct coverings shall not extend through walls or floors required to be fire stopped or required to have a fire resistance rating unless such coverings meet the requirements of 3-4.6.4".
- d. "2-3.3.4 Air duct linings shall be interrupted at fire dampers so as not to interfere with the operation of devices".
- e. "2-3.3.5 Air duct coverings shall not be installed so as to conceal or prevent use of any service opening".
- f. 2-3.3.6 Pipe insulation and coverings shall meet the requirements of 2-3.3.1 and 2-3.3.2 where installed in ducts, plenums, or concealed spaces used as part of the air distribution system".
- g. "2-3.10.1(a) All materials exposed to the airflow shall be noncombustible or limited combustible and have a smoke developed index no higher than 50.....".
- h. "3-4.6.4 Patching, Filling, and Repairing. Where air ducts pass through walls, floors, or partitions required to have a fire resistance rating and where fire dampers are not required, the opening in the construction around the air duct shall not exceed 25 mm (one inch) average clearance on all sides and shall be filled solid with an approved material capable of preventing the passage of flame and hot gases sufficient to ignite cotton waste

when subjected to the same NFPA 251 time-temperature fire condition required for fire barrier penetration....".

2. Test methods: ASTM E84, UL 723, or NFPA 255.
 3. Specified k factors are at 24 °C (75 °F) mean temperature unless stated otherwise. Where optional thermal insulation material is used, select thickness to provide thermal conductance no greater than that for the specified material. For pipe, use insulation manufacturer's published heat flow tables.
 4. All materials shall be compatible and suitable for service temperature, and shall not contribute to corrosion or otherwise attack surface to which applied in either the wet or dry state.
 5. Underwriters Laboratories, Inc., label or listing, or satisfactory certified test report from an approved testing laboratory will be required to show that surface burning characteristics for materials to be used do not exceed specified ratings.
- C. Every package or standard container of insulation or accessories delivered to the job site for use must have a manufacturer's stamp or label giving the name of the manufacturer and description of the material.

1.4 SUBMITTALS:

- A. Submit in accordance with Section 01340, SAMPLES AND SHOP DRAWINGS.
- B. Manufacturer's Literature and Data:
 1. Insulation materials: Each type used. State surface burning characteristics.
 2. Insulation facings and jackets: Each type used. Make it clear that white finish will be furnished for exposed ductwork, casings and equipment.
 3. Insulation accessory materials: Each type used.
 4. Manufacturer's installation and fitting fabrication instructions for flexible unicellular insulation.
 5. Make reference to applicable specification paragraph numbers for coordination.
- C. Samples:
 1. Each type of insulation: Minimum size 100 mm (4 inches) square for board/block/ blanket; 150 mm (6 inches) long, full diameter for round types.

2. Each type of facing and jacket: Minimum size 100 mm (4 inches square).
3. Each accessory material: Minimum 120 ML (4 ounce) liquid container or 120 gram (4 ounce) dry weight for adhesives/cement/mastic.

1.5 APPLICABLE PUBLICATIONS:

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation only.
- B. Federal Specifications (Fed. Spec.):
 - L-P-535E.....Plastic Sheet (Sheeting): Plastic Strip; Poly (Vinyl Chloride) and Poly (Vinyl Chloride - Vinyl Acetate)
 - HH-B-100B.....Barrier Material Vapor (For Pipe, Duct and Equipment Thermal, Insulation)
- C. Military Specifications (Mil. Spec.):
 - MIL-A-3316C AMD 2.....Adhesives, Fire-Resistant, Thermal Insulation
 - MIL-A-24179A NOTICE 1...Adhesive, Flexible Unicellular-Plastic Thermal Insulation
 - MIL-C-19565C(1).....Coating Compounds, Thermal Insulation, Fire-and Water-Resistant, Vapor-Barrier
 - MIL-C-20079H.....Cloth, Glass; Tape, Textile Glass; and Thread, Glass and Wire-Reinforced Glass
- D. American Society for Testing and Materials (ASTM):
 - A167-94.....Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
 - B209-95.....Aluminum and Aluminum-Alloy Sheet and Plate
 - C411 E1-82.....Hot-Surface Performance of High-Temperature Thermal Insulation
 - C449M-95.....Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement
 - C533-95.....Calcium Silicate Block and Pipe Thermal Insulation
 - C534-94.....Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form
 - C547-95.....Mineral Fiber Preformed pipe Insulation
 - C552-91.....Cellular Glass Thermal Insulation

- C553-92.....Mineral Fiber Blanket Thermal Insulation for
Commercial and Industrial Applications
- C585-90.....Inner and Outer Diameters of Rigid Thermal
Insulation for Nominal Sizes of Pipe and Tubing
(NPS System)
- C612-93.....Mineral Fiber Block and Board Thermal
Insulation
- C1126-96.....Faced or Unfaced Rigid Cellular Phenolic
Thermal Insulation
- D1668-94.....Glass Fabrics (Woven and Treated) for Roofing
and Waterproofing
- E84-95.....Surface Burning Characteristics of Building
Materials
- E119-95.....Fire Tests of Building Construction and
Materials
- E136-94.....Behavior of Materials in a Vertical Tube
Furnace at 750 °C
- E. National Fire Protection Association (NFPA):
 - 90A-96.....Installation of Air Conditioning and
Ventilating Systems
 - 96-94.....Standard for Ventilation Control and Fire
Protection of Commercial Cooking Operations
 - 101-97.....Life Safety Code
 - 255-96.....Surface Burning Characteristics of Building
Materials
 - 251-95.....Standard Methods of Fire Tests of Building
Construction and Materials
- F. Underwriters Laboratories, Inc (UL):
 - 723-93.....Tests for Surface Burning Characteristics of
Building Materials

PART 2 - PRODUCTS

2.1 INSULATION FACINGS AND JACKETS:

- A. Fed. Spec. HH-B-100 for Vapor Barrier Types I and II: The mold and mildew test requirement is waived.
 - 1. Type I, low vapor transmission (0.02 perm rating), Beach puncture 50 units: Use for insulation facing on exposed ductwork, casings and equipment, and for pipe insulation jackets. Facings and jackets

shall be white all service type (ASJ) suitable for painting without sizing.

2. Type II, medium vapor transmission, Beach puncture 25 units:
Foil-Scrim-Kraft (FSK) type for concealed ductwork and equipment.
3. Presized Glass Cloth Jacket, Beach puncture 100 units: Not less than 240 grams per square meter (7.8 ounces per square yard), with integral vapor barrier where required; for use where specified and in lieu of Type I or Type II jacket at the Contractor's option.
4. Factory composite materials may be used provided that they have been tested and certified by the manufacturer, and witnessed by the VA to meet Beach puncture units specified above. Witnessing of the test may be waived by the Department of Veterans Affairs.
5. Fire and smoke treatment of jackets and facings shall be permanent. The use of water soluble treatments is not acceptable.
6. Pipe insulation jackets shall have a minimum 40 mm (1 1/2 inch) lap at longitudinal joints and not less than 75 mm (3 inch) butt strips at end joints. Facing on board, blanket and block insulation shall have 50 mm (2 inch) laps or a minimum 75 mm (3 inch) butt strips. Butt strip material shall be the same as the jacket or facing. Laps and butt strips may be self-sealing type with factory applied pressure sensitive adhesive.

B. Metal Protective Jacket:

1. Sheet aluminum: ASTM B209, 3003 alloy, H-14 temper, 0.4 mm (0.016 inch) thick. Provide moisture barrier lining for service temperatures 16 °C (60 °F) or less except where applied over a Type I or II jacket. Longitudinal lap shall be at least 50 mm (2 inches) wide. For service temperatures 16 °C (60 °F) or less, seal all jacket laps in accordance with Mil. Spec. MIL-C-19565, Type II Coating.
2. Fitting covers: Factory fabricated from not lighter than 0.5 mm (0.020 inch) thick type 3003 sheet aluminum.
3. Bands: 20 mm (3/4 inch) wide aluminum on maximum 450 mm (18 inch) centers.
4. Provide metal jackets over insulation as follows:
 - a. All piping and ducts exposed to outdoor weather.
 - b. Piping exposed in building, within 1800 mm (6 feet) of the floor, that connects to sterilizers, kitchen, and laundry equipment.

Jacket may be applied with pop rivets. Provide aluminum angle ring escutcheons at wall, ceiling or floor penetrations.

- c. A 50 mm (2 inch) overlap is required at longitudinal and circumferential joints.

2.2 MINERAL FIBER INSULATION:

- A. Note the NFPA 90A burning characteristic requirements of 25/50 in paragraph 1.3.B. Refer to paragraph 3.1 for items not to be insulated.
- B. ASTM C612 (Board, Block), Class 1 or 2, $k = 0.037$ Watt per meter, per degree C (0.26), external insulation for temperatures up to 204 °C (400 °F).
 1. Exposed, unlined ductwork and equipment in unfinished areas, mechanical and electrical equipment rooms and duct work exposed to outdoor weather:
 - a. 40 mm (1 1/2 inch) thick insulation faced with ASJ (white all service jacket): Supply air duct and after filter housing.
 - b. 25 mm (1 inch) thick insulation faced with ASJ: Return air duct, mixed air plenums and prefilter housing.
 - c. Outside air ducts: 25 mm (one inch) thick insulation faced with ASJ.
 - d. All ducts exposed to outdoor weather: 50 mm (2-inch) thick insulation with metal protective jacket.
 2. Cold equipment: 40 mm (1 1/2 inch) thick insulation faced with ASJ.
 - a. Chilled water pumps, water filter, chemical feeder pot or tank.
 3. Hot equipment: 40 mm (1 1/2 inch) thick insulation faced with ASJ.
 - a. Convertors, air separators.
 - b. Reheat coil casing.
- C. Firestop Pipe and Duct Insulation:
 1. Provide firestopping insulation at fire and smoke barriers through penetrations. Fire stopping insulation shall be UL listed and as defined in Section 07270, FIRESTOPPING.
 2. Pipe and duct penetrations requiring fire stop insulation including, but not limited to the following:
 - a. Pipe risers through mechanical room floors
 - b. Pipe or duct chase walls and floors
 - c. Smoke partitions
 - d. Fire partitions

D. ASTM C553(Blanket, Flexible) Type I, Class B-5, Density 32 kcm (2 pcf),
 k = 0.04 Watt per meter, per degree C (0.27), for use at temperatures
 up to 204 °C (400 °F):

1. Concealed supply air ductwork.
 - a. Above ceilings at a roof level: 50 mm (2 inch) thick insulation
 faced with FSK.
 - b. Above ceilings for other than roof level: 40 mm (1 1/2 inch)
 thick insulation faced with FSK.
2. Concealed return air duct above ceilings at a roof level and in
 chases with external wall or containing steam piping: 40 mm (1 1/2
 inch) thick, insulation faced with FSK. Concealed return air
 ductwork in other locations need not be insulated.
3. Return air duct in interstitial spaces: 40 mm (1 1/2 inch) thick
 insulation faced with FSK.

E. ASTM C547 (Preformed), Class 1, k = 0.037 Watt per meter, per degree C
 (0.26). Pipe and tubing covering, standard thickness by industry
 standard, for temperatures up to 232 °C (450 °F), in nominal thickness
 in millimeters and inches specified in table below, for piping above
 ground:

Nominal Pipe Size, millimeters (inches):	Nominal Thickness of Insulation		
	25 (1) & below	32- 75 (1-1/4- 3)	100-150 (4-6)
122-177 °C (251-350 F) (HPS, HPR, MPS, MCR)	50 (2.0)	65 (2.5)	90 (3.5)
100-121 °C (212-250 °F) (LPS, Vents for PRV safety valves receivers and flash tanks)	40 (1.5)	50 (2.0)	50 (2.0)
38-99 °C (100-211 °F) (LCR, PC, HWS, HWR, GH, GHR)	40 (1.5)	40 (1.5)	40 (1.5)
Runouts to unit heaters and cabinet heaters	15 (0.5)	-	-
Runouts to air terminal unit reheat coils	15 (0.5)	-	-
4-16 °C (40-60 °F) (CWS, CWR, GC, GCR)	25 (1.0)	40 (1.5)	50 (2.0)
Domestic hot water supply and return	25 (1.0)	40 (1.5)	40 (1.5)

1. Condensation control insulation: Minimum 20 mm (0.75 inches) thick for all pipe sizes.
 - a. HVAC: Cooling coil condensation piping to waste piping fixture or inlet.
 - b. Plumbing piping as follows:
 - 1) Body of roof and overflow drains horizontal runs and offsets (including elbows) of interior downspout piping in all areas above pipe basement.
 - 2) Waste piping from electric water coolers to drainage system.
 - 3) Waste piping located above basement floor from air handling units, from fixture (including trap) to main vertical waste pipe.
 - 4) Cold water piping.
2. Above grade outdoor piping: Add 25 mm (one inch) thickness, with metal jacket, for all pipe sizes to thicknesses listed above. Provide for cold water make-up to heating and chilled water piping as described in Section 15705, HVAC PIPING SYSTEMS (Electrical Heating Tracing Systems). Minimum R-Value for outdoor cold water piping shall be R-3.

F. ASTM C547 (Preformed), $k = 0.037$ Watt per meter, per degree C (0.26), Molded Pipe Fitting Covering, for temperatures up to 232 °C (450 °F):

1. This factory made fitting insulation may be used at the Contractor's option. Refer to paragraph 3.2 for fitting options.

2.3 RIGID CELLULAR PHENOLIC INSULATION:

- A. Rigid cellular phenolic insulation may be provided for piping, equipment, and ductwork for temperatures up to 121 °C (250 °F) in lieu of mineral fiber insulation. Insulating efficiency of rigid cellular phenolic must not be less than that of the specified thickness of mineral fiber insulation, where thickness of rigid cellular phenolic insulation is not specified.
- B. Note the NFPA 90A burning characteristic requirements of 25/50 in paragraph 1.3B. Refer to paragraph 3.1 for items not to be insulated.
- C. Preformed (molded) pipe insulation, ASTM C1126, type III, grade 1, $k = 0.021$ Watt per meter, per degree C (0.15), for temperatures up to 121 °C (250 °F) with vapor barrier and all service jacket with polyvinyl chloride premolded fitting covering..

D. Equipment and Duct Insulation, ASTM C 1126, type II, grade 1, $k = 0.021$ Watt per meter, per degree C (0.15), for temperatures up to 121 °C (250 °F). with rigid cellular phenolic insulation and covering, vapor barrier and all service jacket.

E. Firestop Pipe and Duct Insulation: As described under Mineral Fiber Insulation paragraph 2.2.

2.4 FLEXIBLE ELASTOMERIC CELLULAR THERMAL INSULATION:

A. ASTM C534, $k = 0.033$ Watt per meter, per degree C (0.27), flame spread not over 25, smoke developed not over 100, for temperatures from minus 4 °C (40 °F) to 93 °C (200 °F). No jacket required.

B. Pipe Insulation: Insulating efficiency of flexible elastomeric cellular insulation shall not be less than that of the specified thickness of mineral fiber insulation, where thickness of flexible elastomeric cellular insulation is not specified.

C. Use Class S (Sheet), 20 mm (3/4 inch) thick for the following:
 Chilled water pumps

1. Chillers, insulate any cold chiller surfaces subject to condensation which has not been factory insulated.

2.5 INSULATION ACCESSORY MATERIALS:

A. Insulation inserts at pipe supports: Provide for all insulated piping. Install with metal insulation shields furnished with pipe supports, Section, BASIC METHODS AND REQUIREMENTS (MECHANICAL).

1. Material: Premolded, high density mineral fiber blocks, minimum density 320 kcm (20 pcf), of same thickness as adjacent insulation.

Nominal Pipe Size, Millimeters (Inches)	Insert Blocks Millimeters (Inches)
Up through 125 (5)	150 (6) long
150 (6)	150 (6) long

2. Optional insert material: 82 °C (180 °F) segment of cellular glass or mineral fiber 144 kcm (9 pcf) minimum density insert.

B. Adhesive, Mastic, Cement:

1. Mil. Spec. MIL-A-3316, Class 1: Jacket and lap adhesive and protective finish coating for insulation.
2. Mil. Spec. MIL-A-3316, Class 2: Adhesive for laps and for adhering insulation to metal surfaces.

3. Mil. Spec. MIL-A-24179, Type II Class 1: Adhesive for installing flexible unicellular insulation and for laps and general use.
4. Mil. Spec. MIL-C-19565, Type I: Protective finish for outdoor use.
5. Mil. Spec. MIL-C-19565, Type I or Type II: Vapor barrier compound for indoor use.
6. ASTM C449: Mineral fiber hydraulic-setting thermal insulating and finishing cement.
7. Other: Insulation manufacturers' published recommendations.

C. Mechanical Fasteners:

1. Pins, anchors: Welded pins, or metal or nylon anchors with tin-coated or fiber washer, or clips. Pin diameter shall be as recommended by the insulation manufacturer.
2. Staples: Outward clinching monel or stainless steel.
3. Wire: 1.3 mm thick (18 gage) soft annealed galvanized, or 1.9 mm (14 gage) copper clad steel or nickel copper alloy.
4. Bands: 20 mm (3/4 inch) nominal width, brass, galvanized steel, aluminum or stainless steel.

D. Reinforcement and Finishes:

1. Glass fabric, open weave: ASTM D1668, Type III (resin treated) and Type I (asphalt treated).
2. Glass fiber fitting tape: Mil. Spec. MIL-C-20079, Type II, Class 1.
3. Tape for Flexible Unicellular Insulation: Scotch No. 472, Nashua PE-12, or approved equal recommended by the insulation manufacturer.
4. Hexagonal wire netting: 25 mm (one inch) mesh, 0.85 mm thick (22 gage) galvanized steel.
5. Corner beads: 50 mm (2 inch) by 50 mm (2 inch), 0.55 mm thick (26 gage) galvanized steel; or, 25 mm (1 inch) by 25 mm (1 inch), 0.47 mm thick (28 gage) aluminum angle adhered to 50 mm (2 inch) by 50 mm (2 inch) Kraft paper.
6. PVC fitting cover: Fed. Spec. L-P-535, Composition A, 11-86 Type II, Grade GU, with Form B Mineral Fiber insert, for media temperature °C (40 °F) to 121 °C (250 °F). Below 4 °C (40 °F) and above 121 °C (250 °F) provide double layer insert. Provide color matching, vapor barrier, pressure sensitive tape.

E. Firestopping Material, Other Than Pipe and Duct Insulation: Refer to Section 07270 FIRESTOPPING.

PART 3 - EXECUTION

3.1 GENERAL INSULATION REQUIREMENTS:

- A. Required pressure tests of joints and connections shall be completed and the work approved by the Resident Engineer for application of insulation. Surface shall be clean and dry with all foreign materials, such as dirt, oil, loose scale and rust removed.
- B. Except for specific exceptions, insulate entire specified equipment, piping, (pipe, fittings, valves, accessories) and duct systems. Insulate each pipe and duct individually. Do not use scrap pieces of insulation where a full length section will fit.
- C. Where removal of insulation of piping and equipment is required to comply with Section 01569, Asbestos Abatement, such areas shall be reinsulated to comply with this specification.
- D. Insulation materials shall be installed in a first class manner with smooth and even surfaces, with jackets and facings drawn tight and smoothly cemented down at all laps. Insulation shall be continuous through all sleeves and openings, except at fire dampers and duct heaters (NFPA 90A). Vapor barriers shall be continuous and uninterrupted throughout systems with operating temperature 16 °C (60 °F) and below. Lap and seal vapor barrier over ends and exposed edges of insulation. Anchors, supports and other metal projections through insulation on cold surfaces shall be insulated and vapor sealed for a minimum length of 150 mm (6 inches).
- E. Construct insulation on parts of equipment such as chilled water pumps and heads of chillers, convertors and heat exchangers, that must be opened periodically for maintenance or repair, so insulation can be removed and replaced without damage. Install insulation with bolted 1 MM THICK (20 gage) galvanized steel or aluminum covers as complete units, or in sections, with all necessary supports, and split to coincide with flange/split of the equipment.
- F. Insulation on hot piping and equipment shall be terminated square at items not to be insulated, access openings and nameplates. Cover all exposed raw insulation with white sealer or jacket material.
- G. HVAC work not to be insulated:
 - 1. Internally insulated ductwork and air handling units. Omit insulation on relief air ducts (Economizer cycle exhaust air).
 - 2. Exhaust air ducts and plenums, and ventilation exhaust air shafts.

3. Equipment: Expansion tanks, flash tanks, hot water pumps.
 4. In hot piping: Unions, flexible connectors, control valves, PRVs, safety valves and discharge vent piping, vacuum breakers, thermostatic vent valves, steam traps 20 mm (3/4 inch) and smaller, exposed piping through floor for convectors and radiators. Insulate piping to within approximately 75 mm (3 inches) of uninsulated items.
- H. Plumbing water work not to be insulated:
1. Piping and valves of fire protection system.
 2. Chromium plated brass piping.
 3. Small horizontal cold water branch runs in partitions to individual fixtures may be without insulation for maximum distance of 900 mm (3 feet).
- I. Apply insulation materials subject to the manufacturer's recommended temperature limits. Apply adhesives, mastic and coatings at the manufacturer's recommended minimum coverage.

3.2 INSULATION INSTALLATION:

- A. Mineral Fiber Board:
1. Faced board: Apply board on pins spaced not more than 300 mm (12 inches) on center each way, and not less than 75 mm (3 inches) from each edge of board. In addition to pins, apply insulation bonding adhesive to entire underside of horizontal metal surfaces. Butt insulation edges tightly and seal all joints with laps and butt strips. After applying speed clips, cut pins off flush and apply vapor seal patches over clips.
 2. Plain board:
 - a. Insulation shall be scored, beveled or mitered to provide tight joints and be secured to equipment with bands spaced 225 mm (nine inches) on center for irregular surfaces or with pins and clips on flat surfaces. Use corner beads to protect edges of insulation.
 - b. For hot equipment: Stretch 25 mm (1 inch) mesh wire, with edges wire laced together, over insulation and finish with insulating and finishing cement applied in one coat, 6 mm (1/4 inch) thick, trowelled to a smooth finish.
 - c. For cold equipment: Apply 3000 mm by 3000 mm (10 ft by 10 ft) mesh glass fabric in a tack coat 1.5 to 1.7 square meter per

liter (60 to 70 square feet per gallon) of vapor barrier mastic and finish with mastic at 0.3 to 0.4 square meter per liter (12 to 15 square feet per gallon) over the entire fabric surface.

- d. Chilled water pumps: Insulate with removable and replaceable 1 mm thick (20 gage) aluminum or galvanized steel covers lined with insulation. Seal closure joints/flanges of covers with gasket material. Fill void space in enclosure with flexible mineral fiber insulation.

B. Flexible Mineral Fiber Blanket:

1. Adhere insulation to metal with 100 mm (4 inch) wide strips of insulation bonding adhesive at 200 mm (8 inches) on center all around duct. Additionally secure insulation to bottom of ducts exceeding 600 mm (24 inches) in width with pins welded or adhered on 450 mm (18 inch) centers. Secure washers on pins. Butt insulation edges and seal joints with laps and butt strips. Staples may be used to assist in securing insulation. Seal all vapor barrier penetrations with mastic. Sagging duct insulation will not be acceptable. Install firestop duct insulation where required.
2. Supply air ductwork to be insulated includes main and branch ducts from fan discharge to room supply outlets, and the bodies of ceiling outlets to prevent condensation. Insulate sound attenuator units, coil casings and damper frames. To prevent condensation insulate trapeze type supports and angle iron hangers for flat oval ducts that are in direct contact with metal duct.

C. Molded Mineral Fiber Pipe and Tubing Covering:

1. Fit insulation to pipe or duct, aligning longitudinal joints. Seal longitudinal joint laps and circumferential butt strips by rubbing hard with a nylon sealing tool to assure a positive seal. Staples may be used to assist in securing insulation. Seal all vapor barrier penetrations on cold piping with a generous application of vapor barrier mastic. Provide inserts and install with metal insulation shields at outside pipe supports. Install freeze protection insulation over heating cable.
2. Contractor's options for fitting, flange and valve insulation:
 - a. Insulating and finishing cement for sizes less than 100 mm (4 inches) operating at surface temperature of 16 °C (61 °F) or more.

- b. Factory premolded, one piece PVC covers with mineral fiber, (Form B), inserts. Provide two insert layers for pipe temperatures below 4 °C (40 °F), or above 121 °C (250 °F). Secure first layer of insulation with twine. Seal seam edges with vapor barrier mastic and secure with fitting tape.
 - c. Factory molded, ASTM C547 or field mitered sections, joined with adhesive or wired in place. For hot piping finish with a smoothing coat of finishing cement. For cold fittings, 16 °C (60 °F) or less, vapor seal with a layer of glass fitting tape imbedded between two 2 mm (1/16 inch) coats of vapor barrier mastic.
 - d. Fitting tape shall extend over the adjacent pipe insulation and overlap on itself at least 50 mm (2 inches).
- D. Rigid Cellular Phenolic Insulation:
1. Provide secure attachment facilities such as welding pins.
 2. Apply insulation with joints tightly drawn together .
 3. Apply adhesives, coverings, neatly finished at fittings, and valves.
 4. Final installation shall be smooth, tight, neatly finished at all edges.
- E. Pipe and Duct Insulation at Penetrations of Fire or Smoke Barriers:
1. Wrap pipe or duct with firestop pipe insulation, seal jacket seam and seal end joints to adjacent sections of insulation.
 2. Seal opening between insulation and pipe sleeve with firestopping material.
 3. Among pipe and duct penetrations requiring fire stop insulation are the following:
 - a. Floor (platform) of interstitial space (ducts & pipes).
 - b. Pipe risers through mechanical room floors.
 - c. Pipe or duct chase walls and floors.
 - d. Smoke partitions.
 - e. Fire partitions.
- F. Flexible Elastomeric Cellular Thermal Insulation:
1. Apply insulation and fabricate fittings in accordance with the manufacturer's installation instructions.
 2. Pipe and tubing insulation:
 - a. Use proper size material. Do not stretch or strain insulation.

- b. To avoid undue compression of insulation, provide cork stoppers or wood inserts at supports as recommended by the insulation manufacturer. Insulation shields are specified under Section 15050, BASIC METHODS AND REQUIREMENTS (MECHANICAL).
 - c. Where possible, slip insulation over the pipe or tubing prior to connection, and seal the butt joints with adhesive. Where the slip-on technique is not possible, slit the insulation and apply it to the pipe sealing the seam and joints with contact adhesive. Optional tape sealing, as recommended by the manufacturer, may be employed. Make changes from mineral fiber insulation in a straight run of pipe, not at a fitting. Seal joint with tape.
3. Apply sheet insulation to flat or large curved surfaces with 100 percent adhesive coverage. For fittings and large pipe, adhere the seams only.

G. Weatherproofing Outdoor Insulation:

1. Piping, round and oval ducts: Protective metal jacket.
2. Plenums, casing, fans, rectangular or square ducts and equipment: Apply two coats of weatherproof coating, Mil. Spec. MIL-C-19565, each trowelled or sprayed in place to a wet thickness of 6 mm (1/4 inch), reinforced with open weave glass fabric. After the second layer of mastic has dried, coat and seal with a layer of asphalt aluminum sealer brushed in place.
3. Flexible elastomeric cellular insulation: Finish with two coats of weather resistant finish as recommended by the insulation manufacturer.

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**SECTION 15400
PLUMBING SYSTEMS**

PART 1 - GENERAL

1.1 DESCRIPTION:

Domestic water and sewer systems, including piping, equipment, and all necessary accessories as designated in this section.

1.2 RELATED WORK:

- A. Penetrations in rated enclosures: Section 07270, FIRESTOPPING.
- B. Preparation and finish painting and identification of piping systems: Section 09900, PAINTING.
- C. Section 15050, BASIC METHODS AND REQUIREMENTS (MECHANICAL).
- D. Pipe Insulation: Section 15250, INSULATION.

1.3 SUBMITTALS:

- A. Submit in accordance with Section 01340, SAMPLES AND SHOP DRAWINGS.
- B. Manufacturer's Literature and Data:
 - 1. Piping.
 - 2. Valves.
 - 3. Floor Drains.
 - 4. Roof Drains.
 - 5. Backflow Preventers.
 - 6. Strainers.
 - 7. Pressure Gages.
 - 8. Pressure Reducing Valves.
 - 9. Cleanouts.
 - 10. All items listed in Part 2 - Products.
- C. Detailed shop drawing of clamping device and extensions when required in connection with the waterproofing membrane or the floor drain.

1.4 APPLICABLE PUBLICATIONS:

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. Federal Specifications (Fed. Spec.):
 - L-C-530C.....Coating, Pipe, Thermoplastic Resin
 - L-T-1512A.....Tape, Pressure Sensitive Adhesive, Pipe Wrapping
 - 0-C-114B(2).....Calcium Hypochlorite, Technical
 - 0-S-602E.....Sodium Hypochlorite Solution

BB-C-120C.....Chlorine, Technical, Liquid
WW-U-516B.....Unions, Brass or Bronze Threaded, Pipe
Connections and Solder-Joint Tube Connections
WW-V-35C.....Valve Ball Brass or Bronze
WW-V-1967 INT AMD 1.....Valve, Butterfly (Threaded Ends And Solder
Ends)

C. American National Standards Institute (ANSI):

D. American Society of Mechanical Engineers (ASME): (Copyrighted Society)

A11.21.1M-91.....Floor Drains ANSI/ASME
A13.1-81.....Scheme for Identification of Piping Systems
B16.3-92.....Malleable Iron Threaded Fittings ANSI/ASME
B16.4-92.....Cast Iron Threaded Fittings Classes 125 and 250
ANSI/ASME
B16.9-93.....Factory-Made Wrought Steel Buttwelding Fittings
ANSI/ASME
B16.11-91.....Forged Steel Fittings, Socket-Welding and
Threaded ANSI/ASME
B16.12-83.....Cast Iron Threaded Drainage Fittings ANSI/ASME
B16.15-85.....Cast Bronze Threaded Fittings ANSI/ASME
B16.18-84.....Cast Copper Alloy Solder-Joint Pressure
Fittings ANSI/ASME
B16.22-89.....Wrought Copper and Copper Alloy Solder Joint
Pressure Fittings ANSI/ASME
B31.8-94.....Gas Transmission and Distribution Piping
Systems ANSI/ASME
B40.1-91.....Gauges-Pressure Indicating Dial Type-Elastic
Element ANSI/ASME

E. American Society for Testing and Materials (ASTM):

A47-90.....Ferritic Malleable Iron Castings Revision 1989
A53-95.....Pipe, Steel, Black and Hot-Dipped, Zinc-coated
Welded and Seamless
A74-94.....Cast Iron Soil Pipe and Fittings
A183-83(R1990.....Carbon Steel Track Bolts and Nuts
A312-94.....Seamless and Welded Austenitic Stainless Steel
Pipe
A536-84(R1993.....Ductile Iron Castings

- A733-93.....Welded and Seamless Carbon Steel and Austenitic
Stainless Steel Pipe Nipples
- B32-95.....Solder Metal
- B61-93.....Steam or Bronze Castings
- B62-93.....Composition Bronze or Ounce Metal Castings
- B75-93 (Rev A).....Seamless Copper Tube
- B88-95.....Seamless Copper Water Tube
- B306-95.....Copper Drainage Tube (DWV)
- B584-93.....Copper Alloy Sand Castings for General
Applications Revision A
- B687-88.....Brass, Copper, and Chromium-Plated Pipe Nipples
- C564-95.....Rubber Gaskets for Cast Iron Soil Pipe and
Fittings
- D2000-90.....Rubber Products in Automotive Applications
- D2146-82.....Propylene Plastic Molding and Extrusion
Materials
- D2447-93.....Polyethylene (PE) Plastic Pipe, Schedule 40 and
80, Based on Outside Diameter
- D2564-94.....Solvent Cements for Poly (Vinyl Chloride) (PVC)
Plastic Pipe and Fittings
- D2665-94 Revision A.....Poly (Vinyl Chloride) (PVC) Plastic Drain,
Waste, and Vent Pipe and Fittings
- D4101-91.....Propylene Plastic Injection and Extrusion
Materials
- F. American Water Works Association (AWWA):
- C110-93.....Ductile Iron and Gray Iron Fittings - 75 mm
thru 1200 mm (3 inch thru 48 inches) for Water
and other liquids
- C151-91.....Ductile-Iron Pipe, Centrifugally Cast in Metal
Molds or Sand-Lined Molds, for Water or Other
Liquids
- C203-91.....Coal-Tar Protective Coatings and Linings for
Steel Water Pipelines - Enamel and Tape - Hot
Applied
- C651-92.....Disinfecting Water Mains
- C701-88.....Cold Water Meters-Turbine Type, for Customer
Service

- G. National Fire Protection Association (NFPA):
 - 54-92.....National Fuel Gas Code
- H. American Welding Society (AWS):
 - A5.8-92.....Filler Metals for Brazing
- I. National Association of Plumbing - Heating - Cooling Contractors (PHCC):
 - National Standard Plumbing Code - 1996
- J. Cast Iron Soil Pipe Institute (CISPI):
 - 301-90.....Hubless Cast Iron Soil and Fittings
- K. International Association of Plumbing and Mechanical Officials (IAPMO):
 - Uniform Plumbing Code - 1991
 - IS6-93.....Installation Standard
- L. Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS):
 - SP-67-95.....Butterfly Valve of the Single flange Type (Lug Wafer)
 - SP-70-90.....Cast Iron Gate Valves, Flanged and Threaded Ends.
 - SP-72-92.....General Purpose Ball Valves
 - SP-80-87.....Gate Valve-Bronze
- M. American Society of Sanitary Engineers (ASSE):
 - 1001-70.....Pipe Applied Atmospheric Type Vacuum Breakers
 - 1013-93.....Reduced Pressure Principle Backflow Preventers
 - 1015-93.....Double Check Backflow Prevention Assembly
 - 1018-86.....Performance for trap seal primer valve-water supply fed
 - 1020-81.....Vacuum Breakers, Anti-Siphon, Pressure Type
- N. Factory Mutual (FM):
 - 1680-89.....Coupling Used in Hubless Cast Iron Systems for Drains, Waste and Vent Systems.

PART 2 - PRODUCTS

2.1 SANITARY, WASTE, STORM WATER DRAIN AND VENT PIPING:

- A. Cast Iron Soil Pipe and Fittings: Used for pipe buried in or in contact with earth and for extension of pipe to a distance of approximately 1500 mm (5 feet) outside of building walls and interior waste and vent piping above grade. Pipe shall be bell and spigot, modified hub, or plain end (no-hub) as required by selected jointing method.

1. Material, (Pipe and Fittings): ASTM A74, C1SP1-301, Service Class.
2. Joints: Provide any one of the following types to suit pipe furnished.
 - a. Lead and oakum and caulked by hand.
 - b. Double seal, compression-type molded neoprene gasket. Gaskets shall suit class of pipe being jointed.
 - c. Mechanical: Meet the requirements and criteria for pressure, leak, deflection and shear tests as outlined in Factory Mutual No. 1680 for Class 1 couplings.
 - 1) Stainless steel clamp type coupling of elastomeric sealing sleeve, ASTM C564 and a Series 300 stainless steel shield and clamp assembly. Sealing sleeve with center-stop to prevent contact between pipes/fittings being joined shall be marked ASTM C564.
 - 2) Cast Iron coupling with neoprene gasket and stainless steel bolts and nuts.
 - d. Mechanical Grooved Couplings: Shall consist of ductile iron (ASTM A536, Grade 65-45-12), or malleable iron (ASTM A47, Grade 32510) housings, a pressure responsive elastomeric gasket (ASTM D2000), and steel track head bolts. Shall be for use on pipe and fittings grooved to the manufacturer's specifications. Couplings and fittings to be of the same manufacturer.
 - e. Adapters: Where service weight pipe is connected to extra heavy pipe and extra heavy fittings of chair carriers, provide adapters or similar system to make tight, leakproof joints.
- B. Steel Pipe and Fittings: May be used for vent piping and storm water piping above grade.
 1. Pipe Galvanized: ASTM A53, standard weight.
 2. Fittings:
 - a. Soil, Waste and Drain Piping: Cast iron, ANSI B16.12, threaded, galvanized.
 - b. Sanitary and Exhaust Vent Piping: Malleable iron, ANSI B16.3, or cast iron, ANSI B16.4. All piping shall be of the same kind. Couplings of vent piping may be standard couplings furnished with pipe.
 - c. Unions: Tucker connection or equivalent type throughout.

- d. Mechanical Grooved Couplings: Shall consist of ductile iron (ASTM A536, Grade 65-45-12), or malleable iron (ASTM A47, Grade 32510) housings, a pressure responsive elastomeric gasket (ASTM D2000), and steel track head bolts. Shall be for use on pipe and fittings grooved to the manufacturer's specifications. Couplings and fittings to be of the same manufacturer.
- C. Copper Tube, (DWV): May be used for piping above ground, except for urinal drains.
1. Tube: ASTM B306.
 2. Fittings:
 - a. Solder type.
 - b. Grooved fittings, 50 to 150 mm (2 to 6 inch) wrought copper conforming to ASTM B75 C12200, 125 to 150 mm (5 to 6 inch) bronze casting conforming to ASTM B584, CDA 844(81-3-7-9). Mechanical grooved couplings, ductile iron, ASTM A536 (Grade 65-45-12), or malleable iron, ASTM A47 (Grade 32510) housings, with EPDM gasket, steel track head bolts, ASTM A183, coated with copper colored alkyd enamel.
 3. Joints: ASTM B32, 50/50, special alloy, lead free. Solder using non-corrosive flux.

2.2 INTERIOR DOMESTIC WATER PIPING:

- A. Pipe: Copper tube, ASTM B88, type K or L, drawn.
- B. Fittings for Copper Tube:
 1. Wrought copper or bronze castings conforming to ANSI B16.18 and B16.22. Unions shall be bronze, Fed. Spec. WW-U-516. Solder or braze joints.
 2. Grooved fittings, 50 to 150 mm (2 to 6 inch) wrought copper ASTM B75 C12200, CDA 844. Mechanical grooved couplings, ductile iron, ASTM A536 (Grade 65-45-12), or malleable iron, ASTM A47 (Grade 32510) housing, with EPDM gasket, steel track head bolts, ASTM A183, coated with copper colored alkyd enamel.
 3. Mechanically formed tee connection: Form mechanically extracted collars in a continuous operation by drilling pilot hole and drawing out tube surface to form collar, having a height of not less than three times the thickness of tube wall. Adjustable collaring device shall insure proper tolerance and complete uniformity of the joint. Notch and dimple joining branch tube in a single process to provide

free flow where the branch tube penetrates the fitting. Braze joints.

- C. Adapters: Provide adapters for joining screwed pipe to copper tubing.
- D. Solder: ASTM B32 Composition Sb5 HA or HB. Provide non-corrosive flux.
- E. Brazing alloy: AWS A5.8, Classification BCuP.

2.3 EXPOSED WATER, WASTE AND MEDICAL GAS PIPING:

- A. Finished Room: Use full iron pipe size chrome plated brass piping for exposed water, waste, fuel gas, medical and laboratory gas piping connecting fixtures, casework, cabinets, equipment and reagent racks when not concealed by apron including those furnished by the Government or specified in other sections.
 - 1. Pipe: Fed. Spec. WW-P-351, standard weight.
 - 2. Fittings: ANSI B16.15 cast bronze threaded fittings, (125 and 250).
 - 3. Nipples: ASTM B 687, Chromium-plated.
 - 4. Unions: Fed. Spec. WW-U-516, Brass or Bronze. Unions 65 mm (2-1/2 inches) and larger shall be flange type with approved gaskets.
 - 5. Valves: Fed. Spec. WW-V-35, Brass or bronze.
- B. Unfinished Rooms and Mechanical Rooms: Chrome-plated brass piping is not required. Paint piping systems as specified in Section 09900, PAINTING.

2.4 TRAP PRIMER WATER PIPING:

- A. Pipe: Copper tube, ASTM B88, type K, hard drawn.
- B. Fittings: Bronze castings conforming to ANSI B16.18 Solder joints.
- C. Solder: ASTM B32 composition Sb5. Provide non-corrosive flux.

2.5 VALVES:

- A. Asbestos packing is prohibited.
- B. Shut-off:
 - 1. Cold, Hot and Recirculating Hot Water:
 - a. Fifty millimeter (2 inches) and smaller:
 - 1) Ball, Fed. Spec. WW-V-35, Type II, Class 125, Style 1, three piece or double union end construction, full ported, full flow, with solder end connections, 2750 kPa (400 psi) WOG, MSS-SP-67.
 - b. Larger than 50 mm (2 inches): Butterfly, iron body, aluminum bronze disc, 416 stainless steel stem, EPDM seat, wafer design, lever operator to six 150 mm (6 inch) size, 1375 kPa (200 pound) WOG, Fed. Spec WW-V-1967.

C. Balancing:

1. Hot Water Recirculating, 50 mm (2 inches) and smaller: Combination type, calibrated, bronze with bronze disc, equipped with readout valves with integral check valve, indexing position pointer and calibrated name plate, internal EPT O-ring seals and factory molded insulating enclosures.

D. Check:

1. Less than 100 mm (3 inches) and smaller): Bronze body and trim, swing type, MSS-SP-80, 850 kPa (125 pound) WSP.

E. Globe:

1. Eighty millimeters (3 inches) or smaller: Bronze body and bonnet, MSS-SP-80, 850 kPa (125 pound) WSP.

2.6 WATER PRESSURE REDUCING VALVE AND CONNECTIONS:

- A. Single-seated, for dead end service for 200 to 850 kPa (30 to 125 pounds) range on low pressure side. Composition diaphragm and stainless steel springs, bronze body with threaded connections for sizes 15 to 55 mm (1/2 to 2 inch), cast iron or semi-steel body with brass or bronze trimmings and flanged connections for sizes 15 to 50 mm (2-1/2 to 4 inch).
- B. Operation: Diaphragm and spring to act directly on valve stem. Delivered pressure shall vary not more than one kPa for each 10 kPa (one pound for each 10 pounds) variation on inlet pressure.
- C. Setting: Entering water pressure, discharge pressure, capacity, size, and related measurements shall be as shown on the drawings.
- D. Connections Valves and Strainers: Install shut off valve on each side of reducing valve and full sized bypass with shut off valve. Install strainer on inlet side of, and same size as pressure reducing valve. Install pressure gage on low pressure side of line.

2.7 CLEANOUTS:

- A. Same size as the pipe, up to 100 mm (4 inches); not less than 100 mm (4 inches) for larger pipe. Cleanouts for chemical waste drain pipe shall be of same material as the pipe. Cleanouts shall be easily accessible. Provide a minimum clearance of 600 mm (24 inches) for the rodding.
- B. In Floors: Floor cleanouts shall have cast iron body and frame with square adjustable scoriated secured nickel bronze top. Unit shall be vertically adjustable for a minimum of 50 mm (2 inches). When a waterproof membrane is used in the floor system, provide clamping

collars on the cleanouts. Cleanouts shall consist of "Y" fittings and 3 mm (1/8 inch) bends with brass or bronze screw plugs. Cleanouts in the resilient tile floors, quarry tile and ceramic tile floors shall be provided with square top covers recessed for tile insertion. In the carpeted areas, provide carpet cleanout markers. Provide two way cleanouts where indicated on drawings.

- C. Provide cleanouts at or near the base of the vertical stacks with the cleanout plug located approximately 600 mm (24 inches) above the floor. If there are no fixtures installed on the lowest floor, the cleanout shall be installed at the base of the stack. Extend the cleanouts to the wall access cover. Cleanout shall consist of sanitary tees. Furnish nickel-bronze square frame and stainless steel cover with minimum opening of 150 by 150 mm (6 by 6 inches) at each wall cleanout. Where the piping is concealed, a fixture trap or a fixture with integral trap, readily removable without disturbing concealed roughing work, shall be accepted as a cleanout equivalent providing the opening to be used as a cleanout opening is the size required by the NPHCC National Standard Plumbing Code.
- D. In horizontal runs above grade, cleanouts shall consist of cast brass tapered screw plug in fitting or caulked/no hub cast iron ferrule. Plain end (no-hub) piping in interstitial space or above ceiling may use plain end (no-hub) blind plug and clamp.

2.8 FLOOR DRAINS:

- A. ANSI A112.21.1. Provide a caulking flange for connection to cast iron pipe, screwed or no hub outlets for connection to steel pipe, and side outlet when shown. Provide membrane clamp and extensions if required, where installed in connection with waterproof membrane. Puncturing membrane other than for drain opening will not be permitted. Double drainage pattern floor drains shall have integral seepage pan for embedding into floor construction, and weep holes to provide adequate drainage from pan to drain pipe. For drains not installed in connection with a waterproof membrane, provide a 2.2 kg (16-ounce) soft copper membrane, 600 mm (24 inches) square.
- B. Refer to drawings for drain schedule.

2.9 ROOF DRAINS AND CONNECTIONS:

- A. Roof Drains: Cast iron with clamping device for making watertight connection. Free openings through strainer shall be twice area of drain

outlet. For roof drains not installed in connection with a waterproof membrane, provide a soft copper membrane 300 mm (12 inches) in diameter greater than outside diameter of drain collar. Provide an integral gravel stop for drains installed on roofs having built-up roofing covered with gravel or slag. Provide integral no-hub, soil pipe gasket or threaded outlet connection.

1. Flat Roofs: Beehive or dome shaped strainer with integral flange not less than 300 mm (12 inches) in diameter. For insulated roofs, provide a roof drain with an adjustable drainage collar, which can be raised or lowered to meet required insulation heights, sump receiver and deck clamp. Bottom section shall serve as roof drain during construction before insulation is installed.
2. Canopy Roofs: Beehive or dome shaped strainer with the integral flange not larger than 200 mm (8 inches) in diameter. For insulated roof provide a roof drain with an adjustable drainage collar, which can be raised or lowered to meet the required insulation heights, sump receiver and deck clamp. Bottom section shall serve as roof drain during construction before insulation is installed.
3. Protective Roof Membrane Insulation Assembly: Perforated stainless steel extension filter, non-puncturing clamp ring, large sump with extra wide roof flange and deck clamp.
 - a. Non-pedestrian Roofs: Large polypropylene or aluminum locking dome.
 - b. Pedestrian Roof: Bronze promenade top 350 mm (14 inches) square, set in square secured frame support collar.
- B. Expansion Joints: Heavy cast iron with cast brass or copper expansion sleeve having smooth bearing surface working freely against a packing ring held in place and under pressure of a bolted gland ring, forming a water and air tight flexible joint. Asbestos packing is prohibited.
- C. Downspout Nozzle: The nozzle fitting shall be of brass, unfinished, with internal pipe thread for connection to downspout.

2.10 TRAPS:

Provide on all sanitary branch waste connections from fixtures or equipment not provided with traps. Exposed brass shall be polished brass chromium plated with nipple and set screw escutcheons. Concealed traps may be rough cast brass or same material as pipe connected to. Slip joints not permitted on sewer side of trap. Traps shall correspond

to fittings on cast iron soil pipe or steel pipe respectively, and size shall be as required by connected service or fixture.

2.11 TRAP PRIMERS:

- A. Trap Primer (TP-2): Hydraulic.
 - 1. Fifteen millimeter (1/2 inch) Inlet/ fifteen millimeter (1/2 inch) Outlet fully automatic, all brass trap primer valve, activated by a drop in building water pressure, no adjustment required. Model for one (1) to four (4) traps with distribution unit, may be located anywhere in an active cold water line, as indicated on the drawings or as required by code. ASSE Standard 1018. Omit distribution unit when serving a single trap.

2.12 BACKFLOW PREVENTERS:

- A. Provide a backflow prevention device at any point in the plumbing system where the potable water supply comes in contact with a potential source of contamination. Device shall be certified by the American Society of Sanitary Engineers. Listed below is a partial list of connection to the potable water system which shall be protected against backflow or back siphonage.
- B. Reduced Pressure Backflow Preventer: ASSE 1013.
 - 1. Water make-up to heating systems, chilled water system, and generators.
- C. Atmospheric Vacuum Breaker: ASSE 1001
 - 1. Hose bibs and sinks w/threaded outlets.

2.13 WATERPROOFING:

- A. Provide at points where pipes pass through membrane waterproofed floors or walls in contact with earth.
- B. Floors: Provide cast iron stack sleeve with flashing device and a underdeck clamp. After stack is passed through sleeve, provide a waterproofed caulked joint at top hub.
- C. Walls: See detail shown on drawings.

2.14 STRAINERS:

- A. Provide on high pressure side of pressure reducing valves, on suction side of pumps, on inlet side of indicating and control instruments and equipment subject to sediment damage and where shown on drawings. Strainer element shall be removable without disconnection of piping.
- B. Gas Lines: "Y" type with removable mesh lined brass strainer sleeve.

- C. Water: Basket or "Y" type with easily removable cover and brass strainer basket.
- D. Body: Smaller than 80 mm (3 inches), brass or bronze; 80 mm (3 inches) and larger, cast iron or semi-steel.

2.15 PRESSURE GAUGES FOR WATER AND SEWAGE USAGE:

ANSI B40.1 all metal case 114 mm (4-1/2 inches) diameter, bottom connected. throughout, graduated as required for service, and identity labeled. Range shall be 1375 kPa (0 to psi) gauge.

2.16 DIELECTRIC FITTINGS:

Provide dielectric couplings or unions between ferrous and non-ferrous pipe.

2.17 STERILIZATION CHEMICALS:

- A. Liquid Chlorine: Fed. Spec. BB-C-120.
- B. Hypochlorite: Fed. Spec. O-C-114, or Fed. Spec. O-S-602, grade B.

2.18 WATER HAMMER ARRESTER:

Closed copper tube chamber with permanently sealed 410 kPa (60 psig) air charge above a triple o-ring piston. Three high heat Buna-N O-rings pressure packed and lubricated with FDA approved Dow Corning No. 11 silicone compound. All units shall be designed in accordance with ASSE 1010 for sealed wall installations without an access panel. Size and install in accordance with Plumbing and Drainage Institute requirements. Unit shall be as manufactured by Precision Plumbing Products Inc., Watts or Sioux Chief. Provide water hammer arrestors at all solenoid valves, at all groups of two or more flush valves, at all quick opening or closing valves, and at all medical washing equipment.

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. General: Comply with the PHCC National Standard Plumbing Code and the following:
 - 1. Install branch piping for water, waste and fuel gas, from the respective piping systems and connect to all fixtures, valves, cocks, outlets, casework, cabinets and equipment, including those furnished by the Government or specified in other sections.
 - 2. Pipe shall be round and straight. Cutting shall be done with proper tools. Pipe, except for plastic and glass, shall be reamed to full size after cutting.

3. All pipe runs shall be laid out to avoid interference with other work.
4. Install valves with stem in horizontal position whenever possible. All valves shall be easily accessible. Install valve in each water connection to fixture.
5. Install union and shut-off valve on pressure piping at connections to equipment.
6. All gravity waste drain lines inside the building with vertical drops over 6 m (20 feet) shall be provided with joint restraint on the vertical drop and horizontal offset or branch below the vertical drop. Joint restraint shall be accomplished by threaded, soldered, lead and oakum or grooved joints or a combination of pipe clamps and tie-rods as detailed in NFPA 24. Vertical joint restraint shall be provided from the fitting at the bottom of the vertical drop through every joint up to the riser clamp at the floor penetration of the floor above. Horizontal joint restraint shall be provided from the same fitting at the bottom of the vertical drop through every joint on the horizontal offset or branch for a minimum of 18 m (60 feet) or to anchoring point from the building structure. Joint restraint below ground shall be accomplished by thrust blocks detailed in NFPA 24.
7. All piping shall be supported per of the National Standard Plumbing Code, Chapter No. 8. If the vertical distance exceeds 6 m (20 feet) for cast iron pipe additional support shall be provided in the center of that span. Provide all necessary auxiliary steel to provide that support.
8. Install cast escutcheon with set screw at each wall, floor and ceiling penetration in exposed finished locations and within cabinets and millwork.
9. Penetrations:
 - a. Fire Stopping: Where pipes pass through fire partitions, fire walls, smoke partitions, or floors, install a fire stop that provides an effective barrier against the spread of fire, smoke and gases as specified in Section 07270, FIRESTOPPING. Completely fill and seal clearances between raceways and openings with the fire stopping materials.

- b. Waterproofing: At floor penetrations, completely seal clearances around the pipe and make watertight with sealant as specified in Section 07920, SEALANTS AND CAULKING.
- B. Piping shall conform to the following:
1. Waste, Storm Water Drain and Vent Drain to main stacks:

Pipe Size	Minimum Pitch
. 80 mm (3 inches) and smaller	1 : 50 (1/4" to the foot).
. 80 mm (4 inches) and larger	1 : 100 (1/8" to the foot).
 2. Exhaust Vent: Extend separately through roof. Sanitary vents shall not connect to exhaust vents.
 3. Domestic Water:
 - a. Where possible, grade all lines to facilitate drainage. Provide drain valves at bottom of risers. All unnecessary traps in circulating lines shall be avoided.
 - b. Connect branch lines at bottom of main serving fixtures below and pitch down so that main may be drained through fixture. Connect branch lines to top of main serving only fixtures located on floor above.

3.2 TESTS:

- A. General: Test system either in its entirety or in sections.
- B. Soil, Waste, Storm Water Drain, Vent: Conduct before trenches are backfilled or fixtures are connected. Conduct water test or air test, as directed.
 1. Water Test: If entire system is tested, tightly close all openings in pipes except highest opening, and fill system with water to point of overflow. If system is tested in sections, tightly plug each opening except highest opening of section under test, fill each section with water and test with at least a 3 m (10 foot) head of water. In testing successive sections, test at least upper 3 m (10 feet) of next preceding section so that each joint or pipe except upper most 3 m (10 feet) of system has been submitted to a test of at least a 3 m (10 foot) head of water. Keep water in system, or in portion under test, for at least 15 minutes before inspection starts. System shall then be tight at all joints.
 2. Air Test: Maintain air pressure of 35 kPa (5 psi) gage for at least 15 minutes without leakage. Use force pump and mercury column gage.

3. Final Tests: Either one of the following tests may be used.
 - a. Smoke Test: After fixtures are permanently connected and traps are filled with water, fill entire drainage and vent systems with smoke under pressure of 1.3 kPa (one inch of water) with a smoke machine. Chemical smoke is prohibited.
 - b. Peppermint Test: Introduce (two ounces) of peppermint into each line or stack.
- C. Potable Water System: Test after installation of piping and domestic water heaters, but before piping is concealed, before covering is applied, and before plumbing fixtures are connected. Fill systems with water and maintain hydrostatic pressure of 690 kPa (100 psi) gage for two hours. No decrease in pressure is allowed. Provide a pressure gage with a shutoff and bleeder valve at the highest point of the piping being tested.
- D. All Other Piping Tests: Test new installed piping under 1 1/2 times actual operating conditions and prove tight.

3.3 STERILIZATION:

- A. After tests have been successfully completed, thoroughly flush and sterilize the interior domestic water distribution system in accordance with AWWA C651.
- B. Use either liquid chlorine or hypochlorite for sterilization.

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**SECTION 15450
PLUMBING FIXTURES AND TRIM**

PART 1 - GENERAL

1.1 DESCRIPTION:

Plumbing fixtures, associated trim and fittings necessary to make a complete installation from wall or floor connections to rough piping, and certain accessories.

1.2 RELATED WORK:

- A. Sealing between fixtures and other finish surfaces: Section 07920, SEALANTS AND CAULKING.
- B. Flush panel access doors: Section 08305, ACCESS DOORS.
- C. Through bolts: Section 10162, TOILET PARTITIONS AND URINAL SCREENS.
- D. Section 15050, BASIC METHODS AND REQUIREMENTS (MECHANICAL).

1.3 SUBMITTALS:

- A. Submit in accordance with Section 01340, SAMPLES AND SHOP DRAWINGS.
- B. Submit plumbing fixture information in an assembled brochure, showing cuts and full detailed description of each fixture.

1.4 APPLICABLE PUBLICATIONS:

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American National Standard Institute (ANSI):
- C. The American Society of Mechanical Engineers (ASME):
 - A112.6.1M-90.....Supports for Off-the-Floor Plumbing Fixtures
for Public Use
 - A112.19.1M-89.....Enameled Cast Iron Plumbing fixtures
 - A112.19.2M-90.....Vitreous China Plumbing Fixtures
 - A112.19.3M-90.....Stainless Steel Plumbing fixtures (Designed for
Residential Use)
- D. American Society for Testing and Materials (ASTM):
 - A276-A94.....Stainless and Heat-Resisting Steel Bars and
Shapes
- E. National Association of Architectural Metal Manufacturers (NAAMM):
 - Metal Finishes Manual (1988)
- F. American Society of Sanitary Engineers (ASSE):

1016-88.....Individual Thermostatic, Pressure Balancing and
Combination Control Valves for Bathing
Facilities

PART 2 - PRODUCTS

2.1 STAINLESS STEEL:

- A. Corrosion-resistant Steel (CRS):
 - 1. Plate, Sheet, and Strip: CRS flat products shall conform to chemical composition requirements of any 300 series steel specified in ASTM A276.
 - 2. Finish: Exposed surfaces shall have standard polish (ground and polished) equal to NAAMM finish Number 4.
- B. Die-cast zinc alloy products are prohibited.

2.2 STOPS:

- A. Provide lock-shield loose key or screw driver pattern angle stops, straight stops or stops integral with faucet, with each compression type faucet whether specifically called for or not, including sinks in wood and metal casework, laboratory furniture and pharmacy furniture. Locate stops centrally above or below fixture in accessible location.
- B. Furnish keys for lock shield stops to Resident Engineer.
- C. Supply from stops not integral with faucet shall be chrome plated copper flexible tubing or flexible stainless steel with inner core of non-toxic polymer.
- D. Supply pipe from wall to valve stop shall be rigid threaded IPS copper alloy pipe

2.3 ESCUTCHEONS:

Heavy type, chrome plated, with set screws. Provide for piping serving plumbing fixtures and at each wall, ceiling and floor penetrations in exposed finished locations and within cabinets and millwork.

2.4 LAMINAR FLOW CONTROL DEVICE:

- A. Smooth, bright stainless steel or satin finish, chrome plated metal laminar flow device shall provide non-aeration, clear, coherent laminar flow that will not splash in basin. Device shall also have a flow control restrictor and have vandal resistant housing.
- B. Flow Control Restrictor:
 - 1. Capable of restricting flow from 95 to 110 mL/s (1.5 to 1.7 gpm) for lavatories; 125 to 140 mL/s (2.0 to 2.2 gpm) for sinks.

2. Compensates for pressure fluctuation maintaining flow rate specified above within 10 percent between 170 and 550 kPa (25 and 80 psi).
3. Operates by expansion and contraction, eliminates mineral/sediment build-up with self-clearing action, and is capable of easy manual cleaning.

C. Device manufactured by OMNI Products, Inc. or equal.

2.5 CARRIERS:

- A. ASME/ANSI A112.6.1M, with adjustable gasket faceplate chair carriers for wall hung closets with auxiliary anchor foot assembly, hanger rod support feet, and rear anchor tie down.
- B. ASME/ANSI A112.6.1M, lavatory, chair carrier. All lavatory chair carriers shall be capable of supporting the lavatory with a 250-pound vertical load applied at the front of the fixture.
- C. Where water closets, lavatories or sinks are installed back-to-back and carriers are specified, provide one carrier to serve both fixtures in lieu of individual carriers.

2.6 WATER CLOSETS:

Refer to attached fixture data sheet for manufacturer and description.

2.7 LAVATORIES:

Refer to attached fixture data sheet for manufacturer and description.

2.8 SINKS:

Refer to attached fixture data sheet for manufacturer and description.

2.9 EMERGENCY FIXTURES:

Refer to attached fixture data sheet for manufacturer and description.

2.10 WALL HYDRANT

Wall Hydrant: Cast bronze non-freeze hydrant with detachable T-handle. Brass operating rod within casing of bronze pipe of sufficient length to extend through wall and place valve inside building. Brass valve with coupling and union elbow having metal-to-metal seat. Valve rod and seat washer removable through face of hydrant; 20 mm (3/4-inch) hose thread on spout; 20 mm (3/4-inch) pipe thread on inlet. Finish may be rough; exposed surfaces shall be chrome plated. Set not less than 460 mm (1-1/2 feet) nor more than 920 mm (3-feet) above grade. On porches and platform, set approximately 760 mm (3-feet) above grade. On porches and platforms, set approximately 760 mm (2-1/2 feet) above finished floor. Provide integral vacuum breaker which automatically drains when shut off.

PART 3 - EXECUTION

3.1 GENERAL

- A. Fixture Setting: Opening between fixture and floor and wall finish shall be sealed as specified under Section, SEALANTS AND CAULKING.
- B. Supports and Fastening: Secure all fixtures, equipment and trimmings to partitions, walls and related finish surfaces. Exposed heads of bolts and nuts in finished rooms shall be hexagonal, polished chrome plated brass with rounded tops.
- C. Through Bolts: For free standing marble and metal stud partitions refer to Section TOILET PARTITIONS AND URINAL SCREENS.
- D. Toggle Bolts: For hollow masonry units, finished or unfinished.
- E. Expansion Bolts: For brick or concrete or other solid masonry. Shall be 6 mm (1/4-inch) diameter bolts, and to extend at least 75 mm (3-inches) into masonry and be fitted with loose tubing or sleeves extending into masonry. Wood plugs, fiber plugs, lead or other soft metal shields are prohibited.
- F. Power Set Fasteners: May be used for concrete walls, shall be 6 mm (1/4-inch) threaded studs, and shall extend at least 35 mm (1-1/4 inches) into wall.
- G. Tightly cover and protect fixtures and equipment against dirt, water and chemical or mechanical injury.
- H. Where water closet waste pipe has to be offset due to beam interference, provide correct and additional piping necessary to eliminate relocation of water closet.
- I. Do not use aerators on lavatories and sinks.

3.2 CLEANING:

At completion of all work, fixtures, exposed materials and equipment shall be thoroughly cleaned.

- - - E N D - - -

Plumbing Fixture Data Sheet	Water Closet	P1
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<p>Manufacturer: Kohler Model K-4330, Toto CT-708, Crane Placidus #3446</p> <p>Material: Vitreous china.</p> <p>Type: 1.6 gallon flush, elongated bowl design, siphon jet flushing, 2-1/4-inch passageway, 1-1/2-inch top spud.</p> <p>Mounting: Wall mounted.</p> <p>Outlet: Top outlet.</p> <p>Color: White.</p>	 <p>Picture shown may not include all options and accessories indicated</p>
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Accessories:

Flush Valve

Sloan Model Optima 111 ES-S (1.6 gpf). Exposed, sensor operated, diaphragm type, chrome plated closet flushometer with EL-154 transformer (120 VAC).

Carrier

Adjustable carrier fitting, for wall hung application.

Seat

Heavy duty white solid plastic, elongated, open front with heavy duty check hinge less cover.

Plumbing Fixture Data Sheet	Lavatory - Wall Mounted	P2
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<p>Manufacturer: American Standard Model 0321.075 or equivalent of Eljer or Kohler.</p> <p>Material: Vitreous china.</p> <p>Type: Rear overflow, faucet ledge, nominal 19-inch by 17-inch.</p> <p>Mounting: Wall mounted.</p> <p>Options: White. Concealed arms support.</p>	 <p>Picture shown may not include all options and accessories indicated</p>
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Accessories:

Faucet

Two lever faucet, polished chrome plate finish, 4-inch blade handles with color-coded index, 4-inch centers, spout, offset grid strainer, 2 gpm flow control with Omni-flow laminar flow outlet, ADA Compliant. Chicago Model 802A-317 or equivalent of American Standard, Kohler, Eljer, Speakman, T&S Brass or Cambridge.



Support

Lavatory support system with concealed arms for back-to-back system. Complete with painted rectangular steel uprights with welded feet, cast-iron adjustable headers, concealed arms, steel sleeves, alignment truss and mounting fasteners. Zurn Model Z-1231-D or equivalent of Wade, Jay R. Smith, Josam or Mifab.

Fitting Insulation Kits

Supplies: Molded white soft plastic covering for supplies with removable covering for stops and handles. Include manufacturer's standard fasteners, straps, and adhesives. Engineered Brass Company, or equivalent of Truebro or Skal + Gardor.

Drain: Molded white soft plastic covering for drains. Include manufacturer's standard fasteners, straps, and adhesives. Engineered Brass Company, or equivalent of Truebro or Skal + Gardor.

Plumbing Fixture Data Sheet	Lavatory Faucet	P3
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Lavatory integral with countertop.

Faucet

Chicago Faucet, deck mounted, 4" centerset, chrome plate finish, single metered faucet, push handle #665 with color coded index, grid strainer, E12, 0.5 gpm, ADA compliant. Chicago Model 802-665 or equivalent of American Standard, Speakman, T&S Brass, or Cambridge.



Plumbing Fixture Data Sheet	Sink - Double Compartment	P4
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<p>Manufacturer: Just Model DL or equivalent of Elkay, Acorn or Kindred.</p> <p>Material: 18-gauge stainless steel.</p> <p>Type: Double compartment, self-rimming, and insulated underside.</p> <p>Mounting: Counter mounted.</p> <p>Options: 22"x37"x10-1/2" deep.</p>	 <p>Picture shown may not include all options and accessories indicated</p>
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Accessories:

Faucet

Dual lever, 4-inch wrist blade handles, polished chrome plate finish, 8-inch gooseneck spout, 2 gpm flow control with Omni-flow laminar Flow outlet. Chicago Model 210A-GN8A-E3-317.



Drains

Stainless steel crumb cup strainer with removable stainless steel basket with locking shell. Just J-35 or equivalent of Elkay or Acorn.

Plumbing Fixture Data Sheet	Water Closet - Wall Mounted	P5
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<p>Manufacturer: Kohler Model K-4330, Toto CT-708, Crane Placidus #3446</p> <p>Material: Vitreous china.</p> <p>Type: Siphon jet, elongated, 1.6 gpf.</p> <p>Mounting: Wall mounted.</p> <p>Options: White. 1-1/2-inch top spud.</p>	 <p>Picture shown may not include all options and accessories indicated</p>
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Accessories:

Flushometer

Exposed flushometer for 1-1/2-inch top spud water closets, diaphragm type, 1.6 gpf, filtered by-pass, vandal-resistant, exposed parts chrome plated. Sloan Royal Model 111 or equivalent of Zurn or Coyne & Delany.

Toilet Seat

Solid white plastic, elongated, open front without cover, and concealed check hinge. Kohler K-4670-C. Use Kohler K-4679-CA 2" seat to comply with ADA requirements.

Support

Adjustable, horizontal or vertical siphon jet water closet with no-hub or hub and spigot connections. Complete with cast-iron right hand, left hand, or double main fitting, with 2-inch adjustable gasketed face plate, universal floor mounted foot supports, corrosion resistant adjustable ABS coupling with integral test cap, fixture bolts, trim, and stud protectors. Zurn Models Z-1203 through Z-1209 or equivalent of Wade, Jay R. Smith, Josam, or Mifab.

Plumbing Fixture Data Sheet	Sink - Double Compartment	P6
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<p>Manufacturer: American Standard Model No. 7741.</p> <p>Material: Enameled cast iron.</p> <p>Type: 3-inch outlet, corner model.</p> <p>Mounting: Floor mounted.</p> <p>Options: 28"x28"x13" deep. White.</p>	 <p>Picture shown may not include all options and accessories indicated</p>
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Accessories:

Faucet

Faucet with top brace, stops, and vacuum breaker. American Standard Model No. 8344.111.



Drain

American Standard Model No. 7721.038 with strainer and socket for 3-inch N.P.T.F. outlet.

Rim Guard

American Standard Model 7745.811, removable black vinyl-coated rim guard.

Plumbing Fixture Data Sheet	Urinal - Wall Mounted	P7
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<p>Manufacturer: American Standard Model 6561.017 or equivalent of Eljer or Kohler.</p> <p>Material: Vitreous china.</p> <p>Bowl Type: Siphon jet flush action, 1.0 gpf, flushing rim.</p> <p>Mounting: Wall mounted.</p> <p>Options: White. Top spud.</p>	
<p>Picture shown may not include all options and accessories indicated</p>	

Accessories:

Flushometer
r

Sloan Model Optima 111 ES-S (1.6 gpf). Exposed, sensor operated, diaphragm type, chrome plated closet flushometer with EL-154 transformer (120 VAC).

Support

Wall urinal support system with top and bottom plates, complete with rectangular steel uprights with welded feet, adjustable support plates, and mounting fasteners. Zurn Model Z-1222 or equivalent of Wade, Jay R. Smith or Josam.

Plumbing Fixture Data Sheet	Sink - Double Compartment	P8
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<p>Manufacturer: Just Model SL or equivalent of Elkay, Acorn or Kindred.</p> <p>Material: 18-gauge stainless steel.</p> <p>Type: Single compartment, self-rimming, and insulated underside.</p> <p>Mounting: Counter mounted.</p> <p>Options: 19"x17"x10" deep.</p>	 <p>Picture shown may not include all options and accessories indicated</p>
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Accessories:

Faucet

Sink faucet, polished chrome plate finish, concealed fitting, rigid spout, 4-inch blade handles with color-coded index, 2 gpm, flow control with omni-flow laminar flow outlet. Chicago Model 786 or equivalent of Speakman, T&S Brass or Cambridge.



Drain

Stainless steel crumb cup strainer with removable stainless steel basket with locking shell. Just J-35 or equivalent of Elkay or Acorn.

Hot Water Dispenser

Instant hot water dispenser with gooseneck spout, and 1/2 gal. Tank. Complete with inlet tube and electrical plug-in. 115V, 6.5 amps, 750W. Just JB1H-1 or equivalent of Elkay or Acorn.

SOL 663-01-05
 VA Seattle Building 100
 Ambulatory Clinic Expansion

Plumbing Fixture Data Sheet	Drinking Fountain - Dual Level	P9
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<p>Manufacturer: Haws Model H1011.8 or equivalent of Elkay, Halsey Taylor, EBCO or Sunroc.</p> <p>Material: Type 304 Stainless steel, 18 Gauge</p> <p>Type: NSF 61 Certified, Dual level, push pad operation, ADA Compliant.</p> <p>Mounting: Wall mounted.</p> <p>Options: No. 4 Satin finish.</p> <p>Capacity: 8.0 GPH, R-134a</p> <p>Electrical: Refrigerant 115V/60Hz, 430 Watt, 4.5 FLA.</p>	 <p>Picture shown may not include all options and accessories indicated</p>
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Accessories:

Support

Haws chiller, mounting plate of heavy gauge galvanized steel or equivalent of Elkay, Halsey Taylor, EBCO or Sunroc.

**SECTION 15500
FIRE PROTECTION**

PART 1 - GENERAL

1.1 DESCRIPTION:

- A. The design and installation of a hydraulically calculated automatic fire sprinkler system complete and ready for operation, for the entire renovated area and addition including the air handling unit, mechanical equipment rooms and accessible shafts.
- B. Modification of the existing sprinkler systems as required for the renovated areas and for the addition. Size system by pipe schedule in accordance with NFPA 13 or hydraulically calculate (Contractor's option).
- C. Existing piping to be reused, replaced or removed as required. Removal of piping to include all valves, flow switches, supervisory devices, hangers, supports, and associated fire alarm system conduit and wire.
- D. Replacement of all existing sprinklers. Work to include all necessary piping modifications and new sprinkler escutcheons.
- E. Expansion or revision of building fire alarm system(s) to incorporate newly installed sprinkler system alarm and supervisory devices.
- F. Provide access doors or panels where control or drain valves are located behind plaster or gypsum walls or ceilings as necessary to install piping above suspended plaster or gypsum ceilings.
- G. Painting of exposed piping and supports to match surrounding background in stairways and other finished areas and red in unfinished areas.

1.2 RELATED WORK:

- A. Treatment of penetrations through rated enclosures: Section 07270, FIRESTOPPING.
- B. Access panels for plaster ceilings: Section 08305, ACCESS DOORS
- C. Painting of exposed pipe: Section 09900, PAINTING
- D. Section 15050, BASIC METHODS AND REQUIREMENTS (MECHANICAL)
- E. Alarm Supervision: Section 16721, FIRE ALARM SYSTEM
- F. Section 01340, SAMPLE AND SHOP DRAWINGS

1.3 DESIGN CRITERIA:

- A. The design, materials, equipment, installation, inspection, and testing of the automatic sprinkler system shall be in accordance with the required advisory provisions of NFPA 13, 14, 20, 25, 75, 82, and 231C.

- B. Base system design hydraulic calculations using the area/density method on the following criteria and in accordance with NFPA 13.
1. Sprinkler Protection:
 - a. All patient care, treatment, office, waiting areas, educational areas and corridors: Light hazard, (0.10 gpm/sq. ft.) over the hydraulically most remote 140 m² (1500 sq. ft.).
 - b. Mechanical Equipment Rooms, Transformer Rooms, Electrical Switchgear Rooms, Electric Closets and storage between 9 and 23 m² (100 and 250 sq. ft.): Ordinary Hazard, Group 1, 6.1 L/minute/m² (0.15 gpm/sq. ft.) over the hydraulically most remote 140 m² (1500 sq. ft.).
 - c. Laboratories, retail sales and storage rooms, storage room over 23 m² (250 sq. ft.), loading docks, warehouse spaces, Pharmacy and SPD areas: Ordinary Group 2, 8.1 L/minute/m² (0.20 gpm/sq. ft.) over the hydraulically most remote 140 m² (1500 sq. ft.).
 - d. Provide sprinklers in accessible shafts per NFPA 13.
 2. Add water allowance of 15 L/s (250 gpm) for inside and outside hose streams to the sprinkler requirements at the connection to the distribution main.
 3. Hydraulic Calculations: The calculated demand including hose stream requirements shall fall no less than 10 percent below the available supply curve.
 4. Water Supply: Contractor shall perform the fire flow tests and obtain the following information.
 - a. Elevation of static and elevation of residual test gage: 600 mm (2 ft.) above site grade.
 - b. Static pressure: _____ kPa (psi).
 - c. Residual pressure: _____ kPa (psi).
 - d. Flow: _____ L/s (gpm).
 - e. Date: _____ Time: _____.
 - C. For each sprinkler zone provide a control valve, flow switch, self-contained test and drain assembly and pressure gage.
 - D. Provide a separate sprinkler valve for each traction elevator machine room and other areas as required by NFPA 13.
 - E. Provide a guard for each sprinkler in the janitors closets, the elevator machine room and sprinklers within 2100 mm (7 ft.) of the floor and other areas as required by NFPA 13.

- F. Locate sprinklers in patient bedrooms assuming all privacy curtains have 13 mm (1/2 in.) openings in mesh extending 450 mm (18 in.) from ceiling.
- G. Seismic Protection: Seismically brace all new and existing piping systems in accordance with Zone 3 of NFPA 13.

1.4 CONTRACTORS QUALIFICATIONS:

- A. Design and installation of this project shall be accomplished by a contractor who meets the following qualifications:
 - 1. Engages on a regular and full time basis in the design and installation of automatic sprinkler systems.
 - 2. Employ or contract on a regular basis for system design, a professional engineer or at least one person having passed the elements for a NICET Level III rating in automatic sprinkler design.
 - 3. Can provide on-site emergency service within four hours notification.

1.5 SUBMITTALS:

- A. Submit as one package in accordance with Section 01340 SAMPLES AND SHOP DRAWINGS.
- B. Sprinkler design professional's Registration or Certification.
- C. Emergency service point of contact name and 24 hour emergency telephone number.
- D. Manufacturer's Literature and Data:
 - 1. Pipe and fittings.
 - 2. Valves.
 - 3. Drips.
 - 4. Sprinklers-each type and model.
 - 5. Inspectors Test Alarm Modules.
 - 6. Sprinkler Cabinets.
 - 7. Sprinkler Plugs.
 - 8. Pressure Gages.
 - 9. Pressure Switches.
 - 10. Pipe Hangers and Supports.
 - 11. Water Flow Switches.
 - 12. Valve Tamper Switches.
 - 13. Valve Cabinet.
- E. Detailed drawings in accordance with NFPA 13. Drawings shall be prepared using CADD software stamped by the sprinkler design

professional and include all new and existing sprinklers and piping. Use format in use at the VA medical center. Drawings are subject to change during the bidding and construction periods. Any wall and ceiling changes occurring prior to the submittal of contractors shop drawings shall be incorporated into the contractors detailed design at no additional contract cost.

F. Hydraulic calculations for each sprinkler system in accordance with NFPA 13.

G. Operation and Maintenance Data:

1. Indicating Valves.
2. Water Flow and valve tamper switches.

H. Recommended preventive maintenance schedule.

1.6 AS-BUILT DOCUMENTATION:

A. A mylar as-built drawing and two blue-line copies shall be provided for each drawing. One copy of final CADD drawing files shall also be provided on 89 mm (3 1/2 in.), 1.44 mb diskette, for each drawing.

B. Four sets of manufacturer's literature and data updated to include submittal review comments and any equipment substitutions.

C. Four sets of hydraulic calculations for each sprinkler system updated to include submittal review comments and any changes to the installation which affect the calculations.

D. Four copies of the hydrostatic report and NFPA 13 material and test certificate for each sprinkler system.

E. Four sets of operation and maintenance data updated to include submittal review comments and any equipment substitutions.

F. Manufacturers literature, hydraulic calculations, reports and operation and maintenance data shall be in a labeled 3-ring binder.

1.7 WARRANTY:

A. All work performed and materials and equipment furnished under this contract shall be free from defects for a period of one year from date of acceptance by the government.

B. All existing piping and equipment incorporated into the new system shall be hydrostatically tested and warranted as new.

1.8 APPLICABLE PUBLICATIONS:

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

- B. National Fire Protection Association (NFPA)
 - 13-1996.....Installation of Sprinkler Systems
 - 14-1996.....Installation of Standpipe and Hose Systems
 - 17A-1994.....Standard for wet chemical extinguishing systems
 - 20-1996.....Installation of Centrifugal Fire Pump
 - 24-1995.....Installation of Private Fire Service Mains and
Their Appurtenances
 - 25-1995.....Inspection, Testing and Maintenance of water
Based Fire Protection Systems
 - 70-1996.....National Electrical Code
 - 72-1996.....National Fire Alarm Code
 - 82-1994.....Incinerators, Waste and Linen Handling Systems
and Equipment
 - 170-1996.....Standards for Fire Safety Symbols
 - 231-1995.....General Storage
 - 231C-1995.....Rack Storage of Materials
 - 291-1995.....Fire Flow Testing and Marking of Hydrants
- C. Underwriters Laboratories Inc. (UL)
 - 1996.....Fire Protection Equipment Directory
- D. Factory Mutual Engineering Corporation (FM)
 - 1996.....Approval Guide
- E. American Society for Testing and Materials (ASTM)
 - F442-96.....Chlorinated Poly (Vinyl Chloride) (CPVC)
Plastic Pipe
- F. American Society of Sanitary Engineering (ASTM)
 - 1015-93.....Double Check Backflow Prevention Assembly
 - 1.10.....POST CONTRACT MAINTENANCE AND EMERGENCY SERVICE
- G. Complete maintenance and inspection service for the sprinkler systems shall be provided by a factory trained authorized representative of the manufacturer of the major equipment for a period of one year after acceptance of the entire installation by the government.
- H. Contractor shall provide all necessary test equipment, parts and labor to perform required maintenance.
- I. All inspections, testing and maintenance work required by NFPA 25 and recommended by the equipment manufacturer shall be provided. Work shall include operation of sprinkler system alarm and supervisory devices.

- J. Maintenance and testing shall be performed on a quarterly basis. A computerized preventive maintenance schedule shall be provided and shall describe the protocol for preventive maintenance of equipment. The schedule shall include a systematic examination, adjustment, and cleaning of all equipment.
- K. Non-included Work: Maintenance service shall not include the performance of any work due to improper use, accidents or negligence for what the contractor is not responsible.
- L. Service and emergency personnel shall report to the Engineering Office or their authorized representative upon arrival at the hospital and again upon the completion of the required work. A copy of the work ticket containing a complete description of work performed and parts replaced shall be provided.
- M. Emergency Service:
 - 1. Normal and overtime emergency call-back service shall consist of an on-site response to calls within four hours of notification.
 - 2. Overtime emergency call-back service shall be limited to minor adjustments and repairs to effect the integrity of the system.

PART 2 - PRODUCTS

2.1 GENERAL:

All devices and equipment shall be Underwriters Laboratories Inc. listed for their intended purpose. All sprinklers shall be Factory Mutual approved.

2.2 PIPING AND FITTINGS:

- A. Pipe and fittings from inside face of building 300 mm (12 in.) above finished floor to a distance of approximately 1500 mm (5 ft.) outside building: Ductile Iron, flanged fittings and 316 stainless steel bolting.
- B. Fire Protection water supply within the building up to sprinkler system isolation valves shall be per NFPA 13 black steel, schedule 10 minimum.
- C. Sprinkler piping downstream of the isolation valve on wet-pipe systems shall be per NFPA 13 black steel, schedule 10 minimum.
- D. Sprinkler piping of a dry pipe system shall be galvanized. Schedule 40 minimum.
- E. Threaded or flanged fittings shall be ANSIB1 6.3 cast iron, class 125 minimum. Threaded fittings are not permitted on pipe with wall thickness less than schedule 40.

- F. All fittings on galvanized piping shall be galvanized in accordance with ASTM A153.
- G. Slip type or clamp-on type rubber gasketed fittings shall be listed for each piping application.

2.3 VALVES:

- A. Listed Indicating Valves:
 - 1. Gate: OS&Y, 1200 kPa (175 lb.) WOG.
 - 2. Butterfly: Gear operated, indicating type, 1200 kPa (175 lb.) WOG
 - 3. Ball (inspectors test and drain only): iron body, stainless steel trim, for 2050 kPa (300 psi) service, indicating type.
 - 4. Ball and butterfly valves shall not be used on incoming water service, and on the suction side of either the fire pump or jockey pump.
- B. Drain Valves: Threaded bronze angle, globe, ball or butterfly, 1000 kPa (150 lb.) WOG equipped with reducer and hose connection with cap or connected to a drain line.
- C. Self-contained Test and Drain Valve:
 - 1. Ductile iron body with bronze "Drain" and "Test" bonnets. Acrylic sight glass for viewing test flow. Various sized orifice inserts to simulate flow through 14 mm (17/32 in.), 13 mm (1/2 in.), 12 mm (7/16 in.), and 10 mm (3/8 in.) diameter sprinklers, 32 mm (1 1/4 in.) female threaded outlets or 32 mm (1 1/4 in.) one-quarter turn locking lug outlets for plain end pipe (end preparation to be in accordance with manufacturer's recommendation).
 - 2. Bronze body, with chrome plated bronze ball, brass stem, steel handle, teflon seat and sight glasses. Provide valve with three position indicator plate (off, test, and drain), 6 mm (1/4 in.) tapping for pressure gage and various other orifice inserts to simulate flow through 10 mm (3/8 in.), 12 mm (7/16 in.), 13 mm (1/2 in.), and 14 mm (17/32 in.) diameter sprinklers.

2.4 AUTOMATIC BALL DRIPS:

Cast brass 20 mm (3/4 in.) in line automatic ball drip with both ends threaded with iron pipe threads.

2.5 SPRINKLERS:

- A. Quick response sprinklers shall be standard type except as noted below. The maximum distance from the deflector to finished ceiling shall be 50 mm (2 in.) for pendent sprinklers. Pendent sprinklers in finished

areas shall be provided with semi-recessed adjustable screwed escutcheons and installed within the center one-third of their adjustment. The sprinkler shall be installed in the flush position with the element exposed below the ceiling line. At the specified locations, provided the following type of sprinklers.

LOCATION	TYPE
Mechanical Equipment Rooms, Electrical & Electrical Switch Gear Rooms	Quick Response, Upright or Telephone Closets, Transformer Vaults Pendent Brass [93 °C (200 °F)]
Elevator Shafts, Dumbwaiter Shafts, Elevator Machine Rooms, Elevator Pits	Standard Upright or Sidewall Brass [93 °C (200 °F)]
Cold rooms, Freezers, Controlled Temperature Rooms and Unheated Areas	Standard Pendent, Dry Type [66- 74 °C (150-165 °F)]
Kitchen Hoods, Exhaust Ducts & Duct Collars	Standard Pendent or Upright (Extra High Temperature [163-191 °C (325- 375 °F.)])
Patient Sleeping, Patient Bathrooms, and Corridors within a Patient Ward	Residential, Recessed Pendent, Chrome Plated, [66-74 °C (150- 165 °F)]
All Patient Treatment, Elevator Lobbies and Corridors	Quick Response, Recessed Pendent, Chrome Plated [66-74 °C [150- 165 °F)]
All Areas Not Listed Above	Quick Response, Recessed Pendent, Sidewall, Chrome Plated [66-74 °C (150-165 °F)]

B. Do not use quick response sprinklers in the same sprinkler zone with other sprinklers types. In sprinklered light hazard patient zones that are expanded into fully sprinklered zones, revise the existing system to contain quick response sprinklers.

2.6 TOOLS AND REPLACEMENT PARTS:

- A. Sprinkler Cabinet
 1. Provide a minimum 5 percent spare sprinklers with escutcheons with a minimum of two of each type.
 2. Provide a minimum of two of each type sprinkler wrenches used.
 3. Install cabinets in each building where directed by the Resident Engineer.
- B. Sprinkler system water flow switch: one of each size provided.
- C. Sprinkler system valve tamper switch: one of each type provided.

- D. Sprinkler system pressure switch: one of each type provided.
- E. Provide two sprinkler plugs attached to multi-section extension poles 2400 mm (8 ft.) minimum.

2.7 IDENTIFICATION SIGNS:

Provide for all new and existing sectional valves, riser control valves, system control valves, drain valves, test and drain connections and alarm devices with securely attached identification signs (enamel on metal) in accordance with NFPA 13.

2.8 HANGERS AND BEAM ATTACHMENTS:

In accordance with NFPA 13 and 14.

2.9 WALL, FLOOR AND CEILING PLATES:

Exposed piping passing through walls, floors or ceilings shall be provided with chrome colored escutcheon plates.

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. Supervisory Switches: For each indicating sprinkler zone control valve, provide a supervisory switch that is connected to the fire alarm system. Standpipe hose valves and test and drain valves shall not be provided with supervisory switches.
- B. Waterflow Switches: For each sprinkler zone, provide a waterflow switch. Install waterflow switch and adjacent valves in easily accessible locations.
- C. Sprinkler Zone: Each sprinkler zone shall coincide with each smoke zone and fire alarm zone.
- D. Drains, Test Pipes and Accessories:
 - 1. Provide a drain at base of risers, drain connection on valved sections, and drains at other locations for complete drainage of the system. Provide valve in drain lines and connect to the central drain riser. Discharge riser outside over splash block, indirectly over standpipe drain connected to storm sewer, or as indicated. The main drain shall be capable of full discharge test without allowing water to flow onto the floor.
 - 2. Provide test pipes in accordance with NFPA 13. Test pipes shall be valved and piped to discharge through proper orifice as specified above for drains.
- E. Conceal all piping, except in pipe basements, stairwells and rooms without ceilings.

- F. Install new piping and sprinklers aligned with natural building and other sprinklers lines.
- G. Locate piping in stairways as near ceiling as possible to prevent tampering by unauthorized personnel. Provide a minimum headroom of 2250 mm (7 ft.-6 in.) for all piping.
- H. Piping arrangement shall avoid contact with other piping and equipment and allow clear access to other equipment or devices requiring access or maintenance.
- I. Cutout disks, which are created by cutting holes in the walls of pipe for flow switches and non-threaded pipe connections, shall be affixed near to the pipe where the originated. They shall be displayed until final inspection and then removed.
- J. Firestopping shall comply with Section 07270, FIRESTOPPING. All holes through stairways, smoke barrier walls, and fire walls shall be sealed on a daily basis.
- K. Provide hydraulic design information signage as required by NFPA 13 and 14.
- L. Install access doors in ceilings of rooms where above ceiling access is required.

3.2 TEST:

Automatic Sprinkler System: NFPA 13 and 25.

3.3 INSTRUCTIONS:

Furnish the services of a competent instructor for not less than two four-hour periods for instructing personnel in the operation and maintenance of the fire pump and sprinkler system, on the dates requested by the COTR.

- - - E N D - - -

**SECTION 15705
HVAC PIPING SYSTEMS**

PART 1 - GENERAL

1.1 DESCRIPTION:

- A. Water piping to connect HVAC equipment, including the following:
 - 1. Chilled water, heating hot water and drain piping.
 - 2. Extension of domestic water make-up piping.
 - 3. Glycol-water piping.
- B. Steam, condensate, and vent piping in buildings.

1.2 RELATED WORK:

- A. Excavation and Backfill: Section 02200, EARTHWORK.
- B. Section 02713, WATER SYSTEM.
- C. Section 15050, BASIC METHODS AND REQUIREMENTS (MECHANICAL).
- D. Section 15140, PUMPS (HVAC).
- E. Section 15250, INSULATION.
- F. Section 15740, AIR TERMINALS.
- G. Section 15902, CONTROLS AND INSTRUMENTATION (DDC).

1.3 QUALITY ASSURANCE:

Section 15050, BASIC METHODS AND REQUIREMENTS (MECHANICAL), which includes welding qualifications.

1.4 SUBMITTALS:

- A. Submit in accordance with Section 01340, SAMPLES AND SHOP DRAWINGS.
- B. Manufacturer's Literature and Data:
 - 1. Pipe and equipment supports.
 - 2. Pipe and tubing, with specification, class or type, and schedule.
 - 3. Pipe fittings, including miscellaneous adapters and special fittings.
 - 4. Flanges, gaskets and bolting.
 - 5. Valves of all types.
 - 6. Strainers.
 - 7. Flexible connectors for water service.
 - 8. Pipe alignment guides.
 - 9. Expansion joints.
 - 10. All specified steam system components.
 - 11. All specified hydronic system components.
 - 12. Water flow measuring devices.
 - 13. Gages.

- 14. Thermometers and test wells.
- 15. Electric heat tracing systems.
- C. Manufacturer's certified data report, Form No. U-1, for ASME pressure vessels:
 - 1. Convertors.
 - 2. Air separators.
 - 3. Expansion tanks.
- D. Coordination Drawings: Refer to Article, SUBMITTALS of Section 15050, BASIC METHODS AND REQUIREMENTS (MECHANICAL).
- E. As-Built Piping Diagrams: Provide drawing as follows for water chillers, pumps, convertors and other equipment.
 - 1. One wall-mounted stick file for prints. Mount stick file in the AHU access space.
 - 2. One set of reproducible drawings.

1.5 APPLICABLE PUBLICATIONS:

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. Federal Specification (Fed. Spec.):
 - WW-T-696E.....Traps, Steam and Air
 - WW-V-35C.....Valve, Ball
 - WW-V-1967 AMD 1.....Valves, Butterfly (Threaded Ends and Solder Ends), Brass or Bronze
- C. Military Specifications (Mil. Spec.):
 - MIL-S-901D.....Shock Tests, H.I. (High Impact) Shipboard Machinery, Equipment, and Systems
- D. American National Standards Institute (ANSI):
 - B1.20.1-83.....Pipe Threads, General Purpose
 - B16.3-92.....Malleable Iron Threaded Fittings, Classes 150 and 300
 - B16.4-92.....Cast Iron Threaded Fittings, Classes 125 and 250
 - B16.5-88.....Pipe Flanges and Flanged Fittings
 - B16.9-93.....Factory-Made Wrought Steel Buttwelding Fittings
 - B16.11-91.....Forged Steel Fittings, Socket-Welding and Threaded

- B16.14-91.....Ferrous Pipe Plugs, Bushings, and Locknuts with
Pipe Threads
- B16.22-89.....Wrought Copper and Copper Alloy Solder Joint
Pressure Fittings
- B16.23-92.....Cast Copper Alloy Solder Joint Drainage
Fittings
- B16.24-91.....Bronze Pipe Flanges and Flanged Fittings, Class
150 and 300
- B16.39-86.....Malleable Iron Threaded Pipe Unions, Classes
150, 250, and 300
- B31.1-95.....Power Piping
- B40.1-91.....Gauges-Pressure Indicating Dial Type - Elastic
Element
- E. American Society of Mechanical Engineers (ASME):
Boiler and Pressure Vessel Code: SEC VIII D1-89, Pressure Vessels,
Division 1
- F. American Society for Testing and Materials (ASTM):
A47-90.....Ferritic Malleable Iron Castings
- A53-95.....Pipe, Steel, Black and Hot-Dipped, Zinc-Coated,
Welded and Seamless
- A106-94.....Seamless Carbon Steel Pipe for High-Temperature
Service
- A126-93.....Gray Iron Castings for Valves, Flanges, and
Pipe Fittings
- A181-95.....Forgings, Carbon Steel, for General-Purpose
Piping
- A183-83 Carbon Steel Track Bolts and Nuts
- A216-93 Steel Castings, Carbon, Suitable for Fusion
Welding, for High Temperature Service
- A285-90 Pressure Vessel Plates, Carbon Steel, Low-and-
Intermediate-Tensile Strength
- A307-94 Carbon Steel Bolts and Studs, 60,000 PSI Tensile
Strength
- A516-90 Pressure Vessel Plates, Carbon Steel, for
Moderate-and- Lower Temperature Service
- A536-84 Ductile Iron Castings
- B32-95 Solder Metal

SOL 663-01-05
VA Seattle Building 100
Ambulatory Clinic Expansion

- B61-93 Steam or Valve Bronze Castings
- B62-93 Composition Bronze or Ounce Metal Castings
- B88-95 Seamless Copper Water Tube
- F439-93 Socket-Type Chlorinated Poly (Vinyl Chloride)
(CPVC) Plastic Pipe Fittings, Schedule 80
- F441-94 Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic
Pipe, Schedules 40 and 80

G. American Welding Society (AWS):

- A5.8-91.....Filler Metals for Brazing

H. Manufacturers Standardization Society (MSS) of the Valve and Fitting Industry, Inc.:

- SP-67-95.....Butterfly Valves
- SP-70-90.....Cast Iron Gate Valves, Flanged and Threaded
Ends
- SP-71-90.....Cast Iron Swing Check Valves, Flanged and
Threaded Ends
- SP-72-92.....Ball Valves with Flanged or Butt-Welding Ends
for General Service
- SP-78-87.....Cast Iron Plug Valves, Flanged and Threaded
Ends
- SP-80-87.....Bronze Gate, Globe, Angle and Check Valves
- SP-84-90.....Valves - Socket Welding and Threaded Ends
- SP-85-94.....Cast Iron Globe and Angle Valves, Flanged and
Threaded Ends

I. Tubular Exchanger Manufacturers Association:

TEMA Standards, 5th Edition, 1968

J. National Board of Boiler and Pressure Vessel Inspectors (NB):

Relieving Capacities of Safety Valves and Relief Valves.

PART 2 - PRODUCTS

2.1 PIPE AND EQUIPMENT SUPPORTS, PIPE SLEEVES, AND WALL AND CEILING PLATES:

Provide in accordance with Section 15050, BASIC METHODS AND REQUIREMENTS (MECHANICAL).

2.2 PIPE AND TUBING:

A. Chilled Water, Heating Hot Water, Glycol-Water and Vent Piping:

Steel: ASTM A53 Grade B, seamless or ERW, Schedule 40.

Copper water tube option: ASTM B88, Type K or L, hard drawn.

- B. Extension of Domestic Water Make-up Piping: ASTM B88, Type K or L, hard drawn copper tubing.
- C. Steam Piping: Seamless steel, ASTM A53, Grade B, or ERW. A106 Grade B, Seamless.
- D. Steam Condensate Piping:
 - 1. Concealed above ceiling, in wall or chase: Copper water tube ASTM B88, Type K, hard drawn.
 - 2. All other locations: Copper water tube ASTM B88, Type K, hard drawn; or steel, ASTM A53, Grade B, Seamless or ERW, or A106 Grade B Seamless, Schedule 80.
- E. Cooling Coil Condensate Drain Piping:
 - 1. From air handling units: Copper water tube, ASTM B88, Type M, or schedule 80 flame retardant polypropylene plastic.
 - 2. From terminal units: Copper water tube, ASTM B88, Type L for runouts and Type M for mains.

2.3 FITTINGS FOR STEEL PIPE:

- A. 65 mm (2-1/2 inches) and Larger: Welded or flanged joints. Mechanical couplings and fittings are optional for water piping only.
 - 1. Butt welding fittings: ANSI B16.9 with same wall thickness as connecting piping. Elbows shall be long radius type, unless otherwise noted.
 - 2. Welding flanges and bolting: ANSI B16.5:
 - a. Steam service: Weld neck or slip-on, raised face, with non-asbestos gasket. Non-asbestos gasket shall be designed for the service conditions such as "Lamons Spiraseal," "Flexitallic spiral-wound," "Lamons Grafoil Grade GHR," or equal.
 - b. Water service: Weld neck or slip-on, plain face, with 6 mm (1/8 inch) thick full face neoprene gasket suitable for 104 °C (220 °F).
 - 1) Contractor's option: Convolute, cold formed 150 pound steel flanges, with teflon gaskets, may be used for water service.
 - c. Flange bolting: Carbon steel machine bolts or studs and nuts, ASTM A307, Grade B.
- B. 50 mm (2 inches) and Smaller: Screwed or welded. Mechanical couplings are optional for water piping only.
 - 1. Butt welding: ANSI B16.9 with same wall thickness as connecting piping.

2. Forged steel, socket welding or threaded: ANSI B16.11.
 3. Screwed: 150 pound malleable iron, ANSI B16.3. 125 pound cast iron, ANSI B16.4, may be used in lieu of malleable iron, except for steam piping. Bushing reduction of a single pipe size, or use of close nipples, is not acceptable.
 4. Unions: ANSI B16.39.
 5. Water hose connection adapter: Brass, pipe thread to 20 mm (3/4 inch) garden hose thread, with hose cap nut.
 6. Steam PRV station quick-couple blowdown hose connection: Straight through, plug and socket, screw or cam locking type for 15 mm (1/2 inch) ID hose. No integral shut-off is required.
- C. Welded Branch and Tap Connections: Forged steel weldolets, or branchlets and thredolets may be used for branch connections up to one pipe size smaller than the main. Forged steel half-couplings, ANSI B16.11 may be used for drain, vent and gage connections.
- D. Mechanical Pipe Couplings and Fittings: May be used, with cut or roll grooved pipe, in water service up to 110 °C (230 °F) in lieu of welded, screwed or flanged connections.
1. Grooved mechanical couplings: Malleable iron, ASTM A47 or ductile iron, ASTM A536, fabricated in two or more parts, securely held together by two or more track-head, square, or oval-neck bolts, ASTM A183.
 2. Gaskets: Rubber product recommended by the coupling manufacturer for the intended service.
 3. Grooved end fittings: Malleable iron, ASTM A47; ductile iron, ASTM A536; or steel, ASTM A53 or A106, designed to accept grooved mechanical couplings. Tap-in type branch connections are acceptable.

2.4 FITTINGS FOR COPPER TUBING:

- A. Solder Joint: Wrought copper, ANSI B16.22.
1. Solder for water and drain piping: ASTM B32, alloy 50A, 50-50 tin-lead; alloy 95 TA tin-antimony; or brazing alloy.
 2. Brazing alloy for steam condensate: Cadmium free silver solder, American Welding Society Bag series.
 3. Mechanically formed tee connection in water and drain piping: Form mechanically extracted collars in a continuous operation by drilling pilot hole and drawing out tube surface to form collar, having a height of not less than three times the thickness of tube wall.

Adjustable collaring device shall insure proper tolerance and complete uniformity of the joint. Notch and dimple joining branch tube in a single process to provide free flow where the branch tube penetrates the fitting. Braze joint with cadmium free brazing alloy.

B. Bronze Flanges and Flanged Fittings: ANSI B16.24.

2.5 DIELECTRIC FITTINGS:

- A. Provide where copper tubing and ferrous metal pipe are joined.
- B. 50 mm (2 inches) and Smaller: Threaded dielectric union, ANSI B16.39.
- C. 65 mm (2 1/2 inches) and Larger: Flange union with dielectric gasket and bolt sleeves, ANSI B16.42.
- D. Temperature Rating, 99 °C (210 °F) for water systems, 121 °C (250 °F) for steam condensate and as required for steam service.

2.6 SCREWED JOINTS:

- A. Pipe Thread: ANSI B1.20.
- B. Lubricant or Sealant: Oil and graphite or other compound approved for the intended service.

2.7 VALVES:

- A. Asbestos packing is not acceptable.
- B. All valves of the same type shall be products of a single manufacturer. Provide gate and globe valves with packing that can be replaced with the valve under full working pressure.
- C. Provide chain operators for valves 100 mm (4 inches) and larger when the centerline is located 2400 mm (8 feet) or more above the floor or operating platform.
- D. Gate Valves:
 - 1. 50 mm (2 inches) and smaller: MSS-SP80, Bronze, 1034 kPa (150 lb.), wedge disc, rising stem, union bonnet.
 - 2. 65 mm (2 1/2 inches) and larger: Flanged, outside screw and yoke.
 - a. All services: MSS-SP 70, iron body, bronze mounted, 861 kPa (125 psi) wedge disc.
- E. Globe, Angle and Swing Check Valves:
 - 1. 50 mm (2 inches) and smaller: MSS-SP 80, bronze, 1034 kPa (150 lb.) Globe and angle valves shall be union bonnet with metal plug type disc.
 - 2. 65 mm (2 1/2 inches) and larger:
 - a. Globe valves for high pressure steam 413 kPa (60 psi) and above nominal MPS system): Cast steel body, ASTM A216 grade WCB,

flanged, OS&Y, 1034 kPa (150 psi) at 260 °C (500 °F), 11-1/2 to 13 percent chrome stainless steel disc and renewable seat rings.

- b. All other services: 861 kPa (125 psi), flanged, iron body, bronze trim, MSS-SP-85 for globe valves and MSS-SP-71 for check valves.
- F. Non-Slam or Silent Check Valve: Spring loaded double disc swing check or internally guided flat disc lift type check for bubble tight shut-off. Provide where check valves are shown in chilled water and hot water piping. Check valves incorporating a balancing feature may be used.
1. Body: Cast iron, ASTM A126, Class B, or steel, ASTM A216, Class WCB, or ductile iron, ASTM 536, flanged, grooved, or wafer type.
 2. Seat, disc and spring: 18-8 stainless steel, or bronze, ASTM B62. Seats may be elastomer material.
- G. Butterfly Valves: May be used in lieu of gate valves in water service except for direct buried pipe. Provide stem extension to allow 50 mm (2 inches) of pipe insulation without interfering with valve operation.
1. 50 mm (2 inches) and smaller: Fed. Spec. WW-V-1967.
 2. 65 mm (2 1/2 inches) and larger: MSS-SP 67, flange lug type (for end of line service) or grooved end rated 1205 kPa (175 psi) working pressure at 93 °C (200 °F).
 - a. Body: Cast iron, ASTM A126, Class B. Malleable iron, ASTM A47 electro-plated, or ductile iron, ASTM A536, Grade 65-45-12 electro-plated.
 - b. Trim: Bronze, aluminum bronze, or 300 series stainless steel disc, bronze bearings, 316 stainless steel shaft and manufacturer's recommended resilient seat. Resilient seat shall be field replaceable, and fully line the body to completely isolate the body from the product. A phosphate coated steel shaft or stem is acceptable, if the stem is completely isolated from the product.
 - c. Actuators: Field interchangeable. Valves for balancing service shall have adjustable memory stop to limit open position.
 - 1) Valves 150 mm (6 inches) and smaller: Lever actuator with minimum of seven locking positions, except where chain wheel is required.
 - 2) Valves 200 mm (8 inches) and larger: Enclosed worm gear with handwheel, and where required, chain-wheel operator.

- H. Ball Valves: Fed. Spec. WW-V-35, Class A (bronze), or Class F (malleable iron), Style 1 (permits inspection and repair of seats and seals without removing the valve from the line), screwed or solder connections. Provide stem extension to allow operation without interfering with pipe insulation.
- I. Water Flow Balancing Valves: For flow regulation and shut-off. Valves shall be line size rather than reduced to control valve size and be one of the following types.
 - 1. Butterfly valve as specified herein with memory stop.
 - 2. Eccentric plug valve: Iron body, bronze or nickel-plated iron plug, bronze bearings, adjustable memory stop, operating lever, rated 861 kPa (125 psi) and 121 °C (250 °F).
- J. Circuit Setter Valve: A dual purpose flow balancing valve and adjustable flow meter, with bronze or cast iron body, calibrated position pointer, valved pressure taps or quick disconnects with integral check valves and preformed polyurethane insulating enclosure. Provide a readout kit including flow meter, readout probes, hoses, flow charts or calculator, and carrying case.
- K. Triple Duty Valve: Contractors option for use at pump discharge in lieu of check valve and balancing/shut-off valve. Triple duty valve is a non-slam check valve with spring-loaded weighted disc and a calibrated adjustment feature permitting regulation of pump discharge flow and shut-off. Valves shall be designed to permit repacking under full line pressure. Unit shall be installed on discharge side of pump in a horizontal or vertical position with the stem up. Unit shall be cast iron body construction suitable for maximum working pressure of 1205 kPa (175 PSI) and maximum operating temperature of 149 °C (300 °F), bronze disc and seat, stainless steel stem and spring.
- L. Manual Radiator/Convactor Valves: Brass, packless, with position indicator.

2.8 WATER FLOW MEASURING DEVICES:

- A. Minimum overall accuracy plus or minus three percent over a range of 70 to 110 percent of design flow. Select devices for not less than 110 percent of design flow rate.
- B. Venturi Type: Bronze, steel, or cast iron with bronze throat, with valved pressure sensing taps upstream and at the throat.

C. Flow Measurement/Balance Valves: A system comprised of two valves of bronze and stainless steel metallurgy designed for 1205 kPa (175 psi) pressure at 121 °C (250 °F), with thermal insulation sleeve.

1. Measurement and shut-off valve: An on/off ball valve with integral high regain venturi and dual quick connect valves with integral check valves and color coded safety caps for pressure/temperature readout.
2. A butterfly balancing valve as specified herein, with memory stop and quick connect valve for pressure/temperature readout.

D. Insertion Turbine Type Sensor: Section 15902, CONTROLS AND INSTRUMENTATION (DDC).

E. Flow Measuring Device Identification:

1. Metal tag attached by chain to the device.
2. Include meter or equipment number, manufacturer's name, meter model, flow rate factor and design flow rate in L/M (gpm).

2.9 STRAINERS:

A. Basket or Y Type. Tee type is acceptable for water service.

B. All Services: Rated 861 kPa (125 psi) saturated steam.

1. 65 mm (2-1/2 inches) and larger: Flanged, iron body.
2. 50 mm (2 inches) and smaller: Cast iron or bronze.

C. Screens: Bronze, monel metal or 18-8 stainless steel, free area not less than 2-1/2 times pipe area, with perforations as follows:

1. 75 mm (3 inches) and smaller: 20 mesh for steam and 1.1 mm (0.045 inch) diameter perforations for liquids.
2. 100 mm (4 inches) and larger: 1.1 mm (0.045) inch diameter perforations for steam and 3.2 mm (0.125 inch) diameter perforations for liquids.

D. Suction Diffusers: Specified in Section 15140, PUMPS (HVAC).

2.10 FLEXIBLE CONNECTORS FOR WATER SERVICE:

A. Flanged Spool Connector:

1. Single arch or multiple arch type. Tube and cover shall be constructed of chlorobutyl elastomer with full faced integral flanges to provide a tight seal without gaskets. Connectors shall be internally reinforced with high strength synthetic fibers impregnated with rubber or synthetic compounds as recommended by connector manufacturer, and steel reinforcing rings.
2. Working pressures and temperatures shall be as follows:

- a. Connector sizes 50 mm to 100 mm (2 inches to 4 inches), 1137 kPa (165 psi) at 121 °C (250 °F).
 - b. Connector sizes 125 mm to 300 mm (5 inches to 12 inches), 965 kPa (140 psi) at 121 °C (250 °F).
3. Provide ductile iron retaining rings and control units.
- B. Mechanical Pipe Couplings:
1. See other fittings specified under Part 2, PRODUCTS.

2.11 PIPE ALIGNMENT GUIDES:

Factory-made cast semi-steel or fabricated steel, consisting of a bolted two-section outer cylinder and base with two-section guiding spider bolted or welded tight to the pipe. Guide and spider shall be of sufficient size to clear pipe insulation and long enough to prevent over travel of spider and cylinder. Guides shall not be used as pipe supports.

2.12 STEAM SYSTEM COMPONENTS:

- A. Safety Valves and Accessories: Comply with ASME Boiler and Pressure Vessel Code, Section VIII. Capacities shall be certified by National Board of Boiler and Pressure Vessel Inspectors, maximum accumulation 10 percent. Provide lifting lever. Provide drip pan elbow where shown.
- B. Steam PRV for Individual Equipment: Cast iron or bronze body, screwed ends, rated 861 kPa (125 psi) working pressure. Single-seated, diaphragm operated, spring loaded, adjustable range, all parts renewable.
- C. Steam Trap: Conform to Fed. Spec. WW-T-696. Each type of trap shall be the product of a single manufacturer. Provide trap sets at all low points and at 61 m (200 feet) intervals on the horizontal main lines.
1. Floats and linkages shall provide sufficient force to open trap valve over full operating pressure range available to the system. Unless otherwise indicated on the drawings, traps shall be sized for capacities indicated at minimum pressure drop as follows:
 - a. For equipment with modulating control valve: 1.7 kPa (1/4 psi), based on a condensate leg of 300 mm (12 inches) at the trap inlet and gravity flow to the receiver.
 - b. For main line drip trap sets and other trap sets at steam pressure: Up to 70 percent of design differential pressure. Condensate may be lifted to the return line.

2. Trap bodies: Bronze, cast iron, or semi-steel, constructed to permit ease of removal and servicing working parts without disturbing connecting piping. For systems without relief valve traps shall be rated for the pressure upstream of the PRV supplying the system.
 3. Balanced pressure thermostatic elements: Phosphor bronze, stainless steel or monel metal.
 4. Valves and seats: Suitable hardened corrosion resistant alloy.
 5. Mechanism: Brass, stainless steel or corrosion resistant alloy.
 6. Floats: Stainless steel.
 7. Inverted bucket traps: Provide bi-metallic thermostatic element for rapid release of non-condensables.
- D. Thermostatic Air Vent (Steam): Brass or iron body, balanced pressure bellows, stainless steel (renewable) valve and seat, rated 861 kPa (125 psi) working pressure, 20 mm (3/4 inch) screwed connections. Air vents shall be balanced pressure type that responds to steam pressure-temperature curve and vents air at any pressure.

2.13 HYDRONIC SYSTEM COMPONENTS:

- A. Convertor: Shell and tube type, U-bend removable tube bundle, steam in shell, water in tubes, equipped with support cradles.
1. Maximum tube velocity: 2.3 m/S (7.5 feet per second).
 2. Tube fouling factor: TEMA Standards, 5th Edition, but not less than 0.001.
 3. Materials:
 - a. Shell: Steel.
 - b. Tube shell and tube supports: Steel or brass.
 - c. Tubes: 20 mm (3/4 inch) OD copper.
 - d. Head or bonnet: Cast iron or steel.
 4. Construction: In accordance with ASME Pressure Vessel Code for 861 kPa (125 psi) working pressure for shell and tubes. Provide manufacturer's certified data report, Form No. U-1.
- B. Air Purger: Cast iron or fabricated steel, 861 kPa (125 psi) water working pressure, for in-line installation.
- C. Tangential Air Separator: ASME Pressure Vessel Code construction for 861 kPa (125 psi) working pressure, flanged tangential inlet and outlet connection, internal perforated stainless steel air collector tube designed to direct released air into expansion tank, bottom blowdown connection. Provide Form No. U-1. If scheduled on the drawings, provide

a removable stainless steel strainer element having 5 mm (3/16 inch) perforations and free area of not less than five times the cross-sectional area of connecting piping.

- D. Diaphragm Type Pre-Pressurized Expansion Tank: ASME Pressure Vessel Code construction for 861 kPa (125 psi) working pressure, welded steel shell, rust-proof coated, with a flexible elastomeric diaphragm suitable for a maximum operating temperature of 116 °C (240 °F). Provide Form No. U-1. Tank shall be equipped with system connection, drain connection, standard air fill valve and be factory pre-charged to 83 kPa (12 psi) or as indicated.
- E. Pressure Reducing Valve (Water): Diaphragm or bellows operated, spring loaded type, with minimum adjustable range of 28 kPa (4 psi) above and below set point. Bronze, brass or iron body and bronze, brass or stainless steel trim, rated 861 kPa (125 psi) working pressure at 107 °C (225 °F).
- F. Pressure Relief Valve: Bronze or iron body and bronze or stainless steel trim, with testing lever. Comply with ASME Code for Pressure Vessels, Section 8, bear ASME stamp.
- G. Automatic Air Vent Valves (where shown): Cast iron or semi-steel body, 1034 kPa (150 psi) working pressure, stainless steel float, valve, valve seat and mechanism, minimum 15 mm (1/2 inch) water connection and 6 mm (1/4 inch) air outlet.

2.14 GAGES, PRESSURE AND COMPOUND:

- A. ANSI B40.1, Accuracy Grade 1A, (pressure, vacuum, or compound for air, steam, oil or water), initial mid-scale accuracy 1 percent of scale (Qualify grade), metal or phenolic case, 115 mm (4-1/2 inches) in diameter, 6 mm (1/4 inch) NPT bottom connection, white dial with black graduations and pointer, clear glass or acrylic plastic window, suitable for board mounting. Provide red "set hand" to indicate normal working pressure.
- B. Provide brass, lever handle union cock. Provide brass/bronze pressure snubber for gages in water service. Provide brass pigtail syphon for steam gages.
- C. Range of Gages: For services not listed provide range equal to at least 130 percent of normal operating range:

Low pressure steam to 103 kPa (15 PSI)	0 to 207 kPa (30 PSI).
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Medium pressure steam nominal 413 kPa (60 PSI)	0 to 689 kPa (100 PSI).
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2.15 PRESSURE/TEMPERATURE TEST PROVISIONS:

- A. Pete's Plug: 6 mm (1/4 inch) MPT by 75 mm (3 inches) long, brass body and cap, with retained safety cap, nordel self-closing valve cores, permanently installed in piping where shown, or in lieu of pressure gage test connections shown on the drawings.
- B. Provide one each of the following test items to the Resident Engineer:
 - 1. 6 mm (1/4 inch) FPT by 3 mm (1/8 inch) diameter stainless steel pressure gage adapter probe for extra long test plug. PETE'S 500 XL is an example.
 - 2. 90 mm (3-1/2 inch) diameter, one percent accuracy, compound gage, Fed. Spec. GG-G-76D, 762 mm (30 inches) Hg to 689 kPa (100 psi) range.
 - 3. 0 - 104 °C (220 °F) pocket thermometer one-half degree accuracy, 25 mm (one inch) dial, 125 mm (5 inch) long stainless steel stem, plastic case.

2.16 THERMOMETERS:

- A. Mercury or organic liquid filled type, red or blue column, clear plastic window, with 150 mm (6 inch) brass stem, straight, fixed or adjustable angle as required for each in reading.
- B. Case: Chrome plated brass or aluminum with enamel finish.
- C. Scale: Not less than 225 mm (9 inches), range as described below, two degree graduations.
- D. Separable Socket (Well): Brass, extension neck type to clear pipe insulation.
- E. Scale ranges may be slightly greater than shown to meet manufacturer's standard. Required ranges in degrees C (F):

Chilled Water and Glycol-Water 0 to 38 °C (100 °F)	Hot Water and Glycol-Water -1 °C to 116 °C (30 °F to 240 °F).
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2.17 FIRESTOPPING MATERIAL:

Refer to Section 15050, BASIC METHODS AND REQUIREMENTS (MECHANICAL).

2.18 ELECTRICAL HEAT TRACING SYSTEMS:

- A. Systems shall meet requirements of the National Electrical Code (NEC), Section 427.
- B. Provide tracing for outdoor piping for domestic cold water and HVAC piping and as follows:

SECTION 15705
HVAC PIPING SYSTEMS

Domestic cold water/HVAC make-up water piping to AHU.

- C. Heating Cable: Flexible, parallel circuit construction consisting of a continuous self-limiting resistance, conductive inner core material between two parallel copper bus wires, designed for cut-to-length at the job site and for wrapping around valves and complex fittings. Self-regulation shall prevent overheating and burnouts even where the cable overlaps itself.
1. Provide end seals for ends of circuits. Wire at the ends of circuits are not to be tied together.
 2. Provide sufficient cable, as recommended by the manufacturer, to keep the pipe surface at 2.2 °C (36 °F) minimum during winter outdoor design temperature, but not less than the following:
 - a. 75 mm (3 inch) pipe and smaller with 25 mm (1 inch) thick insulation: 4 watts per foot of pipe.
 - b. 100 mm 300 mm (foot) pipe and larger 38 mm (1-1/2 inch) thick insulation: 8 watts per 300 mm (foot) of pipe.
- D. Electrical Heating Tracing Accessories:
1. Power supply connection fitting and stainless steel mounting brackets. Provide stainless steel worm gear clamp to fasten bracket to pipe.
 2. 13 mm (1/2 inch) wide fiberglass reinforced pressure sensitive cloth tape to fasten cable to pipe at 300 mm (12 inch) intervals.
 3. Pipe surface temperature control thermostat: Cast aluminum, NEMA 4 (watertight) enclosure, 15 mm (1/2 inch) NPT conduit hub, SPST switch rated 20 amps at 480 volts AC, with capillary and copper bulb sensor. Set thermostat to maintain pipe surface temperature at not less than 1.1 °C (34 °F).
 4. Signs: Manufacturer's standard (NEC Code), stamped "ELECTRIC TRACED" located on the insulation jacket at 3000 mm (10 feet) intervals along the pipe on alternating sides.

PART 3 - EXECUTION

3.1 GENERAL:

- A. The drawings show the general arrangement of pipe and equipment but do not show all required fittings and offsets that may be necessary to connect pipes to equipment, fan-coils, coils, radiators, etc., and to coordinate with other trades. Provide all necessary fittings, offsets and pipe runs based on field measurements and at no additional cost to

the government. Coordinate with other trades for space available and relative location of HVAC equipment and accessories to be connected on ceiling grid. Pipe location on the drawings shall be altered by contractor where necessary to avoid interferences and clearance difficulties.

- B. Store materials to avoid excessive exposure to weather or foreign materials. Keep inside of piping relatively clean during installation and protect open ends when work is not in progress.
- C. Support piping securely. Refer to PART 3, Section 15050, BASIC METHODS AND REQUIREMENTS (MECHANICAL). Install convertors and other exchangers at height sufficient to provide gravity flow of condensate to the flash tank and condensate pump.
- D. Install piping generally parallel to walls and column center lines, unless shown otherwise on the drawings. Space piping, including insulation, to provide 25 mm (one inch) minimum clearance between adjacent piping or other surface. Unless shown otherwise, slope steam, condensate and drain piping down in the direction of flow not less than 25 mm (one inch) in 12 m (40 feet). Provide eccentric reducers to keep bottom of sloped piping flat.
- E. Locate and orient valves to permit proper operation and access for maintenance of packing, seat, and disc. Generally locate valve stems in overhead piping in horizontal position. Provide a union adjacent to one end of all threaded end valves. Control valves usually require reducers to connect to pipe sizes shown on the drawing. Install butterfly valves with the valve open as recommended by the manufacturer to prevent binding of the disc in the seat.
- F. Offset equipment connections to allow valving off for maintenance and repair with minimal removal of piping. Provide flexibility in equipment connections and branch line take-offs with 3-elbow swing joints where noted on the drawings.
- G. Tee water piping runouts or branches into the side of mains or other branches. Avoid bull-head tees, which is two return lines entering opposite ends of a tee and exiting out the common side.
- H. Connect piping to equipment as shown on the drawings. Install components furnished by others such as:
 - 1. Water treatment pot feeders and condenser water treatment systems.

2. Flow elements (orifice unions), control valve bodies, flow switches, pressure taps with valve, and wells for sensors.
- I. Thermometer Wells: In pipes 65 mm (2-1/2 inches) and smaller increase the pipe size to provide free area equal to the upstream pipe area.
- J. Firestopping: Fill openings around uninsulated piping penetrating floors or fire walls, with firestop material. For firestopping insulated piping refer to Section 15250, INSULATION.
- K. Seismic Bracing: Refer to Section 15050, Basic Methods and Requirements (Mechanical).

3.2 PIPE JOINTS:

- A. Welded: Beveling, spacing and other details shall conform to ANSI B31.1.
- B. Screwed: Threads shall conform to ANSI B2.1; joint compound shall be applied to male threads only and joints made up so no more than three threads show. Coat exposed threads on steel pipe with joint compound, or red lead paint for corrosion protection.
- C. Mechanical Joint: Pipe grooving shall be in accordance with joint manufacturer's specifications. Lubricate gasket exterior including lips, pipe ends and housing interiors to prevent pinching the gasket during installation. Lubricant shall be as recommended by coupling manufacturer.
- D. 125 Pound Cast Iron Flange (Plain Face): Mating flange shall have raised face, if any, removed to avoid overstressing the cast iron flange.
- E. Solvent Welded Joints: As recommended by the manufacturer.

3.3 STEAM TRAP PIPING:

Install to permit gravity flow to the trap. Provide gravity flow (avoid lifting condensate) from the trap where modulating control valves are used. Support traps weighing over 11 kg (25 pounds) independently of connecting piping.

3.4 LEAK TESTING:

- A. Inspect all joints and connections for leaks and workmanship and make corrections as necessary, to the satisfaction of the Resident Engineer. Tests may be either of those below, or a combination, as approved by the Resident Engineer.
- B. An operating test at design pressure, and for hot systems, design maximum temperature.

C. A hydrostatic test at 1.5 times design pressure. For water systems the design maximum pressure would usually be the static head, or expansion tank maximum pressure, plus pump head. Factory tested equipment (convertors, exchangers, coils, etc.) need not be field tested. Avoid excessive pressure on mechanical seals and safety devices.

3.5 FLUSHING AND CLEANING PIPING SYSTEMS:

- A. Steam, Condensate, and Vent Piping: No flushing or chemical cleaning required. Accomplish cleaning by pulling all strainer screens and cleaning all scale/dirt legs during start-up operation.
- B. Water Piping: Clean systems as recommended by the suppliers of chemicals specified in Section 15704, WATER TREATMENT (HVAC).
1. Initial flushing: Remove loose dirt, mill scale, metal chips, weld beads, rust, and like deleterious substances without damage to any system component. Provide temporary piping or hose to bypass coils, control valves, exchangers and other factory cleaned equipment unless acceptable means of protection are provided and subsequent inspection of hide-out areas takes place. Isolate or protect clean system components, including pumps and pressure vessels, and remove any component which may be damaged. Open all valves, drains, vents and strainers at all system levels. Remove plugs, caps, spool pieces, and components to facilitate early debris discharge from system. Sectionalize system to obtain debris carrying velocity of 1.8 m/S (6 feet per second), if possible. Connect dead-end supply and return headers as necessary. Flush bottoms of risers. Install temporary strainers where necessary to protect down-stream equipment. Supply and remove flushing water and drainage by various type hose, temporary and permanent piping and Contractor's booster pumps. Flush until clean as approved by the Resident Engineer.
 2. Cleaning: Using products supplied in Section 15704, WATER TREATMENT, (HVAC), circulate systems at normal temperature to remove adherent organic soil, hydrocarbons, flux, pipe mill varnish, pipe joint compounds, iron oxide, and like deleterious substances not removed by flushing, without chemical or mechanical damage to any system component. Removal of tightly adherent mill scale is not required. Keep isolated equipment which is "clean" and where dead-end debris accumulation cannot occur. Sectionalize system if possible, to circulate at velocities not less than 1.8 m/S (6 feet per second).

Circulate each section for not less than four hours. Blow-down all strainers, or remove and clean as frequently as necessary. Drain and prepare for final flushing.

3. Final Flushing: Return systems to conditions required by initial flushing after all cleaning solution has been displaced by clean make-up. Flush all dead ends and isolated clean equipment. Gently operate all valves to dislodge any debris in valve body by throttling velocity. Flush for not less than one hour.

3.6 ELECTRIC HEAT TRACING:

- A. Install tracing as recommended by the manufacturer.
- B. Coordinate electrical connections.

3.7 OPERATING AND PERFORMANCE TEST AND INSTRUCTION:

- A. Refer to PART 3, Section 15050, BASIC METHOD AND REQUIREMENTS (MECHANICAL).
- B. Adjust red set hand on pressure gages to normal working pressure.

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**SECTION 15740
AIR TERMINALS**

PART 1 - GENERAL

1.1 DESCRIPTION:

A. Air terminal units, unit heaters and cabinet unit heaters.

1.2 RELATED WORK:

- A. Section 01001, GENERAL CONDITIONS.
- B. Section 01010, GENERAL REQUIREMENTS.
- C. Section 01340, SAMPLES AND SHOP DRAWINGS.
- D. Section 15050, BASIC METHODS AND REQUIREMENTS (MECHANICAL).
- E. Section 15200, NOISE AND VIBRATION CONTROL.
- F. Section 15840, DUCTWORK AND ACCESSORIES.
- G. Section 15902, CONTROLS AND INSTRUMENTATION (DDC).
- H. Section 15980, TESTING, ADJUSTING, AND BALANCING.

1.3 QUALITY ASSURANCE:

Refer to Paragraph, QUALITY ASSURANCE, in Section 15050, BASIC METHODS AND REQUIREMENTS (MECHANICAL).

1.4 SUBMITTALS:

- A. Submit in accordance with Section 01340, SAMPLES AND SHOP DRAWINGS.
- B. Manufacturer's Literature and Data:
 - 1. Air Terminal Units: Submit test data.
 - 2. Unit heaters.
 - 3. Cabinet unit heaters.
- C. Samples: Provide one typical air terminal unit for approval by the Resident Engineer. This unit will be returned to the Contractor after all similar units have been shipped and deemed acceptable at the job site.
- D. Certificates:
 - 1. Compliance with paragraph, QUALITY ASSURANCE.
 - 2. Compliance with specified standards.
- E. Operation and Maintenance Manuals: Submit in accordance with paragraph, INSTRUCTIONS, in Section 01010, GENERAL REQUIREMENTS.

1.5 APPLICABLE PUBLICATIONS:

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. Air Conditioning and Refrigeration Institute (ARI):

- 440-97.....Room Fan-coil and Unit Ventilator
- C. ARI/ADC (Air Diffusion Council) Industry Standard:
 - 880-94.....Air Terminals
- D. Underwriters Laboratories, Inc. (UL):
 - 181-96.....UL Standard for Safety Factory-Made Air Ducts
and Air Connectors
 - 883-86.....UL Standard for Safety Fan-Coil Units and Room
Fan-Heater Units
- E. National Fire Protection Association (NFPA)
 - 90A-96.....Standard for the Installation of Air
Conditioning and Ventilating Systems
 - 70-96.....National Electrical Code

1.6 GUARANTY:

In accordance with Section 01001, GENERAL CONDITIONS.

PART 2 - PRODUCTS

2.1 AIR TERMINAL UNITS (BOXES):

- A. General: Factory built, pressure independent units, factory set-field adjustable volume, suitable for single duct applications, with hot water heating coils, as indicated. Clearly show on each unit the unit number and factory set air volumes corresponding to the contract drawings. Section 15980, TESTING, ADJUSTING AND BALANCING work assumes factory set air volumes. Coordinate flow controller sequence and damper operation details with the drawings and Section 15902, CONTROLS AND INSTRUMENTATION (DDC).
- B. Rating and Performance Certification: ARI/ADC Industry Standard 880.
 - 1. Maximum pressure drop: As shown on the drawings.
 - 2. Maximum room sound levels: Not to exceed criteria on drawings and in Section 15200, NOISE AND VIBRATION CONTROL (Low-pressure duct is usually unlined) at the inlet pressure shown on drawings or not less than 374 Pa (1-1/2 inches WG), if not shown. Provide terminal sound attenuators where necessary to comply with the noise criteria. Sound tests and correction of deficiencies is specified in Section 15980, TESTING, ADJUSTING AND BALANCING.
- C. Casing: Construct portions of casing exposed to high upstream static pressures of die cast aluminum, 0.70 mm (24 gage) galvanized sheet metal, or equivalent strength aluminum sheet. Downstream portions of casing may be constructed of not lighter than 0.55 mm (26 gage)

galvanized sheet metal, or equivalent strength aluminum sheet. Provide hanger brackets for attachment of supports.

1. Lining material: Suitable to provide required acoustic performance, thermal insulation and prevent sweating. Meet the requirements of NFPA 90A and comply with UL 181 for erosion, 13 mm (one-half inch) minimum thickness, secured to supporting surfaces in such a manner that it will not sag, delaminate, or settle. Comply with UL Standard 181 for erosion. Material shall be fiber-free closed cell foam or foil-faced fiberglass surfaces, including all edges, shall be faced with non-porous, sealed coating so that the air stream will not detach material. Exposed fiberglass is not acceptable.
 2. Access panels (or doors): Provide panels large enough for access to all moving parts (except neoprene bellows when bellows are the only moving part) for inspection, adjustment and maintenance without disconnecting ducts, and for access for cleaning heating coil attached to unit. Panels shall be flush, gasketed airtight and shall require no tool other than a screwdriver to remove. Access panels on low-pressure side, i.e., downstream of volume damper, do not require gasket if tightly fitted.
 3. Total leakage from casing: Not to exceed 3 percent of the nominal capacity of the unit when subjected to a static pressure of 13 mm (1/2-inch water gage), with all outlets sealed shut and inlets fully open.
- D. Construct dampers and other internal devices of corrosion resisting materials, which do not require lubrication or other periodic maintenance.
- E. Hot Water Reheat Coils: Hot water reheat coils shall be enclosed in a minimum 20 gauge galvanized steel casing with slip and drive construction for attachment to metal ductwork. Coils shall be factory installed on the terminal discharge. Fins shall be rippled and corrugated heavy gauge aluminum, mechanically bonded to tubes. Tubes shall be copper with minimum wall thickness of .016" with male solder header connections. Coils shall be leak tested to 300 psi with minimum burst pressure of 2000 psi at ambient temperature. Number of coil rows and circuits shall be selected to provide performance as required per the drawings. Coil performance data shall be based on tests run in accordance with ARI Standard 410.

- F. Single Duct Terminals: Provide manufacturer's standard cataloged heating coil where indicated on the drawings.
1. Variable volume units (VAV): Externally powered DDC control, variable volume, with field adjustable maximum and minimum set point.
 - a. Volume damper: Provide internal or external factory mounted damper operator. Maximum leakage rate of closed damper shall not exceed 4.0 percent of nominal capacity of unit when inlet static pressure is 747 Pa (3.0 inches water gage).
 - b. Electronic controller: Provide pressure independent electronic controls, which can be reset to modulate airflow between, zero and the maximum cataloged CFM. Provide multi-point, center-averaging velocity sensor, with a minimum of four measuring ports. Provide a minimum differential pressure signal of 7.5 Pa (0.03"wg.) at inlet velocity of 2.6 m/s (500 fpm). Provide control signal accuracy of plus or minus 5 percent with the same inlet size at any inlet condition. The velocity controller shall have a constant 2 degrees temperature reset span regardless of the minimum and maximum airflow limit. Provide 24 vac reversible actuator, class II 24 vac transformer, and disconnect switch. Actuator shall be direct connection shaft mount type without linkage, and be equipped with magnetic clutch. All controls shall be installed in approved NEMA 1 enclosure.

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. Handle and install units in accordance with manufacturer's written instructions.
- B. Support units rigidly so they remain stationary at all times. Cross-bracing or other means of stiffening shall be provided as necessary. Method of support shall be such that distortion and malfunction of units cannot occur.
- C. Locate air terminal units to provide a straight section of inlet duct for proper functioning of volume controls.

3.2 OPERATIONAL TEST:

Section 15050, BASIC METHODS AND REQUIREMENTS (MECHANICAL).

- - - E N D - - -

**SECTION 15750
HEATING AND COOLING COILS**

PART 1 - GENERAL

1.1 DESCRIPTION:

A. Heating and cooling coils for air handling unit and duct applications.

1.2 RELATED WORK:

A. Section 15050, BASIC METHODS AND REQUIREMENTS (MECHANICAL).

B. Section 15763, AIR HANDLING UNITS.

C. Reheat coils for VAV/CV terminals: Section 15740, AIR TERMINALS.

1.3 QUALITY ASSURANCE:

A. Refer to paragraph, QUALITY ASSURANCE, Section 15050, BASIC METHODS AND REQUIREMENTS (MECHANICAL).

B. Unless specifically exempted by these specifications, heating and cooling coils shall be tested, rated, and certified in accordance with ARI Standard 410 and shall bear the ARI certification label.

1.4 SUBMITTALS:

A. Submit in accordance with Section 01340, SAMPLES AND SHOP DRAWINGS.

B. Manufacturer's Literature and Data for Heating and Cooling Coils: Submit type, size, arrangements and performance details. Present application ratings in the form of tables, charts or curves. Provide installation, operating and maintenance instructions.

C. Certification Compliance: Evidence of listing in current ARI Directory of Certified Applied Air Conditioning Products.

D. Coils may be submitted with Section, AIR HANDLING UNITS.

1.5 APPLICABLE PUBLICATIONS:

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

B. Air Conditioning and Refrigeration Institute (ARI):
Directory of Certified Applied Air Conditioning Products
ARI 410-91.....Forced Circulation Air Cooling and Air Heating
Coils.

C. Underwriters Laboratories, Inc. (UL):
1996-96.....Electric Duct Heaters

PART 2 - PRODUCTS

2.1 HEATING AND COOLING COILS:

A. Tubes: Seamless copper tubing.

- B. Fins: 0.1397 mm (0.0055 inch) aluminum or 0.1143 mm (0.0045 inch) copper mechanically bonded or soldered or helically wound around tubing.
- C. Headers: Copper, welded steel or cast iron.
- D. "U" Bends, Where Used: Machine die formed, silver brazed to tube ends.
- E. Coil Casing: 1.6 mm (16 gage) galvanized steel with tube supports at 1200 mm (48 inch) maximum spacing. Construct casing to eliminate air bypass and moisture carry-over. Provide duct connection flanges.
- F. Pressures kPa (PSIG):

Pressure	Water Coil
Test	2070 (300)
Working	1380 (200)

- G. Protection: Unless protected by the coil casing, provide cardboard, plywood, or plastic material at the factory to protect tube and finned surfaces during shipping and construction activities.
- H. Vents and Drain: Coils that are not vented or drainable by the piping system shall have capped vent/drain connections extended through coil casing.
- I. Cooling Coil Condensate Drain Pan: Section, AIR HANDLING UNITS.

2.2 WATER COILS, INCLUDING GLYCOL-WATER:

- A. Drainable Type (Self-Draining, Self-Venting):
 - 1. Cooling, all types.
 - 2. Heating or preheat.

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. Follow coil manufacturer's instructions for handling and installation.
- B. Comb fins if damaged. Eliminate air bypass or leakage at coil sections.

- - - E N D - - -

**SECTION 15763
AIR HANDLING UNITS**

PART 1 - GENERAL

1.1 DESCRIPTION:

- A. Air handling units including integral components specified herein.
- B. Definitions:
 - 1. Air Handling Unit (AHU): A factory fabricated, custom designed, exterior penthouse type, assembly consisting of a casing, fans, coils, filters, base, access doors, vibration isolators, stratification eliminators, service corridor, louvers, dampers, variable frequency drives, hoods, motors, wiring and electrical components, and other accessories and necessary equipment to perform one or more of the following functions of circulating, cleaning, heating, cooling, dehumidifying, and mixing of air. Design capacities of units shall be as scheduled on the drawings. Refer to drawings for unit configuration.
- C. Air handling units shall be designed and manufactured in the USA to the specific requirements of this project.

1.2 RELATED WORK:

- A. Section 15050, BASIC METHODS AND REQUIREMENTS (MECHANICAL).
- B. Section 15200, NOISE AND VIBRATION CONTROL.
- C. Section 15250, INSULATION.
- D. Section 15705, HVAC PIPING SYSTEMS.
- E. Section 15750, HEATING AND COOLING COILS.
- F. Section 15822, FANS.
- G. Section 15840, DUCTWORK AND ACCESSORIES.
- H. Section 15885, AIR FILTERS.
- I. Section 15902, CONTROLS AND INSTRUMENTATION (DDC).
- J. Section 15980, TESTING ADJUSTING AND BALANCING.
- K. Section 16150, MOTORS.
- L. Section 16155, MOTOR STARTERS.

1.3 QUALITY ASSURANCE:

- A. Refer to Article, Quality Assurance, in Section 15050, BASIC METHODS AND REQUIREMENTS (MECHANICAL).
- B. Air Handling Units Certification:

1. Fans shall conform to AMCA bulletins regarding testing and construction. Airfoil fans shall bear the AMCA certified rating seal for airflow and sound.
2. Coils shall be ARI certified.
3. Filter media shall be ULC listed.
4. Units shall be factory UL/ETL/CSA approved and labeled. Failure to comply with this requirement will necessitate the manufacturer, at his expense, to have a certified UL/ETL/CSA representative inspect the equipment prior to affixing a label.
5. All air handling units shall be factory tested prior to shipment, in accordance with paragraph Test Procedure.

C. Performance Criteria:

1. The fan schedule indicates design cubic meter per minute (cubic feet per minute) and design static pressure. Scheduled fan motors, 375 watts (1/2 horsepower) and larger, are sized for the maximum of present or future design cubic meter per minute (cubic feet per minute) at 110 percent design static pressure, but not to exceed 187 Pa (3/4 inch water) additional pressure.
 2. Provide fans and motors capable of stable operation at design conditions and at design cubic meters per minute (cubic feet per minute) and 110 percent pressure as stated above.
 3. Lower than design pressure drop of approved individual components may allow use of a smaller fan motor and still provide the safety factor. When submitted as a deviation, a smaller motor may be approved in the interest of energy conservation. Such a deviation shall not qualify for any value engineering incentive claim or reward.
 4. Select fan operating point to right hand side of peak static pressure point and near the peak of static efficiency.
 5. Heating, Cooling, and Air Handling Capacity and Performance Standards: ARI 430, ARI 410, ASHRAE 51, and AMCA 210.
 6. Operating Limits: AMCA 99.
- D. Units shall be constructed by a manufacturer who has been manufacturing air handling units for at least ten (10) years.
- E. Units shall be produced by a recognized manufacturer who maintains a local service agency and parts stock.

F. Condensation: During first year guarantee period, if condensation forms on any section of air handler when unit is operating at design conditions, contractor shall replace or repair unit to correct the situation. Repairs shall not impair unit or component accessibility and future repairability and inherent access for maintenance. All repairs shall be subject to Contracting Officer's approval.

1.4 SUBMITTALS:

A. The contractor shall, in accordance with Section 01340, SAMPLE AND SHOP DRAWINGS furnish a complete submission for all air handling units covered in the project. The submission shall include all information listed below. Partial and incomplete submissions shall be rejected without reviews.

B. Manufacturer's Literature and Data:

1. Submittals for AHUs shall include fans, drives, motors, coils, sound attenuators, mixing box with outside/return air dampers, filter housings, and all other related accessories. The contractor shall provide custom drawings showing total air handling unit assembly including dimensions, weights, capacities, certifications, access sections, diffusion plates, casing, construction details, gauges, material finishes, flexible connections, door swings, control penetrations, electrical disconnect, lights, duplex outlets, switches, wiring, utility connection points, unit support system, vibration isolators, drain pan, and rigging points. Submittal drawings of section or component only, will not be acceptable. Contractor shall also submit performance data including performance test results, charts, curves or certified computer selection data; data sheets; fabrication and insulation details; and the number of pieces that each unit will have to be broken into to meet shipping and job site rigging requirements.
2. The submittal shall provide all technical information relevant to the product being provided, including but not limited to, all the information shown in the schedules of this specification. It is the responsibility of the supplier to highlight any variances his equipment has with the requirements of this specification. Information shall be provided in the same measurement units as indicated elsewhere in this specification.

3. Submit sound power levels in each octave band for fan and at entrance and discharge of AHUs and radiated values at both present and future scheduled conditions. Include sound attenuator capacities and itemized internal component attenuation. Internal lining of supply air ductwork with sound absorbing material is not permitted. In absence of sound power ratings refer to Section 15200, NOISE AND VIBRATION CONTROL.
4. Provide fan curves showing cubic meters per minute (cubic feet per minute), static pressure, efficiency, and horsepower for both present and future design point of operation and at maximum of present and future design cubic meters per minute (cubic feet per minute) and 110 percent of design static pressure.
5. Submit total fan static pressure, external static pressure, for AHU including total, inlet and discharge pressures, and itemized specified internal losses and unspecified internal losses. Refer to air handling unit schedule on drawings.
6. The submittal shall provide coil selection worksheets, clearly showing proper consideration for altitude, air density, glycol corrections and indicate coil tube fin and casing construction.
7. The submittal shall provide filter information, including: initial APD, final APD, dust spot efficiency, final dust holding capacity, filter media description, filter frame details, and filter removal details.
8. The manufacturer shall submit electrical requirements for power supply wiring including wiring diagrams for interlock and control wiring, clearly indicating factory-installed and field-installed wiring.
9. The manufacturer shall submit the manufacturers recommended installation instructions.

C. Maintenance and operating manuals in accordance with Section 01010, GENERAL REQUIREMENTS.

D. Submit written test procedures two weeks prior to factory testing. Submit written results of factory tests for approval prior to shipping.

1.5 APPLICABLE PUBLICATIONS:

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

- B. Military Specifications (Mil. Spec.):
- C. DOD-P-21035A-77 Paint, High Zinc Dust Content, Galvanizing Repair.
- D. Air-Conditioning and Refrigeration Institute (ARI):
 - 410-87.....Standard for Forced-Circulation Air-Heating and Air-Cooling Coils.
 - 430-89.....Standard for Central Station Air Handling Units.
 - ARI-DCAACP.....Directory of Certified Applied Air Conditioning Products.
- E. Air Moving and Conditioning Association (AMCA):
 - 99-86.....Standard Handbook.
 - 210-85.....Laboratory Methods of Testing Fans for Rating.
- F. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE):
 - 51-85.....Standard, Laboratory Methods of Testing Fans for Rating.
- G. American Society for Testing and Materials (ASTM):
 - A525-93.....Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process
 - B117-94.....Salt Spray (Fog) Testing
 - C1071-91.....Thermal and Acoustical Insulation (Mineral Fiber, Duct Lining Material)
 - D1654-92.....Standard Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
 - D1735-92.....Water Resistance of Coatings Using Water Fog Apparatus
 - D3359-95.....Measuring Adhesion by Tape Test
 - E84-95.....Surface Burning Characteristics of Building Materials
 - G23-95.....Operating Light-Exposure Apparatus
- H. Anti-Friction Bearing Manufacturer's Association, Inc. (AFBMA):
 - 9-1990.....Load Ratings and Fatigue life for Ball Bearings
- I. National Fire Protection Association (NFPA):
 - 90A-1996.....Installation of Air Conditioning and Ventilating Systems

1.6 DELIVERY, STORAGE AND HANDLING

- A. The manufacturer shall deliver products to site on a factory-installed base rail or shipping skid and ship units by truck with 10 mil poly shrink-wrap.
- B. The contractor shall store products in a clean dry place, protect them from weather and construction traffic, and shall handle products carefully to avoid damage to components, enclosures, and finish. Units shall be heated and ventilated during storage.

1.7 ENVIRONMENTAL REQUIREMENTS

Units shall not be operated for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings lubricated, and the fan has been test run under observation.

1.8 EXTRA STOCK

The manufacturer shall provide one extra set of disposable filters.

PART 2 - PRODUCTS

2.1 AIR HANDLING UNITS:

- A. General:
 - 1. AHUs shall be entirely of double wall galvanized steel construction. Galvanizing shall be hot dipped conforming to ASTM A525 and shall provide a minimum of 0.275 kg of zinc per square meter (0.90 oz. of zinc per square foot) (G90). Aluminum constructed units may be provided subject to VA approval and documentation that structural rigidity is equal or greater than the galvanized steel specified.
 - 2. The contractor and the AHU manufacturer shall be responsible for insuring that the unit will not exceed the allocated space shown on the drawings, including required clearances for service and future overhaul or removal of unit components. All structural, piping, wiring, and ductwork alterations of units, which are dimensionally different than those specified, shall be the responsibility of the contractor at no additional cost to the government.
 - 3. AHUs shall be fully assembled by the manufacturer in the factory in accordance with the arrangement shown on the drawings. The unit shall be assembled into the largest sections possible subject to shipping and rigging restrictions. The correct fit of all components and casing sections shall be verified in the factory for all units prior to shipment. Factory tested units shall be fully assembled, tested and then split to accommodate shipment and job site rigging.

On units not shipped fully assembled, the manufacturer shall tag each section and include air flow direction to facilitate assembly at the job site. Lifting lugs or shipping skids shall be provided for each section to allow for field rigging and final placement of unit.

4. The AHU manufacturer shall provide the necessary gasketing, caulking, and all screws, nuts, and bolts required for assembly. The manufacturer shall provide a local representative at the job site to supervise the assembly and to assure the units are assembled to meet manufacturer's recommendations and requirements noted on the drawings. Provide documentation that this representative has provided this service on similar jobs to the Contracting Officer. If a local representative cannot be provided, the manufacturer shall provide a factory representative.
5. Gaskets: All door and panel gaskets shall be high quality which seal air tight and retain their structural integrity and sealing capability after repeated assembly and disassembly of bolted panels and opening and closing of hinged components. Bolted sections may use a more permanent gasketing method provided they are not disassembled.
6. Structural Rigidity: Provide structural reinforcement when required by span or loading so that the deflection of the assembled structure shall not exceed 1/200 of the span based on a differential static pressure of 1991 Pa (8 inches water) or 1-1/2 times design static pressure whichever is greater.

B. Base:

1. Provide a heavy duty steel base for supporting all AHU major components. Bases shall be constructed of wide-flange steel I-beams or channels, minimum 152 mm (6 inch) high. Welded or bolted cross members shall be provided as required for lateral stability. Contractor shall provide supplemental steel supports as required to obtain proper operation heights for cooling coil condense drain trap and steam condensate return trap as shown on drawings.
2. AHUs shall be completely self supporting for installation on concrete curb as shown on drawings.

3. The AHU bases not constructed of galvanized material shall be cleaned, primed with a rust inhibiting primer, and finished with a rust inhibiting exterior enamel.
4. Maximum base deflection shall be 1/4-inch on 240-inch unsupported span.

C. Casing (including wall, floor and roof):

1. General: AHU shall be designed and constructed such that removal of any panel shall not affect the structural integrity of the unit. Plug panels may be used to enhance structural stability provided access space is not reduced.
2. Casing shall be double wall galvanized steel, minimum 102 mm (4 inches) thick, constructed of minimum 1.6 mm (16 gauge) outer skin and 1.0 mm (20 gauge) solid inner skin. Perforated panels are not allowed in cooling coil sections, floors, door panels and where solid sheet is required to avoid air bypass. Wall seams shall be turned inward to provide a clean, flush exterior finish.
3. Outdoor units shall have roof panels broken outward to provide a lapped joint watertight seal. Outdoor roofs shall be sloped a minimum of 5/8" away from the access side.
4. Blank-Off: Provide where required to insure no air bypass between sections, around coils or filters. Blank-Off shall be installed at each component of the air handling unit and also at the internal panels to prevent recirculation of the air through panels. Seal any holes where bypass occurs.
5. Thermal Conductance (C): Maximum overall thermal conductance of casing panels shall not exceed 0.34 W/square meter. K (0.06 Btu/(h. square feet. degree F)).
6. Condensation Requirements: AHUs shall be designed to insure that there is no condensation on the exterior of the unit based on outside design conditions. Through metal connections between inner and outer panels shall be kept to an absolute minimum. If tubular structural members are used, inside of tube shall be insulated equal to casing.
7. Unit sections shall be tightly joined in the field through the use of all-thread rod or casing brackets and shall be gasketed to make air tight.

8. Exterior and interior panels shall be secured to the support channels with stainless steel or zinc-chromate plated screws and gaskets installed around the panel perimeter. Screw spacing shall not be greater than 203 mm (eight inches). Panels shall be completely removable to allow removal of fan, coils, and other internal components for future maintenance, repair, or modifications. Welded exterior panels are not acceptable.
9. Access Doors: Provide where shown in each access section and where shown on drawings. Doors shall be a minimum of 102 mm (4 inches) thick with same double wall, insulated construction as the unit casing. Doors shall be a minimum of 600 mm (24 inches) wide and shall be the full casing height up to a maximum of 1850 mm (6 feet). Doors shall be sized to allow removal of motor and other replaceable components. Doors shall be gasketed, hinged, and latched to provide an airtight seal. Each door shall include a minimum 300 mm (12 inch) round or square double thickness, hermetically sealed, reinforced glass in a gasketed frame.
 - a. Hinges: Stainless steel, continuous piano hinge, designed for door size, weight and pressure classifications. Hinges shall hold door completely rigid with minimum 45 kg (100 pound) weight hung on latch side of door.
 - b. Latches: Non-corrosive alloy construction, with operating levers for positive cam action, operable from either inside or outside. Doors that do not open against unit operating pressure shall be provided with high pressure, safety "Vent lock, Model #310"-style latches which allow the door to open approximately 75 mm (3 inches) and then require approximately 0.785 radian (45 degrees) further movement of the handle for complete opening. Latch shall be capable of restraining explosive opening of door with a force equal to a minimum of 2986 Pa (12 inches water) of differential static pressure or 1-1/2 times operating differential pressure whichever is greater.
 - c. Gaskets: Neoprene, 1/2-inch hollow round, continuous around door, positioned for direct compression with no sliding action between the door and gasket. Secure with mechanical fasteners to eliminate possibility of gasket slipping or coming loose.

- d. All access doors must swing against the air pressure (i.e. positive pressure plenum doors must swing in).
10. Provide sealed sleeves, metal or plastic escutcheons or grommets for penetrations through casing for power, piping and temperature control wiring. Coordinate number and location with electrical and temperature control subcontractors. Coordinate lights, switches, and duplex outlets and disconnect switch location and mounting. All penetrations and equipment mounting may be provided in the factory or in the field. All field penetrations shall be performed neatly by drilling or saw cutting. No cutting by torches will be allowed. Neatly seal all openings airtight.
- D. Service Corridor:
1. The manufacturer shall supply and install a 96" wide x 120" high service corridor the entire length of the unit with casing construction of the same material as the rest of the air handler.
 2. The manufacturer shall supply vapor proof fluorescent lights, complete with duplex receptacle and switch with indicator light, mounted inside the corridor. The manufacturer shall provide factory wiring from the switch to all lights in an EMT conduit. Electric power for the lighting shall be 120 volt.
- E. Painted Exterior Finish: Galvanized steel (G90) exterior shall be mill prepared for painting by bonderizing and factory prepared for prime coat of paint by acid etch cleaning, as required, to assure paint adhesion. Provide factory applied prime coat and enamel finish coat to match paint of exterior wall panels specified in Section 07410, PREFORMED WALL AND ROOF PANELS. Paint corrosion resistance and adhesion shall have satisfactorily passed ASTM B117, D1654, D1735, D3359 and G23 for a minimum of 500 hours. Rating of failure at the scribe mark shall be not less than 6, average creepage not greater than 3 mm (1/8 inch). Rating of the inscribed area shall not be less than 10, no failure. Refer to Section 09900, PAINTING.
- F. Insulation:
1. Insulation: Section 15250, INSULATION.
 2. The walls, roof and floor of the AHU shall be insulated. Insulation shall be held securely in position between the inner and outer skin of casing.

3. Insulation shall be same thickness as specified for AHU casing, 48 kg/cubic meter (3 pound per cubic feet) density rigid glass fiber. Neoprene-coated, matte-faced, or 0.025 mm (1 mil) plastic liner which meets the requirements of NFPA 90A is required. All insulation edges shall be protected with metal lagging. Insulation systems using stickpins or adhesives are not acceptable. Insulation shall meet ASTM 1071 requirements.
4. Glass fiber insulation shall not be exposed to the air-stream.
5. Materials shall meet NFPA 90A flame spread and smoke generation requirements.

G. Floor:

1. A 12 gauge checker plate floor shall be installed on the base. The floor shall be flat, reinforced from below, with all seams continuously welded. Drive screw attachment and caulking are not acceptable. The base shall be provided with lifting lugs, a minimum of four 4 per unit section. The base shall be insulated with 2" fiberglass insulation and sheeted with a 22 gauge galvanized steel liner. Floors that "oil can" are not acceptable.
2. The manufacturer shall provide a 1.5" perimeter collar around the entire unit and around each floor opening to ensure the unit is internally watertight. The entire base shall act as an auxiliary drain pan and hold up to 1.5" of water.
3. Unit floor shall be level without offset space or gap and designed to support a minimum of 488 kg/square meter (100 pounds per square foot) distributed load without permanent deformation or crushing of internal insulation. Provide adequate structural base members beneath floor in service access sections to support typical service foot traffic and to prevent damage to unit floor or internal insulation. Unit floors in casing sections, which may contain water or condensate, shall be watertight with drain pan.
4. Thermal Conductance (C): Maximum overall thermal conductance of casing floors shall not exceed 0.68 W/square meter. K (0.12 Btu/(h. square feet. degree F).
5. Where indicated, furnish and install floor drains, flush with the floor, with nonferrous grate cover and stub through floor for external connection. All drain connections on floor mounted air handling units shall terminate at the side of the unit.

6. The manufacturer shall provide 1" capped floor drain connections on the side of the unit for complete drainability of the base pan for the following sections:
 - a. Fresh air plenums.
 - b. Service corridors.
 - c. Fan sections.
 - d. Sections upstream and downstream of coils.
- H. Condensate Drain Pan: Drain pan shall be designed to extend entire length of cooling coils including headers and return bends. Depth of drain pan shall be at least 43 mm (1.7 inches) and shall handle all condensate without overflowing. Drain pan shall be constructed of #304 stainless steel and shall be sloped to drain. Drain pan shall be continuous metal or welded watertight. No mastic sealing of joints exposed to water will be permitted. Drain pan shall be placed on top of casing floor or integrated into casing floor assembly. Maximum overall thermal conductance of floor/drain pan assembly shall not exceed 0.68 W/square meter K (0.12 Btu/(h. sq. ft. degree F)).
 1. An intermediate condensate drip pan shall be provided on stacked cooling coils and shall be constructed of #304 stainless steel with copper downspouts factory piped to main condensate pan. Use of intermediate condensate drain channel on upper casing of lower coil is permissible provided it is readily cleanable. Design of intermediate condensate drain shall prevent upper coil condensate from flowing across face of lower coil.
 2. Drain pan shall be piped to the exterior (side) of the unit. Drain pan shall be readily cleanable.
 3. Installation, including frame, shall be designed and sealed to prevent blow-by.
- I. Fans Sections:
 1. Fans shall be minimum Class II construction, air foil plug type as indicated on drawings, factory balanced and rated in accordance with AMCA 210 or ASHRAE 51. Provide self-aligning, pillow block, regreasable ball-type bearings selected for a B(10) life of not less than 40,000 hours and an L(50) average fatigue life of 200,000 hours per AFBMA Standard 9. Extend bearing grease lines to motor and drive side of fan section. Fan shall be located in airstream to assure proper air flow.

- a. Fans shall incorporate a wheel, heavy gauge reinforced steel inlet plate with removable spun inlet cone, structural steel frame, and shaft and bearings in AMCA Arrangement 3 configuration as an entire assembly.
 - b. All fan wheels shall have tapered spun wheel cones or shrouds providing stable flow and high rigidity. The wheels shall be non-overloading type.
 - c. The blades shall be continuously-welded, die-formed Airfoil type, designed for maximum efficiency and quiet operation. Partial welding will not be acceptable on airfoil blades.
 - d. Impellers shall be statically and dynamically balanced and the complete fan assembly shall be test balanced at the operating speed prior to shipment.
 - e. Shafts shall be of AISI C-1018, 1040 or 1045 hot rolled steel accurately turned, ground, polished, and ring gauged for accuracy.
 - f. Shafts shall be sized for first critical speed of at least 1.43 times the maximum speed for the class.
 - g. The manufacturer shall provide OSHA approved fully enclosed metal belt guard sides of galvanized steel and an expanded metal face. The belt guard shall be sized to allow either sheave to be increased by two sizes.
 - h. The plenum fan assembly must have an enclosed safety screen as per OSHA Standards.
 - i. Fans shall have inlet OSHA approved inlet screens.
2. Allowable vibration tolerances for fan shall not exceed a self-excited vibration maximum velocity of 0.005 m/s (0.20 inch per second) RMS, filter in, when measured with a vibration meter on bearing caps of machine in vertical, horizontal and axial directions or measured at equipment mounting feet if bearings are concealed. After field installation, compliance to this requirement shall be demonstrated with field test in accordance with Section 15200, NOISE AND VIBRATION CONTROL and Section 15980, TESTING, ADJUSTING AND BALANCING.
- J. Fan Motor, Drive and Mounting Assembly:
1. Provide internally vibration isolated fan, motor and drive, mounted on a common integral bolted or welded structural steel base with

- adjustable motor slide rail with locking device. Provide vibration isolators and flexible duct connections at fan discharge to completely isolate fan assembly. Provide vibration isolators as scheduled on the drawings. Isolators shall have earthquake restraints. Refer to Section 15200: NOISE AND VIBRATION CONTROL, for additional requirements.
2. Fan Motor and Drive: Motors shall be heavy duty, open drip-proof, energy efficient type and suitable for use in variable frequency drive applications on AHUs where this type of drive is indicated. Refer to Section 15050: BASIC METHODS AND REQUIREMENTS (MECHANICAL), for additional motor and drive specifications. Provide variable speed motor controllers (VSMC), which shall be compatible with fan and motor. Refer to Specification Section 16155: MOTOR STARTERS.
 3. Fan drive and belts shall be factory mounted with final alignment and belt adjustment to be made by the Contractor after installation. Drive and belts shall be as specified in section 15050, BASIC METHODS AND REQUIREMENTS (MECHANICAL). Unit manufacturer shall provide additional drive(s) if required during balancing, to achieve desired airflow.
- K. Louvers: Louver blades of extruded aluminum construction shall be fixed on a 45° angle and on 4" centers. Frames shall be of extruded aluminum, minimum 4" wide. Birdscreen shall be galvanized mesh with 0.5" x 0.5" openings and shall be fixed to the rear with cadmium plated screws. The finish shall be natural mill finish.
- L. Hoods: Fresh air hoods shall be provided complete with 0.5" x 0.5" birdscreen and finished to match the color of the units. Hoods shall be of 16 gauge galvanized steel construction. The manufacturer shall provide continuous rain gutters with drain connections around the perimeter of the hood.
- M. Aluminum Airfoil Dampers:
1. Aluminum airfoil frames and blades shall be a minimum of 12 gauge extruded aluminum. Blades shall be of a single unit airfoil design 6" wide.
 2. Frames shall be extruded aluminum channel with grooved inserts for vinyl seals. Standard frames shall be 2" x 4" x 5/8" on the linkage side, 1" x 4" x 1" on the other 3 sides.

3. Pivot rods shall be 7/8" hexagon extruded aluminum interlocking into the blade section. Bearings shall be of a double sealed type with a Celcon inner bearing on a rod within a Polycarbonate outer bearing inserted into the frame to prevent the outer bearing from rotating.
 4. The bearing shall be designed so there are no metal-to-metal or metal-to-bearing riding surfaces. The interconnecting linkage shall have a separate Celcon bearing to eliminate friction inside the linkage.
 5. Blade linkage hardware shall be installed in a frame outside the airstream. All hardware shall be of non-corrosive, reinforced cadmium plated steel.
 6. Damper seals shall be designed for minimum air leakage by means of overlapping seals.
 7. Jack shaft assemblies shall be provided for multiple damper installations.
 8. Leakage rate shall not exceed 2.5 cubic meters/min/square meter (8 cfm per square foot) at 250 Pa (1 inch water) and 3.7 cubic meters/min/square meter (12 cfm per square foot) at 995 Pa (4 inches water)
 9. Electronic damper operators shall be furnished and mounted in an accessible and easily serviceable location by the air handling unit manufacturer at the factory. Damper operators shall be of same manufacturer as controls furnished under Section 15902.
- N. Filter Section: Provide filters with AHU. Refer to section 15885, AIR FILTERS, for additional filter requirements.
1. Prefilters: Prefilters shall be 30% efficient, pleated and disposable. Each filter shall consist of a non-woven cotton and synthetic fabric media, media support grid and enclosing frame. The filter shall be listed by Underwriters' Laboratories as Class 2. Prefilters shall be installed in a prefabricated channel rack. Prefilters shall be lift-out where access is available upstream of the filter, or slide out when access is not available.
 2. Final Filters: Final filters shall be high performance, deep pleated, totally rigid and disposable. Each filter shall consist of high density microfine glass fiber media, media support grid, contour stabilizer and enclosing frame. The final filter media shall be of high density microfine glass fibers laminated to a non-woven

synthetic backing to form a lofted filter blanket. The filter media shall have an average of 90-95% on the ASHRAE Test Standard [52-76] and an average arrestance of not less than 99% on that standard. Filters shall be listed by Underwriters' Laboratories as Class 2. Holding frames shall be factory fabricated of 16 gauge galvanized steel and shall be equipped with gaskets and 2 heavy duty positive sealing fasteners. Each fastener shall be capable of withstanding 25 lbs. pressure without deflection and be attached or removed without the use of tools. Final filters shall be lifted out where access is available upstream of the filter, or equipped with a side slideout when access is not available.

3. Filter Gauges: The manufacturer shall provide Dwyer 2000 magnehelic gauges. Magnehelic gauges shall be accurate to $\pm 2\%$ of full range. One gauge shall be provided for each filter bank. Gauges shall be recessed into the cabinet casing.
4. Filters including one complete set for temporary use at site shall be provided independent of the AHU. AHU manufacturer shall install filter housings and racks in filter section compatible with filters furnished. The AHU manufacturer shall be responsible for furnishing VA Grade "D" 50 mm (2 inch) thick, temporary filters required for AHU testing at the factory or at any independent testing agency.
- O. Coils: Coils shall be mounted on hot dipped galvanized steel supports to assure proper anchoring of coil and future maintenance. Coils shall be face or side removable for future replacement thru the access doors or removable panels. Each coil shall be removable without disturbing adjacent coil. Cooling coils and glycol-water coils shall be designed and installed to insure no condensate carry over. Provide factory installed extended supply, return, drain and vent piping connections. Refer to Drawings and Section 15750; HEATING AND COOLING COILS, for additional coil requirements.
- P. Discharge Section: Provide aerodynamically designed framed discharge openings or spun bellmouth fittings to minimize pressure loss.
- Q. Electrical and Lighting: Wiring and equipment specifications shall conform to Division 16, Electrical.
 1. The manufacturer shall factory wire, test, and have all air handling units approved by CSA, ETL or UL.

2. The manufacturer shall supply one single point 460 V/60 Hz/3 Ph power connection for each unit. All fans, variable frequency drives, and other 460 V/60 Hz/3 Ph loads shall be factory-wired. The manufacturer shall provide and wire all 120 V/60 Hz/1 Ph components such as lights, convenience outlet, controls, heaters, etc. from a panel with circuit breakers for each type of electric device. The panel for 120 V/60 Hz/1 Ph is fed from a separate service.
 3. The manufacturer shall label and number code all wiring and electrical devices in accordance with the unit electrical diagram. The manufacturer shall mount the devices in a control panel inside the unit's service enclosure or on the outside and ensure the control panel meets the CSA, ETL or UL.
 4. The manufacturer shall provide a system of motor control including all necessary terminal blocks, motor contactors, motor overload protection, grounding lugs, auxiliary contactors and terminals for the connection of external control devices or relays. The manufacturer shall individually fuse all fan and branch circuits.
 5. The manufacturer shall provide wiring from the motors to the motor control in accordance with CSA, ETL or UL and contained by EMT conduit with liquid tight connections. The manufacturer shall seal the casing penetrations in a manner that eliminates air leaks.
 6. Vapor-proof lights using cast aluminum base style with glass globe and cast aluminum guard shall be installed in each access section. A switch shall control the lights in each compartment with pilot light mounted outside the respective compartment access door. Wiring between switches and lights shall be factory installed. All wiring shall run in neatly installed electrical conduits and terminate in a junction box for field connection to the building system. Provide single point 115 volt - one phase connection at junction box.
 7. Install compatible 100 watt bulb in each light fixture.
 8. Provide a convenience duplex outlet next to the light switch.
 9. Disconnect switch and power wiring: Provide factory mounted disconnect switch. Coordinate with Electrical Specifications.
- R. Air Flow Measuring Station:
1. Provide provisions for airflow measuring stations for the supply fan, the return fan, and the outside air intake duct. Coordinate

space, electrical and other requirements for air flow measuring stations to be provided under Section 15902.

2.2 TESTING:

A. General:

1. Non-ARI certified AHUs: All units shall be factory assembled and tested.
2. Units specified to be tested shall be factory assembled and tested in accordance with specified Test Procedure to demonstrate compliance with required unit capacities, ensure correct fit of all components and minimize field assembly labor.

B. Factory Test:

1. General: The test procedure, instrumentation and calculation shall use those methods specified in Specification Section 15980, TESTING, ADJUSTING AND BALANCING, however test methods including instruments used must be submitted and approved by VA prior to initiating testing. The AHUs shall be tested for air volume, static pressure for AHU and each component, fan RPM and power consumption for the maximum of present or future design conditions. Submit fan curves showing test results.
2. Test Procedure (Airflow):
 - a. Provide straight runs of full size ducts at inlet and discharge of AHU with lengths equal to 2-1/2 times fan diameter and with volume dampers to adjust static pressure located at ends. Locate a four-point static pressure sensor 2/3 the distance down the discharge duct and connected to an inclined manometer to be used to measure external static pressure.
 - b. Six static pressure tap sensors shall be located on both entering and leaving sides of cooling coil and a Meriam micro manometer used to read cooling coil pressure drop. Unit cubic meters per minute (cubic feet per minute) may be determined by dry coil air friction curve.
 - c. Adjust dampers to compensate for variations in pressure drops due to clean vs. dirty filters, dry vs. wet cooling coils, and as required to simulate fan design conditions.
 - d. Drain connections shall be plugged. Piped connection openings shall be sealed.

- e. Correct cubic meters per minute (cubic feet per minute), static pressure and watts (horsepower) to standard air conditions of 1.2 kg/cubic meter (0.075 lbs. per cubic foot) density, 21 °C (70 °F) temperature, and 101 kPa (29.92 in. Hg) barometric pressure at sea level. Measure supply air wet bulb and dry bulb temperatures. Obtain barometric pressure readings from local airport.
 - f. Determine fan motor watts (horsepower) consumption by use of wattmeter, voltmeter, ammeter and obtaining motor efficiency from manufacturer. Refer to standard testing and balancing procedure. Determine fan RPM by use of tachometer.
 - g. Obtain values for the items in the following formula. (Fan Total Static Pressure = External Static Pressure + Specified Internal Losses + Unspecified Internal Losses). Refer to AHU schedule on the drawings for additional information.
3. Air Leakage Test:
- a. The unit manufacturer shall factory pressure test each air handling unit to ensure the leakage rate of the casing does not exceed 1.0% of the unit air flow at 1.5 times the rated static pressure. A leakage test shall be performed with VSD panels installed.
 - b. The test shall be conducted in accordance with SMACNA duct construction manual. A calibrated orifice shall be used to measure leakage airflow.
 - c. An officer of the manufacturing company shall certify test results.
 - d. "Double duct" or "side by side" units shall have each duct or side tested independently.
 - e. Positive pressure plenums shall be tested positively and negative pressure plenums shall be tested negatively.

C. Approval:

- 1. Tests shall be witnessed by the Contracting Officer or authorized representative. Contractor shall provide the VA with a minimum two-week notice prior to proposed schedule test.
- 2. Failure of AHU to meet test requirements shall require correction of deficiency and re-testing of unit.
- 3. Submit written results of factory tests for approval prior to shipping.

2.3 ACOUSTICAL PERFORMANCE

- A. The housing shall have been tested for acoustical performance by an accredited independent laboratory.
- B. Test methods and facilities used to establish sound transmission loss values shall conform explicitly with the ASTM designation E90-85 and E413-73.
- C. Sound Transmission Loss DB ASTM E-90 & E413-73
1 2 3 4 5 6 7 8
4" Walls 20 20 28 41 51 56 55 57 STC=40
- D. Test methods and facilities used to establish sound absorption values shall conform explicitly with the requirements of the ASTM Standard Test Method for Sound Absorption Coefficients by the Reverberation Method: ASTM C423-84A and E795-83
- E. Sound Absorption ASTM C423-84A & E795-83
1 2 3 4 5 6 7 8
4" Walls .40 .65 1.38 1.28 1.09 1.05 1.02 1.02 STC=40
- F. The manufacturer shall submit the lab report for approval.

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. Assemble air handling unit components following manufacturer's instructions for handling, testing and operation. Repair damaged galvanized areas with paint in accordance with Military Spec. DOD-P-21035. Repair painted units by touch up of all scratches with finish paint material. Vacuum clean interior of air handling units prior to operation.
- B. Leakage and test requirements for air handling units shall be the same as specified for ductwork in Specification Section 15840, DUCTWORK AND ACCESSORIES except leakage shall not exceed Leakage Class (C_L) 12 listed in SMACNA HVAC Air Duct Leakage Test Manual when tested at 1.5 times the design static pressure. Repair casing air leaks that can be heard or felt during normal operation and to meet test requirements.
- C. Perform field mechanical (vibration) balancing in accordance with Section 15200, NOISE AND VIBRATION CONTROL.
- D. Seal and/or fill all openings between the casing and AHU components and utility connections to prevent air leakage or bypass.
- E. Make casing penetrations according to the casing manufacturer's instructions and details. Provide sleeves through the unit casing.

- F. AHU Manufacturer shall provide factory service for pre-start-up site inspection, start-up and operating instruction to VA personnel.
- G. The contractor shall install units on a level surface, which has sufficient strength to support the units.
- H. The contractor shall provide all water piping so as to ensure that water circuits are serviceable and excessive lengths of pipe need not be dismantled.
- I. The contractor shall provide valves in water piping upstream and downstream of each coil to isolate the coils for maintenance and to balance and trim the system.
- J. The contractor shall provide drain valves and vent cocks to each coil.
- K. The contractor shall provide strainers ahead of all pumps and automatic modulating valves.
- L. The contractor shall provide certified wiring schematics to the electrical division for the field-installed equipment and controls.
- M. The contractor shall provide all necessary control wiring as recommended by the manufacturer.
- N. The contractor shall provide condensate traps in accordance with the manufacturer's recommendations.

- - - E N D - - -

SECTION 15822
FANS

PART 1 - GENERAL

1.1 DESCRIPTION:

- A. Fans for heating, ventilating, and air conditioning.
- B. Product Definitions: AMCA Publication 99, Standard 1-66.

1.2 RELATED WORK:

- A. Section 15050, BASIC METHODS AND REQUIREMENTS (MECHANICAL).
- B. Section 15200, NOISE AND VIBRATION CONTROL.
- C. Section 15763, AIR HANDLING UNITS.

1.3 QUALITY ASSURANCE:

- A. Refer to paragraph, QUALITY ASSURANCE, in Section, BASIC METHODS AND REQUIREMENTS (MECHANICAL).
- B. Fans and power ventilators shall be listed in the current edition of AMCA 261, and shall bear the AMCA performance seal.
- C. Operating Limits for Centrifugal Fans: AMCA 99 (Class I, II, and III).
- D. Fans and power ventilators shall comply with the following standards:
 - 1. Testing and Rating: AMCA 210.
 - 2. Sound Rating: AMCA 300.
- E. Vibration Tolerance for Fans and Power Ventilators: Section, NOISE AND VIBRATION CONTROL.
- F. Performance Criteria:
 - 1. The fan schedule shows cubic meters per minute (CFM) and design static pressure. Scheduled fan motors, 0.37 kw (1/2 horsepower) and larger, are sized for design cubic meters per minute (CFM) at 110 percent design static pressure, but not to exceed 185 Pa (3/4-inch) additional pressure.
 - 2. Provide fans and motors capable of stable operation at design conditions and at 110 percent pressure as stated above.
 - 3. Lower than design pressure drop of approved individual components may allow use of a smaller fan motor and still provide the safety factor. When submitted as a deviation a smaller motor may be approved in the interest of energy conservation.
 - 4. Select fan operating point as follows:
 - a. Forward curved and axial fans: Right hand side of peak pressure point.

- b. Airfoil, backward inclined or tubular: Near the peak of static efficiency.
- G. Safety Criteria: Provide manufacturer's standard screen on fan inlet and discharge exposed to operating and maintenance personnel.
- H. Corrosion Protection:
 - 1. All steel shall be mill-galvanized, or phosphatized and coated with minimum two coats, corrosion resistant enamel paint. Manufacturers paint and paint system shall meet the minimum specifications of: ASTM D1735 water fog; ASTM B117 salt spray; ASTM D3359 adhesion; and ASTM G23 weathermeter.

1.4 SUBMITTALS:

- A. Submit in accordance with Section 01340, SAMPLES AND SHOP DRAWINGS.
- B. Manufacturers Literature and Data:
 - 1. Fan sections, motors and drives.
 - 2. Centrifugal fans, motors, drives, accessories and coatings.
 - a. In-line centrifugal fans.
 - 3. Prefabricated roof curbs.
 - 4. Roof and wall power ventilators.
 - 5. Centrifugal ceiling fans.
- C. Sound power levels for each fan.
- D. Maintenance and operating manuals in accordance with Section 01010, GENERAL REQUIREMENTS.
- E. Fan curves for each fan showing cubic meters per minute (CFM) versus static pressure, efficiency, and horsepower for design point of operation and at 110 percent of design static pressure. Include product application data to indicate the effect of capacity control devices such as inlet vane dampers on flow, pressure and Kw (horsepower).

1.5 APPLICABLE PUBLICATIONS:

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. Air Moving and Control Association (AMCA):
 - 99-86.....Standards Handbook
 - 210-85.....Laboratory Methods of Testing Fans for
Aerodynamic Performance Rating
 - 261.....Directory of Products Licensed To use the AMCA
Certified Ratings Seal - Published Annually

300-96.....Reverberant Room Method for Sound Testing of
Fans

C. American Society for Testing and Materials (ASTM):

B117-97.....Standard Practice for Operating Salt Spray(Fog)
Apparatus.

D1735-97.....Standard Practice for Testing Water Resistance
of Coatings Using Water Fog Apparatus

D3359-97.....Standard Test Method for Measuring Adhesion by
Tape Test

G23-96.....Standard Practice for Operating Light-Exposure
Apparatus(Carbon-Arc Type) with and without
Water for Exposure of Non-Metallic Materials

D. Anti-Friction Bearing Manufacturers Association, Inc. (AFBMA):

9-90.....Load Ratings and Fatigue Life for Ball Bearings

E. National Fire Protection Association (NFPA):

NFPA 96-98.....Standard for Ventilation Control and Fire
Protection of Commercial Cooking Operations.

PART 2 - PRODUCTS

2.1 FAN SECTION (CABINET FAN):

Refer to Section, AIR HANDLING UNITS, for specifications.

2.2 CENTRIFUGAL FANS:

A. Standards and Performance Criteria: Refer to Paragraph, QUALITY
ASSURANCE. Record factory vibration test results on the fan or furnish
to the Contractor.

B. Fan arrangement, unless noted or approved otherwise:

1. DWD1 fans: Arrangement 3.
2. SWS1 fans: Arrangement 1, 3, 9 or 10.

C. Construction: Wheel diameters and outlet areas shall be in accordance
with AMCA standards.

1. Housing: Low carbon steel, arc welded throughout, braced and
supported by structural channel or angle iron to prevent vibration
or pulsation, flanged outlet, inlet fully streamlined. Provide
lifting clips, and casing drain. Provide manufacturer's standard
access door. Provide 12.5 mm (1/2") wire mesh screens for fan inlets
without duct connections.

2. Wheel: Steel plate with die formed blades welded or riveted in
place, factory balanced statically and dynamically.

3. Shaft: Designed to operate at no more than 70 percent of the first critical speed at the top of the speed range of the fans class.
 4. Bearings: Heavy duty ball or roller type sized to produce a B10 life of not less than 40,000 hours, and an average fatigue life of 200,000 hours. Extend lubrication tubes for interior bearings or ducted units to outside of housing.
 5. Motor, adjustable motor base, drive and guard: Furnish from factory with fan. Refer to Section, BASIC METHODS AND REQUIREMENTS (MECHANICAL) for specifications. Provide protective sheet metal enclosure for fans located outdoors.
- D. In-line Centrifugal Fans: In addition to the requirements of paragraphs A and C, provide inlet and outlet flanges, bolted access door and arrangement 1, 4 or 9 supports as required.

2.3 PREFABRICATED ROOF CURBS:

- A. Construction: Galvanized steel, with continuous welded corner seams, two inch wall thickness, treated wood nailer, 38 mm (1-1/2 inch) thick, 48 kg per cubic meter (3 pound) density rigid mineral fiberboard insulation with metal liner, built-in cant strip, (except for gypsum or tectum decks). For surface insulated roof deck provide raised cant strip to start at the upper surface of the insulation. Curbs shall be built for pitched roof or ridge mounting as required to keep top of curb level.
- B. Curb Height: 300 mm (12 inches) overall curb height.

2.4 ROOF OR WALL POWER VENTILATOR:

- A. Standards and Performance Criteria: Refer to Paragraph, QUALITY ASSURANCE.
- B. Type: Centrifugal fan, backward inclined blades.
- C. Construction: Steel or aluminum, completely weatherproof, for curb or wall mounting, exhaust cowl or entire drive assembly readily removable for servicing, aluminum bird screen on discharge, UL approved safety disconnect switch, conduit for wiring, vibration isolators for wheel, motor and drive assembly. Provide self acting back draft damper.
- D. Motor and Drive: Refer to Section, BASIC METHODS AND REQUIREMENTS (MECHANICAL). Bearings shall be pillow block with B-10 average life of 200,000 hours.
- E. Prefabricated Roof Curb: As specified in this section.

2.5 CENTRIFUGAL CEILING FANS (SMALL CABINET FAN) :

- A. Standards and Performance Criteria: Refer to Paragraph, QUALITY ASSURANCE.
- B. Steel housing, baked enamel finish, direct connected fan assembly, attached grille. Provide back draft assembly, aluminum wall cap and insect screen.
- C. Acoustical Lining: 12.5 mm (One-half inch) thick mineral fiber, dark finish.
- D. Motor: Shaded pole or permanent split capacitor, sleeve bearings, supported by steel brackets in combination with rubber isolators.
- E. Ceiling Grille, (Where indicated): White plastic egg crate design, 80 percent free area.

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. Install fan, motor and drive in accordance with manufacturer's instructions.
- B. Align fan and motor sheaves to allow belts to run true and straight.
- C. Bolt equipment to curbs with galvanized lag bolts.

3.2 PRE-OPERATION MAINTENANCE:

- A. Grease bearings.
- B. Rotate impeller by hand and check for shifting during shipment and check all bolts, collars, and other parts for tightness.

3.3 START-UP AND INSTRUCTIONS:

- A. Check vibration and correct as necessary for air balance work.
- B. After air balancing is complete and permanent sheaves are in place perform necessary field mechanical balancing to meet vibration tolerance in Section, NOISE AND VIBRATION CONTROL.

- - - E N D - - -

**SECTION 15840
DUCTWORK AND ACCESSORIES**

PART 1 - GENERAL

1.1 DESCRIPTION:

- A. Ductwork and accessories for HVAC including the following:
 - 1. Supply air, return air, outside air, exhaust, and relief systems.
- B. Definitions:
 - 1. SMACNA Standards as used in this specification means the HVAC Duct Construction Standards, Metal, and Flexible.
 - 2. Seal or Sealing: Use of liquid or mastic sealant, with or without compatible tape overlay, or gasketing of flanged joints, to keep air leakage at duct joints, seams and connections to an acceptable minimum.
 - 3. Duct Pressure Classification: SMACNA HVAC Duct Construction Standards, Metal, and Flexible.
 - 4. Exposed Duct: Exposed to view in a finished room.

1.2 RELATED WORK:

- A. Section 07270, FIRESTOPPING.
- B. Section 10200, LOUVERS, AND WALL VENTS.
- C. Section 15050, BASIC METHODS AND REQUIREMENTS (MECHANICAL).
- D. Section 15200, NOISE AND VIBRATION CONTROL.
- E. Section 15400, PLUMBING SYSTEMS.
- F. Section 15740, AIR TERMINALS.
- G. Section 15763, AIR HANDLING UNITS.
- H. Section 15822, FANS.
- I. Section 15885, AIR FILTERS.
- J. Section 15902, CONTROLS AND INSTRUMENTATION (DDC).
- K. Section 15980, TESTING, ADJUSTING, AND BALANCING
- L. Smoke Detectors: Section 16721, FIRE ALARM - LOCAL BUILDING SYSTEM.

1.3 QUALITY ASSURANCE:

- A. Refer to article, QUALITY ASSURANCE, in Section 15050, BASIC METHODS AND REQUIREMENTS (MECHANICAL).
- B. Fire Safety Code: Comply with NFPA 90A.
- C. Duct System Construction and Installation: Referenced SMACNA Standards are the minimum acceptable quality.
- D. Duct Sealing, Air Leakage Criteria, and Air Leakage Tests:

1. All ducts shall be sealed as per SMACNA duct sealing requirements in section 1 of SMACNA HVAC Air Duct Leakage Test Manual for actual duct pressure classes shown on the drawings. All ducts less than 500 Pa (2 inches w.g.) pressure classification shall meet requirements of class C seal.
2. At the beginning of the work, leak test representative samples of the duct construction for each pressure class greater than 750 Pa (3 inches w.g.). The sample specimen shall be minimum 25% of the ductwork of the selected system representing each pressure class, and shall include at least five transverse joints, typical seams, an access door, and at least two typical branch connections and an elbow. The sample specimen shall be part of the actual ductwork to be installed for the project.
3. The leakage amount shall not exceed the permissible leakage rate in CFM per 100 square feet of duct surface for the pressure and leakage classes shown in table below. The permissible leakage rate shall be calculated as per section 4 of SMACNA HVAC Air Duct Leakage Test Manual.

DUCT CONSTRUCTION CLASS (Representing Pressure Class)	LEAKAGE CLASS
1500 pa (6 inches w.g.)	6
1000 pa (4 inches w.g.)	6
750 pa (3 inches w.g.)	12

4. Follow leakage testing procedures, test apparatus, and test reports to be submitted to the Resident Engineer as per SMACNA HVAC Air Duct Leakage Test Manual. All tests shall be performed in the presence of the Resident Engineer. The Test and Balance agency shall measure and record duct leakage as specified herein, and shall report any unusual conditions to the Resident Engineer and identify leakage source.
5. If a specimen fails to meet the permissible leakage level, the contractor shall modify all ductwork installed represented by this specimen to bring it into compliance and shall retest it until acceptable leakage is demonstrated to the Resident Engineer.
6. Tests and re-tests and necessary repairs shall be completed prior to insulation and concealment of ducts.

- E. Duct accessories exposed to the air stream, such as dampers of all types (except smoke dampers) and access openings, shall be of the same material as the duct, or provide at least the same level of corrosion resistance.

1.4 SUBMITTALS:

- A. Submit in accordance with Section 01340, SAMPLES AND SHOP DRAWINGS.
- B. Manufacturer's Literature and Data:
 - 1. Rectangular ducts:
 - a. Schedules of duct systems, materials and selected SMACNA construction alternatives for joints, sealing, gage and reinforcement.
 - b. Duct liner.
 - c. Sealants and gaskets.
 - d. Access doors.
 - 2. Round and flat oval duct construction details:
 - a. Manufacturer's details for duct fittings.
 - b. Duct liner.
 - c. Sealants and gaskets.
 - d. Access sections.
 - e. Installation instructions.
 - 3. Volume dampers, back draft dampers.
 - 4. Upper hanger attachments.
 - 5. Fire dampers, fire doors, and smoke dampers with installation instructions.
 - 6. Sound attenuators, including pressure drop and acoustic performance.
 - 7. Flexible ducts and clamps, with manufacturer's installation instructions.
 - 8. Flexible connections.
 - 9. Instrument test fittings.
 - 10. Diffusers, registers, grilles and accessories.
 - 11. Details and design analysis of alternate or optional duct systems.
- C. Coordination Drawings: Refer to article, SUBMITTALS, in Section 15050, BASIC METHODS AND REQUIREMENTS (MECHANICAL).

1.5 APPLICABLE PUBLICATIONS:

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

- B. Air Diffusion Council Test Code:
 - 1062R4.....Certification, Rating, and Test Manual (1977)
- C. Air Moving and Conditioning Association (AMCA):
 - 500-75.....Test Method and Louvers, Dampers and Shutters
- D. American Society for Testing and Materials (ASTM):
 - A167-94.....Standard Specification for Stainless and
Heat-Resisting Chromium-Nickel, Steel Plate,
Sheet and Strip
 - A527-90.....Standard Specification for Steel Sheet,
Zinc-Coated (Galvanized) by the Hot-Dip
Process, Lock-Forming Quality
 - A569-91.....Standard Specification for Steel, Carbon (0.15
Maximum, Percent), Hot-Rolled Sheet and Strip,
Commercial Quality
 - B209-95.....Standard Specification for Aluminum and
Aluminum-Alloy Sheet and Plate
 - C1071-91.....Standard Specification for Thermal and
Acoustical Insulation (Mineral Fiber, Duct
Lining Material)
 - E84-95.....Standard Test Method for Surface Burning
Characteristics of Building Materials
- E. National Fire Protection Association (NFPA):
 - 90A-96.....Standard for the Installation of Air
Conditioning and Ventilating Systems
 - 96-94.....Standard for the Installation of Equipment for
the Removal of Smoke and Grease-Laden Vapors
from Commercial Cooking Equipment
- F. Sheet Metal and Air Conditioning Contractors National Association
(SMACNA):
 - HVAC Duct Construction Standards, Metal and Flexible, 2nd Edition -
1995
 - HVAC Air Duct Leakage Test Manual, 1st Edition, 1985
 - Fibrous Glass Duct Construction Standards, 6th Edition - 1992
- G. Underwriters Laboratories, Inc. (UL):
 - 33-87.....UL Standard for Safety Heat Responsive Links
for Fire Protection Service

- 181-90.....UL Standard for Safety Factory-Made Air Ducts
and Connectors
- 555-90.....UL Standard for Fire Dampers
- 555S-83.....UL Standard for Safety Leakage Rated Dampers
for Use in Smoke Control Systems

PART 2 - PRODUCTS

2.1 DUCT MATERIALS AND SEALANTS:

- A. General: Except for systems specified otherwise, construct ducts, casings, and accessories of galvanized sheet steel, ASTM A527, coating G90.
- B. Joint Sealing: Refer to SMACNA Standards, paragraph S1.8 and S1.9.
 - 1. Sealant: Elastomeric compound, gun or brush grade, maximum 25 flame spread and 50 smoke developed (dry state) compounded specifically for sealing ductwork as recommended by the manufacturer. Generally provide liquid sealant, with or without compatible tape, for low clearance slip joints and heavy, permanently elastic, mastic type where clearances are larger. Oil base caulking and glazing compounds are not acceptable because they do not retain elasticity and bond.
 - 2. Tape: Use only tape specifically designated by the sealant manufacturer and apply only over wet sealant. Pressure sensitive tape shall not be used on bare metal or on dry sealant.
 - 3. Gaskets in Flanged Joints: Soft neoprene.
- C. Approved factory made joints such as DUCTMATE SYSTEM may be used.

2.2 DUCT CONSTRUCTION AND INSTALLATION:

- A. Follow SMACNA HVAC Duct Construction Standards.
- B. Duct Pressure Classes:
 - 1. Supply air ductwork, outdoors and in crawlspaces: 1500 pa (6-inch wg).
 - 2. Supply air ductwork, upstream of terminal units, in building: 1000 pa (4-inch wg).
 - 3. Supply air ductwork, downstream of terminal units: 500 pa (2-inch wg).
 - 4. Return air ductwork, outdoors: 750 pa (3-inch wg), negative pressure.
 - 5. Return air ductwork, in building: 500 pa (2-inch wg), negative pressure.
 - 6. Exhaust ductwork: 500 pa (2-inch wg), negative pressure.

- C. Seal Classes: As specified and in accordance with SMACNA HVAC Air Duct Leakage Test Manual.
- D. Round and Flat Oval Ducts: Furnish duct and fittings made by the same manufacturer to insure good fit of slip joints. When submitted and approved in advance, round and flat oval duct, with size converted on the basis of equal pressure drop, may be furnished in lieu of rectangular duct design shown on the drawings.
1. Elbows: Diameters 80 through 200 mm (3 through 8 inches) shall be two section die stamped, all others shall be gored construction, maximum 18 degree angle, with all seams continuously welded or standing seam. Coat galvanized areas of fittings damaged by welding with corrosion resistant aluminum paint or galvanized repair compound.
 2. Provide bellmouth, conical tees or taps, laterals, reducers, and other low loss fittings as shown in SMACNA Standards.
 3. Ribbed Duct Option: Lighter gage round/oval duct and fittings may be furnished provided certified tests indicating that the rigidity and performance is equivalent to SMACNA standard gage ducts are submitted.
 - a. Ducts: Manufacturer's published standard gage, G90 coating, spiral lock seam construction with an intermediate standing rib.
 - b. Fittings: May be manufacturer's standard as shown in published catalogs, fabricated by spot welding and bonding with neoprene base cement or machine formed seam in lieu of continuous welded seams.
 4. Provide flat side reinforcement of oval ducts as recommended by the manufacturer and SMACNA Standard S3.13. Because of high pressure loss, do not use internal tie-rod reinforcement unless approved by the Resident Engineer.
- E. Casings and Plenums: Construct in accordance with SMACNA Standards Section VI, including curbs, access doors, pipe penetrations, eliminators and drain pans. Access doors shall be hollow metal, insulated, with latches and door pulls, 500 mm (20 inches) wide by 1200 - 1350 mm (48 - 54 inches) high. Provide viewport in the doors where shown. Provide drain for outside air louver plenum. Outside air plenum shall have exterior insulation. Drain piping shall be routed to the nearest floor drain.

F. Volume Dampers: Single blade or opposed blade, multi-louver type as detailed in SMACNA Standards.

G. Duct Hangers and Supports: Refer to SMACNA Standards Section IV. Avoid use of trapeze hangers for round duct.

2.3 DUCT ACCESS DOORS, PANELS AND SECTIONS:

A. Provide access doors, sized and located for maintenance work, upstream, in the following locations:

1. Each fire damper (for link service), smoke damper and automatic control damper.
2. Each duct mounted smoke detector.

B. Openings shall be as large as feasible in small ducts, 300 mm by 300 mm (12 inch by 12 inch) minimum where possible. Access sections in insulated ducts shall be double-wall, insulated. Transparent shatterproof covers are preferred for uninsulated ducts.

1. For rectangular ducts: Refer to SMACNA Standards (Figure 2-12).
2. For round and flat oval duct: Access sections shall be not less than 1.0 mm (20 gage) housing welded or riveted to a duct section.

2.4 COMBINATION FIRE/SMOKE DAMPERS:

A. Galvanized steel, interlocking blade type, UL listing and label, 1-1/2 hour rating, 74 °C (165 °F) fusible line, 100 percent free opening with no part of the blade stack or damper frame in the air stream.

1. The damper frame may be of design and length as to function as the mounting sleeve, thus eliminating the need for a separate sleeve, as allowed by UL 555. Otherwise provide sleeves and mounting angles, minimum 1.9 mm (14 gage), required to provide installation equivalent to the damper manufacturer's UL test installation.
2. Submit manufacturers installation instructions conforming to UL rating test.

B. Maximum air velocity, through free area of open damper, and pressure loss: Low pressure and medium pressure duct (supply, return, exhaust, outside air): 450 m/min (1500 fpm). Maximum static pressure loss: 32 Pa (0.13 inch WG).

C. Maximum air leakage, closed damper: 0.32 cubic meters /min/square meter (4.0 cfm per square foot) at 750 Pa (3 inches wg) differential pressure.

D. Minimum requirements for dampers:

1. Meet requirements of Table 6-1 of UL 555S, except the Fire Endurance and Hose Stream Test.
 2. Frame: Galvanized steel channel with side, top and bottom stops or seals.
 3. Blades: Galvanized steel, parallel type preferably, 300 mm (12 inch) maximum width, edges sealed with neoprene, silicone rubber or felt, if required to meet minimum leakage. Airfoil (streamlined) type for minimum noise generation and pressure drop are preferred for duct mounted dampers.
 4. Shafts: Galvanized steel.
 5. Bearings: Stainless steel sleeve or ball type.
 6. Hardware: Zinc plated.
 7. Operation: Automatic open/close. No smoke damper that requires manual reset or link replacement after actuation is acceptable. See drawings for required control operation.
- E. Motor operator(actuator): Provide electric as required by the automatic control system, externally mounted on stand-offs to allow complete insulation coverage.

2.5 FIRE DOORS:

Galvanized steel, interlocking blade type, UL listing and label, 71 °C (160 °F) fusible link, 3 hour rating and approved for openings in Class A fire walls with rating up to 4 hours, 100 percent free opening with no part of the blade stack or damper frame in the air stream.

2.6 FLEXIBLE AIR DUCT CONNECTORS:

- A. General: Factory fabricated, complying with NFPA 90A for connectors not passing through floors of buildings. Flexible ducts shall not penetrate any fire or smoke barrier which is required to have a fire resistance rating of one hour or more. Flexible duct length shall not exceed 1.5 m (5 feet). Provide insulated acoustical air duct connectors in supply air duct systems and elsewhere as shown.
- B. Flexible ducts shall be listed by Underwriters Laboratories, Inc., complying with UL 181. Ducts larger than 200 mm (8 inches) in diameter shall be Class 1. Ducts 200 mm (8 inches) in diameter and smaller may be Class 1 or Class 2.
- C. Insulated Flexible Air Duct: Factory made including mineral fiber insulation with maximum C factor of 0.25 at 24 °C (75 °F) mean temperature, encased with a low permeability moisture barrier outer

jacket, having a puncture resistance of not less than 50 Beach Units. Acoustic insertion loss shall not be less than 3 dB per 300 mm (foot) of straight duct, at 500 Hz, based on 150 mm (6 inch) duct, of 750 m/min (2500 fpm).

D. Application Criteria:

1. Temperature range: -18 to 93 °C (0 to 200 °F) internal.
2. Maximum working velocity: 1200 m/min (4000 feet per minute).
3. Minimum working pressure, inches of water gage: 2500 Pa (10 inches) positive, 500 Pa (2 inches) negative.

E. Duct Clamps: 100 percent nylon strap, 80 kg (175 pounds) minimum loop tensile strength manufactured for this purpose or stainless steel strap with cadmium plated worm gear tightening device. Apply clamps with sealant and as approved for UL 181, Class 1 installation.

2.7 FLEXIBLE CONNECTIONS:

Where duct connections are made to fans and air handling units, install a non-combustible flexible connection of 822 g (29 ounce) neoprene coated fiberglass fabric approximately 150 mm (6 inches) wide. For connections exposed to sun and weather provide hypalon coating in lieu of neoprene. Burning characteristics shall conform to NFPA 90A. Securely fasten flexible connections to round ducts with stainless steel or zinc-coated iron draw bands with worm gear fastener. For rectangular connections, crimp fabric to sheet metal and fasten sheet metal to ducts by screws 50 mm (2 inches) on center. Fabric shall not be stressed other than by air pressure. Allow at least 25 mm (one inch) slack to insure that no vibration is transmitted.

2.8 SOUND ATTENUATING UNITS:

A. Casing, not less than 1.0 mm (20 gage) galvanized sheet steel, or 1.3 mm (18 gage) aluminum fitted with suitable flanges to make clean airtight connections to ductwork. Sound-absorbent material faced with glass fiber cloth and covered with not less than 0,6 mm (24 gage) or heavier galvanized perforated sheet steel, or 0.85 mm (22 gage) or heavier perforated aluminum. Perforations shall not exceed 4 mm (5/32-inch) diameter, approximately 25 percent free area. Sound absorbent material shall be long glass fiber acoustic blanket meeting requirements of NFPA 90A.

- B. Entire unit shall be completely air tight and free of vibration and buckling at internal static pressures up to 2000 Pa (8 inch water gage) at operating velocities.
- C. Pressure drop through each unit: Not to exceed indicated value at design air quantities indicated.
- D. Submit complete independent laboratory test data showing pressure drop and acoustical performance.
- E. Cap open ends of attenuators at factory with plastic, heavy duty paper, cardboard, or other appropriate material to prevent entrance of dirt, water, or any other foreign matter to inside of attenuator. Caps shall not be removed until attenuator is installed in duct system.

2.9 PREFABRICATED ROOF CURBS:

Galvanized steel or extruded aluminum 300 mm (12 inches) above finish roof service, continuous welded corner seams, treated wood nailer, 40 mm (1-1/2 inch) thick, 48 kg/cubic meter (3 pound/cubic feet) density rigid mineral fiberboard insulation with metal liner, built-in cant strip (except for gypsum or tectum decks). For surface insulated roof deck, provide raised cant strip (recessed mounting flange) to start at the upper surface of the insulation. Curbs shall be constructed for pitched roof or ridge mounting as required to keep top of curb level.

2.10 EQUIPMENT SUPPORTS:

Section 15050, BASIC METHODS AND REQUIREMENTS (MECHANICAL).

2.11 FIRESTOPPING MATERIAL:

Refer to Section 07270, FIRESTOPPING.

2.12 SEISMIC RESTRAINT FOR DUCTWORK:

- A. Ductwork shall be supported and braced to resist all directional (transverse, longitudinal and vertical) forces.
- B. Brace all duct branches, minimum of one brace per branch.
- C. Provide required bracing material.
- D. Provide one of the following options:
 - 1. Design and installation to meet the criteria listed above, and meet requirements of the latest Sheet Metal and Air Conditioning Contractors National Association (SMACNA), Seismic Restraint Manual Guidelines for Mechanical Systems for the prescribed Seismic Hazard Level (SHL) A.
 - 2. Design and installation to meet the criteria listed above, and meet the most current requirements of the National Uniform Seismic

Installation Guidelines (NUSIG). Contractor shall submit all design tables and information for the design force levels, stamped and signed by a professional engineer registered in the State where project is located.

3. Where SMACNA or NUSIG requirements are not met completely, submit proposed alternate details and calculations to completely address seismic bracing requirements. Such designs shall use more severe of the Local Code and the Uniform Building Code requirements for determining seismic forces, and be performed, stamped and signed by a professional engineer registered in the State where project is located. Revise if necessary any details shown on the contract drawings for vertical support and lateral bracing, and submit for the approval of the Resident Engineer to meet the design criteria listed above.

2.13 THERMOMETER (AIR) :

Section 15902, CONTROLS AND INSTRUMENTATION (DDC).

2.14 INSTRUMENT TEST FITTINGS:

- A. Manufactured type with a minimum 50 mm (two inch) length for insulated duct, and a minimum 25 mm (one inch) length for duct not insulated. Test hole shall have a flat gasket for rectangular ducts and a concave gasket for round ducts at the base, and a screw cap to prevent air leakage.
- B. Provide instrument test holes at each duct or casing mounted temperature sensor or transmitter, and at entering and leaving side of each heating coil, cooling coil, and heat recovery unit.

2.15 AIR OUTLETS AND INLETS:

- A. Materials:
 1. Steel or aluminum. Provide manufacturer's standard gasket.
 2. Exposed Fastenings: The same material as the respective inlet or outlet. Fasteners for aluminum may be stainless steel.
 3. Contractor shall review all ceiling drawings and details and provide all ceiling mounted devices with appropriate dimensions and trim for the specific locations.
- B. Performance Test Data: In accordance with Air Diffusion Council code 1062R4. Refer to Section 15200, NOISE AND VIBRATION CONTROL for NC criteria.
- C. Air Supply Outlets:

1. Ceiling Diffusers: Suitable for surface mounting, exposed T-bar or special tile ceilings, off-white finish, square or round neck connection as shown on the drawings. Provide plaster frame for units in plaster ceilings.
 - a. Square, louver, fully adjustable pattern: Round neck, surface mounting unless shown otherwise on the drawings. Provide equalizing or control grid and volume control damper.
 - b. Louver face type: Square or rectangular, removable core for 1, 2, 3, or 4 way directional pattern. Provide equalizing or control grid and opposed blade damper.
 - c. Slot diffuser/plenum:
 - 1) Galvanized steel boot lined with 13 mm (1/2 inch) thick fiber-free conforming to NFPA 90A and complying to UL 181 for erosion. Form slots or use adjustable pattern controllers, to provide stable, horizontal air flow pattern over a wide range of operating conditions.
 - 2) Provide inlet connection diameter equal to duct diameter shown on drawings or provide transition coupling if necessary.
 - 3) Maximum pressure drop at design flow rate: 37 Pa (0.15 inch) wg.
 2. Registers: Double deflection type with horizontal face bars and opposed blade damper with removable key operator.

Margin: Flat, 30 mm (1-1/4 inches) wide.

Bar spacing: 20 mm (3/4 inch) maximum.
- a. Finish: Off white baked enamel for ceiling mounted units. Wall units shall have a prime coat for field painting, or shall be extruded with manufacturer's standard finish.
3. Grilles: Same as registers but without the opposed blade damper.
- D. Return and Exhaust Registers and Grilles: Provide opposed blade damper without removable key operator for registers.
1. Finish: Off-white baked enamel for ceiling mounted units. Wall units shall have a prime coat for field painting, or shall be extruded aluminum with manufacturer's standard aluminum finish.
 2. Standard Type: Fixed horizontal face bars set at 30 to 45 degrees, approximately 30 mm (1-1/4 inch) margin.
 3. Door Grilles: Are furnished with the doors.

2.16 WIRE MESH GRILLE:

- A. Fabricate grille with 2 x 2 mesh 13 mm (1/2 inch) galvanized steel or aluminum hardware cloth in a spot welded galvanized steel frame with approximately 40 mm (1-1/2 inch) margin.
- B. Use grilles where shown in unfinished areas such as mechanical rooms.

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. Comply with provisions of Section 15050, BASIC METHODS AND REQUIREMENTS (MECHANICAL), particularly regarding coordination with other trades and work in existing buildings.
- B. Fabricate and install ductwork and accessories in accordance with referenced SMACNA Standards:
 - 1. Drawings show the general layout of ductwork and accessories but do not show all required fittings and offsets that may be necessary to connect ducts to equipment, boxes, diffusers, grilles, etc., and to coordinate with other trades. Fabricate ductwork based on field measurements. Provide all necessary fittings and offsets at no additional cost to the government. Coordinate with other trades for space available and relative location of HVAC equipment and accessories on ceiling grid. Duct sizes on the drawings are inside dimensions which shall be altered by Contractor to other dimensions with the same air handling characteristics where necessary to avoid interferences and clearance difficulties.
 - 2. Provide duct transitions, offsets and connections to dampers, coils, and other equipment in accordance with SMACNA Standards, Section II. Provide streamliner, when an obstruction cannot be avoided and must be taken in by a duct. Repair galvanized areas with galvanizing repair compound.
 - 3. Provide bolted construction and tie-rod reinforcement in accordance with SMACNA Standards, Section VI.
 - 4. Construct casings, eliminators, and pipe penetrations in accordance with SMACNA Standards, Section VI. Design casing access doors to swing against air pressure so that pressure helps to maintain a tight seal.
- C. Install duct hangers and supports in accordance with SMACNA Standards, Section IV.

- D. Install fire dampers in accordance with the manufacturer's instructions to conform to the installation used for the rating test.
- E. Seal openings around duct penetrations of floors and fire rated partitions with fire stop material as required by NFPA 90A.
- F. Flexible duct installation: Refer to SMACNA Standards, Section III. Ducts shall be continuous, single pieces not over 1.5 m (5 feet) long (NFPA 90A), as straight and short as feasible, adequately supported. Centerline radius of bends shall be not less than two duct diameters. Make connections with clamps as recommended by SMACNA. Clamp per SMACNA S3.33 and S3.34 with one clamp on the core duct and one on the insulation jacket. Flexible ducts shall not penetrate floors, or any chase or partition designated as a fire or smoke barrier, including corridor partitions fire rated one hour or two hour. Support ducts SMACNA Standards.
- G. Where diffusers, registers and grilles cannot be installed to avoid seeing inside the duct, paint the inside of the duct with flat black paint to reduce visibility.
- H. Control Damper Installation:
 - 1. Provide necessary blank-off plates required to install dampers that are smaller than duct size. Provide necessary transitions required to install dampers larger than duct size.
 - 2. Assemble multiple sections dampers with required interconnecting linkage and extend required number of shafts through duct for external mounting of damper motors.
 - 3. Provide necessary sheet metal baffle plates to eliminate stratification and provide air volumes specified. Locate baffles by experimentation, and affix and seal permanently in place, only after stratification problem has been eliminated.
 - 4. Install all damper control/adjustment devices on stand-offs to allow complete coverage of insulation.
- I. Air Flow Measuring Devices (AFMD): Install units with minimum straight run distances, upstream and downstream as recommended by the manufacturer.
- J. Protection and Cleaning: Adequately protect equipment and materials against physical damage. Place equipment in first class operating condition, or return to source of supply for repair or replacement, as determined by Resident Engineer. Protect equipment and ducts during

construction against entry of foreign matter to the inside and clean both inside and outside before operation and painting. When new ducts are connected to existing ductwork, clean both new and existing ductwork by mopping and vacuum cleaning inside and outside before operation.

3.2 DUCT LEAKAGE TESTS AND REPAIR:

- A. Perform tests AS required. See article, QUALITY ASSURANCE.
- B. Seal all openings in ducts.

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**SECTION 15885
AIR FILTERS**

PART 1 - GENERAL

1.1 DESCRIPTION:

- A. Air filters for heating, ventilating and air conditioning.
- B. Definitions: Refer to ASHRAE 52.1-92 for definitions of face velocity, net effective filtering area, media velocity, resistance (pressure drop), atmospheric dust spot efficiency and dust-holding capacity.

1.2 RELATED WORK:

- A. Section 15050, BASIC METHODS AND REQUIREMENTS (MECHANICAL).
- B. Section 15763, AIR HANDLING UNITS.

1.3 QUALITY ASSURANCE:

- A. Air Filter Performance Report For Extended Surface Filters:
 - 1. Submit a test report for each Grade of filter being offered. The report shall be less than five years old and will have been prepared by an independent testing laboratory using test equipment, method and duct section as specified by ASHRAE Standard 52.1-92 for type filter under test and acceptable to Resident Engineer, indicating that filters comply with the requirements of this specification. Test for 150 m/min (500 fpm) will be accepted for lower velocity rated filters provided the test report of an independent testing laboratory complies with all the requirements of this specification.
 - 2. Selection procedures: All filters tested shall have been procured by the independent testing laboratory from the open market independent of manufacturer of these filters and a statement to this effect must accompany test report.
 - 3. Government Option: The Government at its option may take one of the filters for each different type submitted and run an independent test to determine if the filter meets the requirements of this specification. When the filter meets the requirements, the Government will pay for the test. When the filter does not meet the specification requirements, the manufacturer will be required to pay for the test and replace the filters with filters that will perform as required by the specifications.
- B. Filter Supplier Warranty for Extended Surface Filters: Guarantee the filters against leak, blow-outs, and other deficiencies during their

normal useful life. Defective filters shall be replaced at no cost to the Government.

- C. Nameplates: Each filter shall bear a label or name plate indicating manufacturer's name, filter size, rated efficiency, UL classification, and file number.

1.4 SUBMITTALS:

- A. Submit in accordance with Section 01340, SAMPLES AND SHOP DRAWINGS.
- B. Manufacturer's Literature and Data:
 - 1. Extended surface filters.
 - 2. Holding frames. Identify locations.
 - 3. Magnehelic gages.
- C. Air filter performance reports.
- D. Suppliers warranty.

1.5 APPLICABLE PUBLICATIONS:

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation only.
- B. American Society of Heating, Refrigerating and Air-conditioning Engineers, Inc. (ASHRAE):
 - 52.1-92.....Methods of Testing Air Cleaning Devices Used in
General Ventilation For Removing Particulate
Matter
- C. Underwriters Laboratories, Inc. (UL):
 - 586-90.....UL Standard for Safety High-Efficiency,
Particulate, Air Filter Units
 - 900-87.....UL Standard for Safety Test Performance of Air
Filter Units
- D. Federal Specification (Fed. Spec.):
 - A-A-1419D.....Filter, Element Air Conditioning
(Viscous-Impingement and Dry Type,
Replaceable).

PART 2 - PRODUCTS

2.1 REPLACEMENT FILTER ELEMENTS TO BE FURNISHED:

- A. To allow temporary use of HVAC systems for testing and in accordance with Paragraph, TEMPORARY USE OF MECHANICAL AND ELECTRICAL SYSTEMS in Section 01010, GENERAL REQUIREMENTS, provide one complete set of additional (replacement) filter elements.

- B. The Resident Engineer will direct whether these additional filters will either be installed as replacements for dirty units or turned over to VA for future use as replacements.

2.2 EXTENDED SURFACE AIR FILTERS:

- A. Use factory assembled air filters of the extended surface type with supported or non-supported cartridges for removal of particulate matter in air conditioning, heating and ventilating systems. Filter units shall be of the extended surface type fabricated for disposal when the dust-load limit is reached as indicated by maximum (final) pressure drop.
- B. Filter Classification: UL approved Class 1 or Class 2 conforming to UL Standard 900.
- C. Filter Grades, Percent, Nominal Efficiency and Application:
 - 1. Grade A: 90-95 after-filter.
 - 2. Grade B: 80-85 after-filter.
 - 3. Grade C: 50-60 pre-filter.
 - 4. Grade D: 25-30 pre-filter.
- D. Filter Media:
 - 1. Grade A, B and C Supported (Rigid Pleated) Type: Media shall be composed of high density glass fibers or other suitable fibers. Fastening methods used to maintain pleat shape, (metal backing or aluminum separators) shall be sealed in a proper enclosing frame to insure no air leakage for life of filter. Staples and stays are prohibited.
 - 2. Grade D (Pleated) Type: Media shall be composed of synthetic/natural fibers. A metal grid backing shall be bonded to the air leaving side of the media to maintain uniform pleat shape and stability for proper air flow and maximum dust loading. The media frame shall be constructed of high strength moisture resistant fiber or beverage board. Bond the pleated media pack on all four edges to insure no air leakage for the life of the filter. Staples and stays are prohibited.
- E. Filter Efficiency and Arrestance: Efficiency and arrestance of filters shall be determined in accordance with ASHRAE 52.1-92. Atmospheric dust spot efficiency and synthetic dust weight arrestance shall not be less than the following:

	Percentage of Initial Efficiency	Percentage of Average Efficiency	Percentage of Average Arrestance
Grade A	75.4	86.4	99.0
Grade B	58.0	79.0	98.0
Grade C	25.0	53.0	97.0
Grade D	Less than 20.0	22.0	89.0

F. Maximum initial and final resistance, Pa (inches of water), for each filter cartridge when operated at 150 m/min (500 feet per minute) face velocity:

	Initial Resistance	Final Resistance
Grade A (Rigid Pleated)	185 (0.74)	250 (1.00)
Grade B (Rigid Pleated)	150 (0.60)	250 (1.00)
Grade C (Rigid Pleated)	85 (0.35)	200 (0.80)
Grade D (2-inch deep)	80 (0.32)	175 (0.70)
Grade D (4-inch deep)	65 (0.27)	175 (0.70)

G. Dust Holding Capacity: When tested to 250 Pa (1.00-inch water) at 150 m/min (500 fpm) face velocity, the dust holding capacity for each 600 mm by 600 mm (24 inches by 24 inches) (face area) filter shall be at least the values listed below. For other filter sizes the dust holding capacity shall be proportionally higher or lower to the face area.

Grade A (Rigid Pleated)	90 grams
Grade B (Rigid Pleated)	175 grams
Grade C (Rigid Pleated)	250 grams
Grade D (2 inch deep)	150 grams
Grade D (4 inch deep)	300 grams

H. Minimum Media Area: The minimum net effective media area in square meter (square feet) for each 600 mm by 600 mm (24 inches by 24 inches) (face area) filter at 150 m/min (500 fpm) face velocity shall be at least the values listed below. For other filter sizes the net effective media area shall be proportionally higher or lower.

Grade A (Rigid Pleated)	5.3 (57.0)
Grade B (Rigid Pleated)	5.3 (57.0)

Grade C (Rigid Pleated)	5.3 (57.0)
Grade D (2-inch deep)	1.4 (14.8)
Grade D (4-inch deep)	2.1 (23.0)

I. Holding Frame System:

1. Minimum 1.6 mm (16 gage) galvanized steel, 100 mm (4 inches) deep, factory complete with hardware necessary for field assembly, suitable for either upstream or downstream filter servicing. All members shall be cut to size and prepunched for easy assembly into modules of the size and capacity noted in the schedules.
2. The framing members shall be permanently gasketed to prevent the bypass of unfiltered air. If required, furnish suitable vertical support members to prevent deflection of horizontal members. The vertical support members shall not interfere with either the installation or operation of the filters.
3. The framing system shall incorporate a factory installed positive sealing device for each row of filters. This device shall allow for easy installation and removal of cartridges and shall insure the seal between the gasketed filter elements while the bank is in operation.

J. Magnehelic Differential Pressure Filter Gages: Nominal 100 mm (four inch) diameter, zero to 500 Pa (zero to two inch water gage) range, flush mounted in aluminum panel board, complete with static tips, copper or aluminum tubing, and accessory items to provide zero adjustment. Provide one gage for each extended surface filter section. Provide Petcocks for each gauge.

K. Equipment Identification: Section 15050, BASIC METHODS AND REQUIREMENTS (MECHANICAL).

PART 3 - EXECUTION

3.1 INSTALLATION:

Install supports, filters and gages in accordance with manufacturer's instructions.

3.2 START-UP AND TEMPORARY USE:

- A. Clean and vacuum air handling units and plenums to the satisfaction of the Resident Engineer prior to starting air handling systems.
- B. Install or deliver replacement filter units as directed by the Resident Engineer.

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VA Seattle Building 100
Ambulatory Clinic Expansion

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SECTION 15885
AIR FILTERS

**SECTION 15902
CONTROLS AND INSTRUMENTATION (DDC)**

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Supply all labor and materials required for the construction of the BMCS/ATC system as outlined in this specification.
- B. Provide testing and checkout of HVAC system and its associated controls per paragraph 3.01, General of this specification
- C. Operate the control system for the Balancing Contractor during system balancing operations.
- D. Power wiring to control panels.
- E. Provide initial programming to achieve the sequence of operations, alarms, and reports as required by these drawings and specifications.
- F. Provide 2 days of on-site operator training on the use and programming of the system.
- G. Definitions:
 - 1. BMCS - Building Management Control System
 - 2. ATC - Automatic Temperature Control
 - 3. DDC - Direct Digital Control
 - 4. CCL - Custom Control Language
 - 5. PID - Proportional, Integral & Derivative Control
 - 6. RTC - Real Time Clock

1.2 RELATED WORK

- A. Section 15705, HVAC PIPING SYSTEMS
- B. Section 15740, AIR TERMINALS
- C. Section 15763, AIR HANDLING UNITS

1.3 APPROVAL TO BID

The controls system for this project shall be 100 percent compatible with the medical center network based system currently installed throughout the campus and in building 100, manufactured by Alerton Controls. The contractor must be able to show that they have installed and serviced Alerton Controls for a minimum of three years. The contractor must also be able to show that they were a licensed representative of Alerton Controls, Inc during this time period.

PART 2 - PRODUCTS

2.1 BUILDING MANAGEMENT SYSTEM

- A. The BMCS shall be composed of one or more independent, stand alone, microprocessor-based master control panels installed in the building. The panels shall provide control for all distributed stand alone unit controllers located on each major piece of HVAC equipment. Panels shall communicate with HVAC unit controllers and provide for the miscellaneous equipment points detailed on the drawings and listed in individual specifications. Before contract award, BMCS supplier will be required to document expansion points available in the proposed system.
- B. The contractor will provide the most current version of the Alerton BACnet Software in all controllers. All existing user workstation software will be upgraded to the most current version of the Alerton BACnet software. Workstations are currently located in building 18, Central Energy Plant and Engineering Shops.
- C. Each panel memory shall be protected for a minimum of 30 days in the event of power failure. Internal clock shall continue to run during a power failure so that the system makes the appropriate adjustment to all connected points when power is restored. Should database be lost, provide a means of rapid reprogramming from an archive copy of the database.
- D. The operating system of the panels provided must manage communication signals, both in and out, to allow panels to share real and virtual point information with each other and to allow central monitoring, central alarms, and editing of all panels from a single operator station as described below. The system of panels shall be capable of communicating with each other and the Campus BMCS by use of standard FTTA-10 networks.
- E. Binary outputs shall provide a continuous low voltage signal for on/off control of remote devices. Where specified or indicated outputs shall have three position manual override switch (On/Off/ Auto), a status light, and shall be selected for either normally open or closed operation.
- F. Analog outputs shall provide a modulating signal for control of remote devices. Outputs shall provide either a 0 to 10 VDC or a 4 to 20

milliamp output signal as required to provide proper control for the output device.

- G. Binary Inputs shall allow the monitoring of on/off signals from remote devices. The Binary Inputs shall be compatible with commonly available signaling devices. All status points shown on point list or mentioned in unit sequence of operation shall be positive proof binary switches, sensing the medium being controlled.
- H. Analog Inputs shall allow the monitoring of variable, low voltage, current, or resistance signals have a minimum of a 12 bit resolution, The Analog Inputs shall be compatible with, and field configurable to, commonly available sensing devices.
- I. Time Override Switches: The system shall include the necessary switch hardware and corresponding inputs for the remote, timed initiation of after hours equipment operation in a building. Inputs shall be provided at each room temperature sensor.
- J. Alarms: The system shall provide audio, visual, contact closure and remote telephone annunciation for:
 - 1. Remote equipment failure.
 - 2. Equipment run time, number of starts, or date.
 - 3. Program failure.
 - 4. Card failure.
 - 5. Sensor failure.

In addition, each analog sensor and binary input and output shall be capable of individually alarmed for values in excess of individual high/low limits or status.

- K. System Diagnostics: The system shall continuously check the status of all processor and memory circuits. Upon failure, the panel shall:
 - 1. Switch equipment into preassigned failure mode per normally open/closed relay setting.
 - 2. Emit alarm.
 - 3. Display card failure identification.
- L. Standalone Unit Controllers: Controllers shall be microprocessor-based and interconnected in a network with other controllers and panels. All software control functions shall be performed by this intelligent standalone unit controller. Software functions shall include the following:
 - 1. Fully prompted English man-machine interface.

2. Direct Digital Control (DDC), Energy Management Control System, Facilities Management System.
3. Floating point mathematics and relational logic functions.
4. Standard HVAC system applications, such as single zone heating coils, air handlers and boilers.
5. Full standalone control capability with battery backed Real Time Clock (RTC).
6. 30 day battery back-up of Real Time Clock and static RAM (EEPROM backup is acceptable).

2.2 BMCS PANEL SOFTWARE

- A. Anti-Recycle Protection: Anti-recycle equipment protection timers protection of each HVAC unit shall be provided through individually programmable "minimum on" and "minimum off" timers. These shall have the priority over all application software functions except fire shutdown/smoke evacuation modes. All timers shall be individually programmable from 0 to 120 minutes.
- B. User Access
 1. User access shall be through the use of a prompted, menu driven, English language communications routine. When using the system, the user shall be able to both list program options from menu and directly access them. At any time, the user shall be able to depress a "help" key in order to display instructions for the user interface. The communications routine shall be compatible with any ASCII based, RS232 compatible terminal.
 2. User access shall be secured using individual security passwords for a minimum of eight users. It will be partitioned into multiple levels of user access with data entry restrictions being assignable by password. User log on/log off attempts will be recorded.
- C. Time-of-Day Scheduling: The scheduling program shall have 32, eight-day (seven day plus holiday) master schedules. To these master schedules, up to 24 system loads (HVAC equipment, lights, etc.), or groups of loads, can be assigned. The master schedules shall be individually editable for each of the days of the week and holiday. On any day, up to six time-of-day events shall be edited including: equipment start and stop, optimum start and stop duty cycle start and stop, and night purge cycle start.
- D. Direct Digital Control

1. The DDC control program shall allow the modulating control of remote devices based upon sensed data. The control shall allow the combination of proportional, integral, and derivative control routines (PID Control). Control routines shall allow full flexibility in setting parameters and provide ease of adjustment for non-technical operators.
 2. The DDC program shall include a dynamic graphic display printout routine to indicate the status and real-time performance of the control loop. DDC loop setup and modification shall be done through a single, pre-formatted edit screen, with parameters listed in English language.
- E. Custom Control Language: The CCL capability shall be suitable for user written, real time, equation based custom control routines. Any binary or analog points in the system shall be available as inputs to custom routines. Equation options shall include math functions such as: addition, subtraction, multiplication, division, square root, minimum, maximum, average; and logical functions: and, or, greater than, less than, equal to, not equal to, less than or equal to, greater than or equal to, variable timing, and delays.
- F. Optimum Start/Stop: The optimum start/stop program shall determine the required equipment start/stop timing by using inside/outside temperatures and the user's time-of-day schedule. The optimum start/stop program shall run independently for each controlled load or zone, and shall automatically self adjust based upon historical data.
- G. Duty Cycle: The duty cycling program shall be capable of suspending cycle control if sensed temperature and/or humidity is outside the user-defined comfort range.
- H. Electrical Demand Control
1. The Building Management master panels shall have the capability to allow the control of the building peak kilowatt demand by selectively turning off loads. This capability will not be used for this project. The control program shall be based upon a predicative sliding window technique, shall contain a self-adjusting demand limiting routine, and shall be able to control two independent demand limiting applications. The user shall be able to designate the estimated kW value, maximum off time and priority level for each load.

2. For each of the demand routines, the program will shed the predicted kW requirements by starting with the lowest level of priority. When all available loads within a priority level have been shed, the program will then proceed to the next priority level. HVAC equipment and comfort are protected by equipment "maximum off" entries and demand limiting temperature deadbands. Anti-recycle timers will protect the controlled equipment.
 3. The system shall be able to monitor building power consumption from signals generated by a pulse generator (provided by others) mounted at the building power meter or from a watts transducer and current capability shall also be provided for an end-of-billing period indication.
- I. Temperature Control: The control temperature program shall coordinate day and night temperature control and optimum start and stop. In all cases, it shall be able to initiate contact closure and/or adjust equipment operation based upon occupied and unoccupied heating and cooling setpoints. The program shall include user selectable deadbands for automatic adjustment or demand, night setback and duty cycling strategies based upon deviation from zone to set point. It shall also be capable of automatically terminating equipment operation in order to prevent simultaneous heating and cooling within a zone.
 - J. After Hours Override: The user shall have the ability to override the scheduled status of a load for a user defined period of one to 720 minutes. The system shall be capable of accepting a signal to begin after hour operation through a remote binary input mounted switch, a remote analog input mounted switch, and/or a CRT command, initiated by the operator. The system shall be able to independently override a minimum of 27 timed override groups, each containing a minimum of four loads, and keep track of total minutes of override per month for each group.
 - K. Run Time and Maintenance: The system shall be able to monitor equipment status and generate maintenance messages based upon user designated run time, starts and/or calendar date limits. A minimum of 32 separate devices shall be monitored under run time and maintenance.
 - L. Expanded Messages: The user shall be able to define a minimum of 10 40 - character expanded messages for automatic printing in the event of system alarm and/or run time and maintenance event.

2.3 AIR HANDLER CONTROLLERS (TO BE USED ON UNITS WITH LESS THAN 40 POINTS)

- A. AHU Controllers shall be capable of meeting the requirements of the sequence of operation found in the Execution portion of this specification and for future expansion.
- B. AHU Controllers shall support all the necessary point inputs and outputs as required by the sequence and operate in a standalone fashion.
- C. AHU Controllers shall be fully user programmable to allow for modification of the application software.
- D. An LCD display shall be optionally available for readout of point values and to allow operators to change setpoints and system parameters.
- E. A manual override switch shall be provided for all digital and analog outputs on the AHU Controller. The position of the switch shall be monitored in software and available for operator displays and alarm notification.

2.4 VAV TERMINAL UNIT CONTROLLERS

- A. VAV Terminal Unit Controllers shall support, but not limited to the control of the following configurations of VAV boxes to address current requirements as described in the Execution portion of this specification, and for future expansion:
 - B. Single Duct Cooling Only
 - C. Single Duct Cooling with Reheat (Electric or Hot Water)
 - D. Fan Powered (Parallel or Series)
 - E. Dual Duct (Constant or Variable Volume)
 - F. Supply/Exhaust
- G. VAV Controllers for single duct applications will come equipped with a built-in actuator for modulation of the air damper. The actuator shall have a minimum torque rating of 35 in-lb., and contain an override mechanism, for manual positioning of the damper during startup and service. VAV Controllers shall contain an integral velocity sensor accurate to +/- 5% of the full range of the box's CFM rating. Each control shall perform the sequence of operation described in Part 3 of this specification, and have the capability for time of day scheduling, occupancy mode control, after hours operation, lighting control, alarming, and trending. VAV Controllers shall be able to communicate

with any other Standalone Digital Control Unit on the same field bus with or without communication to the NCU managing the field bus.

2.5 OPERATOR INTERFACE

- A. The contractor will utilize the existing network based operator workstations and displays located in Building 18, Central Energy Plant, and Engineering Shops. The contractor shall provide programming for initial graphics displays consisting of the building floor plan and system flow diagrams. Displays shall be created with the use of a mouse, joystick or digitizer, and be able to display up to 256 colors simultaneously. The graphics package must be capable of presenting dynamic information in the form of descriptors, values and/or symbols. Dynamic points are located on the graphic by using either a mouse or the keyboard as a pointing device. Refresh of dynamic information shall be manual and/or automatic, with a frequency of up to 5 seconds. A manual refresh mode alone is unacceptable.
- B. Operator interface to graphic displays shall be controlled using a mouse and/or function keys, in conjunction with pop-up menu windows. The package must provide the capability to both link graphics sequentially and directly access multiple displays from a single graphic. While in graphics mode, the interface must also provide the interactive ability of manually overriding a point. In addition, the user must have access to complete remote panel programming via a single keystroke from the graphics mode. Packages not offering these capabilities are not acceptable.
- C. Notification of alarms from the panels must be provided on the graphic display while the system is in graphics mode. This notification will consist of a permanent alarm pending message (as part of the display header), and a more specific, removable pop-up message window.
- D. A library of HVAC symbols shall be provided for use in generating custom displays. The graphic symbols shall include fans, pumps, valves, chillers, air handlers, cooling towers, rooftops, and self contained units. It shall also be possible to represent dynamic point information using symbols. A method must be provided to automatically displaying a different symbol in response to a dynamic point's change of state.

The system shall automatically blank the CRT after user designated duration of non-use in order to protect the CRT screen. The screen will automatically be restored upon either an audible alarm or the use of the keyboard.

2.6 PORTABLE COMPUTER

- A. Provide portable computer with the following as a minimum:
 - DELL Pentium IV processor @ 100MHz (or higher).
 - 128 MB RAM on motherboard.
 - 1 CD-ROM drive.
 - Hard disk drive with a minimum of 10GB free space
 - Microsoft Windows 2000 or Windows XP.

2.7 USER EDITING CAPABILITIES

- A. English language based user programming shall allow a user to examine and change all panel data.
- B. Operator interface shall be controlled using a mouse and/or function keys. The graphics package shall have prompts on the displays for system function keys.
- C. There shall be three levels of security. The security system shall have a minimum of six users, each with designated three operator ID and four character password.
- D. The system shall protect itself from unauthorized use by automatically logging off following the last keystroke. The delay time shall be user designated.
- E. For ease of system operation, a "help" directory describing system operation shall be included.

2.8 DIAGNOSTICS

- A. Central System Alarm Operation - When a panel reports the alarm message, software shall automatically store the message and notify the user. User notification shall be accomplished by sending the alarm message to a printer, sounding and audible tone in the personal computer, and flashing an alarm message on the display.
- B. System Alarms and Troubleshooting Library - Included shall be displays containing symptom/diagnosis troubleshooting guides for central system, panels, and microprocessor based HVAC unit controllers connected to remote panels. This shall allow the operator to use the alarm message/failure code received from the panel of HVAC unit to generate troubleshooting information related to the problem.

- C. Self Diagnostics - Software shall initiate self-tests that notify the operator of any detected failures. All panels failing to respond shall be identified on a display printout.

2.9 REPORTS AND LOGS

- A. The system shall include the capability to store for user review and for printing, the following reports and logs. In addition, these reports may also be saved to diskette as an ASCII file, making the information available for use by other software packages.
 1. Current summary report - an instantaneous summary of building status including heating and cooling degree days, on and off electrical demand performance, current electrical kWh consumption, and summary for critical temperature sensors listing current, today's minimum, and today's maximum values.
 2. Monthly summary report - and end of month summary building status including heating and cooling degree days, on and off peak electrical demand performance, current electrical kWh consumption, and a summary of critical temperature sensors listing the month's minimum and maximum values.
 3. Monthly demand limiting report - a report for logging the electrical demand performance (both on and off peak) and kWh consumption for each of the two utility meter programs. Included are the times of today's and yesterday's demand peaks as well as the time and date of the monthly demand peaks. This report logs electrical performance for the present day and previous 32 days.
 4. Yearly demand limiting report - a report for logging the electrical demand performance (both on and off peak) and kWh consumption for each of the two utility meter programs. This report logs electrical performance for the present month and previous 12 months.
 5. Yearly meter report - a report for logging the electrical kWh consumption for up to six submeters. This report logs electrical performance for the present month and previous 12 months.
 6. Yearly degree day report - a current month's and previous 12 months summary of heating and cooling degree days.
 7. Weekly temperature report - a previous seven day's summary of the minimum and maximum temperatures for the critical zone temperature sensors.

8. Weekly override time report - a previous seven day's summary of after hours override usage (in hours and minutes) for the 27 times override groups.
9. Monthly override time report - a current and previous month's summary of after hours override usage (in hours and minutes) for the 27 times override groups.
10. Trend logs - a total of 32 custom reports that allow the storage of up to 24 samples of a sensed value based upon a scheduled basis.
11. Event log - a summary of up to 32 system events including alarms, operator log-on, and diagnostics.
12. Input/output status reports - allows operator review of all points and their status in the system.
13. HVAC equipment reports - automatic, preformatted reports, that indicate the control status and status of all input/output points of connects air conditioning equipment.
14. Custom reports - up to 19 reports, each containing the status of up to 20 user designated points. The reports shall provide a simple method to group related points into a single report.

2.10 AIR FLOW CONTROL

A. Airflow and static pressure shall be controlled via digital controller (CUs) with inputs from airflow control measuring stations and static pressure inputs as specified. Controller outputs shall be true analog output signals to pneumatic positioners or variable frequency drives. Pulse width modulation outputs are not acceptable. The CUs shall include the capability to control via simple proportional (P) control, proportional plus integral (PI), proportional plus integral plus derivative (PID), and on-off. The airflow control programs shall be factory-tested programs that are documented in the literature of the control manufacturer.

1. Thermal Sensor Probe:

- a. Each thermal sensor shall contain two individual sensing elements. One element shall determine the velocity of the air stream while the other element shall compensate for changes in temperature. Each thermal flow sensor and its associated control circuit and signal conditioning circuit shall be factory calibrated and be interchangeable to allow replacement of a sensor without recalibration of the entire flow station. The

sensor in the array shall be located at the center of equal area segment of the duct and the number of sensors shall be adequate to accommodate the expected velocity profile and variation in flow and temperature. The airflow station shall be of the insertion type in which sensor support structures are inserted from the outside of the ducts to make up the complete electronic velocity array.

- b. Thermal flow sensor shall be constructed of nickel chromium or reference grade platinum wire, wound over an epoxy, stainless steel or ceramic mandrel and coated with a material suitable for the conditions to be encountered. Each dual sensor shall be mounted in an extruded aluminum strut of 6061-T6 alloy.
 - c. Thermal sensors and its sensor holder shall not exhibit more than +/- 2 percent error in output for variations in the angle of flow of up to 10 percent in any direction from its calibrated orientation.
2. Thermal Sensor Grid Array:
- a. Each sensor grid shall consist of a lattice network of thermistors and linear integral controllers (ICs) situated inside an aluminum casing suitable for mounting in a duct. Each thermistor sensor shall be mounted within a strut facing downstream of the airflow and located so that it is protected on the upstream side. All wiring shall be encased (out of the air stream) to protect against mechanical damage.
 - b. The casing shall be made of welded aluminum of sufficient strength to prevent structural bending and bowing. Steel or iron composite shall not be acceptable in the casing material.
3. Electronics Panel:
- a. Electronics panel shall consist of a surface mounted enclosure complete with solid-state microprocessor and software.
 - b. Electronic panel shall be A/C powered 120 VAC or 24 VAC and shall have the capability to transmit signals of 0-5 VDC, 0-10 VCD or 4-20 ma for use in control of the HVAC Systems. The electronic panel shall have the capability to accept user defined scaling parameters for all output signals.
 - c. The electronic panel shall have the capability to digitally display airflow and temperature in CFM for flow and degree F for

temperature. The displays shall be provided as an integral part of the electronics panel. The electronic panel shall have the capability to totalized the output flow in CFM for two or more systems, as required. A single output signal may be provided which will equal the sum of the systems totalized. Output signals shall be provided for temperature and airflow. Provide remote mounted CFM or temperature displays where indicated on the plans.

4. Pressure drop through the flow station shall not exceed 4 pascal (0.015" W.G.) at 1,000 meter per minute (3,000 FPM).
5. The entire system shall be factory calibrated in an NBS traceable wind tunnel to an accuracy of +/- 2 percent reading at +1/2 percent of full range over a temperature range of -20 to 60 degrees C (0 to 125 degrees F) and a velocity range of 30 meters per minute to 1,500 meter per minute (100-5,000 fpm). Repeatability shall be no more than +/- 0.5 percent of reading.
6. Thermal flow sensors and its electronics shall be installed as per manufacturer's instructions. The number of sensors shall be such that accuracy of the total flow rate shall no way be different than what is specified in paragraph 1.5 above.
 - a. Static/Total Pressure Sensors: A network of total and static pressure sensors shall be positioned on the equal traverse principle, with a maximum of 0.02 square meter (36 square inches) per total pressure sensor and 0.10 square meter (144 square inches) per static pressure sensor on units. Interconnecting sensor manifolds shall average and relate each type of sensor measurement into one total pressure and one static pressure metering port. The manifold mounting hardware shall not penetrate the manifold tubes and shall be so constructed as to eliminate any possible violation of the integrity of the total or static pressure measurements. The meter tubing for the averaged total static pressure shall not be exposed to internal duct conditions.
 - b. Static Pressure Control: Systems shall consist of one or more static pressure sensors and transmitters along with relays or auxiliary devices as required to produce a complete functional system. The span of the transmitter shall not exceed two times the design static pressure at the point of measurement. The output of the transmitter shall be true representation of the

input pressure with plus or minus 25 pascal (0.1 inch) wg of the true input pressure.

- 1) Static pressure sensors shall have the same requirements as Airflow Measuring Devices except that total pressure sensors are optional, and only multiple static pressure sensors positioned on an equal area basis connected to a network of headers are required.
- 2) For systems with multiple major trunk supply duct, furnish a static pressure transmitter for each trunk duct. The transmitter signal representing the lowest static pressure shall be selected and this shall be the input signal to the CU.
- 3) The CU shall receive the static pressure transmitter signal and CU shall provide a control output signal to the supply fan capacity control device. The control mode shall be proportional plus integral (PI) (automatic reset) and where required shall also include derivative mode.
- 4) In systems with multiple static pressure transmitters, provide a switch located near the fan discharge to prevent excessive pressure during abnormal operating conditions.

B. Airflow Synchronization:

1. Systems shall consist of a differential pressure transmitter for each supply and return duct, the CU and such relays as required to provide a complete functional system that will maintain a constant difference between supply and return air volumes to meet the accuracy specified below. In systems where there is no suitable location for a flow measuring station that will sense total supply or return flow, provide multiple flow stations with a differential pressure transmitter for each station. Signals from the multiple transmitters shall be added through the CU such that the resultant signal is a true representative of total flow.
2. The total flow signals from supply and return shall be the input signals to the CU. This CU shall operate the return air fan capacity control device to maintain return air flow rate control device to maintain return air flow rate at a constant difference between supply and return flow to maintain the theoretical return air flow

rate plus or minus 4.0 percent of design maximum supply flow rate under all conditions.

2.11 CONTROL VALVES

- A. All valves, except radiant or and unitary, 2 inches and smaller shall be screw connected globe pattern, made from high grade cast brass. Valves 2-1/2 inches and over shall be flanged bodied cast iron. Valves through 2 inches shall be packed with either teflon or molded graphite packing. Valves shall be capable of being serviced, including replacement of packing, stems and disks. Characteristics are similar to products as manufactured by Barber Coleman, Honeywell, Landis & Gyr Powers, Johnson, and Robertshaw.
- B. Globe valves through 2 inches shall be rated at 250 PSIG. Union connected bodies and bodies over 2-1/2 inches shall be rated at 125 PSIG except where otherwise specified.
- C. Specification requirements for valve bodies and internal components shall be as specified in Section 15705, HVAC PIPING SYSTEMS.

2.12 AUTOMATIC CONTROL DAMPERS

- A. Dampers shall be provided as shown on the mechanical plans and shall be of the type designed and manufactured especially for the air flow in heating, ventilating and air conditioning equipment. Frames and blades to the minimum 12 gauge extruded aluminum. Blades to be of the single unit design 6 inches wide maximum. Frames to a combination of 4 inches extruded aluminum channel and angle with reinforcing houses and groove inserts in both frames and blades.
- B. Bearings shall be teflon or oil impregnated sintered bronze. Rod bearings shall be designed to that there shall be no metal-to-metal to bearing riding surfaces. Interconnecting linkages are to have bearings to eliminate linkage friction. Blade linkage hardware shall be installed in angle channel frame sections out of air stream.
- C. All dampers in excess of ten square feet shall have reinforced corners by means of gusset plates.
- D. Dampers, when closed, shall have less than 8 CFM per square foot leakage at 5 inches static, pressure drop through the dampers shall not exceed 0.125 inches w.g. at 2000 FPM.

2.13 VALVE AND DAMPER ACTUATORS

Gear Train type: Actuators shall be heavy-duty reversible type, with driving motor and gear train or hydraulic, completely submerged in oil

and sealed in a die cast case. Actuators shall be proportional or two-position as required. Proportional actuators shall have a built-in electro-mechanical system to provide for positive repeatability of position, regardless of changes in output load. Belimo Actuators or approved substitute.

2.14 SENSORS

- A. Sensors shall be provided as required by the drawings, points list, or sequence of operation.
- B. Sensors shall be the Controls System manufacturer's standard, and shall be compatible with his equipment.
- C. Sensors shall accurately measure conditions required. Conditions such as providing airflow information based solely on damper position are not acceptable.
- D. Where sensors have direct contact with liquid working fluid, provide an isolation valve or cock.
- E. Provide a timed over-ride switch with each room temperature sensor.

2.15 VARIABLE SPEED MOTOR CONTROLLERS

Provide in accordance with criteria specified in section 16155, Motor Starters, unless provided as part of air handling equipment.

PART 3 - EXECUTION

3.1 GENERAL

- A. Due to the complexity of modern controls systems, the Controls Contractor shall perform HVAC system start-up under the supervision of the Mechanical Contractor. The responsibilities are defined as follows:
 - 1. Commissioning of systems consists of testing as detailed in these specifications, operation of mechanical systems for a period of seven days, system checkout and system balancing. Cycle through all sequences described in the Controls sequence of operations at least six times. Visually verify the operation of every actuator, valve, damper, controller or other component. Make records of this checkout available to the Owner's Representative upon request, up to one year after project final acceptance.
 - 2. The Balancing Contractor and Controls Contractor shall work together to commission all process, hydronic and HVAC systems. The Division 15 Contractor shall correct all deficiencies discovered during

- system test and checkout. Final acceptance of work Under Division 15 will not be tendered until system commissioning is complete.
- B. The Controls Contractor shall provide a technician to operate the controls system for the Balancing Contractor during HVAC system balancing.
 - C. The Controls Contractor shall examine the contract documents carefully and notify the Contracting Officer's Representative of any oversights or omissions prior to commencing installation. Any items discovered at this time shall be resolved in accordance with the change order provisions of this contract.
 - D. It shall be the Control Contractor's responsibility to ensure that the HVAC system operates as described in the contract documents. The Contractor shall not be completed with the installation until the system operates properly and the Contracting Officer's Representative has accepted the installation.
 - E. Provide lockable wire mesh guards for all adjustable devices or devices subject to damage located in the finished space.

3.2 CONTROL WIRING

All control wiring shall be run in rigid conduit per Division 16. Open, plenum rated cable is acceptable above accessible acoustical ceilings.

3.3 CONTROLS INSTALLATION

- A. Install the controls components as described herein and shown on the drawings.
- B. The system shall be as shown on the drawings. The points list and sequence of operation shall be as described in these specifications.
- C. Provide all actuators to achieve the sequence of operations described herein.
- D. Coordinate with the VAV terminal box manufacturer for installation of terminal box controls at the manufacturer's facility. Provide for shipping of the required control components. Flow sensors and speed controllers shall be manufacturer's standard, per specification Section 15740, TERMINAL UNITS.
- E. Provide any required power wiring and conduit from the motor starter to the equipment.
- F. Provide all programming, to include graphical programming, to achieve the sequence of operations and control specified herein. In addition

to programming of the building personal computer, incorporate the graphics programming into the existing campus head end computer.

- G. Relocate any existing control conduit to be retained as necessary for pipe or duct installation. Remove all existing controls components not needed because of the work of this contract. The contractor shall provide, as the basis of bid, about 16 hours for relocation work. The contractor shall notify the contracting officer's representative in writing prior to exceeding the basis for bid allowance.
- H. The control installed in Building 61 shall not require connection to any other building or facility to perform all required control functions. Building 61 shall be stand-alone.

3.4 OPERATING AMBIENTS

Electronic controls mounted in unconditioned space shall be rated for ambient operating conditions from -40° F to 158° F. Controls not meeting these limits shall be mounted in an accessible location within conditioned space.

3.5 CALIBRATION AND ADJUSTMENTS

After completion of the installation, perform final calibrations and adjustments of the equipment provided under this contract and supply services incidental to the proper performance of the ATC and BMCS system under warranty below.

3.6 ACCEPTANCE PROCEDURE

- A. Upon completion of the calibration, contractor shall commission the system and perform all necessary testing and run diagnostic tests to ensure proper operation. Contractor shall be responsible for generating all software and entering all database necessary to perform the sequence of control and specified software routines. An acceptance test in the presence of the Contracting Officer's Representative or Engineer shall be performed.
- B. The project will be completed in two phases. The control system shall be commissioned and completely operational at the end of each phase. The systems and equipment on the north side of "B" floor need not be operational at the end of the first phase, with the exception of the VAV terminals serving the center spaces on "A" and "B" floors. Both of these VAV terminals are connected to the north air handling unit. During Phase II construction, they shall operate in heating mode only with the primary air valve fully closed.

3.7 WARRANTY

All ATC/BMCS devices and installation shall be warranted to be free from defects in workmanship and material for a period of one year from the date of job acceptance by the Government. Any equipment, software, or labor found to be defective during this period shall be repaired or replaced without expense to the Government.

3.8 SEQUENCE OF OPERATION

Refer to controls sequence of operations as shown on the drawings.

3.9 ACCEPTANCE TESTING

- A. Point Verification: To verify end-to-end operation of the system, the Contractor shall provide a hard copy of an All Points Summary Listing to the Contracting Officer's Representative of each part or system to be placed in warranty by the Government. For central host station systems, the Contractor shall additionally provide a print screen of the process display showing real time dynamic point information for all points on the subsystem(s) to be accepted.
- B. Sequence Verification
1. The Contractor shall notify the Contracting Officer's Representative of systems which perform all specified sequences. The Contracting Officer's Representative shall verify all sequences of operation and place the system into warranty acceptance test.
 2. The warranty acceptance test shall be of 7 days duration and the system shall perform as follows:
 3. During the seven days, the BMCS system shall not report any system diagnostics from the subsystem under test.
 4. The subsystem shall be performance verified as operational using temporary trends of each control loop located in the Stand-Alone Digital Controller (SDC).
 5. During the occupied periods, BMCS control loops under test shall maintain control of the process variable within the following scales:
 6. Duct Temperature Loops +/- 2 degree F.
 7. Room Temperature Loops +/- 1 degree F.
 8. Pipe Temperature Loops +/- 2 degree F.
 9. The Contractor shall provide a hard copy printout of the process variable, process variable set point and control loop output % for

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the period of 2 hours prior to occupancy to 2 hours after occupancy
with samples taken every 15 minutes.

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SECTION 15980
TESTING, ADJUSTING AND BALANCING

PART 1 - GENERAL

1.1 DESCRIPTION:

A. Testing, adjusting, and balancing (TAB) of heating, ventilating and air conditioning (HVAC) systems. TAB includes the following:

1. Planning systematic TAB procedures.
2. Inspecting equipment and installations for conformance with design.
3. Balancing air and water distribution systems; adjustment of total system to provide design performance; and testing performance of equipment and automatic controls.
4. Vibration and sound measurements.
5. Recording and reporting results.

B. Definitions:

1. Basic TAB used in this Section: Chapter 34, "Testing, Adjusting and Balancing" of ASHRAE Handbook, "HVAC Applications".
2. TAB: Testing, Adjusting and Balancing. The process of checking and adjusting HVAC systems to meet design objectives.
3. AABC: Associated Air Balance Council.
4. NEBB: National Environmental Balancing Bureau.
5. Hydronic Systems: Includes chilled water, heating hot water and glycol-water systems.
6. Air Systems: Includes all outside air, supply air, return air, exhaust air and relief air systems.
7. Flow rate tolerance: The allowable percentage variation, minus to plus, of actual flow rate from values (design) in the contract documents.

1.2 RELATED WORK:

- A. Section 15050, BASIC METHODS AND REQUIREMENTS (MECHANICAL).
- B. Section 15200, NOISE AND VIBRATION CONTROL.
- C. Section 15250, INSULATION.
- D. Section 15740, AIR TERMINALS.
- E. Section 15840, DUCTWORK AND ACCESSORIES.
- F. Section 15902 CONTROLS AND INSTRUMENTATION (DDC).

1.3 QUALITY ASSURANCE:

- A. Refer to Articles, Quality Assurance and Submittals, in Section, BASIC METHODS AND REQUIREMENTS (MECHANICAL).

- B. TAB Agency Qualification: Current membership in AABC or certification by NEBB.
- C. Test Equipment Criteria: The basic instrumentation requirements and accuracy/calibration required by AABC, National Standards or by NEBB Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems.
- D. Tab Criteria:
 - 1. One or more of the applicable AABC, NEBB or SMACNA publications, supplemented by ASHRAE Handbook "HVAC Applications" Chapter 34, shall be the basis for planning, procedures, and reports.
 - 2. Flow rate tolerance: Values are based on discussion in ASHRAE Handbook "HVAC Applications", Chapter 34. Air Filter resistance during tests, artificially imposed if necessary, shall be at least 80 percent of final values for prefilters and after filters.
 - a. Air handling unit cubic meters/min (cubic feet per minute): Minus 0 percent to plus 10 percent.
 - b. All other fans: Minus 0 percent to plus 10 percent.
 - c. Air terminal units (Max): Minus 5 percent to plus 10 percent.
 - d. Exhaust hoods/cabinets: Minus 0 percent to plus 10 percent.
 - e. Minimum outside air: Minus 0 percent to plus 10 percent.
 - f. Individual room air outlets and inlets, and air flow rates not mentioned above: Minus 10 percent to plus 10 percent.
 - g. Heating hot water pumps and hot water coils: Minus 10 percent to plus 10 percent.
 - h. Chilled water pumps: Minus 0 percent to plus 10 percent.
 - i. Chilled water coils: Minus 5 percent to plus 5 percent.
 - 3. Systems shall be adjusted for energy efficient operation as described in PART 3.
 - 4. Typical TAB procedures and results shall be demonstrated to the Resident Engineer for one air distribution system (including all fans, three terminal units, three rooms) and one hydronic system (pumps and three coils) as follows:
 - a. When field TAB work begins.
 - b. During each partial final inspection and the final inspection for the project if requested by VA.

1.4 SUBMITTALS:

- A. Submit in accordance with Section 01340, SAMPLES AND SHOP DRAWINGS.

- B. TAB Agency qualifications: Submit names and qualifications of company officers and job supervisor. Submit information on three recently completed projects. Submit list of proposed test equipment.
- C. For use by the resident engineer staff, submit one complete set of applicable AABC or NEBB publications that will be the basis of TAB work.
- D. TAB Reports to be Submitted for Review:
 - 1. Inspection reports covering equipment and systems installation. These reports are to be submitted during early stages of the project in order to allow timely correction of deficiencies.
 - 2. TAB reports covering flow balance and adjustments, performance tests, vibration tests, and sound tests. These reports shall be submitted prior to or at the time of requesting final inspection, or partial final inspections of contract work.
 - 3. Include in final reports uncorrected installation deficiencies noted during TAB and applicable explanatory comments on test results that differ from design requirements.

1.5 APPLICABLE PUBLICATIONS:

- A. The following publications form a part of this specification to the extent indicated by the reference thereto. In text the publications are referenced to by the initials of the organization.
- B. American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. (ASHRAE):
- C. ASHRAE Handbook, 1995 HVAC Applications, Chapter 34, Testing, Adjusting, and Balancing; Chapter 43, Sound and Vibration Control.
- D. Associated Air Balance Council (AABC):
 - AABC National Standards MN-1, 5th Edition, 1989.
- E. National Environmental Balancing Bureau (NEBB):
 - Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems, 5th Edition, September 1991.
 - Procedural Standards for the Measurement and Assessment of Sound and Vibration, 1994 Edition.
- F. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):
 - HVAC SYSTEMS-Testing, Adjusting, and Balancing, 2nd Edition, 1993.

PART 2 - PRODUCTS

2.1 PLUGS:

Provide plastic plugs to seal holes drilled in ductwork for test purposes.

2.2 INSULATION REPAIR MATERIAL:

Section, INSULATION. Provide for repair of insulation removed or damaged for TAB work.

PART 3 - EXECUTION

3.1 GENERAL:

- A. Refer to TAB Criteria in Article, Quality Assurance.
- B. Obtain applicable contract documents and copies of approved submittals for HVAC equipment and automatic control systems.
- C. Coordinate TAB procedures with any phased construction completion requirements for the project. Systems serving completed phases of the project will require TAB for such phases prior to partial final inspections and for final phase inspection.
- D. Allow sufficient time in construction schedule for TAB and submission of reports prior to partial final inspections and for final phase.

3.2 INSPECTING EQUIPMENT AND INSTALLATIONS FOR CONFORMANCE WITH DESIGN:

- A. GENERAL: The inspection and report is to be done after air distribution equipment is on site and duct installation has begun, but well in advance of performance testing and balancing work. The purpose of the inspection is to identify and report deviations from design and ensure that systems will be ready for TAB at the appropriate time.
- B. Reports: Follow check list format developed by AABC, NEBB or SMACNA, supplemented by narrative comments, with emphasis on air handling units and fans. Check for conformance with submittals. Verify that diffuser and register sizes are correct. Check air terminal unit installation including flexible duct sizes and routing.

3.3 TAB PROCEDURES:

- A. General: During TAB all related system components shall be in full operation. Fan and pump rotation, motor loads and equipment vibration shall be checked and corrected as necessary before proceeding with TAB. Set controls and/or block off parts of distribution systems to simulate design operation of variable volume air or water systems for test and balance work.

- B. Air Balance and Equipment Test: Include air handling units, fans, terminal units, room diffusers/outlets/inlets, and laboratory hoods and cabinets.
1. Artificially load air filters by partial blanking to produce air pressure drop of at least 80 percent of the design final pressure drop.
 2. Adjust fan speeds to provide design air flow. V-belt drives, including fixed pitch pulley requirements, are specified in Section, BASIC METHODS AND REQUIREMENTS (MECHANICAL).
 3. Test and balance systems in all specified modes of operation, including variable volume, economizer, and fire emergency modes. Verify that dampers and other controls function properly.
 4. Variable air volume (VAV) systems:
 - a. Coordinate TAB, including system volumetric controls, with Section, CONTROLS AND INSTRUMENTATION (DDC).
 - b. Section, AIR TERMINALS, specifies that maximum and minimum flow rates for air terminal units (ATU) be factory set. Check and adjust ATU flow rates if necessary. Balance air distribution from ATU on full cooling maximum scheduled cubic meters per minute (cubic feet per minute). Reset room thermostats and check ATU operation from maximum to minimum cooling, to the heating mode, and back to cooling. Record and report the heating coil leaving air temperature when the ATU is in the maximum heating mode.
 5. Record final measurements for air handling equipment performance data sheets.
- C. Water Balance and Equipment Test: Include circulating pumps, convertors, and coils.
1. Adjust flow rates for equipment, coils and evaporator for instance, to values on equipment submittals if different from values on contract drawings.
 2. Variable Volume systems: Coordinate TAB with Section, CONTROLS AND INSTRUMENTATION (DDC). Balance systems at design flow then verify that variable flow controls function properly.
 3. Record final measurements for hydronic equipment performance data sheets. Include entering and leaving water temperatures for heating and cooling coils, and for convertors. Include entering and leaving air temperatures (DB/WB for cooling coils) for air handling units

and reheat coils. Make air and water temperature measurements at the same time.

3.4 VIBRATION TESTING:

- A. Furnish instruments and perform vibration measurements as specified in Section, NOISE AND VIBRATION CONTROL. Field vibration balancing is specified in Section, BASIC METHODS AND REQUIREMENTS (MECHANICAL). Provide measurements for all rotating HVAC equipment 373 watts (1/2 horsepower) and larger, including centrifugal/screw compressors, pumps, fans and motors.
- B. Record initial and final measurements for each unit of equipment on test forms. Where vibration readings exceed the allowable tolerance and efforts to make corrections have proved unsuccessful, forward a separate report to the Resident Engineer.

3.5 SOUND TESTING:

- A. Perform and record required sound measurements in accordance with Paragraph, QUALITY ASSURANCE in Section, NOISE AND VIBRATION CONTROL.
 - 1. Take readings in rooms, approximately five percent of total rooms, designated by the Resident Engineer.
 - 2. Provide cooling tower sound measurements. Refer to Section, COOLING TOWER.
- B. Take measurements with a calibrated sound level meter and octave band analyzer of the accuracy required by AABC or NEBB.
- C. Sound reference levels, formulae and coefficients shall be according to ASHRAE Handbook, "HVAC Applications", Chapter 43, SOUND AND VIBRATION CONTROL.
- D. Determine compliance with specifications as follows:
 - 1. Where sound pressure levels are specified, including the NC Criteria in Section, NOISE AND VIBRATION CONTROL:
 - a. Reduce the background noise as much as possible by shutting off unrelated audible equipment.
 - b. Measure octave band sound pressure levels with specified equipment "off."
 - c. Measure octave band pressure levels with specified equipment "on."
 - d. Use the DIFFERENCE in corresponding readings to determine the sound pressure due to equipment.

DIFFERENCE:	0	1	2	3	4	5 - 9	10 or More
FACTOR:	10	7	4	3	2	1	0

- e. Sound pressure level due to equipment equals sound pressure level with equipment "on" minus FACTOR.
 - f. Plot octave bands of sound pressure level due to equipment for typical rooms on a graph which also shows noise criteria (NC) curves.
2. When sound power levels are specified:
- a. Perform steps 1.a. thru 1.d., as above.
 - b. For indoor equipment: Determine room attenuating effect, i.e., difference between sound power level and sound pressure level. Determined sound power level will be the sum of sound pressure level due to equipment plus the room attenuating effect.
 - c. For outdoor equipment: Use directivity factor and distance from noise source to determine distance factor, i.e., difference between sound power level and sound pressure level. Measured sound power level will be the sum of sound pressure level due to equipment plus the distance factor.
3. Where sound pressure levels are specified in terms of dB(A), measure sound levels using the "A" scale of meter. Single value readings will be used instead of octave band analysis.
- E. Where measure sound levels exceed specified level, the installing contractor or equipment manufacturer shall take remedial action approved by the Resident Engineer and the necessary sound tests shall be repeated.

3.6 DUCT AIR LEAKAGE TESTING:

Refer Article, Quality Assurance, in section 15840, Ductwork and Accessories for TAB agency's role and responsibilities.

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**SECTION 16050
BASIC METHODS AND REQUIREMENTS (ELECTRICAL)**

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section, Basic Methods and Requirements (Electrical) applies to all sections of Division 16.
- B. Furnish and install electrical wiring, systems, equipment and accessories in accordance with the specifications and drawings. Capacities and ratings of motors, transformers, cable, switchboards, switchgear, panelboards, motor control centers, and other items and arrangements for the specified items are shown on drawings.
- C. Electrical service entrance equipment (arrangements for temporary and permanent connections to the power company's system) shall conform to the power company's requirements. Coordinate fuses, circuit breakers and relays with the power company's system, and obtain power company approval for sizes and settings of these devices.
- D. Wiring ampacities specified or shown on the drawings are based on copper conductors, with the conduit and raceways accordingly sized. Aluminum conductors are prohibited.

1.2 MINIMUM REQUIREMENTS

- A. References to the National Electrical Code (NEC), Underwriters Laboratories, Inc. (UL) and National Fire Protection Association (NFPA) are minimum installation requirement standards.
- B. Drawings and other specification sections shall govern in those instances where requirements are greater than those specified in the above standards.

1.3 TEST STANDARDS

- A. All materials and equipment shall be listed, labeled or certified by a nationally recognized testing laboratory to meet Underwriters Laboratories, Inc., standards where test standards have been established. Equipment and materials which are not covered by UL Standards will be accepted provided equipment and material is listed, labeled, certified or otherwise determined to meet safety requirements of a nationally recognized testing laboratory. Equipment of a class which no nationally recognized testing laboratory accepts, certifies, lists, labels, or determines to be safe, will be considered if inspected or tested in accordance with national industrial standards,

such as NEMA, or ANSI. Evidence of compliance shall include certified test reports and definitive shop drawings.

B. Definitions:

1. Listed; equipment or device of a kind mentioned which:
 - a. Is published by a nationally recognized laboratory which makes periodic inspection of production of such equipment.
 - b. States that such equipment meets nationally recognized standards or has been tested and found safe for use in a specified manner.
2. Labeled; equipment or device is when:
 - a. It embodies a valid label, symbol, or other identifying mark of a nationally recognized testing laboratory such as Underwriters Laboratories, Inc.
 - b. The laboratory makes periodic inspections of the production of such equipment.
 - c. The labeling indicates compliance with nationally recognized standards or tests to determine safe use in a specified manner.
3. Certified; equipment or product is which:
 - a. Has been tested and found by a nationally recognized testing laboratory to meet nationally recognized standards or to be safe for use in a specified manner.
 - b. Production of equipment or product is periodically inspected by a nationally recognized testing laboratory.
 - c. Bears a label, tag, or other record of certification.
4. Nationally recognized testing laboratory; laboratory which is approved, in accordance with OSHA regulations, by the Secretary of Labor.

1.4 QUALIFICATIONS (PRODUCTS AND SERVICES)

- A. Manufacturers Qualifications: The manufacturer shall regularly and presently produce, as one of the manufacturer's principal products, the equipment and material specified for this project, and shall have manufactured the item for at least three years.
- B. Product Qualification:
 1. Manufacturer's product shall have been in satisfactory operation, on three installations of similar size and type as this project, for approximately three years.

2. The Government reserves the right to require the Contractor to submit a list of installations where the products have been in operation before approval.

C. Service Qualifications: There shall be a permanent service organization maintained or trained by the manufacturer which will render satisfactory service to this installation within four hours of receipt of notification that service is needed. Submit name and address of service organizations.

1.5 MANUFACTURED PRODUCTS

A. Materials and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items, for which replacement parts shall be available.

B. When more than one unit of the same class of equipment is required, such units shall be the product of a single manufacturer.

C. Equipment Assemblies and Components:

1. Components of an assembled unit need not be products of the same manufacturer.

2. Manufacturers of equipment assemblies, which include components made by others, shall assume complete responsibility for the final assembled unit.

3. Components shall be compatible with each other and with the total assembly for the intended service.

4. Constituent parts which are similar shall be the product of a single manufacturer.

D. Factory wiring shall be identified on the equipment being furnished and on all wiring diagrams.

E. When Factory Testing Is Specified:

1. The Government shall have the option of witnessing factory tests. The contractor shall notify the VA through the Resident Engineer a minimum of 15 working days prior to the manufacturers making the factory tests.

2. Four copies of certified test reports containing all test data shall be furnished to the Resident Engineer prior to final inspection and not more than 90 days after completion of the tests.

3. When equipment fails to meet factory test and reinspection is required, the contractor shall be liable for all additional expenses, including expenses of the Government.

1.6 EQUIPMENT REQUIREMENTS

Where variations from the contract requirements are requested in accordance with Section 01001, GENERAL CONDITIONS and Section 01340, SAMPLES AND SHOP DRAWINGS, the connecting work and related components shall include, but not be limited to additions or changes to branch circuits, circuit protective devices, conduits, wire, feeders, controls, panels and installation methods.

1.7 EQUIPMENT PROTECTION

Equipment and materials shall be protected during shipment and storage against physical damage, dirt, moisture, cold and rain.

- A. During installation, enclosures, equipment, controls, controllers, circuit protective devices, and other like items, shall be protected against entry of foreign matter; and be vacuum cleaned both inside and outside before testing and operating and repainting if required.
- B. Damaged equipment shall be, as determined by the Resident Engineer, placed in first class operating condition or be returned to the source of supply for repair or replacement.
- C. Painted surfaces shall be protected with factory installed removable heavy kraft paper, sheet vinyl or equal.
- D. Damaged paint on equipment and materials shall be refinished with the same quality of paint and workmanship as used by the manufacturer so repaired areas are not obvious.

1.8 WORK PERFORMANCE

- A. All electrical work must comply with the requirements of NFPA 70 (NEC), NFPA 70B, NFPA 70E, OSHA Part 1910 subpart J, OSHA Part 1910 subpart S and OSHA Part 1910 subpart K in addition to other references required by contract.
- B. Job site safety and worker safety is the responsibility of the contractor.
- C. Electrical work shall be accomplished with all affected circuits or equipment deenergized. When an electrical outage cannot be accomplished in this manner for the required work, the following requirements are mandatory:
 - 1. Electricians must use full protective equipment (i.e., certified and tested insulating material to cover exposed energized electrical components, certified and tested insulated tools, etc.) while working on energized systems in accordance with NFPA 70E.

2. Electricians must wear personal protective equipment while working on energized systems in accordance with NFPA 70E.
 3. Before initiating any work, a job specific work plan must be developed by the contractor with a peer review conducted and documented by the Resident Engineer and Medical Center staff. The work plan must include procedures to be used on and near the live electrical equipment, barriers to be installed, safety equipment to be used and exit pathways.
 4. Work on energized circuits or equipment cannot begin until prior written approval is obtained from the Director of the Medical Center.
- D. For work on existing stations, arrange, phase and perform work to assure electrical service for other buildings at all times. Refer to Article OPERATIONS AND STORAGE AREAS under Section 01010, GENERAL REQUIREMENTS.
- E. New work shall be installed and connected to existing work neatly and carefully. Disturbed or damaged work shall be replaced or repaired to its prior conditions, as required by Section 01010, GENERAL REQUIREMENTS.
- F. Coordinate location of equipment and conduit with other trades to minimize interferences. See Section 01001, GENERAL CONDITIONS.

1.9 EQUIPMENT INSTALLATION AND REQUIREMENTS

- A. Equipment location shall be as close as practical to locations shown on the drawings.
- B. Working spaces shall not be less than specified in the NEC for all voltages specified.
- C. Inaccessible Equipment:
 1. Where the Government determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, the equipment shall be removed and reinstalled as directed at no additional cost to the Government.
 2. "Conveniently accessible" is defined as being capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as, but not limited to, motors, pumps, belt guards, transformers, piping, ductwork, conduit and raceways.

1.10 EQUIPMENT IDENTIFICATION

- A. In addition to the requirements of the NEC, install an identification sign which clearly indicates information required for use and maintenance of items such as panelboards, cabinets, motor controllers (starters), safety switches, separately enclosed circuit breakers, individual breakers and controllers in switchboards, switchgear and motor control assemblies, control devices and other significant equipment.
- B. Nameplates shall be laminated black phenolic resin with a white core with engraved lettering, a minimum of 6 mm (1/4-inch) high. Secure nameplates with screws. Nameplates that are furnished by manufacturer as a standard catalog item, or where other method of identification is herein specified, are exceptions.

1.11 SUBMITTALS

- A. Submit in accordance with section 01340, SAMPLES AND SHOP DRAWINGS.
- B. The Government's approval shall be obtained for all equipment and material before delivery to the job site. Delivery, storage or installation of equipment or material which has not had prior approval will not be permitted at the job site.
- C. All submittals shall include adequate descriptive literature, catalog cuts, shop drawings and other data necessary for the Government to ascertain that the proposed equipment and materials comply with specification requirements. Catalog cuts submitted for approval shall be legible and clearly identify equipment being submitted.
- D. Submittals for individual systems and equipment assemblies which consist of more than one item or component shall be made for the system or assembly as a whole. Partial submittals will not be considered for approval.
 - 1. Mark the submittals, "SUBMITTED UNDER SECTION _____".
 - 2. Submittals shall be marked to show specification reference including the section and paragraph numbers.
 - 3. Submit each section separately.
- E. The submittals shall include the following:
 - 1. Information that confirms compliance with contract requirements. Include the manufacturer's name, model or catalog numbers, catalog information, technical data sheets, shop drawings, pictures, nameplate data and test reports as required.

2. Submittals are required for all equipment anchors and supports. Submittals shall include weights, dimensions, center of gravity, standard connections, manufacturer's recommendations and behavior problems (e.g., vibration, thermal expansion,) associated with equipment or piping so that the proposed installation can be properly reviewed.
 3. Elementary and interconnection wiring diagrams for communication and signal systems, control system and equipment assemblies. All terminal points and wiring shall be identified on wiring diagrams.
 4. Parts list which shall include those replacement parts recommended by the equipment manufacturer, quantity of parts, current price and availability of each part.
- F. Manuals: Submit in accordance with Section 01010, GENERAL REQUIREMENTS.
1. Maintenance and Operation Manuals: Submittals required for systems and equipment specified in the technical sections. Furnish four copies, bound in hardback binders, (manufacturer's standard binders) or an approved equivalent. Furnish one complete manual as specified in the technical section but in no case later than prior to performance of systems or equipment test, and furnish the remaining manuals prior to contract completion.
 2. Inscribe the following identification on the cover: the words "MAINTENANCE AND OPERATION MANUAL," the name and location of the system, equipment, building, name of Contractor, and contract number. Include in the manual the names, addresses, and telephone numbers of each subcontractor installing the system or equipment and the local representatives for the system or equipment.
 3. Provide a "Table of Contents" and assemble the manual to conform to the table of contents, with tab sheets placed before instructions covering the subject. The instructions shall be legible and easily read, with large sheets of drawings folded in.
 4. The manuals shall include:
 - a. Internal and interconnecting wiring and control diagrams with data to explain detailed operation and control of the equipment.
 - b. A control sequence describing start-up, operation, and shutdown.
 - c. Description of the function of each principal item of equipment.
 - d. Installation and maintenance instructions.
 - e. Safety precautions.

- f. Diagrams and illustrations.
 - g. Testing methods.
 - h. Performance data.
 - i. Lubrication schedule including type, grade, temperature range, and frequency.
 - j. Pictorial "exploded" parts list with part numbers. Emphasis shall be placed on the use of special tools and instruments. The list shall indicate sources of supply, recommended spare parts, and name of servicing organization.
 - k. Appendix; list qualified permanent servicing organizations for support of the equipment, including addresses and certified qualifications.
- G. Approvals will be based on complete submission of manuals together with shop drawings.
- H. After approval and prior to installation, furnish the Resident Engineer with one sample of each of the following:
- 1. A 300 mm (12 inch) length of each type and size of wire and cable along with the tag from the coils of reels from which the samples were taken.
 - 2. Each type of conduit coupling, bushing and termination fitting.
 - 3. Conduit hangers, clamps and supports.
 - 4. Duct sealing compound.
 - 5. Each type of receptacle, toggle switch, outlet box, manual motor starter, device plate, engraved nameplate, wire and cable splicing and terminating material and single pole molded case circuit breaker.
 - 6. Each type of light fixture specified in Section 16510 or shown on the drawings.
- I. In addition to the requirement of SUBMITTALS, the VA reserves the right to request the manufacturer to arrange for a VA representative to see typical active systems in operation, when there has been no prior experience with the manufacturer or the type of equipment being submitted.

1.12 SINGULAR NUMBER

Where any device or part of equipment is referred to in these specifications in the singular number (e.g., "the switch"), this

reference shall be deemed to apply to as many such devices as are required to complete the installation as shown on the drawings.

1.14 TRAINING

- A. Training shall be provided in accordance with Article, INSTRUCTIONS, of Section 01010, GENERAL REQUIRMENTS.
- B. Training shall be provided for the particular equipment or system as required in each associated specification.
- C. A training schedule shall be developed and submitted by the contractor and approved by the Resident Engineer at least 30 days prior to the planned training.

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**SECTION 16051
ELECTRICAL SYSTEM PROTECTIVE DEVICE STUDY**

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The Contractor shall have a short circuit and coordination study prepared for the electrical over current devices to be installed under this project to assure proper equipment and personnel protection.

- B. The study shall present an organized time-current analysis of each protective device in series from the branch circuit panelboards back to the source. The study shall reflect the operation of each device during normal and abnormal current conditions.

1.2 SUBMITTALS

In accordance with section 01340, SAMPLES AND SHOP DRAWINGS, furnish the following:

- A. Submit protective equipment shop drawings simultaneously with or after the protective device study. Protective equipment shop drawings will not be accepted prior to protective device study.
- B. Certification: Two weeks prior to final inspection, deliver to the Resident Engineer four copies of the following certifications:
 - 1. Certification by the Contractor that the protective devices have been adjusted and set in accordance with the approved protective device study.

1.3 QUALIFICATIONS

The contractor shall have the coordination study prepared by qualified engineers of the switchgear manufacturer or an approved consultant. The Contractor is responsible for providing all pertinent information required by the preparers to complete the study.

1.4 REQUIREMENTS

- A. The complete study shall include a system one line diagram, short circuit and ground fault analysis, and protective coordination plots.
- B. The extent of this study shall include equipment from the new branch circuit panelboards and mechanical equipment back to the primary interrupter switch at Substation B.
- C. One Line Diagram:
 - 1. Show, on the one line diagram, all electrical equipment and wiring to be protected by the over current devices installed under this

- project. Clearly show, on the one line, the schematic wiring of the electrical distribution system.
2. Also show on the one line diagram the following specific information:
 - a. Calculated fault impedance, X/R ratios, and short circuit values at each bus.
 - b. Breaker and fuse ratings.
 - c. Transformer KVA and voltage ratings, percent impedance, X/R ratios, and wiring connections.
 - d. Voltage at each bus.
 - e. Identification of each bus.
 - f. Conduit material, feeder sizes, length, and X/R ratios.
- C. Short Circuit Study:
1. Systematically calculate the fault impedance to determine the available short circuit and ground fault currents at each bus. Incorporate the motor contribution in determining the momentary and interrupting ratings of the protective devices.
 2. The study may be calculated by means of a computer program or by written calculations. Pertinent data and the rationale employed in developing the calculations shall be incorporated in the introductory remarks of the study.
 3. Present the data determined by the short circuit study in a table format. Include the following:
 - a. Device identification.
 - b. Operating voltage.
 - c. Protective device.
 - d. Device rating.
 - e. Calculated short circuit current.
- D. Coordination Curves:
1. Prepare the coordination curves to determine the required settings of protective devices to assure selective coordination. Graphically illustrate on log-log paper that adequate time separation exists between series devices, including the utility company upstream device. Plot the specific time-current characteristics of each protective device in such a manner that all upstream devices will be clearly depicted on one sheet.

2. The following specific information shall also be shown on the coordination curves:
 - a. Device identification.
 - b. Voltage and current ratio for curves.
 - c. 3-phase and 1-phase ANSI damage points for each transformer.
 - d. No-damage, melting, and clearing curves for fuses.
 - e. Cable damage curves.
 - f. Transformer inrush points.
 - g. Maximum short circuit cutoff point.
3. Develop a table to summarize the settings selected for the protective devices. Include in the table the following:
 - a. Device identification.
 - b. Relay CT ratios, tap, time dial, and instantaneous pickup.
 - c. Circuit breaker sensor rating, long-time, short-time, and instantaneous settings, and time bands.
 - d. Fuse rating and type.
 - e. Ground fault pickup and time delay.

1.5 ANALYSIS

- A. Analyze the short circuit calculations, and highlight any equipment that is determined to be underrated as specified. Propose approaches to effectively protect the underrated equipment. Proposed major corrective modifications will be taken under advisement by the Government, and the Contractor will be given further instructions. Provide minor modifications to conform with the study (Examples of minor modifications are trip sizes within the same frame, the time curve characteristics of induction relays, C.T. ranges, etc.).
- B. After developing the coordination curves, highlight areas lacking coordination. Present a technical evaluation with a discussion of the logical compromises for best coordination.

1.6 ADJUSTMENTS, SETTINGS AND MODIFICATIONS

- A. ACCOMPLISH NECESSARY FINAL FIELD SETTINGS, ADJUSTMENTS, AND MINOR MODIFICATIONS TO CONFORM WITH THE STUDY WITHOUT ADDITIONAL COST TO THE GOVERNMENT.

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**SECTION 16111
CONDUIT SYSTEMS**

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the furnishing, installation, and connection of conduit, fittings, and boxes to form complete, coordinated, grounded raceway systems. Raceways are required for all wiring unless shown or specified otherwise.
- B. Definitions: The term conduit, as used in this specification, shall mean any or all of the raceway types specified.

1.2 RELATED WORK

- A. Bedding of conduits: Section 02200, EARTHWORK.
- B. Mounting board for telephone closets: Section 06100, ROUGH CARPENTRY.
- C. Sealing around penetrations to maintain the integrity of time rated construction: Section 07270, FIRESTOPPING SYSTEMS.
- D. Fabrications for the deflection of water away from the building envelope at penetrations: Section 07600, FLASHING AND SHEET METAL.
- E. Sealing around conduit penetrations through the building envelope to prevent moisture migration into the building: Section 07920, SEALANTS AND CAULKING.
- F. Identification and painting of conduit and other devices: Section 09900, PAINTING.
- G. General electrical requirements and items that are common to more than one section of DIVISION 16: Section 16050, BASIC METHODS AND REQUIREMENTS (ELECTRICAL).
- H. Requirements for personnel safety and to provide a low impedance path for possible ground fault currents: Section 16450, GROUNDING.

1.3 SUBMITTALS

In accordance with Section 01340, SAMPLES AND SHOP DRAWINGS, furnish the following:

- A. Shop Drawings:
 - 1. Size and location of main feeders. Size and location of panels and pull boxes. Layout of required conduit penetrations through structural elements.
 - 2. The specific item proposed and its area of application shall be marked on the catalog cuts.

- B. Certification: Prior to final inspection, deliver to the Resident Engineer four copies of the certification that the material is in accordance with the drawings and specifications and has been properly installed.

1.4 APPLICABLE PUBLICATIONS

- A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. National Fire Protection Association (NFPA):
 - 70-99.....National Electrical Code (NEC)
- C. Underwriters Laboratories, Inc. (UL):
 - 1-93.....Flexible Metal Conduit
 - 5-96.....Surface Metal Raceway and Fittings
 - 6-97.....Rigid Metal Conduit
 - 50-95.....Enclosures for Electrical Equipment
 - 467-93.....Grounding and Bonding Equipment
 - 514A-96.....Metallic Outlet Boxes
 - 514B-97.....Fittings for Cable and Conduit
 - 651-95.....Schedule 40 and 80 Rigid PVC Conduit
 - 651A-95.....Type EB and A Rigid PVC Conduit and HDPE
Conduit
 - 797-93.....Electrical Metallic Tubing
 - 1242-96.....Intermediate Metal Conduit

PART 2 - PRODUCTS

2.1 MATERIAL

- A. Conduit Size: In accordance with the NEC, but not less than 13 mm (1/2 inch) unless otherwise shown. Where permitted by the NEC, 13 mm (1/2 inch) flexible conduit may be used for tap connections to recessed lighting fixtures.
- B. Conduit:
 - 1. Rigid steel: UL 6.
 - 2. Rigid aluminum: UL 6
 - 3. Rigid intermediate steel conduit (IMC): UL 1242.
 - 4. Electrical metallic tubing (EMT): U.L. 797. Maximum size 125 mm (5 inch). Permitted only with cable rated 600 volts or less.
 - 5. Flexible steel conduit (commercial greenfield): UL 1.

6. Liquid-tight flexible metal conduit: Flexible galvanized steel tubing covered with extruded liquid-tight jacket of polyvinyl chloride (PVC). Provide conduit with a continuous copper bonding conductor wound spirally between the convolutions.
7. Direct burial plastic conduit: UL 651 and UL 651A, heavy wall PVC or high density PE.
8. Surface metal raceway: UL 5.

C. Conduit Fittings:

1. Rigid steel and IMC conduit fittings:
 - a. Standard threaded couplings, locknuts, bushings, and elbows: Only steel or malleable iron materials are acceptable. Integral retractable type IMC couplings are acceptable also.
 - b. Locknuts: Bonding type with sharp edges for digging into the metal wall of an enclosure.
 - c. Bushings: Metallic insulating type, consisting of an insulating insert molded or locked into the metallic body of the fitting. Bushings made entirely of metal or nonmetallic material are not permitted.
 - d. Erickson (union-type) and set screw type couplings: Approved for use in concrete are permitted for use to complete a conduit run where conduit is installed in concrete. Use set screws of case hardened steel with hex head and cup point to firmly seat in conduit wall for positive ground. Tightening of set screws with pliers is prohibited.
 - e. Sealing fittings: Threaded cast iron type. Use continuous drain type sealing fittings to prevent passage of water vapor. In concealed work, install fittings in flush steel boxes with blank coverplates having the same finishes as that of other electrical plates in the room.
2. Rigid aluminum conduit fittings:
 - a. Standard threaded couplings, locknuts, bushings, and elbows: Malleable iron, steel or aluminum alloy materials. Zinc or cadmium plate iron or steel fittings. Aluminum fittings containing more than 0.4 percent copper are prohibited.
 - b. Locknuts and bushings: As specified for rigid steel and IMC conduit.
 - c. Set screw fittings: Not permitted for use with aluminum conduit.

3. Electrical metallic tubing fittings:
 - a. Only steel or malleable iron material are acceptable.
 - b. Couplings and connectors: Concrete tight and rain tight, with connectors having insulated throats. Use gland and ring compression type couplings and connectors for conduit sizes 50 mm (2 inches) and smaller. Use set screw type couplings with four set screws each for conduit sizes over 50 mm (2 inches). Use set screws of case-hardened steel with hex head and cup point to firmly seat in wall of conduit for positive grounding.
 - c. Indent type connectors or couplings are prohibited.
 - d. Die-cast or pressure-cast zinc-alloy fittings or fittings made of "pot metal" are prohibited.
 4. Flexible steel conduit (greenfield) fittings:
 - a. UL 5. Only steel or malleable iron materials are acceptable.
 - b. Clamp type, with insulated throat.
 5. Liquid-tight flexible metal conduit fittings:
 - a. Only steel or malleable iron materials are acceptable.
 - b. Fittings must incorporate a threaded grounding cone, a steel or plastic compression ring, and a gland for tightening. Connectors shall have insulated throats.
 6. Direct burial plastic conduit fittings: As recommended by the conduit manufacturer.
 7. Surface metal raceway fittings: As recommended by the raceway manufacturer.
 8. Expansion and deflection couplings:
 - a. UL 467 and UL 514B.
 - b. Accommodate, 19 mm (0.75 inch) deflection, expansion, or contraction in any direction, and allow 30 degree angular deflections.
 - c. Include internal flexible metal braid sized to guarantee conduit ground continuity and fault currents in accordance with UL 467, and the NEC code tables for ground conductors.
 - d. Jacket: Flexible, corrosion-resistant, watertight, moisture and heat resistant molded rubber material with stainless steel jacket clamps.
- D. Conduit Supports:

1. Parts and hardware: Zinc-coat or provide equivalent corrosion protection.
 2. Individual Conduit Hangers: Designed for the purpose, having a pre-assembled closure bolt and nut, and provisions for receiving a hanger rod.
 3. Multiple conduit (trapeze) hangers: Not less than 38 mm by 38 mm (1-1/2 by 1-1/2 inch), 12 gage steel, cold formed, lipped channels; with not less than 9 mm (3/8 inch) diameter steel hanger rods.
 4. Solid Masonry and Concrete Anchors: Self-drilling expansion shields, or machine bolt expansion.
- E. Outlet, Junction, and Pull Boxes:
1. UL-50 and UL-514A.
 2. Cast metal where required by the NEC or shown, and equipped with rustproof boxes.
 3. Sheet metal boxes: Galvanized steel, except where otherwise shown.
- F. Wireways: Equip with hinged covers, except where removable covers are shown.
- G. Warning Tape: Standard, 4-Mil polyethylene 76 mm (3 inch) wide tape detectable type, red with black letters, and imprinted with "CAUTION BURIED ELECTRIC LINE BELOW".

PART 3 - EXECUTION

3.1 PENETRATIONS

- A. Cutting or Holes:
1. Locate holes in advance where they are proposed in the structural sections such as ribs or beams. Obtain the approval of the Resident Engineer prior to drilling through structural sections.
 2. Cut holes through concrete and masonry in new and existing structures with a diamond core drill or concrete saw. Pneumatic hammer, impact electric, hand or manual hammer type drills are not allowed, except where permitted by the Resident Engineer as required by limited working space.
- B. Fire Stop: Where conduits, wireways, and other electrical raceways pass through fire partitions, fire walls, smoke partitions, or floors, install a fire stop that provides an effective barrier against the spread of fire, smoke and gases as specified in Section, FIRESTOPPING SYSTEMS, with rock wool fiber or silicone foam sealant only. Completely

fill and seal clearances between raceways and openings with the fire stop material.

- C. Waterproofing: At floor, exterior wall, and roof conduit penetrations, completely seal clearances around the conduit and make watertight as specified in Section, SEALANTS AND CAULKING.

3.2 CONDUIT SYSTEMS INSTALLATION, GENERAL

- A. Installation: In accordance with UL, NEC, as shown, and as hereinafter specified.

- B. Essential (Emergency) raceway systems: Install entirely independent of other raceway systems, except where specifically "excepted" by NEC Article 517.

- C. Install conduit as follows:

1. In complete runs before pulling in cables or wires.
2. Flattened, dented, or deformed conduit is not permitted. Remove and replace the damaged conduits with new undamaged material.
3. Assure conduit installation does not encroach into the ceiling height head room, walkways, or doorways.
4. Cut square with a hacksaw, ream, remove burrs, and draw up tight.
5. Mechanically and electrically continuous.
6. Independently support conduit. Do not use other supports i.e., (suspended ceilings, suspended ceiling supporting members, lighting fixtures, mechanical piping, or mechanical ducts).
7. Support within 300 mm (1 foot) of changes of direction, and within 1 foot of each enclosure to which connected.
8. Close ends of empty conduit with plugs or caps at the rough-in stage to prevent entry of debris, until wires are pulled in.
9. Conduit installations under fume and vent hoods are prohibited.
10. Secure conduits to cabinets, junction boxes, pull boxes and outlet boxes with bonding type locknuts. For rigid and IMC conduit installations, provide a locknut on the inside of the enclosure, made up wrench tight. Do not make conduit connections to junction box covers.
11. Flashing of penetrations of the roof membrane is specified in Section, FLASHING AND SHEET METAL.

- D. Conduit Bends:

1. Make bends with standard conduit bending machines.

2. Conduit hickey may be used for slight offsets, and for straightening stubbed out conduits.

3. Bending of conduits with a pipe tee or vise is prohibited.

E. Layout and Homeruns:

1. Install conduit with wiring, including homeruns, as shown.

2. Deviations: Make only where necessary to avoid interferences and only after drawings showing the proposed deviations have been submitted to and have been approved by the Resident Engineer.

3.3 CONCEALED WORK INSTALLATION

A. In Concrete:

1. Conduit: Rigid steel, IMC or EMT; except do not install EMT in concrete slabs that are in contact with soil, gravel or vapor barriers.

2. Align and run conduit in direct lines.

3. Install conduit through concrete beams only when the following occurs:

a. Where shown on the structural drawings.

b. As approved by the Resident Engineer prior to construction, and after submittal of drawing showing location, size, and position of each penetration.

4. Installation of conduit in concrete that is less than 75 mm (3 inches) thick is prohibited.

a. Conduit outside diameter larger than 1/3 of the slab thickness is prohibited.

b. Space between conduits in slabs: Approximately six conduit diameters apart, except one conduit diameter at conduit crossings.

c. Install conduits approximately in the center of the slab so that there will be a minimum of 19 mm (3/4 inch) of concrete around the conduits.

5. Make couplings and connections watertight. Use thread compounds that are UL approved conductive type to insure low resistance ground continuity through the conduits. Tightening set screws with pliers is prohibited.

B. Above Furred or Suspended Ceilings and in Walls:

1. Conduit for conductors above 600 volts:

- a. Rigid steel or rigid aluminum. Do not use aluminum in wet locations.
 - b. Aluminum conduit mixed indiscriminately with other types in the same system is prohibited.
2. Conduit for conductors 600 volts and below:
 - a. Rigid steel, IMC, rigid aluminum, or EMT. Types mixed indiscriminately in the same system is prohibited.
 - b. Do not use aluminum in wet locations.
 3. Align and run conduit parallel or perpendicular to the building lines.
 4. Connect recessed lighting fixtures to conduit runs with maximum 1800 mm (six feet) of flexible metal conduit extending from a junction box to the fixture.
 5. Tightening set screws with pliers is prohibited.

3.4 EXPOSED WORK INSTALLATION

- A. Conduit for conductors above 600 volts:
 1. Rigid steel or rigid aluminum. Do not use aluminum in wet locations.
 2. Aluminum conduit mixed indiscriminately with other types in the same system is prohibited.
- B. Conduit for Conductors 600 volts and below:
 1. Rigid steel, IMC, rigid aluminum, or EMT. Types mixed indiscriminately in the system is prohibited.
 2. Do not use aluminum in wet locations.
- C. Align and run conduit parallel or perpendicular to the building lines.
- D. Install horizontal runs close to the ceiling or beams and secure with conduit straps.
- E. Support horizontal or vertical runs at not over 2400 mm (eight foot) intervals.
- F. Surface metal raceways: Use only where shown.
- G. Painting:
 1. Paint exposed conduit as specified in Section, PAINTING.
 2. Paint all conduits containing cables rated over 600 volts safety orange. Refer to Section, PAINTING for preparation, paint type, and exact color. In addition, paint legends, using 50 mm (two inch) high black numerals and letters, showing the cable voltage rating. Provide legends where conduits pass through walls and floors and at maximum 6000 mm (20 foot) intervals in between.

3.5 DIRECT BURIAL INSTALLATION

- A. Exterior routing of Lighting Systems and Other Branch circuits (600 Volt and Less, and 1500 mm (5 feet) from the buildings):
1. Conduit: Thick wall PVC or high density PE, unless otherwise shown.
 2. Mark conduit at uniform intervals to show the kind of material, direct burial type, and the UL approval label.
 3. Install conduit fittings and terminations as recommended by the conduit manufacturer.
 4. Tops of conduits shall be as follows unless otherwise shown:
 - a. Not less than 600 mm (24 inches) below finished grade.
 - b. Not less than 750 mm (30 inches) below road and other paved surfaces.
 5. Work with extreme care near existing ducts, conduits, cables, and other utilities to avoid damaging them.
 6. Excavation for conduit bedding and back-filling of trenches is specified in Section, EARTHWORK.
 - a. Cut the trenches neatly and uniformly.
 - b. Do not kink the conduits.
 7. Seal conduits, including spare conduits, at building entrances and at outdoor terminations for equipment with a suitable compound that prevents the entrance of moisture and gases.
 8. Where metal conduit is shown, install threaded heavy wall rigid steel galvanized conduit or type A20 rigid steel galvanized conduit coated with .5 mm (20 mil) bonded PVC, or rigid steel or IMC, PVC coated or standard coated with bituminous asphaltic compound.
 9. Warning tape shall be continuously placed 300 mm (12 inches) above buried conduit or electric lines.

3.6 HAZARDOUS LOCATIONS

- A. Use rigid steel conduit only, notwithstanding requirements otherwise specified in this or other sections of these specifications.
- B. Install UL approved sealing fittings, that prevent passage of explosive vapors, in hazardous areas equipped with explosive proof lighting fixtures, switches, and receptacles, as required by the NEC.

3.7 WET OR DAMP LOCATIONS

- A. Unless otherwise shown, use conduits of rigid steel or IMC.
- B. Provide sealing fittings, to prevent passage of water vapor, where conduits pass from warm to cold locations, i.e., (refrigerated spaces,

constant temperature rooms, air conditioned spaces building exterior walls, roofs) or similar spaces.

- C. Unless otherwise shown, use rigid steel or IMC conduit within 1500 mm (5 feet) of the exterior and below concrete building slabs in contact with soil, gravel, or vapor barriers. Conduit shall include an outer factory coating of .5 mm (20 mil) bonded PVC or field coat with asphaltum before installation. After installation, completely coat damaged areas of coating.

3.8 MOTORS AND VIBRATING EQUIPMENT

Use flexible metal conduit for connections to motors and other electrical equipment subject to movement, vibration, misalignment, cramped quarters, or noise transmission. Provide liquid-tight flexible metal conduit for installation in exterior locations, moisture or humidity laden atmosphere, corrosive atmosphere, water or spray wash-down operations, inside (air stream) of HVAC units, and locations subject to seepage or dripping of oil, grease or water. Provide a green ground wire with flexible metal conduit.

3.9 EXPANSION JOINTS

- A. Conduits 75 mm (3 inches) and larger, that are secured to the building structure on opposite sides of a building expansion joint, require expansion and deflection couplings. Install the couplings in accordance with the manufacturer's recommendations.
- B. Provide conduits smaller than 75 mm (3 inches) with junction boxes on both sides of the expansion joint. Connect conduits to junction boxes with sufficient slack of flexible conduit to produce 125 mm (5 inch) vertical drop midway between the end. Flexible conduit shall have a copper green ground bonding jumper installed. In lieu of this flexible conduit, expansion and deflection couplings as specified above for 375 mm (15 inches) and larger conduits are acceptable.
- C. Install expansion and deflection couplings where shown.
- D. Seismic Areas: In seismic areas, provide conduits rigidly secured to the building structure on opposite sides of a building expansion joint with junction boxes on both sides of the joint. Connect conduits to junction boxes with 375 mm (15 inches) of slack flexible conduit. Flexible conduit shall have a copper green ground bonding jumper installed.

3.10 CONDUIT SUPPORTS, INSTALLATION

- A. Safe working load shall not exceed 1/4 of proof test load of fastening devices.
- B. Use pipe straps or individual conduit hangers for supporting individual conduits.
- C. Support multiple conduit runs with trapeze hangers. Use trapeze hangers that are designed to support a load equal to or greater than the sum of the weights of the conduits, wires, hanger itself, and 90 kg (200 pounds). Attach each conduit with U-bolts or other approved fasteners.
- D. Support conduit independently of junction boxes, pull boxes, fixtures, suspended ceiling T-bars, angle supports, and similar items.
- E. Fasteners and Supports in Solid Masonry and Concrete:
 - 1. New Construction: Use steel or malleable iron concrete inserts set in place prior to placing the concrete.
 - 2. Existing Construction:
 - a. Steel expansion anchors not less than 6 mm (1/4 inch) bolt size and not less than 28 mm (1-1/8 inch) embedment.
 - b. Power set fasteners not less than 6 mm (1/4 inch) diameter with depth of penetration not less than 75 mm (3 inches).
 - c. Use vibration and shock resistant anchors and fasteners for attaching to concrete ceilings.
- F. Hollow Masonry: Toggle bolts are permitted. Bolts supported only by plaster are not acceptable.
- G. Metal Structures: Use machine screw fasteners or other devices specifically designed and approved for the application.
- H. Attachment by wood plugs, rawl plug, plastic, lead or soft metal anchors, or wood blocking and bolts supported only by plaster is prohibited.
- I. Chain, wire, or perforated strap shall not be used to support or fasten conduit.
- J. Spring steel type supports or fasteners are prohibited for all uses except: Horizontal and vertical supports/fasteners within walls.
- K. Vertical Supports: Vertical conduit runs shall have riser clamps and supports in accordance with the NEC and as shown. Provide supports for cable and wire with fittings that include internal wedges and retaining collars.

3.11 BOX INSTALLATION

- A. Boxes for Concealed Conduits:
 - 1. Mount flush.
 - 2. Provide raised covers for boxes to suit the wall or ceiling, construction and finish.
- B. In addition to boxes shown, install additional boxes where needed to prevent damage to cables and wires during pulling in operations.
- C. Remove only knockouts as required and plug unused openings. Use threaded plugs for cast metal boxes and snap-in metal covers for sheet metal boxes.
- D. Outlet boxes in the same wall mounted back-to-back are prohibited.
- E. Minimum size of outlet boxes for ground fault interrupter (GFI) receptacles is 100 mm (4 inches) square by 55 mm (2-1/8 inches) deep, with device covers for the wall material and thickness involved.
- F. Stencil or install phenolic nameplates on covers of boxes identified on riser diagrams. For example "SIG-FA JB No. 1".

3.12 TELEPHONE CONDUIT

- A. Install the telephone raceway system as shown on drawings.
- B. Minimum conduit size of 19 mm (3/4 inch), but not less than the size shown on the drawings.
- C. All conduit ends shall be equipped with insulated bushings.
- D. All 100 mm (four inch) conduits within buildings shall include pull boxes after every two 90 degree bends. Size per the NEC.
- E. Vertical conduits/sleeves through closets floors shall terminate not less than 75 mm (3 inches) below the floor and not less than 75 mm (3 inches) below the ceiling of the floor below.
- F. Terminate conduit runs to/from a telephone backboard in a closet or interstitial space at the top or bottom of the backboard. Conduits shall enter telephone closets next to the wall and be flush with the backboard.
- G. Where drilling is necessary for vertical conduits, locate holes so as not to affect structural sections such as ribs or beams.
- H. All empty conduits located in telephone closets or on telephone backboards shall be sealed with a standard non-hardening duct seal compound to prevent the entrance of moisture and gases and to meet fire resistance requirements.

I. Conduit runs shall contain no more than four quarter turns (90 degree bends) between pull boxes/backboards. Minimum radius of telephone conduit bends shall be as follows (special long radius):

Sizes of Conduit Trade Size	Radius of Conduit Bends mm, Inches
3/4	150 (6)
1	230 (9)
1-1/4	350 (14)
1-1/2	430 (17)
2	525 (21)
2-1/2	635 (25)
3	775 (31)
3-1/2	900 (36)
4	1125 (45)

J. Furnish and install 19 mm (3/4 inch) thick fire retardant plywood specified in Section, ROUGH CARPENTRY on the wall of telephone closets where indicated. Size plywood 2400 mm (eight feet) high by the width of the closet. Mount the plywood with the bottom edge 300 mm (one foot) above the finished floor.

K. Furnish and install pull wire in all empty conduits. (Sleeves through floor are exceptions).

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SECTION 16115
CABLE TRAYS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Continuous, rigid, welded steel or stainless steel wire mesh cable management system.
- B. Cable tray systems are defined to include, but are not limited to, straight sections, supports and accessories.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.3 SUMMARY

- A. Related Sections include the following:
 - 1. Section 16050 - Basic Methods and Requirements.
 - 2. Section 16111 - Conduit Systems.
 - 3. Section 16127 - Cables Low Voltage
- B. References:
 - 1. ASTM A 510 - Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel
 - 2. ASTM A 380 - Specification for Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems
 - 3. ASTM B 633 - Specification for Electrodeposited Coatings of Zinc on Iron and Steel
 - 4. ASTM A 123 - Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
 - 5. ASTM A 653 - Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality
 - 6. ANSI/NFPA 70 (2002) - National Electrical Code (NEC)
 - 7. IEC 61537 (2001) - Cable Tray Systems and Cable Ladder Systems for Cable Management
 - 8. NEMA VE 1-2002/CSA C22.2 No. 126.1-02 - Metal Cable Tray Systems
 - 9. MIL-S-901D (Navy) -Military Specification, Requirements for Shock Tests, High Impact; Shipboard Machinery, Equipment and Systems
 - 10. MIL-STD-167-1 (Ships) - Military Standards Mechanical Vibrations of Shipboard Equipment

11. TIA 569-A (1998) - Commercial Building Standard for
Telecommunications Pathways & Spaces

1.4 SUBMITTALS

- A. Comply with requirements of submittal Procedures.
- B. Product Data: Submit manufacturer's product data sheets for cable tray indicating dimensions, materials, and finishes, including UL Classification and NEMA/CSA Certification.
- C. Shop Drawings: Submit shop drawings indicating materials, finish, dimensions, accessories, layout, supports, splices, and installation details.
- D. Design Calculations: Verify loading capacities for supports.
- E. Coordination Drawings: Include floor plans and sections drawn to scale. Include scaled cable tray layout and relationships between components and adjacent structural and mechanical elements. Data presented on these drawings are as accurate as preliminary surveys and planning can determine. Field verification, of all dimensions, routing, etc., is directed.
- F. Factory-certified test reports of specified products, complying with IEC 61537, NEC, and NEMA VE 1/CSA C22.2 No. 126.1.
- G. Submit manufacturer's certification indicating ISO 9001 quality certified.
- H. Submit training procedure for certifying cable tray installers.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain cable tray components through one source from a single manufacturer.
- B. Approval and Labeling: Provide cable trays and accessories specified in this Section that are approved and labeled.
 - 1. The Terms "Classified" pertaining to cable trays (rather than "Listed") and "Labeled": As defined in NFPA 70, Article 100.
 - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" as defined in OSHA Regulation 1910.7.
- C. Comply with NFPA 70, National Electrical Code, Article 392: Cable Trays; provide UL Classification and labels.
- D. Comply with IEC 61537, Cable Tray Systems and Cable Ladder Systems for Cable Management.

- E. Comply with NEMA VE 1/CSA C22.2 No. 126.1, Metal Cable Tray Systems, for materials, sizes, and configurations; provide cCSAus Certificate and labels.
- F. Provide documentation of ISO 9001 quality certification.

1.5 COORDINATION

- A. Coordinate layout and installation of cable tray with other installations.
 - 1. Revise locations and elevations from those indicated as required to suit field conditions and as approved by the Architect.
 - 2. Storage and Handling: Avoid breakage, denting and scoring finishes. Damaged products shall not be installed. Store cable trays and accessories in original cartons and in clean dry space; protect from weather and construction traffic. Wet materials should be unpacked and dried before storage.

PART 2 - PRODUCTS

2.1 MANUFACTURERS: Subject to compliance with requirements, provide products by the following:

- A. Cablofil, Inc., 8319 State Route 4, Mascoutah, IL, 62258. Phone (618) 566-3230. Toll Free (800) 658-4641. Fax (618) 566-3250.
www.cablofil.com.
- B. Mono-Systems, Inc. 4 International Drive Rye Brook, NY 10573. Phone (914) 934-2190. contact@monosystems.com

2.2 MATERIALS AND FINISHES

- A. Cable Tray Materials:
 - 1. Carbon steel wire, ASTM A 510, Grade 1008. Wire welded, bent, and surface treated after manufacture.
- B. Cable Tray Finishes:
 - 2. Finish for Carbon Steel Wire: The following finishes shall be applied after welding and bending of mesh.
 - a. Powder-Coated:
 - (1) Black powder-coated surface treatment over Electrodeposited Zinc Plating using ASA 61 black polyester coating.
- C. Cable tray shall consist of continuous, rigid, welded steel wire mesh cable management system, to allow continuous ventilation of cables and maximum dissipation of heat, with UL Classified splices where tray acts as Equipment Grounding Conductor (EGC). Provide splices, supports, and

other fittings necessary for a complete, continuously grounded system. Wire mesh cable tray shall have continuous Safe-T-Edge T-welded top side wire to protect cable insulation and installers.

1. Mesh: 2 x 4 inches (50 x 100 mm).
2. Straight Section Lengths: 118 inches (3,000 mm).
3. Wire Diameter: Patented design includes varying wire sizes to meet application load requirements; to optimize tray strength; and to allow tray to remain lightweight.
4. Safety Edge: Patented Safety Edge technology on side wire to protect cable insulation and installers' hands.
5. Fittings: Wire mesh cable tray fittings are field-fabricated from straight tray sections, in accordance with manufacturer's instructions.

D. Cable Tray Size:

1. Depth: Cable tray depth shall be as shown on drawings.
2. Width: Cable tray width shall as shown on drawings.
3. Length: Cable tray section length shall be 10 feet (3000mm) unless otherwise shown on drawings.
4. Fill Ratio: Cable tray may be filled to 100% of total fill capacity.
5. Load Span Criteria:
 - a. Install and support cable management system in accordance with the following:
 - (1) IEC 61537, with load span criteria of L/200 (to exceed standard requirements of L/100) and a Safety Factor of 1.7,

2.3 CABLE TRAY ACCESSORIES

- A. Fittings: Wire mesh cable tray fittings are field-fabricated from straight tray sections, in accordance with manufacturer's instructions. Supports shall be threaded rod trapeze style hangers, center-hung ceiling hangers, wall brackets, or underfloor supports and shall include the FAS (Fast Assembly System) so that screws, bolts, and additional tools are not required for cable tray mounting; installation time is reduced; and tray path can adapt to installation obstacles without the need for additional parts. Place supports so that support span does not exceed that shown on the drawings.
- B. Cable tray splices, including those approved for electrical continuity (bonding), as recommended by cable tray manufacturer.

- C. Accessories: As required to protect, support, and install a cable tray system. Accessories shall consist of, but are not limited to:
1. CVN Covers, of same material and finish as cable tray.
 2. COT Divider Strips, of same material and finish as cable tray.
 3. Dropouts or Cablexits
 4. EZ BC Beam Clamps
 5. SBD or CEP Box or Conduit Exit Support Plates
 6. HB-2 Wall Termination Brackets
 7. EZ CL Cable Tray Label Clips
 8. SZ MC Seismic Bracing Kits
 9. FAS Roller Cable Pulling Kit

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of cable trays. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Drawings indicate approximate location of tray route. Adjust route to accommodate structural and mechanical conflicts. Provide horizontal and vertical bends and offsets to adjust tray route as required.
- B. Install cable tray level and plumb according to manufacturer's written instructions, Coordination Drawings, original design, and referenced standards.
- C. Cutting: Field-fabricate changes in direction & elevation by cutting & bending cable tray.
1. Cut cable tray wires in accordance with manufacturer's instructions.
 2. Cable tray wires must be cut with side-action bolt cutters with offset head to ensure integrity of protective galvanic layer.
- D. Remove burrs and sharp edges from cable trays.

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**SECTION 16127
CABLES, LOW VOLTAGE (600 VOLTS AND BELOW)**

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the furnishing, installation, and connection of the low voltage power and lighting wiring.

1.2 RELATED WORK

- A. Excavation and backfill for cables that are installed in conduit: Section 02200, EARTHWORK.
- B. Sealing around penetrations to maintain the integrity of time rated construction: Section 07270, FIRESTOPPING SYSTEMS.
- C. General electrical requirements that are common to more than one section in Division 16: Section 16050, BASIC METHODS AND REQUIREMENTS (ELECTRICAL).
- D. Conduits for cables and wiring: Section 16111, CONDUIT SYSTEMS.
- E. Requirements for personnel safety and to provide a low impedance path for possible ground fault currents: Section 16450, GROUNDING.

1.3 SUBMITTALS

In accordance with Section 01340, SAMPLES AND SHOP DRAWINGS, furnish the following:

- A. Manufacturer's Literature and Data: Showing each cable type and rating.
- B. Certificates: Two weeks prior to final inspection, deliver to the Resident Engineer four copies of the certification that the material is in accordance with the drawings and specifications and has been properly installed.

1.4 APPLICABLE PUBLICATIONS

- A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are reference in the text by the basic designation only.
- B. Federal Specifications (Fed. Spec.):
 - J-C-30B-89.....Cable and Wire, Electrical
 - HH-I-595C-76.....Insulation Tape, Electrical, Pressure-Sensitive Adhesive, Plastic
 - W-F-406E-93.....Fittings for Cable, Power, Electrical And Conduit, Metal, Flexible
- C. National Fire Protection Association (NFPA):

70-99.....National Electrical Code (NEC)

D. Underwriters Laboratories, Inc. (UL):

4-96.....Armored Cable

44-99.....Thermoset-Insulated Wires and Cables

83-98.....Thermoplastic-Insulated Wires and Cables

467-93.....Electrical Grounding and Bonding Equipment

486A-97.....Wire Connectors and Soldering Lugs for Use with
 Copper Conductors

486C-97.....Splicing Wire Connectors

486D-97.....Insulated Wire Connector Systems for
 Underground Use or in Damp or Wet Locations

486E-94.....Equipment Wiring Terminals for Use with
 Aluminum and/or Copper Conductors

493-95.....Thermoplastic-Insulated Underground Feeder and
 Branch Circuit Cable

514B-97.....Fittings for Cable and Conduit

1479-94.....Fire Tests of Through-Penetration Fire Stops

PART 2 - PRODUCTS

2.1 CABLE AND WIRE (POWER AND LIGHTING)

A. Cable and Wire shall be in accordance with Fed. Spec. J-C-30B, except as hereinafter specified.

B. Single Conductor:

1. Annealed copper.

2. Shall be stranded for sizes No. 8 AWG and larger, solid for sizes No. 10 AWG and smaller.

3. Shall be minimum size No. 12 AWG, except where smaller sizes are allowed herein.

C. Insulation:

1. THW, XHHW, or dual rated THHN-THWN shall be in accordance with UL 44, and 83.

2. Direct burial: UF or USE shall be in accordance with UL 493.

3. Isolated power system wiring: Type XHHW with a dielectric constant of 3.5 or less.

D. Color Code:

1. Secondary service, feeder and branch circuit conductors shall be color coded as follows:

208/120 volt	Phase	480/277 volt
--------------	-------	--------------

Black	A	Brown
Red	B	Orange
Blue	C	Yellow
White	Neutral	Gray *
* or white with colored (other than green) tracer.		

2. Use solid color compound or solid color coating for No. 12 AWG and No. 10 AWG branch circuit conductors and neutral sizes.
3. Phase conductors No. 8 AWG and larger shall be color-coded using one of the following methods:
 - a. Solid color compound or solid color coating.
 - b. Stripes, bands, or hash marks of color specified above.
 - c. Color as specified using 19 mm (3/4 inch) wide tape. Apply tape in half overlapping turns for a minimum of 75 mm (three inches) for terminal points, and in junction boxes, pull boxes, troughs, manholes, and handholes. Apply the last two laps of tape with no tension to prevent possible unwinding. Where cable markings are covered by tape, apply tags to cable stating size and insulation type.
4. For modifications and additions to existing wiring systems, color coding shall conform to the existing wiring system.
5. Color code for isolated power system wiring shall be in accordance with the NEC.

2.3 SPLICES AND JOINTS

- A. In accordance with UL 486A, C, D, E and NEC.
- B. Branch circuits (No. 10 AWG and smaller):
 1. Connectors: Solderless, screw-on, reusable pressure cable type, 600 volt, 105 degree C with integral insulation, approved for copper and aluminum conductors.
 2. The integral insulator shall have a skirt to completely cover the stripped wires.
 3. The number, size, and combination of conductors, as listed on the manufacturers packaging shall be strictly complied with.
- C. Feeder Circuits:
 1. Connectors shall be indent, hex screw, or bolt clamp-type of high conductivity and corrosion-resistant material.

2. Field installed compression connectors for cable sizes 250 kcmil and larger shall have not less than two clamping elements or compression indents per wire.
3. Insulate splices and joints with materials approved for the particular use, location, voltage, and temperature. Insulate with not less than that of the conductor level that is being joined.
4. Plastic electrical insulating tape: Fed Spec. HH-I-595 shall apply, flame retardant, cold and weather resistant.

2.4 CONTROL WIRING

- A. Unless otherwise specified in other sections of these specifications, control wiring shall be as specified for power and lighting wiring, except the minimum size shall be not less than No. 14 AWG.
- B. Control wiring shall be large enough so that the voltage drop under inrush conditions does not adversely affect operation of the controls.

2.5 COMMUNICATION AND SIGNAL WIRING

- A. Shall conform to the recommendations of the manufacturers of the communication and signal systems; however, not less than what is shown.
- B. Wiring shown is for typical systems. Provide wiring as required for the systems being furnished.
- C. Multi-conductor cables shall have the conductors color coded.

2.6 WIRE LUBRICATING COMPOUND

- A. Suitable for the wire insulation and conduit it is used with, and shall not harden or become adhesive.
- B. Shall not be used on wire for isolated type electrical power systems.

2.7 FIREPROOFING TAPE

- A. The tape shall consist of a flexible, conformable fabric of organic composition coated one side with flame-retardant elastomer.
- B. The tape shall be self-extinguishing and shall not support combustion. It shall be arcproof and fireproof.
- C. The tape shall not deteriorate when subjected to water, gases, salt water, sewage, or fungus and be resistant to sunlight and ultraviolet light.
- D. The finished application shall withstand a 200-ampere arc for not less than 30 seconds.
- E. Securing tape: Glass cloth electrical tape not less than 0.18 mm (7 mils) thick, and 19 mm (3/4 inch) wide.

2.8 WARNING TAPE

- A. The tape shall be standard, 76 mm (3 inch) wide, 4-Mil polyethylene detectable type.
- B. The tape shall be red with black letters indicating "CAUTION BURIED ELECTRIC LINE BELOW".

PART 3 - EXECUTION

3.1 INSTALLATION, GENERALLY

- A. Install in accordance with the NEC, and as specified.
- B. Install all wiring in raceway systems, except where direct burial or HCF Type AC cables are used.
- C. Splice cables and wires only in outlet boxes, junction boxes, pull boxes, manholes, or handholes.
- D. Install cable supports for all vertical feeders in accordance with the NEC. Provide split wedge type which firmly clamps each individual cable and tightens due to cable weight.
- E. For panelboards, cabinets, wireways, switches, and equipment assemblies, neatly form, train, and tie the cables in individual circuits.
- F. Seal cable and wire entering a building from underground, between the wire and conduit where the cable exits the conduit, with a nonhardening approved compound.
- G. Wire Pulling:
 - 1. Provide installation equipment that will prevent the cutting or abrasion of insulation during pulling of cables.
 - 2. Use ropes made of nonmetallic material for pulling feeders.
 - 3. Attach pulling lines for feeders by means of either woven basket grips or pulling eyes attached directly to the conductors, as approved by the Resident Engineer.
 - 4. Pull in multiple cables together in a single conduit.

3.4 SPLICE INSTALLATION

- A. Splices and terminations shall be mechanically and electrically secure.
- B. Where the Government determines that unsatisfactory splices or terminations have been installed, remove the devices and install approved devices at no additional cost to the Government.

3.5 CONTROL, COMMUNICATION AND SIGNAL WIRING INSTALLATION

- A. Unless otherwise specified in other sections of these specifications, install wiring and connect to perform the functions shown and specified in other sections of these specifications.
- B. Except where otherwise required, install a separate power supply circuit for each system so that malfunctions in any system will not affect other systems.
- C. Where power supply circuits are not shown for systems, connect them to the nearest panelboards of suitable voltages, which are intended to supply such systems and have suitable spare circuit breakers or space for installation.
- D. Install a red warning indicator on the handle of the branch circuit breaker for the power supply circuit for each system to prevent accidental de-energizing of the systems.
- E. System voltages shall not exceed 120 volts and shall be lower voltages where shown on the drawings or required by the NEC.

3.6 CONTROL, COMMUNICATION AND SIGNAL SYSTEM IDENTIFICATION

- A. Install a permanent wire marker on each wire at each termination.
- B. Identifying numbers and letters on the wire markers shall correspond to those on the wiring diagrams used for installing the systems.
- C. Wire markers shall retain their markings after cleaning.
- D. In each manhole and handhole, install embossed brass tags to identify the system served and function.

3.7 FEEDER IDENTIFICATION

- A. In each interior, pullbox and junction box, install metal tags on each circuit cables and wires to clearly designate their circuit identification and voltage.
- B. In manholes and handholes, provide tags of the embossed brass type, and also show the cable type and voltage rating. Attach the tags to the cables with slip-free plastic cable lacing units.

3.8 DIRECT BURIAL CABLE INSTALLATION

- A. Tops of the cables:
 - 1. Below the finished grade: Minimum 600 mm (24 inches) unless greater depth is shown.
 - 2. Below road and other pavement surfaces: In conduit as specified, minimum 750 mm (30 inches) unless greater depth is shown.
 - 3. Do not install them under railroad tracks.

- B. Under road and paved surfaces, install cables in bituminous coated galvanized steel rigid conduits, not less than 50 mm (two inch) trade size with bushings at each end of each conduit run.
- C. Work with extreme care near existing ducts, conduits, cables and other utilities to prevent any damage.
- D. Cut the trenches neatly and uniformly:
 - 1. Excavating and backfilling is specified in Section, EARTHWORK.
 - 2. Place a 75 mm (3 inch) layer of sand in the trenches before installing the cables.
 - 3. Place a 75 mm (three inch) layer of sand over the installed cables.
 - 4. Install continuous horizontal, 25 mm by 200 mm (one inch by eight inch) preservative impregnated wood planking 75 mm (three inches) above the installed cables before backfilling.
- E. Provide horizontal slack in the cables for contraction during cold weather.
- F. Install the cables in continuous lengths. Splices within cable runs will not be accepted.
- G. Connections and terminations shall be submersible type designed for the cables being installed.
- H. Warning tape shall be continuously placed 300 mm (12 inches) above buried cable.

3.9 FIELD TESTING

- A. Feeders and branch circuits shall have their insulation tested after installation and before connection to utilization devices such as fixtures, motors, or appliances.
- B. Tests shall be performed by megger and conductors shall test free from short-circuits and grounds.
- C. Test conductors phase-to-phase and phase-to-ground.
- D. The Contractor shall furnish the instruments, materials, and labor for these tests.

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**SECTION 16140
WIRING DEVICES**

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies the furnishing, installation, and connection of wiring devices.

1.2 RELATED WORK

- A. General electrical requirements that are common to more than one section of Division 16: Section 16050, BASIC METHODS AND REQUIREMENTS (ELECTRICAL).
- B. Conduits and outlets boxes: Section 16111, CONDUITS SYSTEMS
- C. Cables and wiring: Section 16127, CABLES, LOW VOLTAGE (600 VOLTS AND BELOW).
- D. Requirements for personnel safety and to provide a low impedance path for possible ground fault currents: Section 16450, GROUNDING.

1.3 SUBMITTALS

In accordance with section 01340, SAMPLES AND SHOP DRAWINGS, furnish the following:

- A. Shop Drawings:
 - 1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
 - 2. Include electrical ratings, dimensions, mounting details, construction materials, grade, and termination information.
- B. Manuals: Two weeks prior to final inspection, deliver four copies of the following to the Resident Engineer.
 - 1. Technical data sheets and information for ordering replacement units.
- C. Certifications: Two weeks prior to final inspection, deliver to the Resident Engineer four copies of the following:
 - 1. Certification by the Contractor that the devices comply with the drawings and specifications, and have been properly installed, aligned, and tested.

1.4 APPLICABLE PUBLICATIONS

- A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by basic designation only.

- B. National Fire Protection Association (NFPA):
 - 70-99.....National Electrical Code (NEC)
- C. National Electrical Manufacturers Association (NEMA):
 - WD1-83.....General Requirements for Wiring Devices
 - WD6-88.....Wiring Devices - Dimensional Requirements
- D. Underwriter's Laboratories, Inc. (UL):
 - 5-96.....Surface Metal Raceways and Fittings
 - 20-95.....General-Use Snap Switches
 - 231-98.....Power Outlets
 - 467-93.....Grounding and Bonding Equipment
 - 498-96.....Attachment Plugs and Receptacles
 - 943-93.....Ground Fault Circuit Interrupters

PART 2 - PRODUCTS

2.1 RECEPTACLES

- A. General: All receptacles shall be listed by Underwriters Laboratories, Inc., as hospital grade (green dot identification) and conform to NEMA WD1. (EXCEPTION - Receptacle types which have no listing as hospital grade but are listed by UL in their respective categories or receptacles indicated on the drawings as "not hospital grade").
 - 1. Mounting straps shall be plated steel, with beak-off plaster ears and shall include a self grounding feature. Terminal screws shall be brass, brass plated or a copper alloy metal.
 - 2. Receptacles shall have provisions for back wiring with separate metal clamp type terminals (four min.) and side wiring from four captively held binding screws.
- B. Duplex receptacles shall be single phase, 20 ampere, 120 volts, 2-pole, 3-wire, hospital grade and conform to the NEMA 5-20R configuration in NEMA WD6. The duplex type shall have break-off feature for two circuit operation. The ungrounded pole of each receptacle shall be provided with a separate terminal.
 - 1. Bodies shall be ivory in color.
 - 2. Switched duplex receptacles shall be wired so that only the top receptacle is switched. The remaining receptacle shall be unswitched.
- 3. Duplex Receptacles on Emergency Circuit:

- a. Bodies shall be red in color. Wall plates shall be red with the word "emergency" engraved in 6 mm, (1/4 inch) white letters on cover.
4. Ground Fault Interrupter Duplex Receptacles: Shall be an integral unit suitable for mounting in a standard outlet box.
 - a. Ground fault interrupter, shall be hospital grade and consist of a differential current transformer, solid state sensing circuitry and a circuit interrupter switch. It shall be rated for operation on a 60 Hz, 120 volt, 20 ampere branch circuit. Device shall have nominal sensitivity to ground leakage current of five milliamperes and shall function to interrupt the current supply for any value of ground leakage current above five milliamperes on the load side of the device. Device shall have a minimum nominal tripping time of 1/30th of a second. Devices shall meet UL 943.
5. Isolated Ground Type Duplex Receptacles:
 - a. Bodies shall be orange in color.
 - b. Shall be hospital grade and UL listed as "Isolated Ground".
- C. Receptacles 20, 30 and 50 Ampere, 250 Volt: Shall be complete with appropriate cord grip plug. Devices shall meet UL 231.
- D. Weatherproof Receptacles: Shall consist of a duplex receptacle, mounted in box with a gasketed, weatherproof, cast metal cover plate and cap over each receptacle opening. The cap shall be permanently attached to the cover plate by a spring hinged flap. The weatherproof integrity shall not be affected when heavy duty specification or hospital grade attachment plug caps are inserted. Cover plates on outlet boxes mounted flush in the wall shall be gasketed to the wall in a watertight manner.
- E. Lamp Receptacles for Outlet Box Mounting:
 1. For use on standard 75 mm (3 inch) and 100 mm (4 inch) outlet boxes.
 2. Keyless, porcelain body and skirt supporting a medium screw shell socket, and integral 3-wire grounding receptacle shall have screw terminals and a minimum rating of 600 watts.
 3. Porcelain neck shall have shade holder groove.

2.2 TOGGLE SWITCHES AND DIMMERS

- A. Toggle switches shall be totally enclosed tumbler type with bodies of phenolic compound. Toggle handles shall be ivory in color unless

otherwise specified. The rocker type switch is not acceptable and will not be approved.

1. Switches installed in hazardous areas shall be explosion proof type in accordance with the NEC and as shown on the drawings.
2. Shall be single unit toggle, butt contact, quiet AC type, heavy-duty general-purpose use with an integral self grounding mounting strap with break-off plaster ears and provisions for back wiring with separate metal wiring clamps and side wiring with captively held binding screws.
3. Shall be color coded for current rating, listed by Underwriters Laboratories, Inc., and meeting the requirements of NEMA WD1, Heavy-Duty and UL 20.
4. Ratings:
 - a. 120 volt circuits: 20 ampere at 120-277 volts AC.
 - b. 277 volt circuits: 20 ampere at 120-277 volts AC.
5. The switches shall be mounted on the striker plate side of doors.
6. Incorporate barriers between switches with multigang outlet boxes where required by the NEC.
7. Switches connected to isolated type electrical power system shall be double pole.
8. All toggle switches shall be of the same manufacturer.

2.3 WALL PLATES

- A. Wall plates for switches and receptacles shall be type 302 stainless steel. Oversize plates will not be acceptable.
- B. Standard NEMA design, so that products of different manufacturers will be interchangeable. Dimensions for openings in wall plates shall be accordance with NEMA WD1.
- C. For receptacles or switches mounted adjacent to each other, wall plates shall be common for each group of receptacles or switches.
- D. In psychiatric areas, wall plates shall have tamperproof proof screws and beveled edges.

2.4 SURFACE MULTIPLE-OUTLET ASSEMBLIES

- A. Assemblies shall conform to the requirements of NFPA 70 and UL 5.
- B. Shall have the following features:
 1. Enclosures:
 - a. Thickness of steel shall be not less than 1 mm (0.040 inch) steel for base and cover. Nominal dimension shall be 40 by 70 mm (1-1/2 by

- 2-3/4 inches) with inside cross sectional area not less than 2250 square mm (3.5 square inches). The enclosures shall be thoroughly cleaned, phosphatized and painted at the factory with primer and the manufacturer's standard baked enamel or lacquer finish.
2. Receptacles shall be duplex, hospital grade. See paragraph 'RECEPTACLES' in this section. Device cover plates shall be the manufacturer's standard corrosion resistant finish and shall not exceed the dimensions of the enclosure.
 3. Unless otherwise shown on drawings, spacing of the receptacles along the strip shall be 600 mm (24 inches) on centers.
 4. Wires within the assemblies shall be not less than #12 AWG copper, with 600 volt ratings.
 5. Installation fittings shall be designed for the strips being installed including bends, offsets, device brackets, inside couplings, wire clips, and elbows.
 6. Bond the strips to the conduit systems for their branch supply circuits.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation shall be in accordance with the NEC, and as shown as on the drawings.
- B. Ground terminal of each receptacle shall be bonded to the outlet box with an approved green bonding jumper, and connected to the green equipment grounding conductor.

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**SECTION 16155
MOTOR STARTERS**

PART 1 - GENERAL

1.1 DESCRIPTION

All motor starters and motor control stations including installation and connection (whether furnished with the equipment specified in other Divisions or otherwise) shall meet these specifications.

1.2 RELATED WORK

- A. Other sections which specify motor driven equipment, except elevator motor controllers.
- B. General electrical requirements and items that are common to more than one Section of Division 16: Section 16050, BASIC METHODS AND REQUIREMENTS (ELECTRICAL).
- C. Requirements for personnel safety and to provide a low impedance path for possible ground fault currents: Section 16450, GROUNDING.

1.3 SUBMITTALS

Submit in accordance with Section 16050, BASIC METHODS AND REQUIREMENTS (ELECTRICAL):

- A. Shop Drawings:
 - 1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
 - 2. Include electrical ratings, dimensions, weights, mounting details, materials, running over current protection, branch circuit, overcurrent protection, wiring diagrams, starting characteristics, interlocking and accessories.
- B. Manuals:
 - 1. Submit, simultaneously with the shop drawings, companion copies of complete maintenance and operating manuals, including technical data sheets, wiring diagrams and information for ordering replacement parts.
 - a. Wiring diagrams shall have their terminals identified to facilitate installation, maintenance and operation.
 - b. Wiring diagrams shall indicate internal wiring for each item of equipment and interconnections between the items of equipment.
 - c. Elementary schematic diagrams shall be provided for clarity of operation.

2. Two weeks prior to the project final inspection, submit four copies of the final updated maintenance and operating manual to the Resident Engineer. (Update manual to include any information necessitated by shop drawing approval).
- C. Certification: Two weeks prior to final inspection, unless otherwise noted, submit four copies of the following certifications to the Resident Engineer:
1. Certification by the manufacturer that the controllers have passed the factory 24 hour operational test. (This certification must be furnished to the Resident Engineer prior to shipping the controller to the job site.)
 2. Certification by the manufacturer that high voltage motor controller(s) conforms to the requirements of the drawings and specifications. (This certification must be furnished to the Resident Engineer prior to shipping the controller to the job site.)
 3. Certification that the equipment has been properly installed, adjusted, and tested.

1.4 APPLICABLE PUBLICATIONS

- A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by basic designation only.
- B. Institute of Electrical and Electronic Engineers (IEEE):
- 519-92.....Recommended Practices and Requirements for
Harmonic Control in Electrical Power Systems
 - C37.90.1-89.....Standard Surge Withstand Capability (SWC) Tests
for Protective Relays and Relay Systems
- C. National Electrical Manufacturers Association (NEMA):
- ICS 1-93.....Industrial Control and Systems General
Requirements
 - ICS 1.1-84.....Safety Guidelines for the Application,
Installation and Maintenance of Solid State
Control
 - ICS 2-93.....Industrial Control and Systems, Controllers,
Contactors and Overload Relays Rated Not More
Than 2000 Volts AC or 750 Volts DC

- ICS 6-93.....Industrial Control and Systems Enclosures
- ICS 7-93.....Industrial Control and Systems Adjustable-Speed
Drives
- ICS 7.1-95.....Safety Standards for Construction and Guide for
Selection, Installation and Operation of
Adjustable-Speed Drives
- D. National Fire Protection Association (NFPA):
 - 70-99.....National Electrical Code (NEC)
- E. Underwriters Laboratories Inc. (UL):
 - 508-99.....Industrial Control Equipment

PART 2 - PRODUCTS

2.1 MOTOR STARTERS, GENERAL

- A. Motor starters shall be in accordance with the requirements of the IEEE, NEC, NEMA (ICS 1, ICS 1.1, ICS 2, ICS 6, ICS 7 and ICS 7.1) and UL.
- B. Shall have the following features:
 - 1. Separately enclosed unless part of another assembly.
 - 2. Circuit breakers and safety switches within the motor controller enclosures shall have external operating handles with lock-open padlocking provisions and shall indicate the ON and OFF positions.
 - 3. Motor control circuits:
 - a. Shall operate at not more than 120 volts.
 - b. Shall be grounded except as follows:
 - 1) Where isolated control circuits are shown.
 - 2) Where manufacturers of equipment assemblies recommend that the control circuits be isolated.
 - c. Incorporate a separate, heavy duty, control transformer within each motor controller enclosure to provide the control voltage for each motor operating over 120 volts.
 - d. Incorporate over current protection for both primary and secondary windings of the control power transformers in accordance with the NEC.
 - 4. Overload current protective devices:
 - a. Overload relay thermal type.
 - b. One for each pole.
 - c. Manual reset on the door of each motor controller enclosure.

- d. Correctly sized for the associated motor's rated full load current.
 - e. Check every motor controller after installation and verify that correct sizes of protective devices have been installed.
 - f. Deliver four copies of a summarized list to the Resident Engineer which indicates and adequately identifies every motor controller installed. Include the catalog numbers for the correct sizes of protective devices for the motor controllers.
5. Hand-Off-Automatic (H-O-A) switch is required unless specifically stated on the drawings as not required for a particular starter. H-O-A switch is not required for manual motor starters.
 6. Incorporate into each control circuit a 120-volt, solid state time delay relay (ON delay), minimum adjustable range from 0.3 to 10 minutes, with transient protection. Time delay relay is not required where H-O-A switch is not required.
 7. Auxiliary contacts, pilot lights, pushbuttons and other devices and accessories as shown on the drawings or otherwise required.
 8. Enclosures:
 - a. Shall be the NEMA types shown on the drawings for the motor controllers.
 - b. Shall be the NEMA types which are the most suitable for the environmental conditions where the motor controllers are being installed.
 - c. Doors mechanically interlocked to prevent opening unless the breaker or switch within the enclosure is open.
 - d. Enclosures shall be primed and finish coated at the factory with the manufacturer's prime coat and standard finish.
 - C. Motor controllers incorporated with equipment assemblies shall also be designed for the specific requirements of the assemblies.
 - D. For motor controllers being installed in existing motor control centers or panelboards, coordinate with the existing centers or panelboards.
 - E. Additional requirements for specific motor controllers, as indicated in other sections, shall also apply.
 - F. Provide a disconnecting means or safety switch near and within sight of each motor.
 - G. Refer to paragraph, MOTOR CONTROL STATIONS, in this section for additional requirements.

2.2 MANUAL MOTOR STARTERS

- A. Shall be in accordance with applicable requirements of 2.1 above.
- B. Manual motor starters.
 - 1. Starters shall be AC, general-purpose Class A, manually operated type with full voltage controller for induction motors, rated in horsepower.
 - 2. Units shall include overload protection, red pilot light, and toggle operator.
- C. Fractional horsepower manual motor starters.
 - 1. Starters shall be AC, general-purpose Class A, manually operated with full voltage controller for fractional horsepower induction motors.
 - 2. Units shall include thermal overload protection, red pilot light and toggle operator.
- D. Motor starting switches.
 - 1. Switches shall be AC, general-purpose Class A, manually operated type with full voltage controller for fractional horsepower induction motors.
 - 2. Units shall include thermal overload protection, red pilot light and toggle operator.

2.3 MAGNETIC MOTOR STARTERS

- A. Shall be in accordance with applicable requirements of 2.1 above.
- B. Starters shall be AC, general-purpose, Class A magnetic controllers for induction motors rated in horsepower. Minimum size 0.
- C. Where combination motor starters are used, combine starter with protective or disconnect device in a common enclosure.
- D. Provide phase loss protection relay, for each starter, with contacts to de-energize the starter upon loss of any phase.

2.6 VARIABLE SPEED MOTOR CONTROLLERS

- A. Shall be in accordance with applicable portions of 2.1 above.
- B. Shall be solid state, micro processor-based with adjustable frequency and voltage, three phase output capable of driving standard NEMA B design, three phase alternating current induction motors at full rated speed. The drives shall utilize a full wave bridge design incorporating diode rectifier circuitry with pulse width modulation (PWM). Other control techniques are not acceptable. Silicon controlled rectifiers (SCR) shall not be used in the rectifying circuitry. The drives shall

be designed to be used on variable torque loads and shall be capable of providing sufficient torque to allow the motor to break away from rest upon first application of power.

- C. Shall be rated for input power of 480 volts, three phase, 60 Hz. Unit shall be capable of operating within voltage parameters of plus 10 to minus 10 percent of line voltage, and be suitably rated for the full load amps of the maximum watts (HP) within its class.
- D. Each controller shall be factory tested at maximum watts (HP), rated full load current and at an ambient temperature of 40 degrees C for a period of not less than 24 hours. If a component fails, it shall be replaced and the test restarted for the full time period. A certified copy of the factory Test Report shall be furnished to the Resident Engineer prior to shipping the controller to the job site.
- E. Controllers shall have the following features:
 - 1. Isolated power for control circuits.
 - 2. Manually re-settable motor overload protection for each phase.
 - 3. Adjustable current limiting circuitry to provide soft motor starting. Maximum starting current shall not exceed 200 percent of motor full load current.
 - 4. Independent acceleration and deceleration time adjustment, manually adjustable from 2 to 30 seconds. (Set timers to the equipment manufacture's recommended time in the above range.)
 - 5. Provide 4 to 20 ma current follower circuitry for interface with mechanical sensor devices.
 - 6. Automatic frequency adjustment from 20 Hz to 60 Hz.
 - 7. Provide circuitry to initiate an orderly shutdown when any of the conditions listed below occur. The controller shall not be damaged by any of these electrical disturbances and shall automatically restart when the conditions are corrected:
 - a. Incorrect phase sequence.
 - b. Single phasing.
 - c. Over voltage in excess of 10 percent.
 - d. Under voltage in excess of 10 percent.
 - e. Running overcurrent above 110 percent (shall not automatically reset for this condition.)
 - f. Instantaneous overcurrent above 150 percent (shall not automatically reset for this condition).

- g. Surge voltage in excess of 1000 volts.
 - h. Short duration power outages of 12 cycles or less (i.e., distribution line switching, generator testing, automatic transfer switch operations.)
- F. Minimum efficiency shall be 95 percent at 100 percent speed and 85percent at 50 percent speed.
- G. The displacement power factor of the controller shall not be less than 95 percent under any speed or load condition.
- H. Controllers shall include a door interlocked fused safety disconnect switch or door interlocked circuit breaker switch which will disconnect all input power.
- I. Include a by-pass starter with circuitry to protect and isolate the variable speed controller. When the variable speed controller is in the by-pass mode, the solid-state components shall be isolated from the power supply on both the line and motor side.
- J. The following accessories are to be door mounted:
- 1. AC Power on light.
 - 2. Ammeter (RMS motor current).
 - 3. HAND-OFF-AUTOMATIC switch.
 - 4. Manual speed control in HAND mode.
 - 5. System protection lights indicating that the system has shutdown and will not automatically restart.
 - 6. System protection light indicating that the system has shutdown but will restart when conditions return to normal.
 - 7. Manual variable speed controller by-pass switch.
 - 8. Diagnostic shutdown indicator lights for each shutdown condition.
 - 9. Provide two N.O. and two N.C. dry contacts rated 120 volts, 10 amperes, 60 HZ for remote indication of the following:
 - a. System shutdown with auto restart.
 - b. System shutdown without auto restart.
 - c. System running.
 - 10. Incorporate into each control circuit a 120-volt, time delay relay (ON delay), adjustable from 0.3-10 minutes, with transient protection. Provide transformer/s for the control circuit/s.
 - 11. Controller shall not add any current or voltage transients to the input AC power distribution system nor shall the controller be affected by transients from other devices on the AC power

distribution system. Controllers shall be protected to comply with IEEE C37.90.1 and UL-508. Line noise and harmonic voltage distortion shall not exceed the values allowed by IEEE 519.

2.7 MOTOR CONTROL STATIONS

- A. Shall have the following features:
1. Designed for suitably fulfilling the specific control functions for which each station is being installed.
 2. Coordinate the use of momentary contacts and maintained contacts with the complete motor control systems to insure safety for people and equipment.
 3. Each station shall have two pilot lights behind red and green jewels and a circuit to its motor controller. Connect the lamps so they will be energized as follows:
 - a. Red while the motor is running.
 - b. Green while the motor is stopped.
 4. Where two or more stations are mounted adjacent to each other, install a common wall plate, except where the designs of the stations make such common plates impracticable.
 5. Identify each station with a permanently attached individual nameplate, of laminated black phenolic resin with a white core and engraved lettering not less than 6 mm (1/4-inch) high. Identify the motor by its number or other designation and indicate the function fulfilled by the motor.
- B. Components of Motor Control Circuits:
1. Shall also be designed and arranged so that accidental faulting or grounding of the control conductors will not be able to start the motors.
 2. Use of locking type STOP pushbuttons or switches, which cause motors to restart automatically when the pushbuttons or switches are released, will not be permitted.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install motor control equipment in accordance with manufacturer's recommendations, the NEC, NEMA and as shown on the drawings.
- B. Install Variable Speed Motor Controllers in accordance with manufacturers recommendations, the NEC, as shown on the drawings and in accordance with NEMA ICS 7.1.C.

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C. Furnish and install heater elements in motor starters to match the installed motor characteristics.

3.2 SPARE PARTS

Two weeks prior to the final inspection, provide one complete set of spare fuses (including heater elements) for each starter/controller installed on this project.

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**SECTION 16160
PANELBOARDS**

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies the furnishing, installation and connection of panelboards.

1.2 RELATED WORK

- A. Section 09900, PAINTING: Identification and painting of panelboards.
- B. Section 13081, SEISMIC RESTRAINT FOR NONSTRUCTURAL COMPONENTS: Requirements for seismic restraint of nonstructural components.
- C. Section 16050, BASIC METHODS AND REQUIREMENTS (ELECTRICAL): General electrical requirements and items that are common to more than one Section of Division 16.
- E. Section 16111, CONDUITS: Conduits and outlet boxes.
- F. Section 16127, CABLES, LOW VOLTAGE (600 VOLTS AND BELOW): Cables and wiring.
- G. Section 16450, GROUNDING: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.

1.3 SUBMITTALS

- A. Submit in accordance with section 16050, BASIC METHODS AND REQUIREMENTS (ELECTRICAL).
- B. Shop Drawings:
 - 1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
 - 2. Include electrical ratings, dimensions, mounting details, materials, wiring diagrams and accessories.
 - 3. Complete nameplate data including manufacturer's name and catalog number.
- C. Certification: Two weeks prior to final inspection, submit four copies of the following to the Resident Engineer:
Certification that the material is in accordance with the drawings and specifications, has been properly installed, and that the loads are balanced.

1.4 APPLICABLE PUBLICATIONS

- A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent

referenced. Publications are referenced in the text by the basic designation only.

- B. Underwriters Laboratories, Inc. (UL):
 - No. 50-1995.....Enclosures for Electrical Equipment
 - No. 67-1993.....Panel boards
 - No. 489-1991.....Molded Case Circuit Breakers and Circuit Breaker enclosures
- C. National Fire Protection Association (NFPA):
 - No. 70-2002.....National Electrical Code (NEC)
- D. National Electrical Manufacturers Association (NEMA):
 - No. PB-1-2002.....Panelboards
 - No. AB-3-1996.....Molded Case Circuit Breakers and Their Application

PART 2 - PRODUCTS

2.1 PANELBOARDS

- A. Panelboards shall be in accordance with UL, NEMA, NEC, and as shown on the drawings.
- B. Panelboards shall be standard manufactured products. All components of the panelboards shall be the product and assembly of the same manufacturer. All similar units of all panelboards to be of the same manufacturer.
- C. All panelboards shall be dead front safety type. Arrange sections for easy removal without disturbing other sections.
- D. All panelboards shall be completely factory assembled with molded case circuit breakers.
- E. Panelboards shall have main breaker or main lugs, bus size, voltage, phase, top or bottom feed, and flush or surface mounting as scheduled on the drawings.
- F. Panelboards shall have the following features:
 - 1. Nonreduced size copper or aluminum bus bars, and connection straps bolted together and rigidly supported on molded insulators. Bus bar taps for panels with single pole branches shall be arranged for sequence phasing of branch circuit devices.
 - 2. Full size neutral bar, mounted on insulated supports.
 - 3. Ground bar with sufficient terminals for all grounding wires. Buses braced for the available short circuit current, but not less than 22,000 amperes symmetrical for 120/208 volt and 120/240 volt

- panelboards, and 14,000 amperes symmetrical for 277/480 volt panelboards.
4. All breakers and phase bus connections shall be arranged so that it will be possible to substitute a 2-pole breaker for two single pole breakers, and a 3-pole breaker for three single pole breakers, when trip is 30 amps or less and frame size is 100 amperes or less, without having to drill and tap the main bus bars at bus straps.
 5. Design interior so that protective devices can be replaced without removing adjacent units, main bus connectors, and without drilling or tapping. Panel phase bus connections to protective devices shall not be riveted to the panel bus and shall be field removable by means of a screw driver.
 6. Where designated on panel schedule as "space", include all necessary bussing, device support and connections. Provide blank cover for each space.
 7. In two section panelboards, the main bus in each section shall be full size. The first section shall be furnished with subfeed lugs on the line side with cable connections to the second section. Panelboard sections with tapped bus or crossover bus are not acceptable.
 8. Series rated panelboards are not permitted.

2.2 CABINETS AND TRIMS

A. Cabinets:

1. Provide galvanized steel cabinets to house panelboards. Cabinets for outdoor panels shall be factory primed and suitably treated with a corrosion-resisting paint finish meeting UL standard for outdoor applications.
2. Cabinet enclosure shall not have ventilating openings.
3. Cabinets for panelboards may be of one piece formed steel or of formed sheet steel with end and side panels welded, riveted, or bolted as required.
4. Provide minimum of four interior mounted studs and necessary hardware for "in" and "out" adjustment of panel interior.
5. Cabinets for two section panelboards shall be arranged side by side, and shall be the same height. Flush mounted cabinets should be 38 mm (1-1/2 inches) apart and coupled by conduit nipple.

6. Gutter size in panel boxes, on all sides, shall be in accordance with the NEC. Cabinets containing through feeders shall have the gutter space increased by the amount required for auxiliary gutters in the NEC. Penetrations through gutter to live area of the panelboard shall incorporate approved non-metallic-grommet type of insulation to protect wire passing through.

B. Trims:

1. Fabricate trim of sheet steel consisting of frame with door attached by concealed hinges. Provide flush or surface trim as shown on the drawings.
2. Flush trims shall overlap the box by at least 19 mm (3/4-inch) all around.
3. Surface trim shall have the same width and height as the box.
4. Flush or surface trims shall not have ventilating openings.
5. Secure trims to back boxes by indicating trim clamps.
6. Provide a welded angle on rear of trim to support and align trim to cabinet.
7. Provide separate trims for each section of multiple section panelboards. Trims and doors of sections shall be of the same height.

C. Doors:

1. Provide doors with flush type latch and manufacturer's standard lock. Doors over 1200 mm (48 inches) in height shall have a vault handle and a three-point catch, arranged to fasten door at top, bottom, and center.
2. In making switching devices accessible, doors shall not uncover any live parts.
3. Provide concealed butt hinges welded to the doors and trims.
4. For magnetic contactors incorporated in panelboards, provide separate doors for the contactors.
5. Provide keyed alike system for all panelboards. In existing buildings where new panels are installed, provide keyed alike locks as directed by Resident Engineer.
6. Provide a directory card, metal holder, and transparent cover. Permanently mount holders on inside of doors.

D. Painting:

1. Thoroughly clean and paint trims and doors at the factory with primer and manufacturer's standard finish.

2.3 MOLDED CASE CIRCUIT BREAKERS FOR PANELBOARDS

A. Breakers shall be UL listed and labeled, in accordance with the NEC, as shown on the drawings, and as specified.

B. Circuit breakers in panelboards shall be bolt on type on phase bus bar or branch circuit bar.

1. Molded case circuit breakers for lighting and appliance branch circuit panelboards shall have minimum interrupting rating as indicated but not less than:
 - a. 120/208 Volt Panelboard: 22,000 amperes symmetrical.
 - b. 120/240 Volt Panelboard: 22,000 amperes symmetrical.
 - c. 277/480 Volt Panelboard: 14,000 amperes symmetrical.
2. Molded case circuit breakers shall have automatic, trip free, non-adjustable, inverse time, and instantaneous magnetic trips for 100 ampere frame or less. Magnetic trip shall be adjustable from 3X to 10X for breakers with 600 ampere frames and higher. Factory setting shall be HI, unless otherwise noted.

C. Breaker features shall be as follows:

1. A rugged, integral housing of molded insulating material.
2. Silver alloy contacts.
3. Arc quenchers and phase barriers for each pole.
4. Quick-make, quick-break, operating mechanisms.
5. A trip element for each pole, thermal magnetic type with long time delay and instantaneous characteristics, a common trip bar for all poles and a single operator.
6. Electrically and mechanically trip free.
7. An operating handle which indicates ON, TRIPPED, and OFF positions.
 - a. Line connections shall be bolted.
 - b. Interrupting rating shall not be less than the maximum short circuit current available at the line terminals as indicated on the drawings. The interrupting rating shall not be less than the minimum requirement indicated in Section 2.3.B.1.
8. An overload on one pole of a multipole breaker shall automatically cause all the poles of the breaker to open.

9. For circuit breakers being added to existing panelboards, coordinate the breaker type with existing panelboards. Modify the panel directory.

2.4 SEPARATELY ENCLOSED MOLDED CASE CIRCUIT BREAKERS

- A. Where separately enclosed molded case circuit breakers are shown on the drawings, provide circuit breakers in accordance with the applicable requirements of those specified for panelboards.
- B. Enclosures are to be of the NEMA types shown on the drawings. Where the types are not shown, they are to be the NEMA type most suitable for the environmental conditions where the breakers are being installed.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation shall be in accordance with NEC, as shown on the drawings, and as specified.
- B. Locate panelboards so that the present and future conduits can be conveniently connected. Coordinate the sizes of cabinets with designated closet space.
- C. In accordance with section PAINTING, paint the panelboard system voltage, and feeder sizes as shown on the riser diagram in 1 inch block lettering on the inside cover of the cabinet door. Paint the words "LIFE SAFETY BRANCH", "CRITICAL BRANCH", or "EQUIPMENT SYSTEM" as applicable and the panel designation in one inch block letters on the outside of the cabinet doors.
- D. Install a typewritten schedule of circuits in each panelboard after being submitted to and approved by the Resident Engineer. Schedules, after approval, shall be typed on the panel directory cards and installed in the appropriate panelboards, incorporating all applicable contract changes pertaining to that schedule. Include the room numbers and items served on the cards.
- E. Mount the panelboard so that maximum height of the top circuit breaker above finished floor shall not exceed 1980 mm (78 inches). For panelboards which are too high, mount panelboard so that the bottom of the cabinets will not be less than 150 mm (6 inches) above the finished floor.
- F. For panelboards located in areas accessible to the public, paint the exposed surfaces of the trims, doors, and boxes with finishes to match surrounding surfaces after the panelboards have been installed.

- G. Circuit numbers indicated on the drawings are shown for the purpose of clarifying the grouping of outlets. The actual number assigned to the circuit in the panelboard shall suit the bussing and branch circuiting of the panel. Provide Resident Engineer as-built drawings showing the actual circuit numbers being used for each device on each branch circuit.
- H. Where new panels are to be installed in existing backboxes, backboxes shall have rust and scale removed from inside. Paint inside of backboxes with rust preventive paint before the new panel interior is installed. Provide new trim and doors for these panels.

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**SECTION 16170
DISCONNECT SWITCHES (MOTOR AND CIRCUIT)**

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies the furnishing, installation and connection of low voltage disconnect switches.

1.2 RELATED WORK

- A. General electrical requirements and items that are common to more than one section of Division 16: Section 16050, BASIC METHODS AND REQUIREMENTS (ELECTRICAL).
- B. Conduits for cables and wiring: Section 16111, CONDUIT SYSTEMS.
- C. Cables and wiring: Section 16127, CABLES, LOW VOLTAGE (600 VOLTS AND BELOW).
- D. Requirements for personnel safety and to provide a low impedance path for possible ground faults: Section 16450, GROUNDING.

1.3 SUBMITTALS

Submit in accordance with Section 16050, BASIC METHODS AND REQUIREMENTS (ELECTRICAL).

- A. Shop Drawings:
 - 1. Include sufficient information, clearly presented, to determine compliance with drawings and specifications.
 - 2. Include electrical ratings, dimensions, mounting details, materials, enclosure types, fuse type and class.
 - 3. Show the specific switch and fuse proposed for each specific piece of equipment or circuit.
- B. Manuals:
 - 1. Provide complete maintenance and operating manuals for disconnect switches, including technical data sheets, wiring diagrams, and information for ordering replacement parts. Deliver four copies to the Resident Engineer two weeks prior to final inspection.
 - 2. Identify terminals on wiring diagrams to facilitate maintenance and operation.
 - 3. Wiring diagrams shall indicate internal wiring and any interlocking.
- C. Certification: Two weeks prior to final inspection, deliver to the Resident Engineer four copies of the certification that the equipment has been properly installed, adjusted, and tested.

1.4 APPLICABLE PUBLICATIONS

- A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. National Electrical Manufacturers Association (NEMA):
KS 1-96.....Enclosed and Miscellaneous Distribution
Equipment Switches (600 Volts Maximum)
- C. National Fire Protection Association (NFPA):
70-99.....National Electrical Code (NEC)
- D. Underwriters Laboratories, Inc. (UL):
98-94.....Enclosed and Dead-Front Switches
198C-86.....High-Interrupting-Capacity Fuses, Current
Limiting Types
198E-88.....Class R Fuses
977-94.....Fused Power-Circuit Devices

PART 2 - PRODUCTS

2.1 LOW VOLTAGE FUSIBLE SWITCHES RATED 600 AMPERES AND LESS

- A. Shall be quick-make, quick-break type in accordance with UL 98, NEMA KS 1 and NEC.
- B. Shall have a minimum duty rating, NEMA classification General Duty (GD) for 240 volts and NEMA classification Heavy Duty (HD) for 277/480 volts.
- C. Shall be horsepower rated.
- D. Shall have the following features:
 - 1. Switch mechanism shall be the quick-make, quick-break type.
 - 2. Copper blades, visible in the OFF position.
 - 3. An arc chute for each pole.
 - 4. External operating handle shall indicate ON and OFF position and shall have lock-open padlocking provisions.
 - 5. Mechanical interlock shall permit opening of the door only when the switch is in the OFF position, defeatable by a special tool to permit inspection.
 - 6. Fuse holders for the sizes and types of fuses specified.
 - 7. Solid neutral for each switch being installed in a circuit which includes a neutral conductor.
 - 8. Ground Lugs: One for each ground conductor.

9. Enclosures:

- a. Shall be the NEMA types shown on the drawings for the switches.
- b. Where the types of switch enclosures are not shown, they shall be the NEMA types which are most suitable for the environmental conditions where the switches are being installed.
- c. Shall be finished with manufacturer's standard gray baked enamel paint over pretreated steel (for the type of enclosure required).

2.2 LOW VOLTAGE UNFUSED SWITCHES RATED 600 AMPERES AND LESS

Shall be the same as Low Voltage Fusible Switches Rated 600 Amperes and Less, except it shall not accept fuses.

2.3 LOW VOLTAGE FUSIBLE SWITCHES RATED OVER 600 AMPERES TO 1200 AMPERES

Shall be the same as Low Voltage Fusible Switches Rated 600 Amperes and Less except the minimum duty rating shall be NEMA classification Heavy Duty (HD). These switches shall also be horsepower rated.

2.4 MOTOR RATED TOGGLE SWITCHES

Refer to Section 16155 for motor rated toggle switches.

2.5 IDENTIFICATION SIGNS

- A. Install nameplate identification signs on each disconnect switch to identify the equipment controlled.
- B. Nameplates shall be laminated black phenolic resin with a white core, with engraved lettering, a minimum of 6 mm (1/4-inch) high. Secure nameplates with screws.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install disconnect switches in accordance with the NEC and as shown on the drawings.
- B. Fusible disconnect switches shall be furnished complete with fuses.

3.2 SPARE PARTS

Two weeks prior to the final inspection, furnish one complete set of spare fuses for each fusible disconnect switch installed on the project. Deliver the spare fuses to the Resident Engineer.

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SECTION 16450
GROUNDING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies general grounding and bonding requirements of electrical installations for personnel safety and to provide a low impedance path for possible ground fault currents.
- B. "Grounding electrode system" refers to all electrodes required by NEC, as well as including made, supplementary, lightning protection system and telecommunications system grounding electrodes.
- C. The terms "connect" and "bond" are used interchangeably in this specification and have the same meaning.

1.2 RELATED WORK

- A. Section 16050, BASIC METHODS AND REQUIREMENTS (ELECTRICAL): General electrical requirements and items that are common to more than one section of Division 16.
- B. Section 16127, CABLES, LOW VOLTAGE (600 VOLTS AND BELOW): Low Voltage power and lighting wiring.
- C. Section 16670, LIGHTNING PROTECTION SYSTEM: Requirements for a lightning protection system.

1.3 SUBMITTALS

- A. Submit in accordance with Section 16050, BASIC METHODS AND REQUIREMENTS (ELECTRICAL).
- B. Shop Drawings:
 - 1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
 - 2. Include the location of system grounding electrode connections and the routing of aboveground and underground grounding electrode conductors.
- C. Test Reports: Provide certified test reports of ground resistance.
- D. Certifications: Two weeks prior to final inspection, submit four copies of the following to the Resident Engineer:
 - 1. Certification that the materials and installation is in accordance with the drawings and specifications.
 - 2. Certification, by the Contractor, that the complete installation has been properly installed and tested.

1.4 APPLICABLE PUBLICATIONS

Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.

- A. National Fire Protection Association (NFPA):
 - 70-2002.....National Electrical Code (NEC)
 - 99-2002.....Health Care Facilities
- B. Underwriters Laboratories, Inc. (UL):
 - 44-1999.....Thermoset-Insulated Wires and Cables
 - 83-1998.....Thermoplastic-Insulated Wires and Cables
 - 467-1993.....Grounding and Bonding Equipment
 - 486A-2000.....Wire Connectors and Soldering Lugs for Use With
Copper Conductors
- C. American Society for Testing and Materials (ASTM):
 - B1-2001.....Standard Specification for Hard-Drawn Copper
Wire
 - B8-1999.....Standard Specification for Concentric-Lay-
Stranded Copper Conductors, Hard, Medium-Hard,
or Soft
- D. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
 - 81-1983.....IEEE Guide for Measuring Earth Resistivity,
Ground Impedance, and Earth Surface Potentials
of a Ground System

PART 2 - PRODUCTS

2.1 GROUNDING AND BONDING CONDUCTORS

- A. Equipment grounding conductors shall be UL 83 insulated stranded copper, except that sizes No. 10 AWG and smaller shall be solid copper. Insulation color shall be continuous green for all equipment grounding conductors, except that wire sizes No. 4 AWG and larger shall be permitted to be identified per NEC.
- B. Bonding conductors shall be ASTM B8 bare stranded copper, except that sizes No. 10 AWG and smaller shall be ASTM B1 solid bare copper wire.
- C. Isolated Power System: Type XHHW-2 insulation with a dielectric constant of 3.5 or less.
- D. Conductor sizes shall not be less than what is shown on the drawings and not less than required by the NEC, whichever is greater.

2.2 GROUND RODS

- A. Copperclad steel, 19 mm (3/4-inch) diameter by 3000 mm (10 feet) long, conforming to UL 467.
- B. Quantity of rods shall be as required to obtain the specified ground resistance.

2.3 SPLICES AND TERMINATION COMPONENTS

Components shall meet or exceed UL 467 and be clearly marked with the manufacturer, catalog number, and permitted conductor size(s).

PART 3 - EXECUTION

3.1 GENERAL

- A. Ground in accordance with the NEC, as shown on drawings, and as hereinafter specified.
- B. System Grounding:
 - 1. Secondary service neutrals: Ground at the supply side of the secondary disconnecting means and at the related transformers.
 - 2. Separately derived systems (transformers downstream from the service entrance): Ground the secondary neutral.
 - 3. Isolation transformers and isolated power systems shall not be system grounded.
- C. Equipment Grounding: Metallic structures (including ductwork and building steel), enclosures, raceways, junction boxes, outlet boxes, cabinets, machine frames, and other conductive items in close proximity with electrical circuits shall be bonded and grounded.
- D. Special Grounding: For patient care area electrical power system grounding, conform to Chapter 4, "Electrical Systems ", of NFPA 99, and Article 517, "Health Care Facilities" of NFPA 70.

3.2 INACCESSIBLE GROUNDING CONNECTIONS

Make grounding connections which are buried or otherwise normally inaccessible (except connections for which periodic testing access is required) by exothermic weld.

3.4 SECONDARY EQUIPMENT AND CIRCUITS

- A. Main Bonding Jumper: Bond the secondary service neutral to the ground bus in the service equipment.
- B. Metallic Piping, Building Steel, and Supplemental Electrode(s):
 - 1. Provide a grounding electrode conductor sized per NEC between the service equipment ground bus and all metallic water and gas pipe systems, building steel, and supplemental or made electrodes. Jumper

- insulating joints in the metallic piping. All connections to electrodes shall be made with fittings that conform to UL 467.
2. Provide a supplemental ground electrode and bond to the grounding electrode system.
- C. Service Disconnect (Separate Individual Enclosure): Provide a ground bar bolted to the enclosure with lugs for connecting the various grounding conductors.
- D. Switchgear, Switchboards, Unit Substations, and Motor Control Centers:
1. Connect the various feeder equipment grounding conductors to the ground bus in the enclosure with suitable pressure connectors.
 2. For service entrance equipment, connect the grounding electrode conductor to the ground bus.
 3. Connect metallic conduits, which terminate without mechanical connection to the housing, by grounding bushings and grounding conductor to the equipment ground bus.
- E. Transformers:
1. Exterior: Exterior transformers supplying interior service equipment shall have the neutral grounded at the transformer secondary. Provide a grounding electrode at the transformer.
 2. Separately derived systems (transformers downstream from service equipment): Ground the secondary neutral at the transformer. Provide a grounding electrode conductor from the transformer to the nearest component of the grounding electrode system.
- F. Conduit Systems:
1. Ground all metallic conduit systems. All metallic conduit systems shall contain an equipment grounding conductor.
 2. Non-metallic conduit systems shall contain an equipment grounding conductor, except that non-metallic feeder conduits which carry a grounded conductor from exterior transformers to interior or building-mounted service entrance equipment need not contain an equipment grounding conductor.
 3. Conduit containing only a grounding conductor, and which is provided for mechanical protection of the conductor, shall be bonded to that conductor at the entrance and exit from the conduit.
- G. Feeders and Branch Circuits: Install equipment grounding conductors with all feeders and power and lighting branch circuits.
- H. Boxes, Cabinets, Enclosures, and Panelboards:

1. Bond the equipment grounding conductor to each pullbox, junction box, outlet box, device box, cabinets, and other enclosures through which the conductor passes (except for special grounding systems for intensive care units and other critical units shown).
 2. Provide lugs in each box and enclosure for equipment grounding conductor termination.
 3. Provide ground bars in panelboards, bolted to the housing, with sufficient lugs to terminate the equipment grounding conductors.
- I. Motors and Starters: Provide lugs in motor terminal box and starter housing or motor control center compartment to terminate equipment grounding conductors.
- J. Receptacles shall not be grounded through their mounting screws. Ground with a jumper from the receptacle green ground terminal to the device box ground screw and the branch circuit equipment grounding conductor.
- K. Ground lighting fixtures to the equipment grounding conductor of the wiring system when the green ground is provided; otherwise, ground the fixtures through the conduit systems. Fixtures connected with flexible conduit shall have a green ground wire included with the power wires from the fixture through the flexible conduit to the first outlet box.
- L. Fixed electrical appliances and equipment shall be provided with a ground lug for termination of the equipment grounding conductor.
- M. Raised Floors: Provide bonding of all raised floor components.
- N. Panelboard Bonding: The equipment grounding terminal buses of the normal and essential branch circuit panelboards serving the same individual patient vicinity shall be bonded together with an insulated continuous copper conductor not less than No. 10 AWG. These conductors shall be installed in rigid metal conduit.

3.5 CONDUCTIVE PIPING

- A. Bond all conductive piping systems, interior and exterior, to the building to the grounding electrode system. Bonding connections shall be made as close as practical to the equipment ground bus.
- B. In operating rooms and at intensive care and coronary care type beds, bond the gases and suction piping, at the outlets, directly to the room or patient ground bus.

3.6 LIGHTNING PROTECTION SYSTEM

Bond the lightning protection system to the electrical grounding electrode system.

3.7 TELECOMMUNICATIONS SYSTEM

Bond telecommunications system grounding equipment to the electrical grounding electrode system.

3.8 GROUND RESISTANCE

- A. Grounding system resistance to ground shall not exceed 5 ohms. Make necessary modifications or additions to the grounding electrode system for compliance without additional cost to the Government. Final tests shall assure that this requirement is met.
- B. Resistance of the grounding electrode system shall be measured using a four-terminal fall-of-potential method as defined in IEEE Standard 81. Ground resistance measurements shall be made before the electrical distribution system is energized and shall be made in normally dry conditions not less than 48 hours after the last rainfall. Resistance measurements of separate grounding electrode systems shall be made before the systems are bonded together below grade. The combined resistance of separate systems may be used to meet the required resistance, but the specified number of electrodes must still be provided.
- C. Services at power company interface points shall comply with the power company ground resistance requirements.
- D. Below-grade connections shall be visually inspected by the Resident Engineer prior to backfilling. The Contractor shall notify the Resident Engineer 24 hours before the connections are ready for inspection.

3.9 GROUND ROD INSTALLATION

- A. Drive each rod vertically in the earth, not less than 3000 mm (10 feet) in depth.
- B. Where permanently concealed ground connections are required, make the connections by the exothermic process to form solid metal joints. Make accessible ground connections with mechanical pressure type ground connectors.
- C. Where rock prevents the driving of vertical ground rods, install angled ground rods or grounding electrodes in horizontal trenches to achieve the specified resistance.

3.10 GROUNDING FOR RF/EMI CONTROL

- A. Install bonding jumpers to bond all conduit, cable trays, sleeves and equipment for low voltage signaling and data communications circuits. Bonding jumpers shall consist of 4" wide copper strip or two No. 10

copper conductors spaced minimum 4" apart. Use No. 6 copper where exposed and subject to damage.

- B. Comply with the following when shielded cable is used for data circuits.
1. Shields shall be continuous throughout each circuit.
 2. Connect shield drain wires together at each circuit connection point and insulate from ground. Do not ground the shield.
 3. Do not connect shields from different circuits together.
 4. Shield shall be connected at one end only. Connect shield to signal reference at the origin of the circuit. Consult with equipment manufacturer to determine signal reference.

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**SECTION 16460
TRANSFORMERS (GENERAL PURPOSE)**

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies the furnishing, installation and connection of the dry type general purpose transformers.

1.2 RELATED WORK

- A. Section 13081, SEISMIC RESTRAINT FOR NONSTRUCTURAL COMPONENTS:
Requirements for seismic restraint of nonstructural components.
- B. Section 16050, BASIC METHODS AND REQUIREMENTS (ELECTRICAL): General electrical requirements and items that are common to more than one section of Division 16.
- C. Section 16111, CONDUITS: Conduits and outlet boxes.
- D. Section 16127, CABLES, LOW VOLTAGE (600 VOLTS AND BELOW): Cables and wiring.
- E. Section 16450, GROUNDING: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.

1.3 SUBMITTALS

- A. Submit in accordance with Section 16050, BASIC METHODS AND REQUIREMENTS (ELECTRICAL).
- B. Shop Drawings:
 - 1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
 - 2. Include electrical rating, impedance, dimensions, weight, mounting details and materials, decibel rating, terminations, temperature rise, no load and full load losses, and connection diagrams.
 - 3. Complete nameplate data including manufacturer's name and catalog number.
- C. Manuals:
 - 1. Submit, simultaneously with the shop drawings, companion copies of complete operating and maintenance manuals including technical data sheets and wiring diagrams.
 - 2. Two weeks prior to the final inspection, submit four copies of the final updated maintenance and operating manuals, if any changes are necessary, to the Resident Engineer.
- D. Certifications: Two weeks prior to the final inspection, submit four copies of the following to the Resident Engineer.

1. Certification by the manufacturer that the transformers conform to the requirements of the drawings and specifications.
2. Certification that the equipment has been properly installed and tested.

1.4 APPLICABLE PUBLICATIONS

- A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.
- B. National Fire Protection Association (NEPA):
70-2002.....National Electrical Code (NEC)
- C. National Electrical Manufacturers Association (NEMA):
ST 20-1992.....Dry-Type Transformers for General Applications

PART 2 - PRODUCTS

2.1 GENERAL PURPOSE DRY TYPE TRANSFORMERS

- A. Unless otherwise specified, dry type transformers shall be in accordance with NEMA, NEC and as shown on the drawings. Transformers shall be UL listed or labeled.
- B. Dry type transformers shall have the following features:
 1. Self-cooled by natural convection, isolating windings, indoor, dry type. Autotransformers shall not be accepted.
 2. Rating and winding connections shall be as shown on the drawings.
 3. Ratings shown on the drawings are for continuous-duty without the use of cooling fans.
 4. Insulation systems:
 - a. Transformers 30 KVA and larger: UL rated 220 degree C system having an average maximum rise by resistance of 150 degree C in a maximum ambient of 40 degree C.
 - b. Transformers below 30 KVA: Same as for 30 KVA and larger or UL rated 185 degree C system having an average maximum rise by resistance of 115 degree C in a maximum ambient of 40 degree C.
 5. Core and coil assemblies:
 - a. Rigidly braced to withstand the stresses caused by short circuit currents and rough handling during shipment.
 - b. Cores shall be grain oriented, non-aging, silicon steel.
 - c. Coils shall be continuous windings without splices except for taps.

- d. Coil loss and core loss shall be optimum for efficient operation.
 - e. Primary and secondary tap connections shall be brazed or pressure type.
 - f. Coil windings shall have end fillers or tie downs for maximum strength.
6. Certified sound levels determined in accordance with NEMA, that do not exceed the following:

Transformer Rating	Sound Level Rating
0 - 9 KVA	40 dB
10 - 50 KVA	45 dB
51 - 150 KVA	50 dB
151 - 300 KVA	55 dB
301 - 500 KVA	60 dB

7. Nominal impedance shall be as shown on the drawings. If not shown on drawings, nominal impedance shall be as permitted by NEMA.
8. Single phase transformers rated 15 KVA through 25 KVA shall have two, 5 percent full capacity taps below normal rated primary voltage. All transformers rated 30 KVA and larger shall have two, 2-1/2 percent full capacity taps above, and four, 2-1/2 percent full capacity taps below normal rated primary voltage.
9. Core assemblies shall be grounded to their enclosures by adequate flexible ground straps.
10. Enclosures:
- a. Not less than code gage steel.
 - b. Temperature rise at hottest spot shall conform to NEMA Standards, and shall not bake and peel off the enclosure paint after the transformer has been placed in service.
 - c. Ventilation openings shall prevent accidental access to live components.
 - d. Thoroughly clean and paint at the factory with manufacturer's prime coat and standard finish.
11. Standard NEMA features and accessories including ground pad, lifting provisions and nameplate with the wiring diagram and sound level indicated on it.

12. Dimensions and configurations shall conform to the spaces designated for their installations.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation shall be in accordance with the NEC, and as shown on the drawings.
- B. Install the transformers with adequate clearance at a minimum of 100 mm (4 inches) from wall and adjacent equipment for air circulation to remove the heat produced by transformers.
- C. Install transformers on vibration pads designed to suppress transformer noise and vibrations.
- D. Use flexible metal conduit to contain the conductors from the transformer to the raceway system.

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**SECTION 16462
DISTRIBUTION SWITCHBOARDS**

PART 1 - GENERAL

1.1 DESCRIPTION:

This section specifies the furnishing, installation, and connection of the distribution switchboards.

1.2 RELATED WORK:

- A. Requirements for Seismic Restraint for Nonstructural Components:
Section 13081, SEISMIC RESTRAINT FOR NONSTRUCTURAL COMPONENTS.
- B. General electrical requirements and items that are common to more than one section of Division 16, Section 16050, BASIC METHODS AND REQUIREMENTS (ELECTRICAL)
- C. Coordination study of overcurrent protection devices: Section 16051, ELECTRICAL SYSTEM PROTECTIVE DEVICE STUDY.
- D. Conduits and outlet boxes: Section 16111, CONDUITS.
- E. Feeder busways and fittings: Section 16112, BUSWAYS.
- F. Cables and wiring: Section 16127, CABLES, LOW VOLTAGE (600 VOLTS AND BELOW)
- G. Requirements for Personnel Safety and to provide a low impedance path for possible fault currents: Section 16450, GROUNDING.

1.3 FACTORY TESTS:

- A. Design Tests: Design tests shall have been performed on a type or style of switchboard similar to that being furnished for this project. Tests shall be in accordance with NEMA PB 2 and UL 891.
- B. Production Tests: Dielectric, mechanical operation, grounding of instrument transformer cases, electrical operation and control wiring, and ground fault sensing equipment tests shall be performed on the switchboards provided for this project. Tests shall be in accordance with NEMA PB 2 and UL 891.

1.4 SUBMITTALS:

Submit in accordance with Section 16050, BASIC METHODS AND REQUIREMENTS (ELECTRICAL):

- A. Shop Drawings:
 - 1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
 - 2. Include electrical ratings, dimensions, mounting details, materials, required clearances, terminations, weight, temperature rise, wiring

and connection diagrams, plan, front, side, and rear elevations, sectional views, bus work, circuit breaker frame sizes, trip and short-circuit rating, long-time, short-time, instantaneous and ground fault settings, coordinated breaker and fuse curves, accessories, and device nameplate data.

3. Show the size, ampere rating, number of bars per phase and neutral in each bus run (horizontal and vertical), bus spacing, equipment ground bus, and bus material.

B. Manuals:

1. Submit, simultaneously with the shop drawings, companion copies of complete maintenance and operating manuals including technical data sheets, wiring diagrams, and information for ordering replacement parts.
 - a. Wiring diagrams shall have their terminals identified to facilitate installation, maintenance, and operation.
 - b. Wiring diagrams shall indicate internal wiring for each item of equipment and the interconnection between the items of equipment.
 - c. Provide a clear and concise description of operation which gives, in detail, the information required to properly operate the equipment.
 - d. Approvals will be based on complete submissions of manuals together with shop drawings.
2. Two weeks prior to final inspection, deliver four copies of the final updated maintenance and operating manuals to the Resident Engineer.
 - a. The manuals shall be updated to include any information necessitated by shop drawing approval.
 - b. Complete "As Installed" wiring and schematic diagrams shall be included which show all items of equipment and their interconnecting wiring.
 - c. Show all terminal identification.
 - d. Include information for testing, repair, trouble shooting, assembly, disassembly, and recommended maintenance intervals.
 - e. Provide a replacement parts list with current prices. Include a list of recommended spare parts, tools, and instruments for testing and maintenance purposes.

f. Furnish manuals in loose-leaf binder or manufacturer's standard binder.

C. Certifications:

1. Two weeks prior to final inspection, submit four copies of the following to the Resident Engineer:
 - a. Certification by the Contractor that the assemblies have been properly installed, adjusted and tested, including circuit breakers settings.
 - b. Certified copies of all of the factory design and production tests, field test data sheets and reports for the assemblies.

D. Manufacturer Seismic Qualification Certification: Submit certification that the switchgear, overcurrent protective devices, accessories, and components will withstand seismic forces at location being installed Include the following:

1. Basis of Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the equipment when subjected to the seismic forces as per specification Section 13081, and the unit will be fully operational after the seismic event."
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

1.5 APPLICABLE PUBLICATIONS:

Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by basic designation only.

- A. Institute of Engineering and Electronic Engineers (IEEE):
- C37.13-90.....Low Voltage AC Power Circuit Breakers Used in Enclosures
 - C37.51-89.....Test Procedures for Low-voltage AC Power Circuit Breakers Used in Enclosures.
 - C57.13-93.....Instrument Transformers
 - C62.41-91.....Surge Voltage in Low Volume AC Power Circuits

C62.45-92.....Testing for Equipment connected to Low-Voltage
AC Power Circuits

B. National Electrical Manufacturer's Association (NEMA):

PB-2-95.....Dead-Front Distribution Switchboards.

PB-2.1-96.....Instructions for Safe Handling, Installation,
Operation, and Maintenance of Switchboards

AB-1-93.....Molded Case Circuit Breakers

C. National Fire Protection Association (NFPA):

70-99.....National Electrical Code (NEC)

D. Underwriters Laboratories, Inc. (UL):

67-93.....Panelboards

489-96.....Molded Case Circuit Breakers and Circuit
Breakers Enclosures

891-98.....Dead-Front Switchboards

1283-98.....Electromagnetic Interference Filters

1449-96.....Transit Voltage Surge Suppressors

PART 2 - PRODUCTS

2.1 GENERAL:

- A. Switchboards shall be in accordance with UL, NEMA, NEC, IEEE, and as shown on the drawings.
- B. Switchboards shall be provided complete, ready for operation including, but not limited to housing, buses, circuit breakers, instruments and related transformers, fuses, and wiring.
- C. Switchboard dimensions shall not exceed the space provided as shown on the drawings.
- D. Manufacturer's nameplate shall include complete ratings of switchboard in addition to date of manufacture.

2.2 BASIC ARRANGEMENT:

- A. Type I: Switchboard shall be front accessible with the following features:
 - 1. Device mounting:
 - a. Main breaker: Individually mounted and compartmented or group mounted with feeder breakers.
 - b. Feeder breakers: Group mounted.
 - 2. Section alignment: As shown on the drawings.
 - 3. Accessibility:
 - a. Main section line and load terminals: Front and side.

- b. Distribution section line and load terminals: Front.
- c. Through bus connections: Front and end.
- 4. Bolted line and load connections.
- 5. Full height wiring gutter covers for access to wiring terminals.
- 6. Short Circuit Current Rating: 22,000 amperes rms symmetrical, minimum, or as shown on the drawings, whichever is higher.

2.3 HOUSING:

- A. Provide a completely enclosed, free standing, steel enclosure not less than the gage required by the ANSI and UL standards. The enclosure is to consist of the required number of vertical sections bolted together to form one metal enclosed rigid switchboard. The sides, top and rear shall be covered with removable screw on sheet steel plates.
- B. Provide ventilating louvers where required to limit the temperature rise of current carrying parts. All openings shall be protected against entrance of falling dirt, water, or foreign matter.
- C. Group the meters and their control switches on a hinged front cover. Provide concealed hinges and latch.
- D. Enclosure shall be thoroughly cleaned, phosphate treated, and primed with rust-inhibiting paint. Final finish coat to be the manufacturers standard gray. Provide a quart of finish paint for touch-up purposes.

2.4 BUSES:

- A. General: Buses shall be arranged for 3 phase, 4 wire distribution. Main phase buses (through bus), full size neutral bus, and ground bus shall be full capacity the entire length of the switchboard. Provide for future extensions by means of bolt holes or other approved method. Brace the bus to withstand the available short circuit current at the particular location and as shown on the drawings. No magnetic material shall be used between buses to form a magnetic loop.
- B. Material and Size: Buses and connections shall be hard drawn copper of 98 percent conductivity or high strength tin plated aluminum. Bus temperature rise shall not exceed 65 degrees C (149 degrees F). Section busing shall be sized based on UL and NEMA Switchboard Standards.
- C. Bus Connections: All contact surfaces of copper or aluminum shall be plated. Provide a minimum of two plated bolts per splice. Where physical bus size permits only one bolt, provide a means other than friction to prevent turning, twisting or bending. Make connections for aluminum bus with plated nuts and bolts with a flat plated steel washer

against the bus and a bellville washer between the flat washer and nut.
Torque bolts to the manufacturer's recommended values.

- D. Neutral Bus: Provide bare or plated bus and mount on insulated bus supports. Provide neutral disconnect link to permit isolation of neutral bus from the common ground bus and service entrance conductors.
- E. Ground Bus: Provide an uninsulated 6 mm by 50 mm (1/4 inch by 2 inch) copper or equivalent aluminum equipment ground bus bar sized per UL 891 the length of the switchboard and secure at each section.
- F. Main Bonding Jumper: Connect an uninsulated 6 mm by 50 mm (1/4 inch by 2 inch) copper bus between the neutral and ground buses to establish the system common ground point.

2.5 INTERNALLY INTEGRATED SURGE PROTECTIVE DEVICES (TVSS) :

A. Integral Surge Suppressor:

- 1. SPD (Surge Protective Devices) shall be Component Recognized and listed in accordance with UL 1449 Second Edition to include Section 37.3 highest fault category testing on devices intended for service entrance use. SPD shall also be UL 1283 listed.
- 2. SPD shall be UL 67 listed, installed by and shipped from the electrical distribution equipment manufacturer's factory.
- 3. SPD shall provide surge current diversion paths for all modes of protection; L-N, L-G, N-G, in WYE systems, and L-L, L-G in DELTA systems.
- 4. SPD shall be modular in design. Each mode shall be fused with a 200kAIC, UL recognized surge rated fuse and incorporate a thermal cutout device.
- 5. SPD shall be integrally mounted to the bus bars of the switchboard.
- 6. Audible diagnostic monitoring shall be by way of audible alarm. This alarm shall activate upon a fault condition. An alarm on/off switch shall be provided to silence the alarm. An alarm push to test switch shall be provided as well.
- 7. SPD shall meet or exceed the following criteria:
 - a. Maximum surge current capability (single pulse rated) per phase shall be:
 - 1) Service Entrance Switchboard 240 kA.
 - 2) Distribution Panelboards 160 kA
 - 3) Branch Panelboards 160 kA
 - 4) Service Entrance MCC 240 kA specified.

5) Distribution Class MCC 160 kA

- b. UL 1449 Second Edition Listed and Recognized Component Suppression Voltage Ratings (SVR's) for Service Entrance and Distribution Location equipment shall not exceed the following:

VOLTAGE	L-N	L-G	N-G
280Y/120	400V	400V	400V
480Y/277	700V	700V	700V

8. SPD shall have a minimum EMI/RFI filtering of -50Db at 100 kHz with an insertion ration of 50:1 using MIL-STD-220A methodology.
9. SPD shall be provided with 1 set of NO/NC dry contacts.
10. SPD shall have a warranty for a period of five years, incorporating unlimited replacements of suppressor parts if they are destroyed by transients during the warranty period. Warranty shall be the responsibility of the electrical distribution equipment manufacturer and shall be supported by their respective field service division.

2.6 NAMEPLATES AND MIMIC BUS:

- A. Nameplates: Provide laminated black phenolic resin with white core with 6 mm (1/4 inch) high engraved lettered nameplates for each circuit breaker (switch) to indicate the feeder, panelboards and equipment served. Mount, with plated screws, on front of the breaker.
- B. Mimic Bus: Provide an approved mimic bus on the front of the switchboard. Color to be blue (480Y/277 volt) or black (208Y/120 volt), either factory painted, plastic, or metal strips. Plastic tape shall not be used. Use symbols similar to a one line diagram. (Refer to drawings). Plastic or metal strips shall be mounted with plated screws.

2.7 METERS AND INSTRUMENT TRANSFORMERS:

- A. Instrument Transformers: IEEE C57.13, and the following:
1. Potential Transformers: Secondary voltage rating of 120 V and NEMA accuracy class of 0.3 with burdens of W, X, and Y.
 2. Current Transformers: Ratios shall be as indicated with accuracy class and burden suitable for connected relays, meters, and instruments.
- B. Power Circuit Monitoring and Control System: The Power Circuit Monitor shall be multi-function, digital instrumentation, data acquisition and

control device and metered over 50 values plus extensive Min/Max data can be viewed on the six-digit LED display. Each Circuit Monitor shall offer true RMS metering and RS-485 communications standard. Provide 0.2% accuracy true RMS metering and other powerful features such as automatic relay control, waveform capture, on-board event and data logging, and programmable logic for special applications like custom data logging and control function. On-board memory can be expanded to add 512 K or 1024K. Provide input/output modules, provide status inputs, a pulse output, relay outputs and analog inputs and outputs.

1. Power Circuit Monitor shall be

- a. Certified ANSI C12.16 revenue accuracy
- b. True RMS Metering through the 31st harmonic
- c. High accuracy: 0.2% on current and voltage
- d. Power quality readings displayed: THD and K-Factor
- e. Harmonic Analysis Data through 63rd harmonic
- f. Automatic Alarm/Relay control
- g. On-board event and data logging
- h. Waveform capture
- i. UL listed, CSA Approved, CE Marketing, NOM Approved
- j. MV-90 compatible

G. Recording Demand Meter: Usable as totalizing relay or as indicating and recording maximum-demand meter with 15-minute interval. Meter shall count and control a succession of pulses entering two channels. House in drawout, back-connected case arranged for semiflush mounting.

2.7 PROVISION FOR FUTURE:

Where "provision for", "future", or "space" is noted on drawings, the space shall be equipped with bus connections to the future overcurrent device with suitable insulation and bracing to maintain proper short circuit rating and physical clearance. Provide buses for the ampere rating as shown for the future device.

2.8 BREAKER REMOVAL EQUIPMENT:

Where draw out circuit breakers are provided, furnish a portable elevating carriage or switchboard mounted device for installation and removal of the breakers.

2.9 CONTROL WIRING:

Control wiring shall be 600 volt class B stranded SIS. Install all control wiring complete at the factory adequately bundled and

protected. Wiring across hinges and between shipping units shall be Class C stranded. Size in accordance with NEC. Provide control circuit fuses.

2.10 MAIN CIRCUIT BREAKERS:

- A. Type I Switchboard: Provide UL listed and labeled molded case circuit breakers in accordance with NEC and as shown on the drawings. Circuit breakers shall be the solid state adjustable trip type.
 - 1. Trip units shall have field adjustable tripping characteristics as follows:
 - a. Ampere setting (continuous).
 - b. Long time band.
 - c. Short time trip point.
 - d. Short time delay.
 - e. Instantaneous trip point.
 - f. Ground fault trip point.
 - g. Ground fault trip delay.
 - 2. Trip settings shall be as indicated on the drawings. Final settings shall be as shown on the electrical system protective device study.
 - 3. Breakers which have same rating shall be interchangeable with each other.

2.11 FEEDER CIRCUIT BREAKERS:

- A. Provide UL listed and labeled molded case circuit breakers, in accordance with the NEC, as shown on the drawings, and as herein specified.
- B. Non-adjustable Trip Molded Case Circuit Breakers:
 - 1. Molded case circuit breakers shall have automatic, trip free, non-adjustable, inverse time, and instantaneous magnetic trips for 100 ampere frame size or less. Magnetic trip shall be adjustable from 3X to 10X for breakers with 600 ampere frame size and higher. Factory setting shall be LOW unless otherwise noted.
 - 2. Breaker features shall be as follows:
 - a. A rugged, integral housing of molded insulating material.
 - b. Silver alloy contacts.
 - c. Arc quenchers and phase barriers for each pole.
 - d. Quick-make, quick-break, operating mechanisms.

- e. A trip element for each pole, thermal magnetic type with long time delay and instantaneous characteristics, a common trip bar for all poles and a single operator.
- f. Electrically and mechanically trip free.
- g. An operating handle which indicates ON, TRIPPED and OFF positions.
- h. Line and load connections shall be bolted.
- i. Interrupting rating shall not be less than the maximum short circuit current available at the line.
- j. An overload on one pole of a multipole breaker shall automatically cause all the poles of the breaker to open.

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. Install switchboards in accordance with the NEC, as shown on the drawings, and as recommended by the manufacturer.
- B. Anchor switchboards to the floor with plated with 12.5 mm (1/2 inch) minimum anchor bolts as recommended by the manufacturer. Anchor the switchboards on two 100 mm (4 inch) minimum channel iron sills with plated 12.5 mm (1/2 inch) bolts. Furnish sills to suit the switchboards. Coordinate installation of sills with concrete pour of floor. Sills shall be level and grouted flush with floor.

3.2 INSTRUCTIONS

Furnish the services of a competent instructor for one 4 hour period for instructing personnel in the operation and maintenance of the switchboard on the date requested by the Resident Engineer.

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**SECTION 16510
BUILDING LIGHTING, INTERIOR**

PART 1 - GENERAL

1.1 DESCRIPTION

This section includes the furnishings, installation of and connection of the interior lighting.

1.2 RELATED WORK

- A. Section 16050, BASIC METHODS AND REQUIREMENTS (ELECTRICAL).
- B. Section 16127, CABLES, LOW VOLTAGE (600 VOLTS AND BELOW).
- C. Section 16140, WIRING DEVICES.
- D. Section 16450, GROUNDING.

1.3 QUALITY ASSURANCE

- A. Refer to Paragraph, QUALIFICATIONS, in Section 16050, BASIC METHODS AND REQUIREMENTS (ELECTRICAL).
- B. Refer to Paragraph, GUARANTY, in Section 01001, GENERAL CONDITIONS.

1.4 SUBMITTALS

Submit in accordance with section 01340, SAMPLES AND SHOP DRAWINGS, the following:

- A. Shop Drawings:
 - 1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
 - 2. Include electrical ratings, dimensions, mounting details, materials, required clearances, terminations, wiring and connection diagrams, photometric data, ballasts, lenses, louvers, lamps, and controls.
 - 3. When catalog data and/or shop drawings for fluorescent fixtures are submitted for approval, photometric data from an independent testing laboratory shall be included with the submittal, indicating average brightness and efficiency of the fixture, as specified in specification or as shown on the drawings. Coefficient of utilization data will not be considered a suitable substitute.
- B. Samples:
 - 1. Concurrently with the shop drawings and catalog cuts deliver to the Resident Engineer a sample of each lighting fixture types: PF4 for approval. The approved samples shall be installed in the location

directed by the Resident Engineer and shall be removed, repackaged and turned over to the Resident Engineer after final inspection.

C. Manuals:

1. Complete operating and maintenance manuals shall be provided, including technical data sheets, and information for ordering replacement parts. Deliver four copies of the above data to the Resident Engineer prior to final inspection.

D. Certifications: Two weeks prior to final inspection, deliver to the Resident Engineer four copies of the following certifications:

1. Certification that the equipment has been properly installed, adjusted, and tested.
2. Include with shop drawings, certification from the manufacturers that all electronic high-frequency ballasts meet the transient protection required by ANSI C62.41, Cat. A.

1.5 APPLICABLE PUBLICATIONS

The publications listed below form a part of this specification to the extent referenced. The issue in effect listed below (including amendments, addenda, revisions, supplements, and errata) on the date of Invitation for Bids shall be applicable. The publications are referenced in the text by designation only.

A. American National Standards Institute (ANSI):

- C62.41-91.....IEEE Recommended Practice on Surge Voltage in Low Voltage AC Power Circuits
- C78.1-91.....Fluorescent Lamps - Rapid-Start Types - Dimensional and Electrical Characteristics
- C78.2-91.....Fluorescent Lamps - Preheat-Start Types - Dimensional and Electrical Characteristics
- C78.3-91.....Fluorescent Lamps - Instart Start and Cold-Cathode Types - Dimensional and Electrical Characteristics
- C78.376-91.....Chromaticity of Fluorescent Lamps
- C82.1-85.....Ballasts for Fluorescent Lamps - Specifications
- C82.2-84.....Fluorescent Lamp Ballasts - Methods of Measurement
- C82.4-92.....Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps
- C82.11-93.....High-Frequency Fluorescent Ballasts

- B. Certified Ballast Manufacturers Association (CBM):
Requirements for Ballast Certification.
- C. National Fire Protection Association (NFPA):
70-96.....National Electrical Code (NEC)
101-97.....Code for Safety to Life from Fire in Buildings
and Structures
- D. National Electrical manufacturer's Association (NEMA)
270-88.....Procedure for Fluorescent/Lamp/Ballast/Fixture
Performance Comparison
- E. Underwriters Laboratories, Inc. (UL):
496-96.....Edison-Base Lampholders
542-94.....Lampholders, Starters, and Starter Holders for
Fluorescent Lamps
844-95.....Electrical Lighting Fixtures for Use in
Hazardous (Classified) Locations
924-95.....Safety Emergency Lighting and Power Equipment
935-95.....Fluorescent-Lamp Ballasts
1029-94.....High-Intensity-Discharge Lamp Ballasts
1570-95.....Fluorescent Lighting Fixtures
1571-95.....Incandescent Lighting Fixtures
1572-95.....High Intensity Discharge Lighting Fixtures
- F. FEDERAL COMMUNICATIONS COMMISSION (FCC):
Code of Federal Regulations (CFR), Title 47, Part 18

PART 2 - PRODUCTS

2.1 LIGHTING FIXTURES

- A. Shall be in accordance with NFPA 70, UL1570, UL1571, UL1572, and shall be as shown on drawings and as specified.
- B. Sheet Metal:
 - 1. Shall be formed to prevent warping and sagging. Housing, trim and lens frame shall be true, straight (unless intentionally curved), and parallel to each other as designed.
 - 2. Wireways and fittings shall be free of burrs and sharp edges and shall accommodate internal and branch circuit wiring without damage to the wiring.
 - 3. Where lighting fixtures are detailed with minimum 20 gauge housing, minimum 22 gauge housings will be acceptable provided they have

- strengthening embossed rib and break formations, which give the equivalent rigidity of a 20 gauge housing.
4. When installed, any exposed fixture housing surface, trim frame, door frame and lens frame shall be free of light leaks; lens doors shall close in a light tight manner.
 5. Hinged door closure frames shall operate smoothly without binding when the fixture is in the installed position, and latches shall function easily by finger action without the use of tools.
- C. Ballasts shall be serviceable while the fixture is in its normally installed position, and shall not be mounted to removable reflectors or wireway covers unless so specified.
- D. Lamp Sockets:
1. Fluorescent: Lampholder contacts shall be the biting edge type or phosphorous-bronze with silver flash contact surface type and shall conform to the applicable requirements of UL 542. Contacts for recessed double contact lampholders and for slimline lampholders shall be silver plated. Lampholders for bi-pin lamps, with the exception of those for "U" type lamps, shall be of the telescoping compression type, or of the single slot entry type requiring a one-quarter turn of the lamp after insertion.
 2. Incandescent: Shall have porcelain enclosures and conform to the applicable requirements of UL 496.
 3. High Intensity Discharge (H.I.D.): Shall have porcelain enclosures.
- E. Recessed incandescent fixtures mounted in an insulated ceiling shall be listed for use in insulated ceilings.
- F. Fluorescent fixtures with louvers or light transmitting panels shall have hinges, latches and safety catches to facilitate safe, convenient cleaning and relamping. Vaportight fixtures shall have pressure clamping devices in lieu of the latches.
- G. Mechanical Safety: Lighting Fixture closures (lens doors, trim frame, hinged housings, etc.) shall be retained in a secure manner by captive screws, chains, captive hinges or fasteners such that they cannot be accidentally dislodged during normal operation or routine maintenance.
- H. Metal Finishes:
1. The manufacturer shall apply his standard finish (unless otherwise specified) over a corrosion resistant primer, after cleaning to free the metal surfaces of rust, grease, dirt and other deposits. Edges

- of pre-finished sheet metal exposed during forming, stamping or shearing processes shall be finished in a similar corrosion resistant manner to match the adjacent surface(s). Fixture finish shall be free of stains or evidence of rusting, blistering, or flaking.
2. Interior light reflecting finishes shall be white with not less than 85 percent reflectances, except where otherwise shown on the drawing.
 3. Exterior finishes shall be as shown on the drawings.
- I. Provide all lighting fixtures with a specific means for grounding their metallic wireways and housings to an equipment grounding conductor.
- J. Light Transmitting Components for Fluorescent Fixtures:
1. Shall be 100 percent virgin acrylic plastic or water white, annealed, crystal glass.
 2. Flat lens panels shall have not less than 3.2 mm (1/8 inch) of average thickness. The average thickness shall be determined by adding the maximum thickness to the minimum unpenetrated thickness and dividing the sum by 2.
 3. Unless otherwise specified, lenses, diffusers and louvers shall be retained firmly in a metal frame by clips or clamping ring in such a manner as to allow expansion and contraction of the lens without distortion or cracking.
- K. Lighting Fixtures in Hazardous Areas: Fixtures shall be suitable for installation in flammable atmospheres (Class and Group) as defined in NFPA 70 and shall comply with UL844.
- L. Compact Fluorescent Fixtures shall be manufactured specifically for compact fluorescent lamps with ballasts integral to the fixture. Assemblies designed to retrofit incandescent fixtures are prohibited except when specifically indicated for renovation of existing fixtures. Fixtures shall be designed for lamps as specified.

2.2 FLUORESCENT LAMP BALLASTS

- A. Where applicable, fluorescent lamps and ballasts shall comply with the National Energy Policy Act of 1992.
- B. Ballasts shall comply with ANSI 82.1, 82.2 and 82.11, NFPA 70, and UL935 unless otherwise specified.
- C. Lamp types F32T8 and F32T8/U shall be operated by electronic, high frequency ballasts. All other fluorescent lamp types shall be operated

by the standard energy saving electromagnetic core-and-coil ballasts. For these applications, the lamps shall be operated by core-and-coil ballasts where specifically required on the drawings as "core-and-coil".

D. Electronic high-frequency ballasts:

1. Ballasts shall operate the lamps at a frequency between 20 and 60 KHz from an input frequency of 60Hz.
2. Ballast package:
 - a. Size: The ballast case shall be sized to be physically interchangeable with standard core and core ballasts and suitable for standard mounting in new or existing lighting fixtures.
 - b. Case marking: Mark the ballast to indicate the required supply voltage, frequency, RMS current, current surge during starting, input watts, and power factor at the design center voltage, open circuit voltage, crest factor and efficacy.
3. Performance:
 - a. Light output:
 - 1) At the design voltage, the light output shall be at least equal to that obtained by a core-and-coil ballasted system meeting ANSI and CBM standards. The comparison test shall be measured in the same fixture at 25 degrees C (plus or minus one degree) ambient room temperature.
 - 2) Tests shall be made in fixtures designed only for the number of lamps being tested.
 - 3) For other applications (higher ambients, etc.) the tests should be operated with equivalent lamp wall temperatures plus or minus 4 degrees C.
 - b. Efficacy: The efficacy of the high-frequency, electronically ballasted system shall be at least 15 percent greater than the equivalent CBM core-and-coil ballasted system (see "Light output" above).
 - c. Starting: The ballast shall be capable of starting and maintaining operation of lamps at an ambient temperature of 10 degrees C (50 degree F) or more for an input voltage of plus or minus 10 percent about the center design voltage unless otherwise indicated. The ballast shall never be started in the instant start mode at any temperature.

- d. Operation:
 - 1) The ballast shall safely and reliably operate in a room ambient temperature from 10 degrees C (50 degree F) to 40 degrees C (105 degree F).
 - 2) The light output shall not vary by more than plus or minus 5 percent for a plus or minus 10 percent variation of the input voltage about the center design voltage. Light output shall remain constant for a plus or minus 5 percent variation of the input voltage.
 - 3) The ballast shall operate the lamps in a manner that will not adversely curtail the normal life of the lamp.
 - e. Transient protection: The ballast shall comply with ANSI C62.41, Cat. A.
 - f. Flicker: The flicker shall be less than 5 percent and without visible flicker.
 - g. Noise: The audible noise levels should be equivalent to or better than the Class A rating of CBM certified ballasts.
 - h. Electromagnetic Interference (EMI) and Radio Frequency Interference (RFI): The EMI and RFI limits shall meet the requirements of the Federal Communications Commission Rules and Regulations (CFR47 Part18).
 - i. Rated life: The ballast shall have a rated life of 10 years or 30,000 hours (based on a 10 hour day).
 - j. The two lamp ballast shall safely operate two F32T8 RS, 32 watt lamps or two F32T8/U lamps. The single lamp ballast shall safely operate one F32T8 RS, 32 watt lamp or one F32T8/U lamp.
 - k. Power factor: Not less than 95 percent.
 - l. Reliability:
 - 1) Labels: Ballasts must be labeled or listed by UL and CBM-ETL.
 - 2) Submit, simultaneously with shop drawings, a certified test report by an independent testing laboratory showing that the electronic ballasts meet or exceed all the performance requirements in this specification.
 - m. Total harmonic distortion (THD) shall be less than 10 percent.
- E. Core and coil ballasts (for lamps other than F32T8 and F32T8/U or where shown on drawings as "core and coil".):
- 1. Shall be rapid starting type.

2. Shall comply with ANSI 82.1 and UL935.
 3. Shall be UL Class P with automatic-resetting, internal, thermal protection.
 4. Shall conform to CBM-ETL label requirements.
 5. Power factor shall be not less than 95 percent. Capacitors in ballasts shall not contain PCB (Polychlorinated Biphenyl) fluids or other fluids recognized as hazardous when discharged into the environment.
 6. Sound ratings shall be Class A or better, except for ballast sizes which are not available with Class A ratings, as standard products from any manufacturer. Ballasts which are not available with Class A ratings shall have the quietest ratings available.
 7. Where core and coil ballasts are specified or detailed in lieu of the normally required electronic high-frequency types, two lamp ballasts shall be energy-saving type, UL listed to operate F40T12 rapid start lamps for both standard 40 watt lamps and the reduced wattage 35/34 watts energy-saving lamps. Lamp output shall be within 5 percent of nominal rating. When operating energy-saving lamps, the input watts to the ballast shall not exceed 78 watts at 120 V.A.C. or 79 watts at 277 V.A.C. Energy-saving type ballasts should not be used in ambient temperatures below manufacturer's recommendations.
- F. Ballasts for lighting fixtures controlled by dimming devices shall be the electronic, high frequency type as specified herein, equipped for dimming and conform to the recommendations of the manufacturer of the associated dimming devices to assure satisfactory operation of the lighting system.
- G. All ballasts serving straight or "U" type lamps shall be mounted by four non-turning studs (or captive bolts) equipped with lock washers and nuts or locking type nuts, or by four thread cutting (TC) sheet metal screws which are firmly secured against the fixture body (or wireway) to maximize dissipation of heat and minimize noise. Exception: electronic high-frequency ballasts may be mounted at a minimum of two points, one at each end of unit.
- H. Ballasts shall be serviceable while the fixture is in its normally installed position, and shall not be mounted to removable reflectors or wireway covers unless so specified.

- I. To facilitate multi-level lamp switching, lamps within fixture shall be wired with the outermost lamp at both sides of the fixture on the same ballast, the next inward pair on another ballast and so on to the innermost lamp (or pair of lamps). Within a given room, each switch shall uniformly control the same corresponding lamp (or lamp pairs) in all fixture units that are being controlled.
- J. Where three-lamp fixtures are indicated, unless switching arrangements dictate otherwise, utilize a common two-lamp ballast to operate the center lamp in pairs of adjacent units that are mounted in a continuous row. The ballast fixture and slave-lamp fixture shall be factory wired with leads or plug devices to facilitate this circuiting. Individually mounted fixtures and the odd fixture in a row shall utilize a single-lamp ballast for operation of the center lamp.

2.3 BALLASTS FOR HIGH INTENSITY DISCHARGE FIXTURES:

- A. Shall comply with ANSI 82.4 and UL1029.
- B. Shall have individual overcurrent protection sized in accordance with the manufacturer's recommendations.
- C. Shall have integral thermal protection where the fixture is recessed in an interior ceiling.
- D. Shall be the constant wattage, high power factor type or the reactor high power factor type. Capacitors shall not contain PCB (Polychlorinated Biphenyl) fluids or other fluids recognized as hazardous when discharged into the environment.
- E. Shall have not less than Class B sound ratings for interior fixtures, when available. Ballasts which are not available with Class B ratings shall be of the next standard rating.

2.4 LAMPS

- A. Fluorescent Lamps:
 - 1. Rapid start fluorescent lamps shall comply with ANSI C78.1; preheat-start type shall comply with ANSI C78.2; and instant-start and cold-cathode lamps shall comply with ANSI C78.3.
 - 2. Chromacity of fluorescent lamps shall comply with ANSI C78.376.
 - 3. The lamps shall include the F32T8, F32T8/U 32 watt energy saving type and EPACT approved F40T12 type if specifically required by contract drawings for special applications.

4. Except as indicated below, lamps shall be energy saving type, have a color temperature of 4100°K, a Color Rendering Index (CRI) of not less than 75, and an initial lumen output not less than 2800. "U" tube lamps shall have the same color temperature and CRI limits as the above.
 - a. In utility areas (Mechanical, Telephone and Electrical Service rooms and closets), maintenance closets and non-medical storage spaces, utilize energy saving light-white lamps.
 - b. In areas with ambient temperatures below 60 degrees use the 40 watt version of the lamp above.
 - c. Over the beds in Intensive Care, Coronary Care, Recovery, Life Support, and Observation and Treatment areas; Electromyographic, Autopsy (Necropsy), Surgery, and certain dental rooms (Examination, Oral Hygiene, Oral Surgery, Recovery, Labs, Treatment, and X-Ray) use color corrected lamps having a CRI of 90 or above and a correlated color temperature between 5000 and 6000°K.
 - d. Other areas as indicated on the drawings.
- B. Incandescent lamps shall be the general service, inside frosted type rated 130 volts except where otherwise shown on the drawings.
- C. High Intensity Discharge Lamps:
 1. Mercury vapor lamps shall be ANSI type "DX". Lamps in open or louvered fixtures mounted less than 4500 mm (15 feet) above the finished floor (or grade) shall be of the safety type in which the arc will automatically extinguish if the outer glass envelope becomes broken.
 2. Multi-vapor lamps shall be as defined on the detail drawings.
 3. High pressure sodium lamps shall be as defined on the detail drawings.
- D. Compact Fluorescent Lamps: Shall have a 4100°K color temperature, 10,000 hours average rated life, and as follows:
 - 1.2 T4, triple tube, rated 26-watts/1800 initial lumens, 32-watts/2400 initial lumens, & 42-watts, 3200 initial lumens.

2.7 RADIO-INTERFERENCE-FREE FLUORESCENT FIXTURES

- A. Shall be specially designed for suppressing radio-frequency energy produced within the fixtures. The Rules and Regulations of FCC (CFR, Part 18) shall apply.
- B. Lenses shall have a light-transparent layer of metal permanently bonded to them, and in positive contact with the steel housing or equal to prevent the radio-frequency interferences from passing through the lenses. The effective light transmittance of the lenses shall be not less than 75 percent.
- C. Install line filters within the body of the fixtures and wired in series with the supply circuit conductors to eliminate the transmission of radio frequency energy into the supply circuit.

2.9 X-RAY FILM ILLUMINATORS

- A. Shall be the high-intensity type, flush-mounted in the walls. Multiples of the basic unit may be combined in a common housing.
- B. Shall have the following features:
 - 1. Fluorescent lighting, designed to provide uniform diffusion of the light.
 - 2. Box dimensions approximately 525 mm (21 inches) high, 350 mm (14 inches) wide and 100 mm (4 inches) deep.
 - 3. Frame shall be satin chrome-plated brass or stainless steel and shall extend approximately 40 mm (1-1/2 inches) from the edges of the box.
 - 4. Viewing glass shall be the heat resistant, borosilicate type or 100 percent virgin acrylic plastic and not less than 3 mm (1/8 inch) thick.
 - 5. Viewing glass shall have adequate dimensions so the films will not overlap the frame and will be positioned with respect to the light source for even illumination without shadows.
 - 6. An ON-OFF switch.
 - 7. Power supply voltage shall be 120 volts, 60 Hz.
- C. Fluorescent lamps shall be the cool-white, rapid-start type.
- D. Ballast shall be low leakage type with leakage not exceeding 30 microamperes.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation shall be in accordance with the NEC, manufacturer's instructions and as shown on the drawings or specified.
- B. Align, mount and level the lighting fixtures uniformly.
- C. Avoid interference with and provide clearance for equipment. Where the indicated locations for the lighting fixtures conflict with the locations for equipment, change the locations for the lighting fixtures by the minimum distances necessary as approved by the Resident Engineer.
- D. For suspended lighting fixtures, the mounting heights shall provide the clearances between the bottoms of the fixtures and the finished floors as shown on the drawings.
- E. Fluorescent bed light fixtures shall be attached to studs in the walls.
- F. Lighting Fixture Supports:
 - 1. Shall provide support for all of the fixtures. Supports may be anchored to channels of the ceiling construction, to the structural slab or to structural members within a partition, or above a suspended ceiling.
 - 2. Shall maintain the fixture positions after cleaning and relamping.
 - 3. Shall support the lighting fixtures without causing the ceiling or partition to deflect.
 - 4. Hardware for recessed lighting fixtures:
 - a. All fixture mounting devices connecting fixtures to the ceiling system or building structure shall have a capacity for a horizontal force of 100 percent of the fixture weight and a vertical force of 400 percent of the fixture weight.
 - b. Mounting devices shall clamp the fixture to the ceiling system structure (main grid runners or fixture framing cross runners) at four points in such a manner as to resist spreading of these supporting members. Each support point device shall utilize a screw or approved hardware to "lock" the fixture housing to the ceiling system, restraining the fixture from movement in any direction relative to the ceiling. The screw (size No. 10 minimum) or approved hardware shall pass through the ceiling member (T-bar, channel or spline), or it may extend over the

inside of the flange of the channel (or spline) which faces away from the fixture, in a manner which prevents any fixture movement.

- c. In addition to the above, the following is required for fixtures exceeding 9 kg (20 pounds) in weight. Note: Ceiling types are defined in ASTM Standard C635-69.
 - 1) Where fixtures mounted in "Intermediate" and "Heavy Duty" ceilings weigh between 9 kg and 25 kg (20 pounds and 56 pounds) provide two 12 gauge safety hangers hung slack between diagonal corners of the fixture and the building structure.
 - 2) Where fixtures weigh over 25 kg (56 pounds) they shall be independently supported from the building structure by approved hangers. Two-way angular bracing of hangers shall be provided to prevent lateral motion.
 - d. Where ceiling cross runners are installed for support of lighting fixtures, they must have a carrying capacity equal to that of the main ceiling runners and be rigidly secured to the main runners.
5. Surface mounted lighting fixtures:
- a. Fixtures shall be bolted against the ceiling independent of the outlet box at four points spaced near the corners of each unit. The bolts (or stud-clips) shall be minimum 6 mm (1/4-20) bolt, secured to main ceiling runners and/or secured to cross runners. Non-turning studs may be attached to the main ceiling runners and cross runners with special non-friction clip devices designed for the purpose, provided they bolt through the runner, or are also secured to the building structure by 12 gauge safety hangers. Studs or bolts securing fixtures weighing in excess of 25 kg (56 pounds) shall be supported directly from the building structure.
 - b. Where ceiling cross runners are installed for support of lighting fixtures they must have a carrying capacity equal to that of the main ceiling runners and be rigidly secured to the main runners.
 - c. Fixtures less than 6.8 kg (15 pounds) in weight and occupying less than 600 mm x 600 mm (two square feet) of ceiling area may, (when designed for the purpose) be supported directly from the outlet box when all the following conditions are met.
 - 1) Screws attaching the fixture to the outlet box pass through round holes (not key-hole slots) in the fixture body.

- 2) The outlet box is attached to a main ceiling runner (or cross runner) with approved hardware.
- 3) The outlet box is supported vertically from the building structure.
- d. Fixtures mounted in open construction shall be secured directly to the building structure with approved bolting and clamping devices.
6. Single or double pendent-mounted lighting fixtures:
 - a. Each stem shall be supported by an approved outlet box, mounted swivel joint and canopy which holds the stem captive and provides spring load (or approved equivalent) dampening of fixture oscillations. Outlet box shall be supported vertically from the building structure.
7. Outlet boxes for support of lighting fixtures (where permitted) shall be secured directly to the building structure with approved devices or supported vertically in a hung ceiling from the building structure with a nine gauge wire hanger, and be secured by an approved device to a main ceiling runner or cross runner to prevent any horizontal movement relative to the ceiling.
- G. Furnish and install the specified lamps for all lighting fixtures installed and all existing lighting fixtures reinstalled under this project.
- H. Coordinate between the electrical and ceiling trades to ascertain approved lighting fixtures are furnished in the proper sizes and installed with the proper devices (hangers, clips, trim frames, flanges), to match the ceiling system being installed.
- I. Bond lighting fixtures and metal accessories to the grounding system as specified in Section 16450, GROUNDING.
- J. At completion of project, relamp all fixtures which have failed/burned-out lamps. Clean all lenses, diffusers and louvers which have accumulated dust/dirt during construction.

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**SECTION 16670
LIGHTNING PROTECTION SYSTEM**

PART 1 - GENERAL

1.1 DESCRIPTION

This section includes the design, furnishing and installation of a complete master labeled lightning protection system, complying with UL 96, UL 96A and NFPA 780.

1.2 RELATED WORK

- A. Section 16050, BASIC METHODS AND REQUIREMENTS (ELECTRICAL).
- B. Section 16450, GROUNDING.

1.3 SUBMITTALS

Submit the following in accordance with Section 01340, SAMPLES AND SHOP DRAWINGS and Section 16050, BASIC METHODS AND REQUIREMENTS:

- A. Shop Drawings:
 - 1. Isometric and plan views showing layout and connections to the required metal surfaces.
 - 2. Show the methods of mounting the system to the adjacent construction.
- B. Qualifications: Submit proof that the installer of the lightning protection system has had suitable and adequate experience installing other lightning protection systems, and is capable of installing the system as recommended by the manufacturer of the equipment.
- C. Certification: Two weeks prior to final inspection, deliver to the Resident Engineer four copies of the certification that the installed lightning protection system has been inspected by a UL representative and has been approved by UL without variation.

1.4 APPLICABLE PUBLICATIONS

The publications listed below form a part of this specification to the extent referenced. The issue in effect listed below (including amendments, addenda, revisions, supplements, and errata) on the date of Invitation for Bids shall be applicable. The publications are referenced in the text by designation only.

- A. National Fire Protection Association (NFPA):
 - 70-99.....National Electrical Code (NEC)
 - 780-97.....Standard for the Installation of Lightning Protection Systems

- B. Underwriters Laboratories, Inc. (UL):
 - 96-94.....Standard for Lightning Protection Components
 - 96A-94.....Installation Requirements for Lightning
Protection Systems

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Attach master labels "A" or "B" to each item by its manufacturer as evidence that the materials have been manufactured in conformance with the UL Standards for master label lightning protection materials.
- B. In addition to conformance to UL 96, the component material requirements are as follows:
 - 1. Conductors: Electrical grade copper.
 - 2. Air terminals: Solid copper, not less than 9 mm (3/8 inch) diameter, with sharp nickel-plated points.
 - 3. Ground rods: Copper clad steel, not less than 13 mm (1/2 inch) diameter by 2400 mm (8 feet) long.
 - 4. Ground plates: Solid copper, not less than 2 mm (1/16 inch) thick.
 - 5. Tubing: Stiff copper or brass.
- C. Anchors and fasteners: Bolt type which are most suitable for the specific anchor and fastener installations.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install the conductors as inconspicuously as practical and with the proper bends.
- B. Install the vertical conductors within the concealed cavity of exterior walls. Run the conductors to the exterior at elevations below the finished grade and make the ground connections to the earth outside of the building or stack perimeter.
- C. Make connections of dissimilar metal with bimetallic type fittings to prevent electrolytic action.
- D. Use the exothermic welding type connections which form solid metal joints in the main vertical and horizontal conductors, and for connections that are not exposed in the finish work.
- E. Protect copper conductors with stiff copper or brass tubing, which enclose the conductors from the top to the bottom of the tubing, between 300 mm (one foot) below and 2100 mm (seven feet) above the finished grade.

- F. Sheath copper conductors, which pass over cast stone, cut stone, architectural concrete and masonry surfaces, with not less than a 2 mm (1/16 inch) thickness of lead to prevent staining of the exterior finish surfaces.
- G. For the earth connections, install ground rods and ground plates, and the conductor connections to them and the main water pipes in the presence of the Resident Engineer. For the conductors located outside of the building or stack, install the conductors not less than 600 mm (two feet) below the finished grade.
- H. For structural steel buildings, connect the steel framework of the buildings to the main water pipe near the water system entrance to the building.
- I. Connect exterior metal surfaces, located within 900 mm (three feet) of the lightning protection system conductors, to the lightning protection system conductors to prevent flashovers.
- J. Grounding: Test the ground resistance to earth by standard methods and conform to the ground resistance requirements specified in Section, GROUNDING.
- K. Where shown, use the structural steel framework or reinforcing steel as the main conductor:
 - 1. Weld or bond the non-electrically-continuous sections together and make them electrically-continuous.
 - 2. Verify the electrical continuity by measuring the ground resistances to earth at the ground level, at the top of the building or stack, and at intermediate points with a sensitive ohmmeter. Compare the resistance readings.
 - 3. Connect the air terminals together with an exterior conductor connected to the structural steel framework at not more than 18000 mm (60 foot) intervals.
 - 4. Install ground connections to earth at not more than 18000 mm (60 foot) intervals around the perimeter of the building.
 - 5. Weld or braze bonding plates, not less than 200 mm (eight inches) square, to cleaned sections of the steel and connect the conductors to the plates.
 - 6. Do not pierce the structural steel in any manner. Connections to the structural steel shall conform to the UL Publication No. 96A.
- L. For smoke stacks, the following additional requirements shall apply:

1. Extend air terminals from approximately 900 mm (three feet) below the top of the smoke stacks to approximately 900 mm (three feet) above the top of the stacks.
 2. Securely seat and rivet the vertical conductors into bronze cable connectors. Cross-connect the vertical conductors at approximately the midpoint between the top and bottom of the smoke stacks.
- M. For obstruction lights, the following additional requirements shall apply:
1. Extend air terminals 300 mm (one foot) above the top of the light fixtures and securely clamp to the light fixture supports.
 2. Install 600 volt class lightning arresters. Connect the arresters to the lightning circuit conductors at suitable locations, and ground and bond them to the lightning protection system.
- N. When the lightning protection systems have been installed, have the systems inspected by a UL representative. Obtain and install a UL numbered master label "C" for each of the lightning protection systems at the location directed by the UL representative and the Resident Engineer.

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**SECTION 16700
ROOM STATUS**

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and General Provisions of Contract including General and Supplemental Conditions and Division 1 Specifications Section, apply to the work of this Section.

1.2 RELATED SECTIONS

- A. Section 16050: Basic Materials and Methods
B. Section 16111: Conduit Systems
C. Section 16127: Cables, Low Voltage

1.3 DESCRIPTION OF WORK

- A. Furnish and install an Out Patient Medical Clinic Room Status System. The system shall be capable of high quality, reliable and satisfactory operation as hereinafter described. The system shall have the ability to integrate with a Pocket Paging and or Computer Report Management System.
- B. One (1) complete and independent system shall be provided and defined as all conduit, raceways, cables, back boxes contacts, software, etc, to achieve a complete and functional system. Also included are all required power supplies, battery backup, phone line monitoring, and interfaces to equipment furnished by others. Documents do not show or list every item to be provided. When an item not shown or listed is clearly necessary for proper installation and operation of the equipment and systems, provide, install and test/certify the item at no increase in contract price.
- C. Components of the system shall be:
1. The Out Patient Medical Clinic Room Status System shall be of one manufacture regarding software, Power Supplies, Room Status Stations, Room and Bath Call Stations, Annunciators and Pocket Page devices.
 2. All components required for a complete and operable system as described shall be included whether or not specifically described here in.
 3. Wiring will be in accordance with the manufacture of the Out Patient Medical Clinic Room Status System and Reporting System.

4. Provide all software, hardware, and system programming for complete and functional system.
5. Provided installation, testing, adjustment, and initial programming for all equipment. Include written documentation and instructions for system as installed.
6. The contractor shall be responsible for fully implementing the functions described in the Specifications and shown on the Drawings. The Contractor shall possess all applicable Contractor's licenses.
7. Provided training to the Owner in the operation, adjustment, servicing and repair of the systems
8. Connect all systems and equipment to the electrical power system.
9. Co-ordinate all telephone and telecom connections, network connections, programming and requirements with building Owner's representative.

1.4 REFERENCES

- A. Published specifications, standards, tests, codes, or recommended standards of trade, industry or governmental organizations apply to work in these Sections, including
 1. ADA - Americans with Disabilities Act
 2. ASCII - American Standard Code for information Interchange
 3. ASTM - American Society for Testing and Materials
 4. EIA - Electronic industry Association
 5. NEMA - National Electrical Manufactures' Association
 6. NFPA - National Fire Protection Association
 7. NEC - National Electrical Code
 8. UL - Underwriters Laboratories, Inc.

1.5 QUALITY ASSURANCE

- A. The system shall be the product of one manufacturer or of an agency experienced in such work. The installation and connections of all equipment and tests of the operation of the system be made by a representative of the manufacturer or aforementioned agency
- B. Comply with NEC as applicable to construction and installation of system components and wiring.
- C. Provide system equipment which is UL listed and labeled.
- D. Equipment and Accessories: to be the product of a manufacturer regularly engaged in its manufacture.

- E. All items of a given type shall be the products of the same manufacturer.
- F. All items shall be of the latest technology, no discontinued models or products are acceptable
- G. The manufacture, or their Authorized Representative, shall confirm that within 50 miles of the project site there is an established agency which:
 - 1. Stocks a full complement of parts
 - 2. Offers service during normal working hours as well as emergency service on all equipment to be furnished.
 - 3. Will supply parts and service without delay and at reasonable costs.
 - 4. Contractor shall be capable of performing service or maintenance work on these specified or accepted systems. Contractor shall be factory certified where such certification is available.

1.6 SUBMITTALS

- A. Complete bill of material
- B. Submit manufacturer's data on all equipment furnished for the project including, but not limited to equipment specifications, dimensions, roughing-in drawings, instructions for installation, and operation and maintenance suitable for inclusion in maintenance manual.
- C. Wiring diagrams of this system shall be submitted for approval. Diagrams shall show connecting to each unit of system. Typical unit connection diagrams are not sufficient.
- D. Complete written sequence of operations for all functions of the system.
- E. Dimensioned Drawings of all power supplies, control panels and fabricated equipment showing locations of all major components. These Drawings shall be to a scale of the contractor's choice but no less than ¼" to the foot.
- F. Service Information, including address of nearest representative. Provide written approval from each manufacture affirming that contractor is certified and approved for systems installation and service for all systems in this specification.
- G. Proposed training program, including name and qualifications of trainer(s). Schedule of training, curricula, and written training materials.

1.7 SYSTEM DESCRIPTION AND OPERATION

- A. The Contractor shall provide a complete and satisfactory operating Out Patient Medical Clinic Room Status and Reporting System. All equipment and installation material requirements shall be furnished and installed including the description of operation specifically enumerated herein.
- B. System Overview
 - 1. The Out Patient Medical Clinic Room Status and Reporting System should allow doctors to know what patient is next and stay in touch with staff without tying them down to a nurse station. By combining corridor lights, system status panels and a host of patient call and monitoring devices staff can be mobile while delivering quality service.
 - 2. A PC interface captures data for in-depth computer analysis. All patient calls and staff responses are recorded with date and time, limiting your liability. An optional desktop printer can be added to print and file numerous management reports to save time and money.
 - 3. A single system shall accommodate up to 512 stations.
 - 4. Easy to install - The Out Patient Medical Clinic Room Status and Reporting System shall utilize simple twisted-pair cable making this system simple to install and easy to modify or expand. The system shall be capable of spanning multiple floors and or remote buildings using the simple twisted-pair or fiber optic cable.

1.8 QUALIFICATIONS

- A. The Supplier and Installer of Equipment shall be:
 - 1. A factory authorized distributor of the system equipment.
 - 2. Experienced in installation; and maintenance of the system.
 - 3. Show satisfactory evidence, upon request of fully-equipped service organization capable of providing inspection and service to system, including replacement parts.

1.9 SUBSTITUTIONS

- A. All materials and equipment shall conform to these specifications. Not substitute materials may be used unless previously accepted in writing by the Architect.
- B. Manufactures listed as acceptable are normally engaged in the type of work specified. The listing of equipment part numbers or particular types of systems by specific manufactures is to establish the

performance, quality, and parameters of the equipment and material specified. The Architect must approve all substitutions.

1.10 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Ship equipment in original packages to prevent damage or entry of foreign matter. All handling shall be in accordance with manufacturers' recommendations. Provide protective covering during construction.
- B. Replace at no expense to Owner, equipment and material damaged during storage and installation as directed by the Architect.
- C. Products delivered to the job site shall be protected from dust, dirt and foreign matter. All equipment shall be protected from dents bumps and scratching.

1.11 WARRANTY

- A. Contractor shall guarantee installation, equipment and all parts and labor for a minimum of one year from substantial completion of the project.
- B. The installing Contractor shall provide upon notification of a problem a field service technician to correct the problem within 24 hours of notification
- C. At least 60 days prior to expiration of guarantee provide maintenance contract proposals for second year of service for the system to the owner.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Manufacturers catalog and system numbers of equipment listed in this specification indicate type, quality, and functions of the equipment require and represent the minimum acceptable standards. Provide all compatible parts for the submitted systems.
- B. Out Patient Medical Clinic Room Status and Reporting System.
 - 1. Clinic-Call System as Manufactured by Tech Works of Corona California. For complete information and a distributor in your area call 800-813-1080.

2.2 FUNCTION

- A. The Light Signaling System shall be a distributed processing intelligent network consisting of a combination of Intelligent Substations having four push buttons and four lights, Intelligent

- Corridor Lights having four lights, and Master Stations capable of displaying up to eight Substations. The buttons/lights shall be provided with custom printed color labeling per the Architect's instruction and clear adhesive Lexan faceplates to easily identify functions or staff. Annunciator panels with surface mounted or exposed labeling will be totally unacceptable under these specifications. The system shall be expandable up to 512 Substations on a single system.
- B. The system shall use RS485 digital communication between intelligent devices. All Substations shall have two sets of dipswitches which allow addressing of each unit. One set of dipswitches will assign a Substation to a Master and the second set selects the column of lights on the Master to represent the Substation. Any Substation status change shall be reflected in the Master lights and annunciated by a tone. Any Masters, Substations, or Corridor Lights with the same address setting shall be totally interactive. This interaction shall allow multi-point control for tailoring a system to meet special needs.
- C. All user interface shall employ moisture and electrostatic resistance to provide reliable yet friendly operation.
- D. Wiring for the Light Signaling System shall consist of two twisted pair network wiring from one device to the next. Size and type of wire shall be as recommended by the manufacturer of the system. Systems, which require a home run to a central equipment location will be totally unacceptable under this specification.
- E. A Doctor Follow/next patient feature shall be included to provide flashing light indication of the next room or patient in sequence of their reporting. The first light reporting in a row shall slow flash to indicate that it is the next patient or room ready of that color. When any subsequent light in that row reports in, it shall be indicated by a steady light until the current slow flashing light status is changed. The current slow flashing light shall change to fast flash when the same Substation's button is pushed a second time. The third button push from that Substation shall turn the light off. Any time a light that is in slow flash mode is changed to fast flash the next Substation in sequence shall change from steady to slow flash. If a room needs to be inserted in the next order, the associated color button on the Substation can be pressed twice within one second and it shall automatically be placed in the next (or slow flash) position.

- F. The Out Patient Medical Clinic Room Status System shall be Tech Works CLINIC-CALL.

2.3 EQUIPMENT

- A. The Light Signaling System Room Status Master shall be a standard four gang electrical box mounting device constructed of ABS plastic with a water resistant Lexan faceplate. This is a digital communication device using Intelligent Substations. A minimum of eight columns of four lights shall be provided to indicate the status of up to eight Substations. Each column of lights represents a room/Substation and shall be color-coded red, yellow, green, and white to easily identify functions or staff. A four-position dipswitch set by the installer addresses the Master. Masters having the same address shall display the same patient rooms. The lights reflect the status, steady, slow flash, or fast flash of Substations assigned to a Master. The Master is a quiet unit with a repeating tone that sounds only to draw attention to any emergency fast flash signal on the top row (red) only. A user silence button is provided to cancel the emergency repeating tone and must have an installer removable jumper to permanently disable the electronic tone if desired. Any system not capable of installer programmable interaction of stations shall not be considered under this specification. The Master/Annunciator shall be an intelligent electronic device requiring no more than 164 mA at 12 Volts DC for full operation. The system shall operate on two twisted pair parallel wiring. Systems requiring more than two twisted pairs from one station to the next for full operation shall not be considered under this specification.

The Light Signaling System Room Status Master shall be Tech Works Model 5200CCDF or 5201CCDF.

- B. The Light Signaling System Intelligent Room Status Substation shall be a standard one gang electrical box mounting device constructed of ABS plastic with a water resistant Lexan faceplate. A minimum of four lights shall be provided to indicate up to eight statuses of each room. The four lights/buttons shall be color-coded red, yellow, green, and white to easily identify functions or staff. Two four-position dipswitches set by the installer shall determine the group and Master address. Any Intelligent Substations having the same address shall be totally interactive. Any system not capable of installer programmable

interaction of Substations shall not be considered under this specification. Each light shall include a push button made of conductive rubber to individually set the status of each light. The push button shall operate as a multi-function stepper switch with the first push of each button changing the status from off to steady or flashing, depending on the dipswitch position and the second push to off. The Substation shall be an intelligent electronic device requiring no more than 60 mA at 12 Volts DC for full operation. The system shall operate on two twisted pair parallel wiring. Systems requiring more than two twisted pairs from one station to the next for full operation shall not be considered under this specification. The Light Signaling System Intelligent Substation shall be Tech Works Model 5210CC.

- C. The Light Signaling System Intelligent Control Interface Module shall be a standard four gang electrical box mounting device constructed of ABS plastic with a water resistant lexan face plate. A minimum of four columns of four buttons and four lights shall be provided to allow both input and output. An electronic tone shall sound at the Master each time a light changes status. The tone must have an installer removable jumper to permanently disable the electronic tone if so desired. Two four position dip switches set by the installer shall determine the Module address. The Module shall be an intelligent electronic device requiring no more than 264 mA at 12 Volts DC for full operation. The Intelligent Module shall employ EIA standard RS485 digital communication. The system shall operate on two twisted pair parallel wiring. Systems requiring more than two twisted pairs from one station to the next for full operation shall not be considered under this specification.

The Light Signaling System Interface Module shall be Tech Works **LIGHT-CALL**, Model 5260-CC.

- D. The Light Signaling System Wide Angle Basic Intelligent Corridor Light shall be a standard one gang electrical box mounting device constructed of ABS plastic with a water resistant Lexan faceplate. A minimum of four LED's shall be provided to indicate up to eight statuses of each room. The four LED's shall be red, yellow, green, and orange to easily identify functions or staff. The Substation shall display either a steady or flashing light depending on the dipswitch software selection.

Two four-position dipswitches set by the installer shall determine the group and Master address. Any Intelligent Substations having the same address shall be totally interactive. Any system not capable of installer programmable interaction of Substations shall not be considered under this specification. The Substation shall be an intelligent electronic device requiring no more than 240 mA at 12 Volts DC for full operation. The system shall operate on two twisted pair parallel wiring. Systems requiring more than two twisted pairs from one station to the next for full operation shall not be considered under this specification.

The Light Signaling System Wide Angle Basic Intelligent Corridor Light shall be Tech Works Model 5223.

- E. The Light Signaling System Intelligent Zone Light shall be a standard one gang electrical box mounting device constructed of ABS plastic with a water resistant lexan face plate. A minimum of four lights shall be provided to indicate the status of any Master/Sub Annunciator Stations. The lights shall be grouped to indicate the status of a Master by a row of lights. Upon activation of any Substation on a Master the Zone Light will reflect the status of the highest priority Substation in the group. If all Substations are off then the Zone Light is off. If any Substation has a steady light and no other Substation has a flashing light the Zone Light will be steady. If any Substation has a flashing light the Zone Light will be flashing until all flashing lights are off. Two four position dip switches set by the installer shall determine the group and Zone Light address. Any system not capable of installer programmable interaction of Substations will not be considered under this specification. The Zone Light shall be an intelligent electronic device requiring no more than 240 mA at 12 Volts DC for full operation. The Intelligent Zone Light shall employ EIA standard RS485 digital communication. The system shall operate on two twisted pair parallel wiring. Systems requiring more than two twisted pairs from one station to the next for full operation shall not be considered under this specification.

The Light Signaling System Intelligent Zone Light shall be Tech Works **CLINIC-CALL**, Model 5223-ZL.

- F. The Light Signaling 4 Color Passive Corridor Light shall be a standard one gang electrical box mounting device constructed of ABS plastic with

a water resistant Lexan faceplate. A minimum of four lights shall be provided to indicate the status of each room. The Substation shall be a passive electronic device requiring no more than 120 mA at 12 Volts DC for full operation. Systems requiring more than two twisted pairs from one station to the next for full operation shall not be considered under this specification.

The Light Signaling 4 Color Passive Corridor Light shall be Tech Works Model 5254.

- G. The Single Color Passive Corridor Light shall be a standard one gang electrical box mounting device constructed of ABS plastic with a water resistant Lexan faceplate. A minimum of four lights shall be provided to indicate the status of each room. The Substation shall be a passive electronic device requiring no more than 220 mA at 12 Volts DC for full operation. Systems requiring more than two twisted pairs from one station to the next for full operation shall not be considered under this specification.

The Light Signaling System Single Color Corridor Light shall be Tech Works Model 5234

- H. The Light Signaling System Room Status Help Button Station shall be a standard one gang electrical box mounting device constructed of ABS plastic with a water resistant Lexan faceplate. A large 1.25 inch square red push button clearly labeled "HELP" shall be included with a call confirmation light to indicate that a call has been placed. The push button Station shall be a passive electronic device requiring no more than 2 mA at 12 Volts DC for full operation.

The Light Signaling Room Status Help Button Station shall be Tech Works Model 5221.

- I. The Visual Only Emergency Pull Station shall be a standard one gang electrical box mounting device constructed of ABS plastic. A large 1.25 inch push button clearly labeled "CANCEL" shall be included with a durable nylon cord to provide pull for help operation. A call confirmation light shall be included to indicate that a call has been placed. The pull station shall be a passive electronic device requiring no more than 3 mA at 12 Volts DC for full operation.

The Light Signaling System Emergency Pull Station shall be Tech Works Model 5252.

J. The System shall be supplied with a 12 Volt Direct Current power supply capable of powering all devices, as shown on plans, simultaneously with a minimum of 25 % reserve power. The power supply shall be UL/CSA Listed for use with alarm and signaling systems. A surface mounting case shall be included to house the power supply. This unit shall operate from an input of 90 to 264 Volts AC and supply a minimum of 4.0 Amps at 12 Volts DC.

The System Power Supply shall be Tech Works, Model DV12400.

K. The Light Signaling System shall include a Digital Interface Module (DIM) for integration of a printer or serial command control device. The DIM shall provide bi-directional interface to the Light Signaling Network. Any change of status in any device on the network shall be output as an ASCII text message capable of including the point identification, point status, time, date, and up to 20 characters of user programmable text. Programming shall be possible with any standard EIA RS232 PC communications interface. DIM's requiring special hardware or software for user interface shall not be considered under this specification.

The Digital Interface Module shall be Tech Works Model 5400

L. A Personal Computer (PC) with a minimum of a 300MHz Processor, 64 Meg RAM, 4 Meg Video RAM, 4 Gig Hard drive space, PS-2 Mouse Pointer, 2 each RS-232 Serial Port, and a VGA Monitor with 800 x 600 rsi. minimum must be provided for the System Status Activity Data Recording and Reporting Software. The PC shall include the Microsoft XP Pro Operating System. The System Status Software shall be a MS Windows based program that provides facility users with a patient-or room status tracking system designed to work with Tech Works Light-Call products. The program shall provide a Graphical User Interface and statistical data base recording of all transactions for creating printed reports. The Graphics shall active buttons used either with a Mouse or a "Touch Screen" to give the operator complete control of system functions. Each "Button" can be labeled with the Dial Code and Name or use of the associated point on the system. A total of 512 points can be tracked with this one system. Tabs at the top of the screen indicate multiple networks. Screen tabs can be labeled to indicate a "Wing", "Floor", or area of a property or building.

The Residence Call PC Software shall be Tech Works Model 5000GUI.

PART 3 EXECUTION

3.1 INSTALLATION

- A. The Contractor shall furnish and install all interconnected cable, equipment, miscellaneous parts and accessories to make a complete and fully operational system as described herein and as shown on the drawings.
- B. All cables shall be sized in accordance with manufactures recommended cabling requirements. All cable and wire shall be air plenum rated even if installed in conduit.
- C. Equipment shall be installed and wired in accordance with accepted engineering and installation practices. Only the highest degree of workmanship will be accepted.
- D. Contractor shall utilize conduit and terminal cabinets, junction and outlet boxes, etc., as currently installed.
- E. Contractor shall identify and tag all cables with permanent type markers to denote locations served.
- F. All cables shall be run continuously and no splicing may be made in any cable run.
- G. Cable and wiring routed through inaccessible spaces or spaces where there is risk of damage to conductors shall be installed in conduit or raceways supplied by other sections of this specification.
- H. All cable and wiring shall be run concealed in ceiling spaces or surface raceways, except for MDF.
- I. All cable and wiring shall be securely fastened to the permanent building structure. Cable and wire not installed in raceway shall be supported at regular intervals appropriate to the cable and wire size. Cable and wiring shall not lay loose on ceiling tiles or grids and shall not be suspended from or attached to existing conduit.
- J. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer have published torque tightening values for equipment connectors. Where manufacturer's torque requirements are not indicated, tighten connectors and terminals to comply with tightening torques per NEC specification.
- K. The following circuit types shall be installed in their own conduits:
 - Microphone and control lines
 - Control lines
 - AC power lines

- L. Provide a #6 AWG insulated copper ground wire from the main equipment to the building main ground bus.
- M. All front panel controls used in the normal operation of the system shall be clearly labeled using plastic laminate engraved labels or approved equal. Labels shall be firmly affixed to the panel or device. Dymo or Kroy tape adhesive backed lettering is not acceptable. Each major system component shall be labeled as to function and area served.
- N. Make all connections as required between the Access Control System and the Telephone service provided for alarms.

3.2 TRAINING

- A. The Contractor shall provide training on all systems provided. Training sessions shall be on-site, limited to 15 people maximum in any one session. Sessions shall last approximately one (1) hours each. In addition, Contractor shall provide a minimum of four (4) hours training for system administrator.
- B. Follow-up training must be provided on all systems, one (1) week after cutover.
- C. A minimum of one (1) session must be provided for every 25 people on the system.

3.3 AS-BUILT DOCUMENTATION

- A. This Contractor shall furnish to the Owner two (2) complete as-built manuals. These manuals shall be assembled in loose-leaf binder and shall contain.

- System Operating Instructions
- System Functional Block Diagram(s)
- System Schematic Diagram(s)
- Component Operating Manual(s)
- Component Service Manual(s)
- System Wiring List(s)

3.4 FINAL CHECKOUT AND ACCEPTANCE

- A. The Contractor shall verify that the system is complete and fully operational before requesting final approval and before scheduling system demonstration.
- B. This Contractor shall be available to demonstrate the operation and use of the system to the Architect/Engineer and to the Owner's representatives.

- C. At the time of the demonstration, this Contractor shall furnish to the Owner one (1) complete record manuals.
- D. Substantial Completion of the system will start the warranty period for both material and labor.

3.5 SYSTEM GUARANTEE

- A. This Contractor shall provide the following regarding warranties and guarantees.
 - 1. Extend the manufactures warranty to the owner. The owner understands that manufactures warranties will vary from manufacture to manufacture.
 - 2. Provide one year of free maintenance on the system from date of substantial completion and the owner is using the system.

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SECTION 16721
FIRE ALARM

PART 1 - GENERAL

1.1 WORK INCLUDED:

- A. Contractor shall furnish, install and place in operating condition the addressable, microprocessor type fire alarm equipment and devices as described herein and shown on the plans. All units of the fire alarm system shall be listed by Underwriters Laboratories Inc. for fire alarm use. The system shall be installed in accordance with requirements of the National Electrical Code and in compliance with applicable provisions of NFPA 72.
- B. All fire alarm wiring shall be in metal conduit and cable tray.
- C. Related Work: N/A
- D. The existing Bldg. 100 Cerberus Pyrotronics fire alarm panel is a node of the existing campus-wide Cerberus fire alarm network.

1.2 SYSTEM OPERATION:

The fire alarm system shall operate with signaling line circuits performing as Class B, Style 4 and notification appliance circuits as class B style Y per NFPA 72 Tables 3-6 and 3-7.1.

1.3 APPLICABLE PUBLICATIONS:

- A. In addition to those listed in other Sections:
 - 1. NFPA Codes, Standards and Manual (latest issue enforced):
 - 2. 72.....National Fire Alarm Code
 - 3. 90A.....Air Conditioning & Ventilating Systems
- B. Other Codes and Standards:
 - 1. Local rules and interpretations required by the "Authority having Jurisdiction".
 - 2. Uniform Fire Code - latest edition.

1.4 SUBMITTALS:

- A. Submit shop drawings and product data in accordance with Section 01010.
- B. Submit manufacturer's descriptive literature. Indicate system components, size of components, interconnecting wiring terminations for each component, and all installation, configuration and programming instructions.
- C. Submit schematic and one-line wiring diagram showing system component locations. Include control panel (s), notification appliance circuit panels and initiating and notification risers

D. Submit battery and voltage drop calculations for notification circuits.

1.5 ADDITIONAL REQUIREMENTS:

- A. Submit shop drawings to the "Authority having Jurisdiction" (AHJ) as defined in NFPA 72. The AHJ for this project will be designated the VA Safety Office. Two (2) copies of the above shop drawings with the AHJ's approval evidenced shall be sent to the Resident Engineer prior to equipment being delivered to the job site. One copy will be returned to remain at the job site with the required "As Built" set of construction drawings.
- B. In addition, the Contractor shall schedule periodic inspections by the AHJ during the course of the installation and shall make any correction, deletions, relocations or additions to the systems as required for acceptance of the completed system by the AHJ.
- C. At the completion of the project a complete, "clean", set of As-Built drawings will be submitted with each O&M manual as required in section 16050 and 01010.

1.6 QUALIFICATIONS:

- A. Installer must be Cerberus Pyrotronics affiliated distributor.
- B. Provide to the VA documents indicating affiliation.
- C. Local service organization with three years of experience and the ability to respond to service calls within 24 hours.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

- A. Catalog numbers used in these specifications are those of Cerberus Pyrotronics only to match the campus wide fire alarm system.
- B. All fire alarm equipment and components shall be UL listed/FM approved for the specific proposed application.

2.2 FIRE ALARM CONTROL PANEL:

N/A

2.3 NOTIFICATION APPLIANCE CIRCUIT EXTENDER PANELS:

N/A.

2.4 NOTIFICATION DEVICES:

- A. Speaker/Strobe, 75cd - Cerberus Model NoI-SM70-S75S
- B. Strobe, 15/75cd - Cerberus Model No. U-S17S
- C. Speaker - Cerberus Model No. I-SM70-W

2.5 MANUAL FIRE ALARM STATION:

Cerberus Model No. MSI-20B

2.6 AUTOMATIC SMOKE DETECTOR:

Cerberus Model No. FP-11

PART 3 - EXECUTION

3.1 APPROVED EQUIPMENT AND PERMIT

- A. No equipment shall be delivered to the job site until shop drawings have been reviewed and AHJ approved. A reviewed and AHJ approved shop drawings set shall be continuously available at the job site during construction.
- B. Obtain a permit from the local VA prior to installation of equipment as required.

3.2 CIRCUITRY

- A. All wiring shall be contained in metallic raceways. Wiring insulation shall be one of the types required by NEC 760 and shall be consistently color-coded throughout the system (See Code Below). Permanent wire markers shall be affixed to all conductors at terminations and splices. Numbering systems shall be consistent with shop drawings. All terminations shall be T&B "Sta-Kon" (or equivalent), self-insulation, flanged or forked tongue lugs where connected at screw type terminals. Wiring in main control cabinet shall be neatly arranged and bundled with Tyraps (or equivalent).

Network Communication:	Fiber Optics (Match Existing)
Initiating Devices:	Red, Red/White
Door Holders:	Brown, Brown/White
Audio Devices:	Purple, Purple/White
Visual Devices:	Blue, Blue/White
Grounds:	Green
Power:	Black, White
Audio/Visual Circuits:	Yellow, Yellow/White
Building Communications:	Orange, Orange/White
24 V DC Power Risers:	Red/Black

3.3 TESTING

- A. The completed system shall be tested and, after one subsequent week (minimum) "On-line" operation, demonstrated to operate satisfactorily in the presence of the Resident Engineer and the VA AHJ. Approval of

the VA AHJ shall be evidenced in writing and a copy forwarded to the Resident Engineer.

3.4 INSTRUCTION

NA

3.5 OPERATION AND MAINTENANCE MANUALS

Provide per Section 01010.

3.6 AS BUILT DRAWINGS

- A. Provide per Section 01010/16050. As Built drawings shall clearly indicate:
1. Actual routing of all raceways.
 2. Actual cable type, numbers and routing.
 3. Actual system wiring diagrams, connections diagrams and interface of all components in the system.
 4. Location of all system junction and terminal boxes.

3.7 WARRANTY

The complete fire alarm system installation shall be guaranteed for a one (1) year period. Refer to General Conditions.

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**SECTION 16740
TELECOMMUNICATIONS**

PART 1 - GENERAL

1.1 WORK INCLUDED

Provide a complete telephone/data system as described in this specification. Work will include relocation of certain existing equipment, rerouting existing cables, installation of CAT 5 cabling and outlets throughout the building, installation of equipment racks, patch panels and other related equipment in the telecommunications room.

1.2 APPLICABLE PUBLICATIONS

- A. In addition to those listed in Section 16050:
1. NFPA Codes, Standards and Manuals (latest issue)

1.3 SUBMITTALS

- A. Submit manufacturer's descriptive literature. Indicate system components, size of components and installation instructions.
- B. Submit as-built drawings as required in this section.

1.4 QUALIFICATIONS

- A. The following requirements shall be met:
1. The Telephone/Data System Installer shall have at least five (5) years experience in the installation of similar systems. Submit at least five (5) similar projects completed in the last three (3) years along with name, contact and telephone number on the project. The installer shall provide documentation upon request to certify that all assigned staff have attended related training courses on the equipment to be installed.
 2. The Telephone/Data System Installer shall, at the time of bid, have all licenses or permits required to install both high voltage power and low voltage electronic cabling systems in the State of Washington.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

Catalog and part numbers referenced in this section are those of Leviton. Equal components manufactured by Ortronics and Siemon are also acceptable.

2.2 WALL OUTLETS

Provide a minimum 4" square by 2-1/8" deep box with a raised single gang plaster ring properly sized for the wall thickness.

2.3 COVER PLATES

Provide blank stainless steel cover plates for all outlets not terminated with telephone data drops per the plans.

2.5 CONDUITS

Provide 3/4" EMT from wall outlet to nearest corridor accessible ceiling space. Bush conduit end.

PART 3 - EXECUTION

3.1 STATEMENT OF WORK

A. Backbone wiring.

1. Provide 400 pair voice cable from Building 28 to Building 100, room 2D-F01A (new telecom room). Terminate on 66 style blocks.
2. Provide (1) 12-strand multi mode and (1) 6-strand single mode fiber optic cable from existing room BB-120 to room 2D-F01A. Terminate to the existing patch-panel in room BB-120; VA furnishes ports. Provide and terminate to Leviton OPT-X 1000 patch panel and ST ports in new telecom room.
3. Re-support (3) existing fiber cables and interducts located in the basement interstitial space.
4. Provide (1) empty spare interduct from room BB-120 to the interstitial space as indicated on the drawings.
5. Identify all cable terminations as directed by the V. A. Project Engineer.

B. Horizontal wiring:

1. Run one Cat 5 voice and 2 Cat 5 data drops to each jack box shown on the floor plan as joint use phone and data.
2. Run one Cat 5 voice drop to each jack box that is for phone only.
3. Run two Cat 5 drops to each jack box that is for data only.
4. Data drops to terminate on orange colored Leviton or equivalent RJ45 inserts PN: 41108-R05 in 4 plex face plates at the jack box, and on 110 style terminal blocks located in the MDF room.
5. Voice drops to terminate on ash or off white Leviton or equivalent Cat 3 RJ11 inserts at the jack box and on 110 blocks in the telecomm

- room. At the jack, the voice drop will be terminated pr. 1&2 first jack, and pr. 3&4 second jack. Space for adding 20% new jacks will be left on each jack field. Mount 110 blocks no higher than 72" and no lower than 24". Provide vertical and horizontal wire management D rings on the top and sides, for cross connect wiring. Jack fields will be clearly marked with jack field number (1.1 and 2.1 respectively) above the connecting block rows. Space will be left on the left of the jack field for mounting the 900 pair MDF cable and space on the right of the 2.1 jack field for mounting the jack blocks for the 3.1 third floor jack field.
6. Provide and install 7 ft. H x 19 in. W floor mount equipment racks with wire management on both sides for mounting the Fiber LIU, patch panels & LAN switch equipment.
 7. Provide and install 12 in. ladder rack around the wall and over to the equipment racks.
 8. Provide and install 48 port Cat 5 Leviton or equivalent patch panels, 568A standard. Number the panels from top to bottom. Install wire management panels PN: OR 60400057 or equivalent for each panel for patch cords.
 9. Install drops in hallways using appropriate sized hangers and provide proper support of wire runs using IAW EIA/TIA 569 standards.
 10. Provide and install Leviton 4-plex faceplates or equivalent, top two jacks voice, bottom two jacks LAN.
 11. Tag LAN jacks at the faceplate with the room # plus jack panel # as it appears in the patch panel. Example 272-2-48 (rm.272/panel2/jack 48). Tag LAN jacks at patch panel with the room number location. Tags will not be hand written.
 12. Tag voice jacks at the faceplate with closet # plus jack # starting with 001. Example, 2nd floor 2.1.001. At the 110 blocks tag with jack number starting with Jack field # plus the Jack # for each floor. Tags will not be hand written.
 13. Voice jacks will tagged in the upper left corner of the faceplate, Data jacks individually above each jack using electronic labeling equipment.
 14. All wire is to be plenum grade. Color scheme will be blue jacket for voice and yellow jacket for data.

15. Leave a 5ft service loop on all drops coiled and neatly tied up in the hallway above the ceiling at the entry point into each room. Do not lay wire on the ceiling tiles.
16. Provide separate as-built drawings for Voice and LAN drops in electronic CAD format showing locations of jacks by jack number. Contractor will provide 1 set of e-size hard copy for voice, and one set for LAN. Drawing files will be provided on CD-R media.
17. Provide fire stopping in accordance with NFPA and NEC requirements, through all fire rated floors, walls, and corridor walls.
18. A certified telecommunications technician must be the on site lead technician.
19. A walk-thru inspection will be scheduled with engineering safety before work begins and after work completion.
20. All applicable OSHA rules, regulations and work rules for this facility must be adhered to.

3.2 INSTALLATION

Telephone/Data raceways shall comply with applicable sections of these specifications (16111 etc.) and the most current edition of the NEC. In addition, conduit bends shall be long radius types.

3.3 PULL CORDS

Install minimum 150 lb. test nylon type pull-lines in all empty conduits to telephone terminal board, one for each telephone/data outlet and tags with room numbers per architectural drawings on each end.

3.4 TELEPHONE/DATA OUTLET HEIGHT

Install wall outlets at +18" AFF unless noted otherwise.

3.5 COVER PLATES

Provide cover plates for every outlet.

3.6 GROUNDING

Provide a #6 bare copper grounding conductor to nearest metal cold water line to the telephone/data terminal board with six feet coiled at the terminal board.

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