PROJECT MANUAL

VOLUME 1 OF 1

BOILER & HOT WATER HEATER UPGRADES
ENFIELD & NORWALK ARMORIES
ENFIELD & NORWALK, CONNECTICUT

PROJECT NO.: 11MIL217-2401
AGENCY TRACKING NO.: ZZ1101

CONNECTICUT ARMY NATIONAL GUARD
FACILITIES MANAGEMENT OFFICE

360 Broad Street, Hartford, Connecticut

PREPARED BY:

BVH INTEGRATED SERVICES, INC.
50 GRIFFIN ROAD SOUTH
BLOOMFIELD, CT
06002
(860) 286-9171 Phone
(860) 242-0236 Fax

February 28, 2011

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Gov. Wm. A. O'Neill Armory, 360 Broad Street **INVITATION TO BID**
Hartford, CT 06105 **PAGE 1 OF 3**

INVITATION TO BID

FOR PROJECTS ESTIMATED TO COST LESS THAN $500,000.00

FOR CURRENTLY DAS CERTIFIED SET-ASIDE CONTRACTORS ONLY

This "Invitation To Bid" is *limited* to participation by ***current*** **certified** "Set-Aside Contractors" that have been certified by the Connecticut Department of Administrative Services (DAS) by the "**bid opening date**."

ADV. NO. 11MIL217-2401 **DATE OF INVITATION: July 27, 2011**

SEALED BIDS ADDRESSED TO THE MILITARY DEPARTMENT- STATE OF CONNECTICUT FOR:

Project Title:	Replace boiler at Enfield Armory & Hot Water System at Norwalk Armory
Project Location	Enfield Armory, 1635 King Street, Enfield Norwalk Armory, 290 New Canaan Avenue, Norwalk
Project Number:	11MIL217-2401
Cost Estimate Range:	$100,000.00 - $250,000.00
Plans & Specs Ready as of:	Download off DAS website or printed copies available as of August 1, 2011 at Gov. Wm. A. O'Neill Armory, 360 Broad Street, Hartford – Room #143 **Between the hours of 10:00 am – 3:00 pm ONLY.**
Non-Refundable Fee Per Set	**$ NOT APPLICABLE**
MBE Participation	**6.25% or good faith effort**
Mandatory Pre-Bid Conference:	**ALL PROSPECTIVE BIDDERS ARE REQUIRED TO ATTEND A MANDATORY PRE-BID CONFERENCE TO BE HELD AS LISTED BELOW:** **Enfield Armory – 1635 King Street, Enfield – Thus., August 11 – 9:00 am** **Norwalk Armory – 290 New Canaan Avenue, Norwalk – Thurs., August 10 – 1:00 pm** **NOTE: Late Arrivals (15 minutes or more) will not be given credit for attendance nor allowed to participate in the bid process. Vendors will not be admitted to state buildings or property without a valid photo ID.** Bids submitted by contractors who have not properly registered and attended the pre-bid conference shall be rejected as non-responsive. All attendees of the pre-bid conference will be required to register. Proper registration means that the attendee has signed his or her name to the official roster and listed the name and address of the company he or she represents on the official roster.
Bid Opening Date:	**Wednesday, August 31, 2011**
Receipt of Bid Package	Bids will be received at the Gov. Wm. A. O'Neill Armory, 360 Broad Street, Hartford, CT 06105 in Rm #143 until **2:00 pm** on the date shown above and thereafter publicly opened and read aloud.
Contract Time Allowed:	Sixty (60) Calendar Days
Ethics Law and Executive Order Requirements Concerning Financial Disclosure, Gifts and Campaign Contributions:	Any contract bid with a value of $50,000 or more must be accompanied by the affidavit required in Section 4-251 of the Connecticut General Statutes, as modified by section 10 of executive Order No. 7B and section 8 of executive order No. 1 of Governor M. Jodi Rell. A second affidavit is also required of the successful bidder for the time period between the signing of the first affidavit and contract execution. Executive Order No. 1 also requires that the affidavit be updated annually by the successful bidder. These affidavits and instructions (General Advice for Filling out Affidavits and Resolutions/Certificate of Authority) can be found at http://www.ct.gov/dpw. You can also find at this website an "Introduction" to the affidavits that explains the applicability of the various affidavits.

Bid Security	As security, each bid must be accompanied by a CERTIFIED CHECK made payable to "Treasurer, State of Connecticut," or the bid must be accompanied by a BID BOND, in the form required by the awarding authority and having surety thereto such Surety Company or Companies as are authorized to do business in this State and/or accepted by the Commissioner of the State Military Department for an amount not less than 10% of the bid **if the bid is in excess of $100,000.00.**
Performance and Labor and Material Bonds	Performance and Labor and Material Bonds to be furnished by the bidder awarded the contract shall be an amount not less than 100% of the contract price **if the bid is in excess of $50,000.00**. The awarding authority reserves the right to waive technical defects or to reject any and all bids.
Prevailing Wage Rates:	Prevailing wages are required on this project, in accordance with the schedule provided in the bid documents, pursuant to Connecticut General Statutes Section 31-53, as may be amended. Each contractor who is awarded a contract on or after October 1, 2002 shall be subject to provisions of the Connecticut General Statutes Section 31-53 and Section 31-55a. Wage Rates will be posted each July 1st on the Department of Labor website: www.ctdol.state.ct.us . Such prevailing wage adjustment shall not be considered a matter for any contract amendment. The wages paid on an hourly basis to any mechanic, laborer or workman employed upon the work herein contracted to be done and the amount of payment or contribution paid or payable on behalf of each such employee to any employee welfare fund, as defined in subsection (h) of section 31-53 of the Connecticut General Statutes, shall be at a rate equal to the rate customary or prevailing for the same work in the same trade or occupation in the town in which such public works project is being constructed. Any contractor who is not obligated by agreement to make payment or contribution on behalf of such employees to any such employee welfare fund shall pay to each employee as part of his wags the amount of payment or contribution for his classification on each pay day.
To access the State Military Department web site: http://www.ct.gov/mil	
To access the Department of Public Works web site: http://www.ct.gov/dpw	
To access Executive Order #1: http://www.ct.gov/governorrell/cwp/view.asp?Q=276038&A=1720	
To access Executive Order #7b: http://www.ct.gov/governorrell/cwp/view.asp?A=1719&Q=306720	

Nonresident contractors: A certificate from the Commissioner of Revenue Services must be provided which evidences that Connecticut General Statutes Section 12-430 for non-resident contractors has been met. For details call the Department of Revenue Services at (860) 541-3280, ext. 7.

EXECUTIVE ORDERS:

The contract is subject to the provisions of Executive Order No. Three of Governor Thomas J. Meskill, promulgated June 16, 1971, concerning labor employment practices, Executive Order No. Seventeen of Governor Thomas J. Meskill, promulgated February 15, 1973, concerning the listing of employment openings and Executive Order No. Sixteen of Governor John G. Rowland promulgated August 4, 1999, concerning violence in the workplace, all of which are incorporated into and are made a part of the Contract as if they had been fully set forth in it. At the Contractor's request, the Client Agency shall provide a copy of these orders to the Contractor. The Contractor may also be subject to Executive Order No. 7C of Governor M. Jodi Rell, promulgated July 13, 2006, concerning contracting reforms and Executive Order No. 14 of Governor M. Jodi Rell, promulgated April 17, 2006, concerning procurement of cleaning products and services in accordance with their respective terms and conditions.

1. The parties agree to abide by such Executive Orders.

2. The State Contracting Standards Board may review this contract and recommend termination of the contract for a violation of the State Ethics Code (Chapter 10 of the general statutes) or section 4a-100 of the general statutes, or wanton or reckless disregard of any state contracting and procurement process by any person substantially involved in such contract or state contracting agency.

3. This contract may be canceled, terminated or suspended by State Military Department or the State Labor Commissioner for violation of or noncompliance with Executive Orders No. Three or Seventeen or any State or federal law concerning nondiscrimination, notwithstanding that the State Labor Commissioner is not party to this contract. The State Labor Commissioner shall have continuing jurisdiction regarding contract performance concerning nondiscrimination and listing all

employment openings with the Connecticut State Employment Service until the contract is completed or until the contract is terminated prior to completion.

4. The contractor agrees, as part consideration hereof, that this contract is subject to the Guidelines and Rules issued by the State Labor Commissioner to implement Executive Order No. Three, and that the contractor will not discriminate in its employment practices or policies, will file all reports as required, and will fully cooperate with the State of Connecticut and the State Labor Commissioner.

5. This contract may be canceled, terminated, or suspended by State Military Department or the State for violation of or noncompliance with Executive Order Sixteen. In addition, the contractor agrees to include a copy of Executive Order Sixteen, and the requirement to comply with said order, in all contracts with its contractors, subcontractors, consultants, subconsultants and vendors.

Sexual Harassment Policy:

This contract is subject to the provisions of the State Military Department's Sexual Harassment Policy ("Policy") and, as such, the contract may be canceled, terminated, or suspended by State Military for violation of or noncompliance with said Policy. Said document is hereby incorporated herein by reference and made a part hereof as though fully set forth herein. This policy may be found at the State Military Department's website: http://www.ct.gov/mil/cwp/view.asp?a=1343&q=256954

All technical questions must be in writing, *(phone calls will not be accepted)* and emailed to the State Military Department Contract Admin listed below:

Contract Admin: Marie Thompson, Purchasing Supervisor
360 Broad Street
Hartford, CT 06105
e-mail: marie.thompson@po.state.ct.us

CFMO Design Coordinator Ed Fulton
CFMO Construction Admin: Ron Wilfinger
Architect/Engineer: BVH Intergrated Services Inc., Bloomfield, CT

Procurement Office
State Military Department
Marie Thompson,
Contract Administrator
Tel: 860-524-4995
Fax: 860-548-3281
e-mail: marie.thompson@po.state.ct.us

SECTION 00020
BID PROPOSAL FORM
PAGE 1 of 2

FOR PROJECT ESTIMATED TO COST LESS THAN $500,000.00

FOR CURRENTLY CERTIFIED SET-ASIDE CONTRACTORS ONLY

To: State Military Department
Contracts Administration
Procurement Department
360 Broad Street - Room 143
Hartford, CT 06105

Bid Date: August 31, 2010

From: _____(Bidder's Legal Company Name)

_____ (Address of Bidder)

_____

_____(Tel. No.)_____(FAX No.)

_____(E-Mail Address)

_____(FEIN)

_____ _____
(Print Contact Person's Name) (Title)

For: #11MIL217-2401
Replace Boiler at Enfield Armory and
Hot Water System at Norwalk Armory

The Undersigned, having familiarized himself with all requirements of the Contract Documents as prepared by the Design Department, State Military Department, and all Addenda to the Documents, hereby proposes to furnish all construction as required by the Documents and Addenda thereto for the completion of the project for the following amounts:

BID SCHEDULE Base Bid:

1) Enfield Armory:_____Dollars ($_____)
(Written amount)

2) Norwalk Armory:_____Dollars ($_____)
(Written amount)

Grand Total:_____Dollars ($_____)
(Written amount)

NOTE: Project award will be based on Grand Total amount from most qualified bidder.

PERCENTAGE OF WORK PERFORMED WITH OWN FORCES

The percentage of the work performed by the contractor on this project shall not be less than the percentage noted in the Commission on Human Rights (CHRO) Regulation Section 00600 subsection 4.1 of the completed Contract Sum of the Work with its own forces.

Supplemental Bids

THERE ARE NO SUPPLEMENTAL BIDS FOR THIS PROJECT.

Contractor Provided Unit Prices

THERE ARE NO CONTRACTOR PROVIDED UNIT PRICES FOR THIS PROJECT.

Contract Time

If awarded this contract, the undersigned will complete the work within sixty (60) calendar days from the date indicated on the Order to Commence Work form.

Addenda Received

Receipt of the following Addenda to the Contract Documents is acknowledged (if applicable):

Addendum No. _____ Dated _____Addendum No. _____ Dated _____

Bid Acceptance

The Undersigned acknowledge and agree to hold the bid price for ninety (90) calendar days and any extensions caused by the Contractor's delays in required submissions. The Contractor and the State may mutually agree to extend this period. The apparent three low bidders are required to submit key supporting documents as noted under the caption Bid Submittal Time Line at the end of this Section 00020, within ten (10) calendar days of the bid opening, If there are any delays in the receipt of these materials then the Bids shall remain valid for the same additional number of days. For example, if the materials are submitted four (4) days later; then the bid shall remain valid for ninety-four (94) days.

If written notice of the acceptance of this Bid is provided by mail, facsimile or other communication technology, or delivered to the Undersigned after the bid opening date or any time thereafter before this bid is withdrawn, the Undersigned will, within 10 days after the date of such notice, furnish all documents requested in the Letter of Intent.

Bidder is (check one, as case may be):

Sole Proprietor ( ) Partnership ( ) Corporation ( ) LLC ( )

_____ _____
Signature of Bidder Title

_____ _____
Print Name Date

Bidders must submit a gift affidavit, "Bid Proposal Affidavit," for contracts with a value of $50,000 or more. This affidavit should be completed and submitted when a bidder submits a bid of $50,000 or more. This affidavit is located in the bid package.

Office of Policy and Management

PERSONAL SERVICE AGREEMENTS (PSA)

Ethics Affidavits & Certifications for State Contracts

Forms & Descriptions Summary Chart Definitions Other Notes

The Office of Policy and Management created the ethics forms (below) to assist executive branch agencies in complying with the State of Connecticut's current contracting requirements, pursuant to the Connecticut General Statutes and Executive Orders of Governor M. Jodi Rell. The forms are effective August 1, 2007.

FORMS & DESCRIPTIONS

Adobe.pdf (all) Word.doc (all) Rev. 02-01-10

Form 1. Gift and Campaign Contribution Certification

Rev. 02-01-10 Adobe.pdf Word.doc

This certification accompanies a State contract with a value of $50,000 or more in a calendar or fiscal year. The completed form is submitted by the contractor to the awarding State agency at the time of contract execution. The form is also used with a multi-year contract to update the initial certification on an annual basis.

Form 2. Rescinded on 01-Aug-07. Use Form 1.

Form 3. Certification of State Agency Official or Employee Authorized to Execute Contract

Rev. 02-01-10 Adode.pdf Word.doc

This certification accompanies a State contract with a value of $50,000 or more in a calendar or fiscal year. The completed form is signed at the time of contract execution by the State agency official or employee authorized to execute the contract on behalf of the awarding State agency.

Form 4. Rescinded on 01-Aug-07. Use Form 1.

Form 5. Consulting Agreement Affidavit

Rev. 02-01-10 Adobe.pdf Word.doc

This affidavit accompanies a State contract for the purchase of goods or services with a value of $50,000 or more in a calendar or fiscal year. Form 5 is normally submitted by the contractor to the awarding State agency with the bid or proposal. However, for a sole source or no bid contract, it is submitted at the time of contract execution.

Form 6. Affirmation of Receipt of State Ethics Laws Summary

Rev. 02-01-10 Adobe.pdf Word.doc

This affirmation accompanies a large State construction contract or a large State procurement contract with a cost of more than $500,000. Form 6 is normally submitted by the contractor to the awarding State agency with the bid or proposal. However, for a sole source or no bid contract, Form 6 is submitted at the time of contract execution.
When applicable, Form 6 is also used by a subcontractor or consultant of the contractor. The subcontractor or consultant submits the form to the contractor, who then submits it to the awarding State agency.

Forms 6A, 6B, 6C. Rescinded on 01-Aug-07. Use Form 6.

SUMMARY CHART

The chart belows summarizes who signs which ethics form, and when each form is submitted during the contracting process.

WHEN TO SUBMIT	ETHICS FORMS		
	Signed by AGENCY	Signed by CONTRACTOR	
		ALL Contracts cost or value $50 K or more	LARGE Contracts cost $500 K or more
submit form **with** bid or proposal		Form 5 *	Form 6 **
submit form **at time of** contract execution	Form 3	Form 1 Form 5 *	Form 6 **
submit form **after** contract execution			Form 6 **
submit form **annually** if multi-year contract		Form 1	

* Form 5 is normally submitted by the contractor to the awarding State agency with the bid or proposal. However, for a sole source or no bid contract, it is submitted at the time of contract execution.

** Form 6 is normally submitted by the contractor to the awarding State agency with the bid or proposal. However, for a sole source or no bid contract, Form 6 is submitted at the time of contract execution. When applicable, Form 6 is also used by a subcontractor or consultant of the contractor. The subcontractor or consultant submits the form to the contractor, who then submits it to the awarding State agency. Depending on when the contractor engages the subcontractor or consultant, the contractor either submits the form at the time of contract execution or after contract execution.

DEFINITIONS

- **Cost of the contract** means the dollar amount (or equivalent benefit) expended by the State in accordance with the contract.

  Example:

  OPM entered into a contract with Servus Management Corporation to manage the State office complex located at 410-474 Capitol Avenue in Hartford. OPM pays the contractor a specified amount of money for this service. This contract represents a cost expended by the State.

- **Value of the contract** means the dollar amount (or equivalent benefit) expended or received by the State in accordance with the contract.

  Example:

  OPM entered into an agreement with Pinpoint Power whereby, in the event of a power shortage, certain State agencies may be asked to use their own emergency generators. In exchange, the contractor pays the State a specified amount of money to compensate for the service interruption. This contract represents a value received by the State.

- **Large state construction contract** or **large procurement contract** means any contract, having a cost of more than $500,000 for (A) the remodeling, alteration, repair or enlargement of any real asset, (B) the construction, alteration, reconstruction, improvement, relocation, widening or changing of the grade of a section of a state highway or a bridge, (C) the purchase or lease of supplies, materials or equipment, as defined in section 4a-50, or (D) the construction, reconstruction, alteration, remodeling,

repair or demolition of any public building.

OTHER NOTES

Affidavits and certifications are **NOT required for grants or loans**, as such awards are not:

1. large state contracts, as defined by Connecticut General Statutes § 4-250;
2. State Contracts, as defined by Executive Order 7C, Paragraph 2(f); or
3. contracts for the purchase of goods and services, as used in Connecticut General Statutes § 4-81.

For Further Information, Contact:
Please direct any questions about the ethics forms to Wanda L. Dupuy, (860) 418-6261, wanda.dupuy@ct.gov.

Content Last Modified on 1/29/2010 3:28:48 PM

STATE OF CONNECTICUT
GIFT AND CAMPAIGN CONTRIBUTION CERTIFICATION

Certification to accompany a State contract with a value of $50,000 or more in a calendar or fiscal year, pursuant to C.G.S. §§ 4-250 and 4-252(c); Governor M. Jodi Rell's Executive Orders No. 1, Para. 8, and No. 7C, Para. 10; and C.G.S. §9-612(g)(2), as amended by Public Act 07-1

INSTRUCTIONS:

Complete all sections of the form. Attach additional pages, if necessary, to provide full disclosure about any lawful campaign contributions made to campaigns of candidates for statewide public office or the General Assembly, as described herein. Sign and date the form, under oath, in the presence of a Commissioner of the Superior Court or Notary Public. Submit the completed form to the awarding State agency at the time of initial contract execution (and on each anniversary date of a multi-year contract, if applicable).

CHECK ONE: ☐ Initial Certification ☐ Annual Update (Multi-year contracts only.)

GIFT CERTIFICATION:

As used in this certification, the following terms have the meaning set forth below:

1) "Contract" means that contract between the State of Connecticut (and/or one or more of it agencies or instrumentalities) and the Contractor, attached hereto, or as otherwise described by the awarding State agency below;
2) If this is an Initial Certification, "Execution Date" means the date the Contract is fully executed by, and becomes effective between, the parties; if this is an Annual Update, "Execution Date" means the date this certification is signed by the Contractor;
3) "Contractor" means the person, firm or corporation named as the contactor below;
4) "Applicable Public Official or State Employee" means any public official or state employee described in C.G.S. §4-252(c)(1)(i) or (ii);
5) **"Gift"** has the same meaning given that term in C.G.S. § 4-250(1);
6) "Planning Start Date" is the date the State agency began planning the project, services, procurement, lease or licensing arrangement covered by this Contract, as indicated by the awarding State agency below; and
7) "Principals or Key Personnel" means and refers to those principals and key personnel of the Contractor, and its or their agents, as described in C.G.S. §§ 4-250(5) and 4-252(c)(1)(B) and (C).

I, the undersigned, am the official authorized to execute the Contract on behalf of the Contractor. I hereby certify that, between the Planning Start Date and Execution Date, neither the Contractor nor any Principals or Key Personnel has made, will make (or has promised, or offered, to, or otherwise indicated that he, she or it will, make) any **Gifts** to any Applicable Public Official or State Employee.

I further certify that no Principals or Key Personnel know of any action by the Contractor to circumvent (or which would result in the circumvention of) the above certification regarding **Gifts** by providing for any other principals, key personnel, officials, or employees of the Contractor, or its or their agents, to make a **Gift** to any Applicable Public Official or State Employee. I further certify that the Contractor made the bid or proposal for the Contract without fraud or collusion with any person.

CAMPAIGN CONTRIBUTION CERTIFICATION:

I further certify that, on or after December 31, 2006, neither the Contractor nor any of its principals, as defined in C.G.S. § 9-612(g)(1), has made any **campaign contributions** to, or solicited any contributions on behalf of, any exploratory committee, candidate committee, political committee, or party committee established by, or supporting or authorized to support, any candidate for statewide public office, in violation of C.G.S. § 9-612(g)(2)(A). I further certify that **all lawful campaign contributions** that have been made on or after December 31, 2006 by the Contractor or any of its principals, as defined in C.G.S. § 9-612(g)(1), to, or solicited on behalf of, any exploratory committee, candidate committee, political committee, or party committee established by, or supporting or authorized to support any candidates for statewide public office or the General Assembly, are listed below:

STATE OF CONNECTICUT
GIFT AND CAMPAIGN CONTRIBUTION CERTIFICATION

Lawful Campaign Contributions to Candidates for Statewide Public Office:

Contribution Date	Name of Contributor	Recipient	Value	Description

Lawful Campaign Contributions to Candidates for the General Assembly:

Contribution Date	Name of Contributor	Recipient	Value	Description

Sworn as true to the best of my knowledge and belief, subject to the penalties of false statement.

_____ _____
Printed Contractor Name **Signature of Authorized Official**

Subscribed and acknowledged before me this _____ day of _____, 20___.

_____
Commissioner of the Superior Court (or Notary Public)

For State Agency Use Only

_____ _____
Awarding State Agency Planning Start Date

_____
Contract Number or Description

OPM Ethics Form 3 Rev. 02-01-10

STATE OF CONNECTICUT

CERTIFICATION OF STATE AGENCY OFFICIAL OR EMPLOYEE AUTHORIZED TO EXECUTE CONTRACT

Certification to accompany a State contract, having a value of more than $50,000, pursuant to Connecticut General Statutes §§ 4-250 and 4-252(b), and Governor M. Jodi Rell's Executive Order 7C, Paragraph 10

INSTRUCTIONS:

Complete all sections of the form. Sign and date in the presence of a Commissioner of the Superior Court or Notary Public. Submit to the awarding State agency at the time of contract execution.

CERTIFICATION:

I, the undersigned State agency official or State employee, certify that (1) I am authorized to execute the attached contract on behalf of the State agency named below, and (2) the selection of the contractor named below was not the result of collusion, the giving of a gift or the promise of a gift, compensation, fraud or inappropriate influence from any person.

Sworn as true to the best of my knowledge and belief, subject to the penalties of false statement.

_____
Contractor Name

_____
Awarding State Agency

_____ _____
State Agency Official or Employee Signature Date

_____ _____
Printed Name Title

Sworn and subscribed before me on this _____ day of _____, 20___.

_____
Commissioner of the Superior Court
or Notary Public

OPM Ethics Form 5 Rev. 02-01-10

STATE OF CONNECTICUT
CONSULTING AGREEMENT AFFIDAVIT

Affidavit to accompany a State contract for the purchase of goods and services with a value of $50,000 or more in a calendar or fiscal year, pursuant to Connecticut General Statutes §§ 4a-81(a) and 4a-81(b)

INSTRUCTIONS:

If the bidder or vendor has entered into a consulting agreement, as defined by Connecticut General Statutes § 4a-81(b)(1): Complete all sections of the form. If the bidder or vendor has entered into more than one such consulting agreement, use a separate form for each agreement. Sign and date the form in the presence of a Commissioner of the Superior Court or Notary Public. **If the bidder or vendor has not entered into a consulting agreement, as defined by Connecticut General Statutes § 4a-81(b)(1):** Complete only the shaded section of the form. Sign and date the form in the presence of a Commissioner of the Superior Court or Notary Public.

Submit completed form to the awarding State agency with bid or proposal. For a sole source award, submit completed form to the awarding State agency at the time of contract execution.

This affidavit must be amended if the contractor enters into any new consulting agreement(s) during the term of the State contract.

AFFIDAVIT: [Number of Affidavits Sworn and Subscribed On This Day: _____]

I, the undersigned, hereby swear that I am the chief official of the bidder or vendor awarded a contract, as described in Connecticut General Statutes § 4a-81(a), or that I am the individual awarded such a contract who is authorized to execute such contract. I further swear that I have not entered into any consulting agreement in connection with such contract, **except for the agreement listed below**:

_____ _____
Consultant's Name and Title Name of Firm (if applicable)

_____ _____ _____
Start Date End Date Cost

Description of Services Provided: _____

_____

_____

Is the consultant a former State employee or former public official? ☐ YES ☐ NO

If YES: _____ _____
Name of Former State Agency Termination Date of Employment

Sworn as true to the best of my knowledge and belief, subject to the penalties of false statement.

_____ _____ _____
Printed Name of Bidder or Vendor **Signature of Chief Official or Individual** **Date**

_____ _____
Printed Name (of above) Awarding State Agency

Sworn and subscribed before me on this _____ day of _____, 20___.

_____
Commissioner of the Superior Court or Notary Public

STATE OF CONNECTICUT
STATE ELECTIONS ENFORCEMENT COMMISSION
20 Trinity Street Hartford, Connecticut 06106—1628

SEEC FORM 10

NOTICE TO EXECUTIVE BRANCH STATE CONTRACTORS AND PROSPECTIVE STATE CONTRACTORS OF CAMPAIGN CONTRIBUTION AND SOLICITATION BAN

This notice is provided under the authority of Connecticut General Statutes 9-612(g)(2), as amended by P.A. 07-1, and is for the purpose of informing state contractors and prospective state contractors of the following law (italicized words are defined on page 2):

Campaign Contribution and Solicitation Ban

No *state contractor, prospective state contractor, principal of a state contractor or principal of a prospective state contractor*, with regard to a *state contract or state contract solicitation* with or from a state agency in the executive branch or a quasi-public agency or a holder, or principal of a holder of a valid prequalification certificate, shall make a contribution to, or *solicit* contributions on behalf of (i) an exploratory committee or candidate committee established by a candidate for nomination or election to the office of Governor, Lieutenant Governor, Attorney General, State Comptroller, Secretary of the State or State Treasurer, (ii) a political committee authorized to make contributions or expenditures to or for the benefit of such candidates, or (iii) a party committee;

In addition, no holder or principal of a holder of a valid prequalification certificate, shall make a contribution to, or solicit contributions on behalf of (i) an exploratory committee or candidate committee established by a candidate for nomination or election to the office of State senator or State representative, (ii) a political committee authorized to make contributions or expenditures to or for the benefit of such candidates, or (iii) a party committee.

Duty to Inform

State contractors and prospective state contractors are required to inform their principals of the above prohibitions, as applicable, and the possible penalties and other consequences of any violation thereof.

Penalties for Violations

Contributions or solicitations of contributions made in violation of the above prohibitions may result in the following civil and criminal penalties:

Civil penalties--$2000 or twice the amount of the prohibited contribution, whichever is greater, against a principal or a contractor. Any state contractor or prospective state contractor which fails to make reasonable efforts to comply with the provisions requiring notice to its principals of these prohibitions and the possible consequences of their violations may also be subject to civil penalties of $2000 or twice the amount of the prohibited contributions made by their principals.

Criminal penalties—Any knowing and willful violation of the prohibition is a Class D felony, which may subject the violator to imprisonment of not more than 5 years, or $5000 in fines, or both.

Contract Consequences

Contributions made or solicited in violation of the above prohibitions may result, in the case of a state contractor, in the contract being voided.

Contributions made or solicited in violation of the above prohibitions, in the case of a prospective state contractor, shall result in the contract described in the state contract solicitation not being awarded to the prospective state contractor, unless the State Elections Enforcement Commission determines that mitigating circumstances exist concerning such violation.

The state will not award any other state contract to anyone found in violation of the above prohibitions for a period of one year after the election for which such contribution is made or solicited, unless the State Elections Enforcement Commission determines that mitigating circumstances exist concerning such violation.

Receipt acknowledged:_____ _____
(signature) (date)
Print name:_____ Title:_____

Company Name:_____

Additional information and the entire text of P.A 07-1 may be found on the website of the State Elections Enforcement Commission, www.ct.gov/seec. Click on the link to "State Contractor Contribution Ban"

Definitions:

"State contractor" means a person, business entity or nonprofit organization that enters into a state contract. Such person, business entity or nonprofit organization shall be deemed to be a state contractor until December thirty-first of the year in which such contract terminates. "State contractor" does not include a municipality or any other political subdivision of the state, including any entities or associations duly created by the municipality or political subdivision exclusively amongst themselves to further any purpose authorized by statute or charter, or an employee in the executive or legislative branch of state government or a quasi-public agency, whether in the classified or unclassified service and full or part-time, and only in such person's capacity as a state or quasi-public agency employee.

"Prospective state contractor" means a person, business entity or nonprofit organization that (i) submits a response to a state contract solicitation by the state, a state agency or a quasi-public agency, or a proposal in response to a request for proposals by the state, a state agency or a quasi-public agency, until the contract has been entered into, or (ii) holds a valid prequalification certificate issued by the Commissioner of Administrative Services under section 4a-100. "Prospective state contractor" does not include a municipality or any other political subdivision of the state, including any entities or associations duly created by the municipality or political subdivision exclusively amongst themselves to further any purpose authorized by statute or charter, or an employee in the executive or legislative branch of state government or a quasi-public agency, whether in the classified or unclassified service and full or part-time, and only in such person's capacity as a state or quasi-public agency employee.

"Principal of a state contractor or prospective state contractor" means (i) any individual who is a member of the board of directors of, or has an ownership interest of five per cent or more in, a state contractor or prospective state contractor, which is a business entity, except for an individual who is a member of the board of directors of a nonprofit organization, (ii) an individual who is employed by a state contractor or prospective state contractor, which is a business entity, as president, treasurer or executive vice president, (iii) an individual who is the chief executive officer of a state contractor or prospective state contractor, which is not a business entity, or if a state contractor or prospective state contractor has no such officer, then the officer who duly possesses comparable powers and duties, (iv) an officer or an employee of any state contractor or prospective state contractor who has managerial or discretionary responsibilities with respect to a state contract, (v) the spouse or a dependent child who is eighteen years of age or older of an individual described in this subparagraph, or (vi) a political committee established or controlled by an individual described in this subparagraph or the business entity or nonprofit organization that is the state contractor or prospective state contractor.

"State contract" means an agreement or contract with the state or any state agency or any quasi-public agency, let through a procurement process or otherwise, having a value of fifty thousand dollars or more, or a combination or series of such agreements or contracts having a value of one hundred thousand dollars or more in a calendar year, for (i) the rendition of services, (ii) the furnishing of any goods, material, supplies, equipment or any items of any kind, (iii) the construction, alteration or repair of any public building or public work, (iv) the acquisition, sale or lease of any land or building, (v) a licensing arrangement, or (vi) a grant, loan or loan guarantee. "State contract" does not include any agreement or contract with the state, any state agency or any quasi-public agency that is exclusively federally funded, an education loan or a loan to an individual for other than commercial purposes.

"State contract solicitation" means a request by a state agency or quasi-public agency, in whatever form issued, including, but not limited to, an invitation to bid, request for proposals, request for information or request for quotes, inviting bids, quotes or other types of submittals, through a competitive procurement process or another process authorized by law waiving competitive procurement.

"Managerial or discretionary responsibilities with respect to a state contract" means having direct, extensive and substantive responsibilities with respect to the negotiation of the state contract and not peripheral, clerical or ministerial responsibilities.

"Dependent child" means a child residing in an individual's household who may legally be claimed as a dependent on the federal income tax of such individual.

"Solicit" means (A) requesting that a contribution be made, (B) participating in any fund-raising activities for a candidate committee, exploratory committee, political committee or party committee, including, but not limited to, forwarding tickets to potential contributors, receiving contributions for transmission to any such committee or bundling contributions, (C) serving as chairperson, treasurer or deputy treasurer of any such committee, or (D) establishing a political committee for the sole purpose of soliciting or receiving contributions for any committee. Solicit does not include: (i) making a contribution that is otherwise permitted by Chapter 155 of the Connecticut General Statutes; (ii) informing any person of a position taken by a candidate for public office or a public official, (iii) notifying the person of any activities of, or contact information for, any candidate for public office; or (IV) serving as a member in any party committee or as an officer of such committee that is not otherwise prohibited in this section.

STATE OF CONNECTICUT
STATE ELECTIONS ENFORCEMENT COMMISSION
20 Trinity Street Hartford, Connecticut 06106—1628

SEEC FORM 11

NOTICE TO EXECUTIVE BRANCH STATE CONTRACTORS AND PROSPECTIVE STATE CONTRACTORS OF CAMPAIGN CONTRIBUTION AND SOLICITATION BAN

This notice is provided under the authority of Connecticut General Statutes 9-612(g)(2), as amended by P.A. 07-1, and is for the purpose of informing state contractors and prospective state contractors of the following law (italicized words are defined below):

Campaign Contribution and Solicitation Ban

No *state contractor, prospective state contractor, principal of a state contractor or principal of a prospective state contractor*, with regard to a *state contract* or *state contract solicitation* with or from a state agency in the executive branch or a quasi-public agency or a holder, or principal of a holder of a valid prequalification certificate, shall make a contribution to, or *solicit* contributions on behalf of (i) an exploratory committee or candidate committee established by a candidate for nomination or election to the office of Governor, Lieutenant Governor, Attorney General, State Comptroller, Secretary of the State or State Treasurer, (ii) a political committee authorized to make contributions or expenditures to or for the benefit of such candidates, or (iii) a party committee;

In addition, no holder or principal of a holder of a valid prequalification certificate, shall make a contribution to, or solicit contributions on behalf of (i) an exploratory committee or candidate committee established by a candidate for nomination or election to the office of State senator or State representative, (ii) a political committee authorized to make contributions or expenditures to or for the benefit of such candidates, or (iii) a party committee.

Duty to Inform

State contractors and prospective state contractors are required to inform their principals of the above prohibitions, as applicable, and the possible penalties and other consequences of any violation thereof.

Penalties for Violations

Contributions or solicitations of contributions made in violation of the above prohibitions may result in the following civil and criminal penalties:

Civil penalties--$2000 or twice the amount of the prohibited contribution, whichever is greater, against a principal or a contractor. Any state contractor or prospective state contractor which fails to make reasonable efforts to comply with the provisions requiring notice to its principals of these prohibitions and the possible consequences of their violations may also be subject to civil penalties of $2000 or twice the amount of the prohibited contributions made by their principals.

Criminal penalties—Any knowing and willful violation of the prohibition is a Class D felony, which may subject the violator to imprisonment of not more than 5 years, or $5000 in fines, or both.

Contract Consequences

Contributions made or solicited in violation of the above prohibitions may result, in the case of a state contractor, in the contract being voided.

Contributions made or solicited in violation of the above prohibitions, in the case of a prospective state contractor, shall result in the contract described in the state contract solicitation not being awarded to the prospective state contractor, unless the State Elections Enforcement Commission determines that mitigating circumstances exist concerning such violation.

The State will not award any other state contract to anyone found in violation of the above prohibitions for a period of one year after the election for which such contribution is made or solicited, unless the State Elections Enforcement Commission determines that mitigating circumstances exist concerning such violation.

Additional information and the entire text of P.A 07-1 may be found on the website of the State Elections Enforcement Commission, www.ct.gov/seec. Click on the link to "State Contractor Contribution Ban."

Definitions:
"State contractor" means a person, business entity or nonprofit organization that enters into a state contract. Such person, business entity or nonprofit organization shall be deemed to be a state contractor until December thirty-first of the year in which such contract terminates. "State contractor" does not include a municipality or any other political subdivision of the state, including any entities or associations duly created by the municipality or political subdivision exclusively amongst themselves to further any purpose authorized by statute or charter, or an employee in the executive or legislative branch of state government or a quasi-public agency, whether in the classified or unclassified service and full or part-time, and only in such person's capacity as a state or quasi-public agency employee.

"Prospective state contractor" means a person, business entity or nonprofit organization that (i) submits a response to a state contract solicitation by the state, a state agency or a quasi-public agency, or a proposal in response to a request for proposals by the state, a state agency or a quasi-public agency, until the contract has been entered into, or (ii) holds a valid prequalification certificate issued by the Commissioner of Administrative Services under section 4a-100. "Prospective state contractor" does not include a municipality or any other political subdivision of the state, including any entities or associations duly created by the municipality or political subdivision exclusively amongst themselves to further any purpose authorized by statute or charter, or an employee in the executive or legislative branch of state government or a quasi-public agency, whether in the classified or unclassified service and full or part-time, and only in such person's capacity as a state or quasi-public agency employee.

"Principal of a state contractor or prospective state contractor" means (i) any individual who is a member of the board of directors of, or has an ownership interest of five per cent or more in, a state contractor or prospective state contractor, which is a business entity, except for an individual who is a member of the board of directors of a nonprofit organization, (ii) an individual who is employed by a state contractor or prospective state contractor, which is a business entity, as president, treasurer or executive vice president, (iii) an individual who is the chief executive officer of a state contractor or prospective state contractor, which is not a business entity, or if a state contractor or prospective state contractor has no such officer, then the officer who duly possesses comparable powers and duties, (iv) an officer or an employee of any state contractor or prospective state contractor who has *managerial or discretionary responsibilities with respect to a state contract,* (v) the spouse or a *dependent child* who is eighteen years of age or older of an individual described in this subparagraph, or (vi) a political committee established or controlled by an individual described in this subparagraph or the business entity or nonprofit organization that is the state contractor or prospective state contractor.

"State contract" means an agreement or contract with the state or any state agency or any quasi-public agency, let through a procurement process or otherwise, having a value of fifty thousand dollars or more, or a combination or series of such agreements or contracts having a value of one hundred thousand dollars or more in a calendar year, for (i) the rendition of services, (ii) the furnishing of any goods, material, supplies, equipment or any items of any kind, (iii) the construction, alteration or repair of any public building or public work, (iv) the acquisition, sale or lease of any land or building, (v) a licensing arrangement, or (vi) a grant, loan or loan guarantee. "State contract" does not include any agreement or contract with the state, any state agency or any quasi-public agency that is exclusively federally funded, an education loan or a loan to an individual for other than commercial purposes.

"State contract solicitation" means a request by a state agency or quasi-public agency, in whatever form issued, including, but not limited to, an invitation to bid, request for proposals, request for information or request for quotes, inviting bids, quotes or other types of submittals, through a competitive procurement process or another process authorized by law waiving competitive procurement.

“Managerial or discretionary responsibilities with respect to a state contract” means having direct, extensive and substantive responsibilities with respect to the negotiation of the state contract and not peripheral, clerical or ministerial responsibilities.

“Dependent child” means a child residing in an individual’s household who may legally be claimed as a dependent on the federal income tax of such individual.

“Solicit” means (A) requesting that a contribution be made, (B) participating in any fund-raising activities for a candidate committee, exploratory committee, political committee or party committee, including, but not limited to, forwarding tickets to potential contributors, receiving contributions for transmission to any such committee or bundling contributions, (C) serving as chairperson, treasurer or deputy treasurer of any such committee, or (D) establishing a political committee for the sole purpose of soliciting or receiving contributions for any committee. Solicit does not include: (i) making a contribution that is otherwise permitted by Chapter 155 of the Connecticut General Statutes; (ii) informing any person of a position taken by a candidate for public office or a public official, (iii) notifying the person of any activities of, or contact information for, any candidate for public office; or (iv) serving as a member in any party committee or as an officer of such committee that is not otherwise prohibited in this section.

Office of Policy and Management

REQUIRED FOR ALL CONTRACT TYPES

Nondiscrimination Certification

Effective Date: June 30, 2009

Form A Representation By Individual
Form B Representation By Entity
Form C Affidavit By Entity
Form D New Resolution By Entity
Form E Prior Resolution By Entity

DESCRIPTION

The Office of the Attorney General has approved the above nondiscrimination certification forms to assist executive branch agencies in complying with the State's contracting requirements under Connecticut General Statutes §§ 4a-60(a)(1) and 4a-60a(a)(1), as amended.

By law, a contractor must provide an awarding State agency with *written representation* or *documentation* that certifies the contractor complies with the State's nondiscrimination agreements and warranties.

A nondiscrimination certification is required for all State contracts – regardless of type, term, cost, or value. The appropriate form must be submitted to the awarding State agency prior to contract execution. ***See list of exempt entities (below).***

FORMS & DESCRIPTIONS

There are five different certification forms. Form A is *always* used for contracts with an individual who is not an entity, regardless of the contract value. Form B is *always* used for contracts with an entity when the contract value is less than $50,000. Form C is *recommended* for contracts valued at $50,000 or more with an entity. If Form C is not used, either Form D or E must be used; both require a resolution (new or prior).

<table>
<tr><th>For Use By:</th><th>Value
Less Than
$50,000</th><th>Value
$50,000 or More</th></tr>
<tr><td>Individual</td><td colspan="2">Form A
Representation</td></tr>
<tr><td rowspan="3">Entity</td><td rowspan="3">Form B
Representation</td><td>Form C
Affidavit</td></tr>
<tr><td>Form D
New Resolution</td></tr>
<tr><td>Form E
Prior Resolution</td></tr>
</table>

Definitions

- *individual:* a person who is not an entity
- *entity:* corporation, limited liability company, or partnership

EXPLANATION OF FORMS

Form A. *Representation:* For use by an individual when entering into any contract, regardless of contract value.

Form B. *Representation:* For use by an entity when entering into any contract valued at less than $50,000 for any year of the contract.

Form C. *Affidavit:* (Recommended) For use by an entity when entering into any contract valued at $50,000 or more for any year of the contract **and** the entity certifies through an affidavit that a complying nondiscrimination policy is currently in place.

Form D. *New Resolution:* For use by a entity when entering into any contract valued at $50,000 or more for any year of the contract **and** the entity has a complying nondiscrimination policy adopted by a new resolution of the board of directors, shareholders, managers, members, or other governing body.

Form E. *Prior Resolution:* For use by a entity when entering into any contract valued at $50,000 or more for any year of the contract **and** the entity has a complying nondiscrimination policy adopted by a prior resolution of the board of directors, shareholders, managers, members, or other governing body.

EXEMPTIONS

The entities listed below are exempt and, therefore, not required to submit a nondiscrimination certification form when entering into a contract with the State:

1. political subdivisions of the State of Connecticut, including, but not limited to municipalities;
2. quasi-public agencies, as defined in C.G.S. § 1-120;
3. other states of the United States, including, but not limited to, the District of Columbia, Puerto Rico, U.S. territories and possessions, and federally recognized Indian tribal governments, as defined in C.G.S. § 1-267;
4. the federal government;
5. foreign governments; and
6. an agency of a subdivision, agency, state or government listed in items 1-5.

For Further Information, Contact:

Please direct any questions about the nondiscrimination certification forms to the Commission on Human Rights and Opportunities:

Tel. 860/ 541-3400
Connecticut Toll Free Tel. 1-800/ 477-5737

Content Last Modified on 7/8/2009 1:37:34 PM

Form A
07-08-2009

STATE OF CONNECTICUT

NONDISCRIMINATION CERTIFICATION — Representation By Individual For All Contract Types Regardless of Value

Written representation that complies with the nondiscrimination agreements and warranties under Connecticut General Statutes §§ 4a-60(a)(1) and 4a-60a(a)(1), as amended

---

INSTRUCTIONS:

For use by an individual who is not an entity (corporation, limited liability company, or partnership) when entering into any contract type with the State of Connecticut, regardless of contract value. Submit to the awarding State agency prior to contract execution.

REPRESENTATION OF AN INDIVIDUAL:

I, _____ , of _____ ,
Signatory Business Address

represent that I will comply with the nondiscrimination agreements and warranties of Connecticut General Statutes §§ 4a-60(a)(1)and 4a-60a(a)(1), as amended.

_____ _____
Signatory Date

_____
Printed Name

Form B
07-08-2009

STATE OF CONNECTICUT

NONDISCRIMINATION CERTIFICATION — Representation By Entity

For Contracts Valued at Less Than $50,000

Written representation that complies with the nondiscrimination agreements and warranties under Connecticut General Statutes §§ 4a-60(a)(1) and 4a-60a(a)(1), as amended

---

INSTRUCTIONS:

For use by an entity (corporation, limited liability company, or partnership) when entering into any contract type with the State of Connecticut valued at less than $50,000 for each year of the contract. Complete all sections of the form. Submit to the awarding State agency prior to contract execution.

REPRESENTATION OF AN ENTITY:

I, _____ , _____ , of _____ ,
Authorized Signatory Title Name of Entity

an entity duly formed and existing under the laws of _____ ,
Name of State or Commonwealth

represent that I am authorized to execute and deliver this representation on behalf of

_____ and that _____
Name of Entity Name of Entity

has a policy in place that complies with the nondiscrimination agreements and warranties of Connecticut General Statutes §§ 4a-60(a)(1) and 4a-60a(a)(1), as amended.

_____ _____
Authorized Signatory Date

_____
Printed Name

Form C
07-08-2009

STATE OF CONNECTICUT

NONDISCRIMINATION CERTIFICATION — Affidavit By Entity For Contracts Valued at $50,000 or More

Documentation in the form of an affidavit signed under penalty of false statement by a chief executive officer, president, chairperson, member, or other corporate officer duly authorized to adopt corporate, company, or partnership policy that certifies the contractor complies with the nondiscrimination agreements and warranties under Connecticut General Statutes §§ 4a-60(a)(1) and 4a-60a(a)(1), as amended

---

INSTRUCTIONS:

For use by an entity (corporation, limited liability company, or partnership) when entering into any contract type with the State of Connecticut valued at $50,000 or more for any year of the contract. Complete all sections of the form. Sign form in the presence of a Commissioner of Superior Court or Notary Public. Submit to the awarding State agency prior to contract execution.

AFFIDAVIT:

I, the undersigned, am over the age of eighteen (18) and understand and appreciate the obligations of an oath. I am _____ of _____ , an entity
Signatory's Title Name of Entity

duly formed and existing under the laws of _____.
Name of State or Commonwealth

I certify that I am authorized to execute and deliver this affidavit on behalf of

_____ and that _____
Name of Entity Name of Entity

has a policy in place that complies with the nondiscrimination agreements and warranties of Connecticut General Statutes §§ 4a-60(a)(1)and 4a-60a(a)(1), as amended.

_____
Authorized Signatory

_____
Printed Name

Sworn and subscribed to before me on this _____ day of _____, 20__ __.

_____ _____
Commissioner of the Superior Court / Notary Public **Commission Expiration Date**

Form D
07-08-2009

STATE OF CONNECTICUT

NONDISCRIMINATION CERTIFICATION — New Resolution By Entity For Contracts Valued at $50,000 or More

Documentation in the form of a corporate, company, or partnership policy adopted by resolution of the board of directors, shareholders, managers, members or other governing body of a contractor that certifies the contractor complies with the nondiscrimination agreements and warranties under Connecticut General Statutes §§ 4a-60(a)(1) and 4a-60a(a)(1), as amended

---

INSTRUCTIONS:

For use by an entity (corporation, limited liability company, or partnership) when entering into any contract type with the State of Connecticut valued at $50,000 or more for any year of the contract. Complete all sections of the form. Submit to the awarding State agency prior to contract execution.

CERTIFICATION OF RESOLUTION:

I, _____ , _____ , of _____ ,
Authorized Signatory Title Name of Entity

an entity duly formed and existing under the laws of _____ ,
Name of State or Commonwealth

certify that the following is a true and correct copy of a resolution adopted on the _____ day of

_____ , 20_____ by the governing body of _____ ,
Name of Entity

in accordance with all of its documents of governance and management and the laws of

_____ , and further certify that such resolution has not been modified
Name of State or Commonwealth

or revoked, and is in full force and effect.

RESOLVED: That the policies of _____ comply with the
Name of Entity

nondiscrimination agreements and warranties of Connecticut General Statutes

§§ 4a-60(a)(1) and 4a-60a(a)(1), as amended.

The undersigned has executed this certificate this _____ day of _____ , 20_____ .

_____ _____
Authorized Signatory Date

_____
Printed Name

Form E
07-08-2009

STATE OF CONNECTICUT

NONDISCRIMINATION CERTIFICATION — Prior Resolution By Entity For Contracts Valued at $50,000 or More

Documentation in the form of a corporate, company, or partnership policy adopted by a prior resolution of the board of directors, shareholders, managers, members or other governing body of a contractor that certifies the contractor complies with the nondiscrimination agreements and warranties under Connecticut General Statutes §§ 4a-60(a)(1) and 4a-60a(a)(1), as amended

---

INSTRUCTIONS:

For use by an entity (corporation, limited liability company, or partnership) when entering into any contract type with the State of Connecticut valued at $50,000 or more for any year of the contract. Complete all sections of the form. Attach copy of previously adopted resolution (*State of CT, Nondiscrimination Certification, Form D: New Resolution*). Submit all documentation to the awarding State agency prior to contract execution.

CERTIFICATION OF PRIOR RESOLUTION:

I, the undersigned, am a duly authorized corporate officer or member of _____.
Name of Entity

I have reviewed the attached prior resolution. I certify that:

(1) the attached prior resolution complies with the nondiscrimination agreements and warranties of Connecticut General Statutes §§ 4a-60(a)(1) and 4a-60a(a)(1), as amended; and

(2) the prior resolution remains in full force and effect on the date this documentation is submitted to the awarding State agency.

_____ _____
Authorized Signatory Title

_____ _____
Printed Name Date

RESERVED FOR STATE USE

I, the undersigned head of the awarding State agency, or designee, certify that the attached prior resolution complies with the nondiscrimination agreements and warranties of Connecticut General Statutes §§ 4a-60(a)(1) and 4a-60a(a)(1), as amended.

_____ _____
Signature of Agency Head (or designee) Date

_____
Awarding State Agency

General advice for filling out affidavits and the Certificate (that serves as the Certificate of Authority for the person signing the affidavit):

(1) The person signing any affidavit or the Gift and Campaign Contribution certification must be the individual authorized to do so in the Certificate (of authority).

(2) The execution of the Certificate (of authority) must be on or soon after the date of execution of the contract, affidavit or the other certification, as the case may be. Please note: The Resolutions that are noted in the Certificate (of authority) need to have been adopted on or before the date the Certificate (of authority) is signed.

(3) Gift and Campaign Contribution Certification: If no gifts were given do not leave the form blank. Write in the word "none" in the area on the form where disclosure is supposed to be made.

(4) A notary public or a commissioner of the superior court (this is an attorney licensed to practice law) must witness the affiant (the person signing the affidavit) signing the affidavit. Therefore, the date that the affiant signs will be the same date as the notary public or commissioner of the superior court signs the affidavit.

(5) If a notary public is used, make sure she or he places her/his seal and commission expiration date on the subject document.

(6) In the Certificate (of authority) form, you cannot authorize yourself to sign the affidavits, unless you solely own the business or your company is an LLC and you are the sole member of the LLC. If you fall into either of these two categories, please include a note with or on the Certificate (of authority) stating that you are the sole owner or the sole member.

(7) Depending on the structure of your company, another officer, member, partner, or general partner needs to authorize the person signing the affidavit to do so.

CORPORATION CERTIFIED RESOLUTION

I, _____, Secretary of _____
(Name of Certifying Officer) (Name of Corporation)

_____, a corporation organized and existing under the laws of the State of

_____ (the "Company"), do hereby certify that the following is a true and
(State of incorporation)

correct copy of a resolution duly adopted at a meeting of the Board of Directors of the Company duly held and convened on _____, 200___, at which meeting a duly
(Month and day) (year)

constituted quorum of the Board of Directors was present and acting throughout, and that such resolution has not been modified, rescinded or revoked, and is at present in full force and effect:

RESOLVED: That _____, _____
(Name and title of signer of contract documents)

of _____ is empowered and authorized, on behalf of the Company,
(Name of corporation)

to execute and deliver contracts and amendments thereto, and all documents required by the Governor, the Connecticut Department of Public Works, the Connecticut State Properties Review Board and the Office of the Attorney General associated with such contracts and amendments.

IN WITNESS WHEREOF, the undersigned has affixed his/her signature and the corporate seal of the Company this _____ day of _____, 200___.

[or, if the corporation has no seal ...]

IN WITNESS WHEREOF, the undersigned has affixed his/her signature this ____ day of _____, 200___. The Company has no corporate seal.

_____
Print name:
Its Secretary

(Corporate Seal)

LLC CERTIFIED RESOLUTION

I, _____, a _____ of
(Name) (Specify Member or Manager)

_____ LLC, a limited liability company organized
(Name of company)

and existing under the laws of the State of _____,

(the "Company"), hereby certify: (i) that _____ is run by
(Name of company)

_____; (ii) that _____ is a
(Specify if it is run by its members or a manager) (Name of signer of contract documents)

_____ of _____; and (iii) that as such,
(Specify Member / Manager) (Company name)

_____ is not prohibited or limited by the articles of
(Name of signer of contract documents)

organization from binding the LLC, and is empowered and authorized, on behalf of the Company, to execute and deliver contracts and amendments thereto, and all documents required by the Governor, the Connecticut Department of Public Works, the Connecticut State Properties Review Board or the Office of the Attorney General associated with such contracts and amendments.

IN WITNESS WHEREOF, the undersigned has affixed his/her signature and the seal of the LLC this ___ day of _____, 200___.

[or, if the LLC has no seal ...]

IN WITNESS WHEREOF, the undersigned has affixed his/her signature this ___ day of _____, 200___. The LLC has no seal.

_____
Print name:
Its: Member / Manager

If the LLC has a seal, place it here.

USE THIS FORMAT WHEN AN LLC HAS A CORPORATION AS THE SOLE MEMBER.

LLC CERTIFIED RESOLUTION

I, _____ (name of Secretary of the corporation), the Secretary of _____ (name of corporation), which corporation is the sole member of _____ LLC (Name of LLC), a limited liability company organized and existing under the laws of the State of _____ (state of incorporation) (the "LLC") hereby certify: (i) that the LLC is run by _____(name of corporation), that (ii) _____ (name of corporation) is the sole member of _____ (name of LLC); and (iii) that _____, President of _____ (name of corporation), the sole member of the LLC, is not prohibited or limited by the articles of organization of the corporation or the LLC from binding the LLC, and is empowered and authorized, on behalf of the corporation and the LLC, to execute and deliver contracts and amendments thereto, and all documents required by the Governor, the Connecticut Department of Public Works, the Connecticut State Properties Review Board, or the Office of the Attorney General associated with such contracts and amendments.

IN WITNESS WHEREOF, the undersigned has affixed his/her signature and the seal of the LLC this _____ day of _____, 200 ___.

[*or if the LLC has no seal*]

IN WITNESS WHEREOF, the undersigned has affixed his/her signature this _____ day of _____, 200 ____. The LLC has no seal.

If the LLC has a seal, place it here.

_____,LLC
(name of LLC)
By: _____ its sole member
(corporation name)

By: _____

Secretary of _____
(name of corporation)
Duly Authorized

PARTNERSHIP CERTIFICATION

I, _____, the undersigned, do certify that I am a general partner of _____ a _____
(Name of company) (State)
partnership, and I do further certify that _____is a
(Name of signer of contract documents)
general partner of said partnership, and, as such, is empowered and authorized on behalf of the partnership to execute contracts and amendments thereto and all documents required by the Governor, the Connecticut Department of Public Works, the Connecticut State Properties Review Board or the Office of the Attorney General associated with such contracts and amendments.

IN WITNESS WHEREOF, the undersigned has affixed his/her signature this _____ day of _____, 200___.

_____
Print name:
General Partner

CERTIFICATE OF AUTHORITY
LIMITED LIABILITY PARTNERSHIP

I, _____, a Partner of _____, LLP a
(Name of company)

Limited Liability Partnership organized and existing under the laws of the State of Connecticut, hereby certify that the following resolution was duly adopted at a meeting by all of the Partners of said Limited Liability Partnership, duly held on the _____
(Day)
day of _____, _____.
(Month) (Year)

Resolved, that _____ is a Partner of _____,
(Name of signer of contract documents) (Name of company)

LLP and is hereby authorized to make, execute, and approve on behalf of this Limited Liability Partnership any and all contracts and amendments thereto, and all documents required by the Governor, the Connecticut Department of Public Works, the Connecticut State Properties Review Board and the Office of the Attorney General associated with such contracts and amendments.

AND I DO FURTHER CERTIFY that the above resolution has not been in any way altered, amended, revoked, or repealed and is now in full force and effect.

In witness whereof, I hereunto set my hand this _____ day of _____, _____.

_____
Print name:
Partner

Seal here

CERTIFICATE OF AUTHORITY
LIMITED PARTNERSHIP

I, _____, the undersigned, do hereby certify that I am a General

Partner of _____
(Name of partnership and address),
a _____ partnership and I do hereby further certify that
(State)
_____, in his/her capacity as a General Partner of said
(Name of signer of contract documents)

partnership is authorized to sign any and all contracts and amendments to contracts and all documents required by the Governor, the Connecticut Department of Public Works, the Connecticut State Properties Review Board or the Office of the Attorney General associated with such contracts and amendments on behalf of the said partnership.

I do further certify that the above authorization has not been amended or revoked and was in full force and effect on _____ and continues to be
(date of or prior to the execution of the subject contract document)

in full force and effect as of the present time.

Dated this _____ day of _____, _____.

_____
Print name:
General Partner

CERTIFICATE OF AUTHORITY
DESIGN BUILD

I, _____, the undersigned, do hereby certify that I am
(Name of Certifying Officer)

the _____, of _____, a
(Title of Certifying Officer) (Name of Company)

_____ corporation, and that the following resolution
(State of Incorporation)

was duly adopted on _____, _____, at a duly called and held
(Date of Adoption of Resolution)

meeting of the Board of Directors of said corporation:

Resolved, that _____, in _____ capacity as
(Name of signer of contract documents) (his/her)

_____ of _____, is fully
(Title of signer of contract documents) (Name of Company)

authorized to execute and sign on behalf of the corporation all bonds, contracts and amendments thereto, and all documents required by the Governor, the Connecticut Department of Public Works, the Connecticut State Properties Review Board or the Office of the Attorney General in connection with the _____ and to affix the
(Project Title and Number)

Corporate Seal on such documents.

I do further certify that the above resolution has not been amended or revoked and is now in full force and effect.

Dated this _____ day of _____, _____.

Affix Corporate Seal Here

_____ (Signature)

Print name: _____
Title: _____

Office of Policy and Management

PERSONAL SERVICE AGREEMENTS (PSA)

Ethics Affidavits & Certifications for State Contracts

Forms & Descriptions Summary Chart Definitions Other Notes

The Office of Policy and Management created the ethics forms (below) to assist executive branch agencies in complying with the State of Connecticut's current contracting requirements, pursuant to the Connecticut General Statutes and Executive Orders of Governor M. Jodi Rell. The forms are effective August 1, 2007.

FORMS & DESCRIPTIONS

Adobe.pdf (all) Word.doc (all) Rev. 02-01-10

Form 1. Gift and Campaign Contribution Certification

Rev. 02-01-10 Adobe.pdf Word.doc

This certification accompanies a State contract with a value of $50,000 or more in a calendar or fiscal year. The completed form is submitted by the contractor to the awarding State agency at the time of contract execution. The form is also used with a multi-year contract to update the initial certification on an annual basis.

Form 2. Rescinded on 01-Aug-07. Use Form 1.

Form 3. Certification of State Agency Official or Employee Authorized to Execute Contract

Rev. 02-01-10 Adode.pdf Word.doc

This certification accompanies a State contract with a value of $50,000 or more in a calendar or fiscal year. The completed form is signed at the time of contract execution by the State agency official or employee authorized to execute the contract on behalf of the awarding State agency.

Form 4. Rescinded on 01-Aug-07. Use Form 1.

Form 5. Consulting Agreement Affidavit

Rev. 02-01-10 Adobe.pdf Word.doc

This affidavit accompanies a State contract for the purchase of goods or services with a value of $50,000 or more in a calendar or fiscal year. Form 5 is normally submitted by the contractor to the awarding State agency with the bid or proposal. However, for a sole source or no bid contract, it is submitted at the time of contract execution.

Form 6. Affirmation of Receipt of State Ethics Laws Summary

Rev. 02-01-10 Adobe.pdf Word.doc

This affirmation accompanies a large State construction contract or a large State procurement contract with a cost of more than $500,000. Form 6 is normally submitted by the contractor to the awarding State agency with the bid or proposal. However, for a sole source or no bid contract, Form 6 is submitted at the time of contract execution.
When applicable, Form 6 is also used by a subcontractor or consultant of the contractor. The subcontractor or consultant submits the form to the contractor, who then submits it to the awarding State agency.

Forms 6A, 6B, 6C. Rescinded on 01-Aug-07. Use Form 6.

SUMMARY CHART

The chart belows summarizes who signs which ethics form, and when each form is submitted during the contracting process.

WHEN TO SUBMIT	ETHICS FORMS		
	Signed by AGENCY	Signed by CONTRACTOR	
		ALL Contracts cost or value $50 K or more	LARGE Contracts cost $500 K or more
submit form **with** bid or proposal		Form 5 *	Form 6 **
submit form **at time of** contract execution	Form 3	Form 1 Form 5 *	Form 6 **
submit form **after** contract execution			Form 6 **
submit form **annually** if multi-year contract		Form 1	

* Form 5 is normally submitted by the contractor to the awarding State agency with the bid or proposal. However, for a sole source or no bid contract, it is submitted at the time of contract execution.

** Form 6 is normally submitted by the contractor to the awarding State agency with the bid or proposal. However, for a sole source or no bid contract, Form 6 is submitted at the time of contract execution. When applicable, Form 6 is also used by a subcontractor or consultant of the contractor. The subcontractor or consultant submits the form to the contractor, who then submits it to the awarding State agency. Depending on when the contractor engages the subcontractor or consultant, the contractor either submits the form at the time of contract execution or after contract execution.

DEFINITIONS

- **Cost of the contract** means the dollar amount (or equivalent benefit) expended by the State in accordance with the contract.

  Example:

  OPM entered into a contract with Servus Management Corporation to manage the State office complex located at 410-474 Capitol Avenue in Hartford. OPM pays the contractor a specified amount of money for this service. This contract represents a cost expended by the State.

- **Value of the contract** means the dollar amount (or equivalent benefit) expended or received by the State in accordance with the contract.

  Example:

  OPM entered into an agreement with Pinpoint Power whereby, in the event of a power shortage, certain State agencies may be asked to use their own emergency generators. In exchange, the contractor pays the State a specified amount of money to compensate for the service interruption. This contract represents a value received by the State.

- **Large state construction contract** or **large procurement contract** means any contract, having a cost of more than $500,000 for (A) the remodeling, alteration, repair or enlargement of any real asset, (B) the construction, alteration, reconstruction, improvement, relocation, widening or changing of the grade of a section of a state highway or a bridge, (C) the purchase or lease of supplies, materials or equipment, as defined in section 4a-50, or (D) the construction, reconstruction, alteration, remodeling,

repair or demolition of any public building.

OTHER NOTES

Affidavits and certifications are **NOT required for grants or loans**, as such awards are not:

1. large state contracts, as defined by Connecticut General Statutes § 4-250;
2. State Contracts, as defined by Executive Order 7C, Paragraph 2(f); or
3. contracts for the purchase of goods and services, as used in Connecticut General Statutes § 4-81.

For Further Information, Contact:
Please direct any questions about the ethics forms to Wanda L. Dupuy, (860) 418-6261, wanda.dupuy@ct.gov.

Content Last Modified on 1/29/2010 3:28:48 PM

STATE OF CONNECTICUT
GIFT AND CAMPAIGN CONTRIBUTION CERTIFICATION

Certification to accompany a State contract with a value of $50,000 or more in a calendar or fiscal year, pursuant to C.G.S. §§ 4-250 and 4-252(c); Governor M. Jodi Rell's Executive Orders No. 1, Para. 8, and No. 7C, Para. 10; and C.G.S. §9-612(g)(2), as amended by Public Act 07-1

INSTRUCTIONS:

Complete all sections of the form. Attach additional pages, if necessary, to provide full disclosure about any lawful campaign contributions made to campaigns of candidates for statewide public office or the General Assembly, as described herein. Sign and date the form, under oath, in the presence of a Commissioner of the Superior Court or Notary Public. Submit the completed form to the awarding State agency at the time of initial contract execution (and on each anniversary date of a multi-year contract, if applicable).

CHECK ONE: ☐ Initial Certification ☐ Annual Update (Multi-year contracts only.)

GIFT CERTIFICATION:

As used in this certification, the following terms have the meaning set forth below:

1) "Contract" means that contract between the State of Connecticut (and/or one or more of it agencies or instrumentalities) and the Contractor, attached hereto, or as otherwise described by the awarding State agency below;
2) If this is an Initial Certification, "Execution Date" means the date the Contract is fully executed by, and becomes effective between, the parties; if this is an Annual Update, "Execution Date" means the date this certification is signed by the Contractor;
3) "Contractor" means the person, firm or corporation named as the contactor below;
4) "Applicable Public Official or State Employee" means any public official or state employee described in C.G.S. §4-252(c)(1)(i) or (ii);
5) **"Gift"** has the same meaning given that term in C.G.S. § 4-250(1);
6) "Planning Start Date" is the date the State agency began planning the project, services, procurement, lease or licensing arrangement covered by this Contract, as indicated by the awarding State agency below; and
7) "Principals or Key Personnel" means and refers to those principals and key personnel of the Contractor, and its or their agents, as described in C.G.S. §§ 4-250(5) and 4-252(c)(1)(B) and (C).

I, the undersigned, am the official authorized to execute the Contract on behalf of the Contractor. I hereby certify that, between the Planning Start Date and Execution Date, neither the Contractor nor any Principals or Key Personnel has made, will make (or has promised, or offered, to, or otherwise indicated that he, she or it will, make) any **Gifts** to any Applicable Public Official or State Employee.

I further certify that no Principals or Key Personnel know of any action by the Contractor to circumvent (or which would result in the circumvention of) the above certification regarding **Gifts** by providing for any other principals, key personnel, officials, or employees of the Contractor, or its or their agents, to make a **Gift** to any Applicable Public Official or State Employee. I further certify that the Contractor made the bid or proposal for the Contract without fraud or collusion with any person.

CAMPAIGN CONTRIBUTION CERTIFICATION:

I further certify that, on or after December 31, 2006, neither the Contractor nor any of its principals, as defined in C.G.S. § 9-612(g)(1), has made any **campaign contributions** to, or solicited any contributions on behalf of, any exploratory committee, candidate committee, political committee, or party committee established by, or supporting or authorized to support, any candidate for statewide public office, in violation of C.G.S. § 9-612(g)(2)(A). I further certify that **all lawful campaign contributions** that have been made on or after December 31, 2006 by the Contractor or any of its principals, as defined in C.G.S. § 9-612(g)(1), to, or solicited on behalf of, any exploratory committee, candidate committee, political committee, or party committee established by, or supporting or authorized to support any candidates for statewide public office or the General Assembly, are listed below:

STATE OF CONNECTICUT
GIFT AND CAMPAIGN CONTRIBUTION CERTIFICATION

Lawful Campaign Contributions to Candidates for Statewide Public Office:

Contribution Date	Name of Contributor	Recipient	Value	Description

Lawful Campaign Contributions to Candidates for the General Assembly:

Contribution Date	Name of Contributor	Recipient	Value	Description

Sworn as true to the best of my knowledge and belief, subject to the penalties of false statement.

_____ _____
Printed Contractor Name **Signature of Authorized Official**

Subscribed and acknowledged before me this _____ day of _____, 20___.

_____
Commissioner of the Superior Court (or Notary Public)

For State Agency Use Only

_____ _____
Awarding State Agency Planning Start Date

_____
Contract Number or Description

OPM Ethics Form 3 Rev. 02-01-10

STATE OF CONNECTICUT

CERTIFICATION OF STATE AGENCY OFFICIAL OR EMPLOYEE AUTHORIZED TO EXECUTE CONTRACT

Certification to accompany a State contract, having a value of more than $50,000, pursuant to Connecticut General Statutes §§ 4-250 and 4-252(b), and Governor M. Jodi Rell's Executive Order 7C, Paragraph 10

INSTRUCTIONS:

Complete all sections of the form. Sign and date in the presence of a Commissioner of the Superior Court or Notary Public. Submit to the awarding State agency at the time of contract execution.

CERTIFICATION:

I, the undersigned State agency official or State employee, certify that (1) I am authorized to execute the attached contract on behalf of the State agency named below, and (2) the selection of the contractor named below was not the result of collusion, the giving of a gift or the promise of a gift, compensation, fraud or inappropriate influence from any person.

Sworn as true to the best of my knowledge and belief, subject to the penalties of false statement.

_____
Contractor Name

_____
Awarding State Agency

_____ _____
State Agency Official or Employee Signature Date

_____ _____
Printed Name Title

Sworn and subscribed before me on this _____ day of _____, 20___.

_____
Commissioner of the Superior Court
or Notary Public

OPM Ethics Form 5 Rev. 02-01-10

STATE OF CONNECTICUT
CONSULTING AGREEMENT AFFIDAVIT

Affidavit to accompany a State contract for the purchase of goods and services with a value of $50,000 or more in a calendar or fiscal year, pursuant to Connecticut General Statutes §§ 4a-81(a) and 4a-81(b)

INSTRUCTIONS:

If the bidder or vendor has entered into a consulting agreement, as defined by Connecticut General Statutes § 4a-81(b)(1): Complete all sections of the form. If the bidder or vendor has entered into more than one such consulting agreement, use a separate form for each agreement. Sign and date the form in the presence of a Commissioner of the Superior Court or Notary Public. **If the bidder or vendor has not entered into a consulting agreement, as defined by Connecticut General Statutes § 4a-81(b)(1):** Complete only the shaded section of the form. Sign and date the form in the presence of a Commissioner of the Superior Court or Notary Public.

Submit completed form to the awarding State agency with bid or proposal. For a sole source award, submit completed form to the awarding State agency at the time of contract execution.

This affidavit must be amended if the contractor enters into any new consulting agreement(s) during the term of the State contract.

AFFIDAVIT: [Number of Affidavits Sworn and Subscribed On This Day: _____]

I, the undersigned, hereby swear that I am the chief official of the bidder or vendor awarded a contract, as described in Connecticut General Statutes § 4a-81(a), or that I am the individual awarded such a contract who is authorized to execute such contract. I further swear that I have not entered into any consulting agreement in connection with such contract, **except for the agreement listed below**:

_____ _____
Consultant's Name and Title Name of Firm (if applicable)

_____ _____ _____
Start Date End Date Cost

Description of Services Provided: _____

_____

_____

Is the consultant a former State employee or former public official? ☐ YES ☐ NO

If YES: _____ _____
Name of Former State Agency Termination Date of Employment

Sworn as true to the best of my knowledge and belief, subject to the penalties of false statement.

_____ _____ _____
Printed Name of Bidder or Vendor **Signature of Chief Official or Individual** **Date**

_____ _____
Printed Name (of above) Awarding State Agency

Sworn and subscribed before me on this _____ day of _____, 20___.

_____
Commissioner of the Superior Court or Notary Public

OPM Ethics Form 6 Rev. 02-01-10

STATE OF CONNECTICUT

AFFIRMATION OF RECEIPT OF STATE ETHICS LAWS SUMMARY

Affirmation to accompany a large State construction or procurement contract, having a cost of more than $500,000, pursuant to Connecticut General Statutes §§ 1-101mm and 1-101qq

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INSTRUCTIONS:

Complete all sections of the form. Submit completed form to the awarding State agency or contractor, as directed below.

CHECK ONE:

☐ I am a person seeking a large State construction or procurement contract. I am submitting this affirmation to the awarding State agency with my bid or proposal. [Check this box if the contract will be awarded through a competitive process.]

☐ I am a contractor who has been awarded a large State construction or procurement contract. I am submitting this affirmation to the awarding State agency at the time of contract execution. [Check this box if the contract was a sole source award.]

☐ I am a subcontractor or consultant of a contractor who has been awarded a large State construction or procurement contract. I am submitting this affirmation to the contractor.

IMPORTANT NOTE:

Contractors shall submit the affirmations of their subcontractors and consultants to the awarding State agency. Failure to submit such affirmations in a timely manner shall be cause for termination of the large State construction or procurement contract.

AFFIRMATION:

I, the undersigned person, contractor, subcontractor, consultant, or the duly authorized representative thereof, affirm (1) receipt of the summary of State ethics laws* developed by the Office of State Ethics pursuant to Connecticut General Statutes § 1-81b and (2) that key employees of such person, contractor, subcontractor, or consultant have read and understand the summary and agree to comply with its provisions.

* The summary of State ethics laws is available on the State of Connecticut's Office of State Ethics website at http://www.ct.gov/ethics/lib/ethics/guides/contractors_guide_09_final.pdf

_____ _____
Signature Date

_____ _____
Printed Name Title

_____
Firm or Corporation (if applicable)

_____ _____ ____ _____
Street Address City State Zip

_____
Awarding State Agency

STATE OF CONNECTICUT
STATE ELECTIONS ENFORCEMENT COMMISSION
20 Trinity Street Hartford, Connecticut 06106—1628

SEEC FORM 10

NOTICE TO EXECUTIVE BRANCH STATE CONTRACTORS AND PROSPECTIVE STATE CONTRACTORS OF CAMPAIGN CONTRIBUTION AND SOLICITATION BAN

This notice is provided under the authority of Connecticut General Statutes 9-612(g)(2), as amended by P.A. 07-1, and is for the purpose of informing state contractors and prospective state contractors of the following law (italicized words are defined on page 2):

Campaign Contribution and Solicitation Ban

No *state contractor, prospective state contractor, principal of a state contractor or principal of a prospective state contractor*, with regard to a *state contract or state contract solicitation* with or from a state agency in the executive branch or a quasi-public agency or a holder, or principal of a holder of a valid prequalification certificate, shall make a contribution to, or *solicit* contributions on behalf of (i) an exploratory committee or candidate committee established by a candidate for nomination or election to the office of Governor, Lieutenant Governor, Attorney General, State Comptroller, Secretary of the State or State Treasurer, (ii) a political committee authorized to make contributions or expenditures to or for the benefit of such candidates, or (iii) a party committee;

In addition, no holder or principal of a holder of a valid prequalification certificate, shall make a contribution to, or solicit contributions on behalf of (i) an exploratory committee or candidate committee established by a candidate for nomination or election to the office of State senator or State representative, (ii) a political committee authorized to make contributions or expenditures to or for the benefit of such candidates, or (iii) a party committee.

Duty to Inform

State contractors and prospective state contractors are required to inform their principals of the above prohibitions, as applicable, and the possible penalties and other consequences of any violation thereof.

Penalties for Violations

Contributions or solicitations of contributions made in violation of the above prohibitions may result in the following civil and criminal penalties:

Civil penalties--$2000 or twice the amount of the prohibited contribution, whichever is greater, against a principal or a contractor. Any state contractor or prospective state contractor which fails to make reasonable efforts to comply with the provisions requiring notice to its principals of these prohibitions and the possible consequences of their violations may also be subject to civil penalties of $2000 or twice the amount of the prohibited contributions made by their principals.

Criminal penalties—Any knowing and willful violation of the prohibition is a Class D felony, which may subject the violator to imprisonment of not more than 5 years, or $5000 in fines, or both.

Contract Consequences

Contributions made or solicited in violation of the above prohibitions may result, in the case of a state contractor, in the contract being voided.

Contributions made or solicited in violation of the above prohibitions, in the case of a prospective state contractor, shall result in the contract described in the state contract solicitation not being awarded to the prospective state contractor, unless the State Elections Enforcement Commission determines that mitigating circumstances exist concerning such violation.

The state will not award any other state contract to anyone found in violation of the above prohibitions for a period of one year after the election for which such contribution is made or solicited, unless the State Elections Enforcement Commission determines that mitigating circumstances exist concerning such violation.

Receipt acknowledged:_____ _____
(signature) (date)
Print name:_____ Title:_____

Company Name:_____

Additional information and the entire text of P.A 07-1 may be found on the website of the State Elections Enforcement Commission, www.ct.gov/seec. Click on the link to "State Contractor Contribution Ban"

Definitions:

"State contractor" means a person, business entity or nonprofit organization that enters into a state contract. Such person, business entity or nonprofit organization shall be deemed to be a state contractor until December thirty-first of the year in which such contract terminates. "State contractor" does not include a municipality or any other political subdivision of the state, including any entities or associations duly created by the municipality or political subdivision exclusively amongst themselves to further any purpose authorized by statute or charter, or an employee in the executive or legislative branch of state government or a quasi-public agency, whether in the classified or unclassified service and full or part-time, and only in such person's capacity as a state or quasi-public agency employee.

"Prospective state contractor" means a person, business entity or nonprofit organization that (i) submits a response to a state contract solicitation by the state, a state agency or a quasi-public agency, or a proposal in response to a request for proposals by the state, a state agency or a quasi-public agency, until the contract has been entered into, or (ii) holds a valid prequalification certificate issued by the Commissioner of Administrative Services under section 4a-100. "Prospective state contractor" does not include a municipality or any other political subdivision of the state, including any entities or associations duly created by the municipality or political subdivision exclusively amongst themselves to further any purpose authorized by statute or charter, or an employee in the executive or legislative branch of state government or a quasi-public agency, whether in the classified or unclassified service and full or part-time, and only in such person's capacity as a state or quasi-public agency employee.

"Principal of a state contractor or prospective state contractor" means (i) any individual who is a member of the board of directors of, or has an ownership interest of five per cent or more in, a state contractor or prospective state contractor, which is a business entity, except for an individual who is a member of the board of directors of a nonprofit organization, (ii) an individual who is employed by a state contractor or prospective state contractor, which is a business entity, as president, treasurer or executive vice president, (iii) an individual who is the chief executive officer of a state contractor or prospective state contractor, which is not a business entity, or if a state contractor or prospective state contractor has no such officer, then the officer who duly possesses comparable powers and duties, (iv) an officer or an employee of any state contractor or prospective state contractor who has managerial or discretionary responsibilities with respect to a state contract, (v) the spouse or a dependent child who is eighteen years of age or older of an individual described in this subparagraph, or (vi) a political committee established or controlled by an individual described in this subparagraph or the business entity or nonprofit organization that is the state contractor or prospective state contractor.

"State contract" means an agreement or contract with the state or any state agency or any quasi-public agency, let through a procurement process or otherwise, having a value of fifty thousand dollars or more, or a combination or series of such agreements or contracts having a value of one hundred thousand dollars or more in a calendar year, for (i) the rendition of services, (ii) the furnishing of any goods, material, supplies, equipment or any items of any kind, (iii) the construction, alteration or repair of any public building or public work, (iv) the acquisition, sale or lease of any land or building, (v) a licensing arrangement, or (vi) a grant, loan or loan guarantee. "State contract" does not include any agreement or contract with the state, any state agency or any quasi-public agency that is exclusively federally funded, an education loan or a loan to an individual for other than commercial purposes.

"State contract solicitation" means a request by a state agency or quasi-public agency, in whatever form issued, including, but not limited to, an invitation to bid, request for proposals, request for information or request for quotes, inviting bids, quotes or other types of submittals, through a competitive procurement process or another process authorized by law waiving competitive procurement.

"Managerial or discretionary responsibilities with respect to a state contract" means having direct, extensive and substantive responsibilities with respect to the negotiation of the state contract and not peripheral, clerical or ministerial responsibilities.

"Dependent child" means a child residing in an individual's household who may legally be claimed as a dependent on the federal income tax of such individual.

"Solicit" means (A) requesting that a contribution be made, (B) participating in any fund-raising activities for a candidate committee, exploratory committee, political committee or party committee, including, but not limited to, forwarding tickets to potential contributors, receiving contributions for transmission to any such committee or bundling contributions, (C) serving as chairperson, treasurer or deputy treasurer of any such committee, or (D) establishing a political committee for the sole purpose of soliciting or receiving contributions for any committee. Solicit does not include: (i) making a contribution that is otherwise permitted by Chapter 155 of the Connecticut General Statutes; (ii) informing any person of a position taken by a candidate for public office or a public official, (iii) notifying the person of any activities of, or contact information for, any candidate for public office; or (IV) serving as a member in any party committee or as an officer of such committee that is not otherwise prohibited in this section.

STATE OF CONNECTICUT
STATE ELECTIONS ENFORCEMENT COMMISSION
20 Trinity Street Hartford, Connecticut 06106—1628

SEEC FORM 11

NOTICE TO EXECUTIVE BRANCH STATE CONTRACTORS AND PROSPECTIVE STATE CONTRACTORS OF CAMPAIGN CONTRIBUTION AND SOLICITATION BAN

This notice is provided under the authority of Connecticut General Statutes 9-612(g)(2), as amended by P.A. 07-1, and is for the purpose of informing state contractors and prospective state contractors of the following law (italicized words are defined below):

Campaign Contribution and Solicitation Ban

No *state contractor, prospective state contractor, principal of a state contractor or principal of a prospective state contractor*, with regard to a *state contract* or *state contract solicitation* with or from a state agency in the executive branch or a quasi-public agency or a holder, or principal of a holder of a valid prequalification certificate, shall make a contribution to, or *solicit* contributions on behalf of (i) an exploratory committee or candidate committee established by a candidate for nomination or election to the office of Governor, Lieutenant Governor, Attorney General, State Comptroller, Secretary of the State or State Treasurer, (ii) a political committee authorized to make contributions or expenditures to or for the benefit of such candidates, or (iii) a party committee;

In addition, no holder or principal of a holder of a valid prequalification certificate, shall make a contribution to, or solicit contributions on behalf of (i) an exploratory committee or candidate committee established by a candidate for nomination or election to the office of State senator or State representative, (ii) a political committee authorized to make contributions or expenditures to or for the benefit of such candidates, or (iii) a party committee.

Duty to Inform

State contractors and prospective state contractors are required to inform their principals of the above prohibitions, as applicable, and the possible penalties and other consequences of any violation thereof.

Penalties for Violations

Contributions or solicitations of contributions made in violation of the above prohibitions may result in the following civil and criminal penalties:

Civil penalties--$2000 or twice the amount of the prohibited contribution, whichever is greater, against a principal or a contractor. Any state contractor or prospective state contractor which fails to make reasonable efforts to comply with the provisions requiring notice to its principals of these prohibitions and the possible consequences of their violations may also be subject to civil penalties of $2000 or twice the amount of the prohibited contributions made by their principals.

Criminal penalties—Any knowing and willful violation of the prohibition is a Class D felony, which may subject the violator to imprisonment of not more than 5 years, or $5000 in fines, or both.

Contract Consequences

Contributions made or solicited in violation of the above prohibitions may result, in the case of a state contractor, in the contract being voided.

Contributions made or solicited in violation of the above prohibitions, in the case of a prospective state contractor, shall result in the contract described in the state contract solicitation not being awarded to the prospective state contractor, unless the State Elections Enforcement Commission determines that mitigating circumstances exist concerning such violation.

The State will not award any other state contract to anyone found in violation of the above prohibitions for a period of one year after the election for which such contribution is made or solicited, unless the State Elections Enforcement Commission determines that mitigating circumstances exist concerning such violation.

Additional information and the entire text of P.A 07-1 may be found on the website of the State Elections Enforcement Commission, www.ct.gov/seec. Click on the link to "State Contractor Contribution Ban."

Definitions:
"State contractor" means a person, business entity or nonprofit organization that enters into a state contract. Such person, business entity or nonprofit organization shall be deemed to be a state contractor until December thirty-first of the year in which such contract terminates. "State contractor" does not include a municipality or any other political subdivision of the state, including any entities or associations duly created by the municipality or political subdivision exclusively amongst themselves to further any purpose authorized by statute or charter, or an employee in the executive or legislative branch of state government or a quasi-public agency, whether in the classified or unclassified service and full or part-time, and only in such person's capacity as a state or quasi-public agency employee.

"Prospective state contractor" means a person, business entity or nonprofit organization that (i) submits a response to a state contract solicitation by the state, a state agency or a quasi-public agency, or a proposal in response to a request for proposals by the state, a state agency or a quasi-public agency, until the contract has been entered into, or (ii) holds a valid prequalification certificate issued by the Commissioner of Administrative Services under section 4a-100. "Prospective state contractor" does not include a municipality or any other political subdivision of the state, including any entities or associations duly created by the municipality or political subdivision exclusively amongst themselves to further any purpose authorized by statute or charter, or an employee in the executive or legislative branch of state government or a quasi-public agency, whether in the classified or unclassified service and full or part-time, and only in such person's capacity as a state or quasi-public agency employee.

"Principal of a state contractor or prospective state contractor" means (i) any individual who is a member of the board of directors of, or has an ownership interest of five per cent or more in, a state contractor or prospective state contractor, which is a business entity, except for an individual who is a member of the board of directors of a nonprofit organization, (ii) an individual who is employed by a state contractor or prospective state contractor, which is a business entity, as president, treasurer or executive vice president, (iii) an individual who is the chief executive officer of a state contractor or prospective state contractor, which is not a business entity, or if a state contractor or prospective state contractor has no such officer, then the officer who duly possesses comparable powers and duties, (iv) an officer or an employee of any state contractor or prospective state contractor who has *managerial or discretionary responsibilities with respect to a state contract,* (v) the spouse or a *dependent child* who is eighteen years of age or older of an individual described in this subparagraph, or (vi) a political committee established or controlled by an individual described in this subparagraph or the business entity or nonprofit organization that is the state contractor or prospective state contractor.

"State contract" means an agreement or contract with the state or any state agency or any quasi-public agency, let through a procurement process or otherwise, having a value of fifty thousand dollars or more, or a combination or series of such agreements or contracts having a value of one hundred thousand dollars or more in a calendar year, for (i) the rendition of services, (ii) the furnishing of any goods, material, supplies, equipment or any items of any kind, (iii) the construction, alteration or repair of any public building or public work, (iv) the acquisition, sale or lease of any land or building, (v) a licensing arrangement, or (vi) a grant, loan or loan guarantee. "State contract" does not include any agreement or contract with the state, any state agency or any quasi-public agency that is exclusively federally funded, an education loan or a loan to an individual for other than commercial purposes.

"State contract solicitation" means a request by a state agency or quasi-public agency, in whatever form issued, including, but not limited to, an invitation to bid, request for proposals, request for information or request for quotes, inviting bids, quotes or other types of submittals, through a competitive procurement process or another process authorized by law waiving competitive procurement.

“Managerial or discretionary responsibilities with respect to a state contract” means having direct, extensive and substantive responsibilities with respect to the negotiation of the state contract and not peripheral, clerical or ministerial responsibilities.

“Dependent child” means a child residing in an individual’s household who may legally be claimed as a dependent on the federal income tax of such individual.

“Solicit” means (A) requesting that a contribution be made, (B) participating in any fund-raising activities for a candidate committee, exploratory committee, political committee or party committee, including, but not limited to, forwarding tickets to potential contributors, receiving contributions for transmission to any such committee or bundling contributions, (C) serving as chairperson, treasurer or deputy treasurer of any such committee, or (D) establishing a political committee for the sole purpose of soliciting or receiving contributions for any committee. Solicit does not include: (i) making a contribution that is otherwise permitted by Chapter 155 of the Connecticut General Statutes; (ii) informing any person of a position taken by a candidate for public office or a public official, (iii) notifying the person of any activities of, or contact information for, any candidate for public office; or (iv) serving as a member in any party committee or as an officer of such committee that is not otherwise prohibited in this section.

General advice for filling out affidavits and the Certificate (that serves as the Certificate of Authority for the person signing the affidavit):

(1) The person signing any affidavit or the Gift and Campaign Contribution certification must be the individual authorized to do so in the Certificate (of authority).

(2) The execution of the Certificate (of authority) must be on or soon after the date of execution of the contract, affidavit or the other certification, as the case may be. Please note: The Resolutions that are noted in the Certificate (of authority) need to have been adopted on or before the date the Certificate (of authority) is signed.

(3) Gift and Campaign Contribution Certification: If no gifts were given do not leave the form blank. Write in the word "none" in the area on the form where disclosure is supposed to be made.

(4) A notary public or a commissioner of the superior court (this is an attorney licensed to practice law) must witness the affiant (the person signing the affidavit) signing the affidavit. Therefore, the date that the affiant signs will be the same date as the notary public or commissioner of the superior court signs the affidavit.

(5) If a notary public is used, make sure she or he places her/his seal and commission expiration date on the subject document.

(6) In the Certificate (of authority) form, you cannot authorize yourself to sign the affidavits, unless you solely own the business or your company is an LLC and you are the sole member of the LLC. If you fall into either of these two categories, please include a note with or on the Certificate (of authority) stating that you are the sole owner or the sole member.

(7) Depending on the structure of your company, another officer, member, partner, or general partner needs to authorize the person signing the affidavit to do so.

CORPORATION CERTIFIED RESOLUTION

I, _____, Secretary of _____
(Name of Certifying Officer) (Name of Corporation)

_____, a corporation organized and existing under the laws of the State of

_____ (the "Company"), do hereby certify that the following is a true and
(State of incorporation)

correct copy of a resolution duly adopted at a meeting of the Board of Directors of the Company duly held and convened on _____, 200___, at which meeting a duly
(Month and day) (year)

constituted quorum of the Board of Directors was present and acting throughout, and that such resolution has not been modified, rescinded or revoked, and is at present in full force and effect:

RESOLVED: That _____, _____
(Name and title of signer of contract documents)

of _____ is empowered and authorized, on behalf of the Company,
(Name of corporation)

to execute and deliver contracts and amendments thereto, and all documents required by the Governor, the Connecticut Department of Public Works, the Connecticut State Properties Review Board and the Office of the Attorney General associated with such contracts and amendments.

IN WITNESS WHEREOF, the undersigned has affixed his/her signature and the corporate seal of the Company this _____ day of _____, 200___.

[or, if the corporation has no seal ...]

IN WITNESS WHEREOF, the undersigned has affixed his/her signature this ____ day of _____, 200___. The Company has no corporate seal.

_____
Print name:
Its Secretary

(Corporate Seal)

LLC CERTIFIED RESOLUTION

I, _____, a _____ of
(Name) (Specify Member or Manager)

_____ LLC, a limited liability company organized
(Name of company)

and existing under the laws of the State of _____,

(the "Company"), hereby certify: (i) that _____ is run by
(Name of company)

_____; (ii) that _____ is a
(Specify if it is run by its members or a manager) (Name of signer of contract documents)

_____ of _____; and (iii) that as such,
(Specify Member / Manager) (Company name)

_____ is not prohibited or limited by the articles of
(Name of signer of contract documents)

organization from binding the LLC, and is empowered and authorized, on behalf of the Company, to execute and deliver contracts and amendments thereto, and all documents required by the Governor, the Connecticut Department of Public Works, the Connecticut State Properties Review Board or the Office of the Attorney General associated with such contracts and amendments.

IN WITNESS WHEREOF, the undersigned has affixed his/her signature and the seal of the LLC this ___ day of _____, 200___.

[or, if the LLC has no seal ...]

IN WITNESS WHEREOF, the undersigned has affixed his/her signature this ___ day of _____, 200___. The LLC has no seal.

_____
Print name:
Its: Member / Manager

If the LLC has a seal, place it here.

USE THIS FORMAT WHEN AN LLC HAS A CORPORATION AS THE SOLE MEMBER.

LLC CERTIFIED RESOLUTION

I, _____ (name of Secretary of the corporation), the Secretary of _____ (name of corporation), which corporation is the sole member of _____ LLC (Name of LLC), a limited liability company organized and existing under the laws of the State of _____ (state of incorporation) (the "LLC") hereby certify: (i) that the LLC is run by _____(name of corporation), that (ii) _____ (name of corporation) is the sole member of _____ (name of LLC); and (iii) that _____, President of _____ (name of corporation), the sole member of the LLC, is not prohibited or limited by the articles of organization of the corporation or the LLC from binding the LLC, and is empowered and authorized, on behalf of the corporation and the LLC, to execute and deliver contracts and amendments thereto, and all documents required by the Governor, the Connecticut Department of Public Works, the Connecticut State Properties Review Board, or the Office of the Attorney General associated with such contracts and amendments.

IN WITNESS WHEREOF, the undersigned has affixed his/her signature and the seal of the LLC this _____ day of _____, 200 ___.

[*or if the LLC has no seal*]

IN WITNESS WHEREOF, the undersigned has affixed his/her signature this _____ day of _____, 200 ____. The LLC has no seal.

If the LLC has a seal, place it here.

_____,LLC
(name of LLC)
By: _____ its sole member
(corporation name)

By: _____

Secretary of _____
(name of corporation)
Duly Authorized

PARTNERSHIP CERTIFICATION

I, _____, the undersigned, do certify that I am a general partner of _____ a _____
(Name of company) (State)
partnership, and I do further certify that _____is a
(Name of signer of contract documents)
general partner of said partnership, and, as such, is empowered and authorized on behalf of the partnership to execute contracts and amendments thereto and all documents required by the Governor, the Connecticut Department of Public Works, the Connecticut State Properties Review Board or the Office of the Attorney General associated with such contracts and amendments.

IN WITNESS WHEREOF, the undersigned has affixed his/her signature this _____ day of _____, 200___.

_____
Print name:
General Partner

CERTIFICATE OF AUTHORITY
LIMITED LIABILITY PARTNERSHIP

I, _____, a Partner of _____, LLP a
(Name of company)

Limited Liability Partnership organized and existing under the laws of the State of Connecticut, hereby certify that the following resolution was duly adopted at a meeting by all of the Partners of said Limited Liability Partnership, duly held on the _____
(Day)
day of _____, _____.
(Month) (Year)

Resolved, that _____ is a Partner of _____,
(Name of signer of contract documents) (Name of company)

LLP and is hereby authorized to make, execute, and approve on behalf of this Limited Liability Partnership any and all contracts and amendments thereto, and all documents required by the Governor, the Connecticut Department of Public Works, the Connecticut State Properties Review Board and the Office of the Attorney General associated with such contracts and amendments.

AND I DO FURTHER CERTIFY that the above resolution has not been in any way altered, amended, revoked, or repealed and is now in full force and effect.

In witness whereof, I hereunto set my hand this _____ day of _____, _____.

_____
Print name:
Partner

Seal here

CERTIFICATE OF AUTHORITY
LIMITED PARTNERSHIP

I, _____, the undersigned, do hereby certify that I am a General

Partner of _____
(Name of partnership and address),
a _____ partnership and I do hereby further certify that
(State)
_____, in his/her capacity as a General Partner of said
(Name of signer of contract documents)

partnership is authorized to sign any and all contracts and amendments to contracts and all documents required by the Governor, the Connecticut Department of Public Works, the Connecticut State Properties Review Board or the Office of the Attorney General associated with such contracts and amendments on behalf of the said partnership.

I do further certify that the above authorization has not been amended or revoked and was in full force and effect on _____ and continues to be
(date of or prior to the execution of the subject contract document)

in full force and effect as of the present time.

Dated this _____ day of _____, _____.

_____
Print name:
General Partner

CERTIFICATE OF AUTHORITY
DESIGN BUILD

I, _____, the undersigned, do hereby certify that I am
(Name of Certifying Officer)

the _____, of _____, a
(Title of Certifying Officer) (Name of Company)

_____ corporation, and that the following resolution
(State of Incorporation)

was duly adopted on _____, _____, at a duly called and held
(Date of Adoption of Resolution)

meeting of the Board of Directors of said corporation:

Resolved, that _____, in _____ capacity as
(Name of signer of contract documents) (his/her)

_____ of _____, is fully
(Title of signer of contract documents) (Name of Company)

authorized to execute and sign on behalf of the corporation all bonds, contracts and amendments thereto, and all documents required by the Governor, the Connecticut Department of Public Works, the Connecticut State Properties Review Board or the Office of the Attorney General in connection with the _____ and to affix the
(Project Title and Number)

Corporate Seal on such documents.

I do further certify that the above resolution has not been amended or revoked and is now in full force and effect.

Dated this _____ day of _____, _____.

Affix Corporate Seal Here

_____ (Signature)

Print name: _____
Title: _____

Office of Policy and Management

REQUIRED FOR ALL CONTRACT TYPES

Nondiscrimination Certification

Effective Date: June 30, 2009

Form A Representation By Individual
Form B Representation By Entity
Form C Affidavit By Entity
Form D New Resolution By Entity
Form E Prior Resolution By Entity

DESCRIPTION

The Office of the Attorney General has approved the above nondiscrimination certification forms to assist executive branch agencies in complying with the State's contracting requirements under Connecticut General Statutes §§ 4a-60(a)(1) and 4a-60a(a)(1), as amended.

By law, a contractor must provide an awarding State agency with *written representation* or *documentation* that certifies the contractor complies with the State's nondiscrimination agreements and warranties.

A nondiscrimination certification is required for all State contracts – regardless of type, term, cost, or value. The appropriate form must be submitted to the awarding State agency prior to contract execution. ***See list of exempt entities (below).***

FORMS & DESCRIPTIONS

There are five different certification forms. Form A is *always* used for contracts with an individual who is not an entity, regardless of the contract value. Form B is *always* used for contracts with an entity when the contract value is less than $50,000. Form C is *recommended* for contracts valued at $50,000 or more with an entity. If Form C is not used, either Form D or E must be used; both require a resolution (new or prior).

<table>
<tr><th>For Use By:</th><th>Value
Less Than
$50,000</th><th>Value
$50,000 or More</th></tr>
<tr><td>Individual</td><td colspan="2">Form A
Representation</td></tr>
<tr><td rowspan="3">Entity</td><td rowspan="3">Form B
Representation</td><td>Form C
Affidavit</td></tr>
<tr><td>Form D
New Resolution</td></tr>
<tr><td>Form E
Prior Resolution</td></tr>
</table>

Definitions

- *individual:* a person who is not an entity
- *entity:* corporation, limited liability company, or partnership

EXPLANATION OF FORMS

Form A. *Representation:* For use by an individual when entering into any contract, regardless of contract value.

Form B. *Representation:* For use by an entity when entering into any contract valued at less than $50,000 for any year of the contract.

Form C. *Affidavit:* (Recommended) For use by an entity when entering into any contract valued at $50,000 or more for any year of the contract **and** the entity certifies through an affidavit that a complying nondiscrimination policy is currently in place.

Form D. *New Resolution:* For use by a entity when entering into any contract valued at $50,000 or more for any year of the contract **and** the entity has a complying nondiscrimination policy adopted by a new resolution of the board of directors, shareholders, managers, members, or other governing body.

Form E. *Prior Resolution:* For use by a entity when entering into any contract valued at $50,000 or more for any year of the contract **and** the entity has a complying nondiscrimination policy adopted by a prior resolution of the board of directors, shareholders, managers, members, or other governing body.

EXEMPTIONS

The entities listed below are exempt and, therefore, not required to submit a nondiscrimination certification form when entering into a contract with the State:

1. political subdivisions of the State of Connecticut, including, but not limited to municipalities;
2. quasi-public agencies, as defined in C.G.S. § 1-120;
3. other states of the United States, including, but not limited to, the District of Columbia, Puerto Rico, U.S. territories and possessions, and federally recognized Indian tribal governments, as defined in C.G.S. § 1-267;
4. the federal government;
5. foreign governments; and
6. an agency of a subdivision, agency, state or government listed in items 1-5.

For Further Information, Contact:

Please direct any questions about the nondiscrimination certification forms to the Commission on Human Rights and Opportunities:

Tel. 860/ 541-3400
Connecticut Toll Free Tel. 1-800/ 477-5737

Content Last Modified on 7/8/2009 1:37:34 PM

Form A
07-08-2009

STATE OF CONNECTICUT

NONDISCRIMINATION CERTIFICATION — Representation By Individual For All Contract Types Regardless of Value

Written representation that complies with the nondiscrimination agreements and warranties under Connecticut General Statutes §§ 4a-60(a)(1) and 4a-60a(a)(1), as amended

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INSTRUCTIONS:

For use by an individual who is not an entity (corporation, limited liability company, or partnership) when entering into any contract type with the State of Connecticut, regardless of contract value. Submit to the awarding State agency prior to contract execution.

REPRESENTATION OF AN INDIVIDUAL:

I, _____ , of _____ ,
Signatory Business Address

represent that I will comply with the nondiscrimination agreements and warranties of Connecticut General Statutes §§ 4a-60(a)(1)and 4a-60a(a)(1), as amended.

_____ _____
Signatory Date

_____
Printed Name

Form B
07-08-2009

STATE OF CONNECTICUT

NONDISCRIMINATION CERTIFICATION — Representation By Entity For Contracts Valued at Less Than $50,000

Written representation that complies with the nondiscrimination agreements and warranties under Connecticut General Statutes §§ 4a-60(a)(1) and 4a-60a(a)(1), as amended

---

INSTRUCTIONS:

For use by an entity (corporation, limited liability company, or partnership) when entering into any contract type with the State of Connecticut valued at less than $50,000 for each year of the contract. Complete all sections of the form. Submit to the awarding State agency prior to contract execution.

REPRESENTATION OF AN ENTITY:

I, _____ , _____ , of _____ ,
Authorized Signatory Title Name of Entity

an entity duly formed and existing under the laws of _____ ,
Name of State or Commonwealth

represent that I am authorized to execute and deliver this representation on behalf of

_____ and that _____
Name of Entity Name of Entity

has a policy in place that complies with the nondiscrimination agreements and warranties of Connecticut General Statutes §§ 4a-60(a)(1) and 4a-60a(a)(1), as amended.

_____ _____
Authorized Signatory Date

_____
Printed Name

Form C
07-08-2009

STATE OF CONNECTICUT

NONDISCRIMINATION CERTIFICATION — Affidavit By Entity For Contracts Valued at $50,000 or More

Documentation in the form of an affidavit signed under penalty of false statement by a chief executive officer, president, chairperson, member, or other corporate officer duly authorized to adopt corporate, company, or partnership policy that certifies the contractor complies with the nondiscrimination agreements and warranties under Connecticut General Statutes §§ 4a-60(a)(1) and 4a-60a(a)(1), as amended

---

INSTRUCTIONS:

For use by an entity (corporation, limited liability company, or partnership) when entering into any contract type with the State of Connecticut valued at $50,000 or more for any year of the contract. Complete all sections of the form. Sign form in the presence of a Commissioner of Superior Court or Notary Public. Submit to the awarding State agency prior to contract execution.

AFFIDAVIT:

I, the undersigned, am over the age of eighteen (18) and understand and appreciate the obligations of an oath. I am _____ of _____ , an entity
Signatory's Title Name of Entity

duly formed and existing under the laws of _____.
Name of State or Commonwealth

I certify that I am authorized to execute and deliver this affidavit on behalf of

_____ and that _____
Name of Entity Name of Entity

has a policy in place that complies with the nondiscrimination agreements and warranties of Connecticut General Statutes §§ 4a-60(a)(1)and 4a-60a(a)(1), as amended.

_____
Authorized Signatory

_____
Printed Name

Sworn and subscribed to before me on this _____ day of _____, 20__ __.

_____ _____
Commissioner of the Superior Court / Notary Public **Commission Expiration Date**

Form D
07-08-2009

STATE OF CONNECTICUT

NONDISCRIMINATION CERTIFICATION — New Resolution By Entity For Contracts Valued at $50,000 or More

Documentation in the form of a corporate, company, or partnership policy adopted by resolution of the board of directors, shareholders, managers, members or other governing body of a contractor that certifies the contractor complies with the nondiscrimination agreements and warranties under Connecticut General Statutes §§ 4a-60(a)(1) and 4a-60a(a)(1), as amended

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INSTRUCTIONS:

For use by an entity (corporation, limited liability company, or partnership) when entering into any contract type with the State of Connecticut valued at $50,000 or more for any year of the contract. Complete all sections of the form. Submit to the awarding State agency prior to contract execution.

CERTIFICATION OF RESOLUTION:

I, _____ , _____ , of _____ ,
Authorized Signatory Title Name of Entity

an entity duly formed and existing under the laws of _____ ,
Name of State or Commonwealth

certify that the following is a true and correct copy of a resolution adopted on the _____ day of

_____ , 20_____ by the governing body of _____ ,
Name of Entity

in accordance with all of its documents of governance and management and the laws of

_____ , and further certify that such resolution has not been modified
Name of State or Commonwealth

or revoked, and is in full force and effect.

RESOLVED: That the policies of _____ comply with the
Name of Entity

nondiscrimination agreements and warranties of Connecticut General Statutes

§§ 4a-60(a)(1) and 4a-60a(a)(1), as amended.

The undersigned has executed this certificate this _____ day of _____ , 20_____ .

_____ _____
Authorized Signatory Date

_____
Printed Name

Form E
07-08-2009

STATE OF CONNECTICUT

NONDISCRIMINATION CERTIFICATION — Prior Resolution By Entity For Contracts Valued at $50,000 or More

Documentation in the form of a corporate, company, or partnership policy adopted by a prior resolution of the board of directors, shareholders, managers, members or other governing body of a contractor that certifies the contractor complies with the nondiscrimination agreements and warranties under Connecticut General Statutes §§ 4a-60(a)(1) and 4a-60a(a)(1), as amended

---

INSTRUCTIONS:

For use by an entity (corporation, limited liability company, or partnership) when entering into any contract type with the State of Connecticut valued at $50,000 or more for any year of the contract. Complete all sections of the form. Attach copy of previously adopted resolution (*State of CT, Nondiscrimination Certification, Form D: New Resolution*). Submit all documentation to the awarding State agency prior to contract execution.

CERTIFICATION OF PRIOR RESOLUTION:

I, the undersigned, am a duly authorized corporate officer or member of _____.
Name of Entity

I have reviewed the attached prior resolution. I certify that:

(1) the attached prior resolution complies with the nondiscrimination agreements and warranties of Connecticut General Statutes §§ 4a-60(a)(1) and 4a-60a(a)(1), as amended; and

(2) the prior resolution remains in full force and effect on the date this documentation is submitted to the awarding State agency.

_____ _____
Authorized Signatory Title

_____ _____
Printed Name Date

RESERVED FOR STATE USE

I, the undersigned head of the awarding State agency, or designee, certify that the attached prior resolution complies with the nondiscrimination agreements and warranties of Connecticut General Statutes §§ 4a-60(a)(1) and 4a-60a(a)(1), as amended.

_____ _____
Signature of Agency Head (or designee) Date

_____
Awarding State Agency

S T A T E O F C O N N E C T I C U T
M I L I T A R Y D E P A R T M E N T

S T A N D A R D B I D B O N D

KNOW ALL MEN BY THESE PRESENTS, That we, _____

_____ , hereinafter called the Principal,

of _____ , as Principal,

and _____ ,hereinafter

called the Surety, a corporation organized and existing under the laws of the

State of _____ , and duly authorized to transact a

surety business in the State of Connecticut, as Surety, are held and firmly bound unto the State of

Connecticut, as Obligee, in the penal sum of ten (10) percent of the amount of the bid set forth in a

proposal hereinafter mentioned, _____

_____ ,

lawful money of the United States of America, for the payment of which, well and truly to be made to the Obligee, the Principal and the Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, That, whereas the Principal has submitted or is about to submit a proposal to the Obligee related to a contract for Project No.: _____

NOW, THEREFORE, if the said contract be awarded to the Principal and the Principal shall, within such time as may be specified, enter into the said contract in writing with the State of Connecticut and give the required bonds, with surety acceptable to the Obligee, or if the Principal shall fail to do so, pay to the Obligee the damages which the Obligee may suffer by reason of such failure not exceeding the penalty of this bond, then this obligation shall be void, otherwise to remain in full force and effect.

SIGNED, SEALED AND DELIVERED this _____ day of _____ , 20 _____

_____	_____
Principal's Signature	Surety
_____	by _____
(Print name)	Its attorney in fact
_____	_____
Company Name	(Print name)

GENERAL CONTRACTOR BIDDER'S QUALIFICATION STATEMENT

PROJECT NO.: #11MIL217-2401

All bidders are required to file this form, properly completed, WITH THEIR PROPOSAL. Failure of a bidder to answer any question or provide required information may be grounds for the awarding authority to disqualify and reject the bid. If a question or request for information does not pertain to your organization in any way, use the symbol "NA" (Not Applicable). Use additional 8 ½" x 11" sheets with your letterhead as necessary.

THE DEPARTMENT RESERVES THE RIGHT TO REQUEST ANY ADDITIONAL OR SUPPLEMENTAL INFORMATION NECESSARY TO COMPLETE ITS EVALUATION OF A BIDDER'S QUALIFICATION.

1. Indicate exactly the name by which this organization is known:

   Name: _____

2. How many years has this organization been in business under its present business name?

   Years: _____

3. How many years has this organization been in business as a General Contractor?

   Years: _____

4. Indicate all other names by which this organization has been known and the length of time known by each name:

   4.1 _____

   4.2 _____

   4.3 _____

5. This firm is a:

   Corporation ☐ Sole Proprietorship ☐

   Partnership ☐ Joint Venture ☐

   Other _____

6. *Attach resumes* of all supervisory personnel, such as Principals, Project Managers, and Superintendents, who will be directly involved with the project on which you are now a bidder. Indicate their construction related training, certifications and licenses and the number of years of actual construction experience. Indicate the number of years of this actual construction experience which were in a Supervisory capacity.

7. List all sub-trades, which your firm customarily performs with own employees:

   7.1 _____

   7.2 _____

7.3 _____

7.4 _____

7.5 _____

8. All Construction Projects your organization has in process (attach separate sheets using the following format as necessary):

8.1 Specific Title &: Location _____

8.2 Contract: Amount _____

8.3 Description of your scope of work performed: _____

8.4 Owners Representative:

_____ _____
(Name) Telephone Number

9. Has your organization ever failed to complete a contract, or has any officer or partner of your organization ever been an officer or partner of another organization that failed to complete a contract?

☐ NO ☐ YES

If yes, indicate the circumstances leading to the project failure and the name of the company which provided the bonding for the failed contract(s):

_____
_____
_____

10. Has your organization had any legal or administrative proceedings against the organization, or any officers, principals, partners, members, or employees of the organization currently pending or concluded adversely within the last five years, and any administrative sanctions that are still in effect against such organization, and any of its officers, principals, partners, members, or employees? (Exclude OSHA violations which are called for elsewhere in this statement.)

☐ NO ☐ YES

If yes, list and explain:

11. Has your organization had any disbarments and suspensions that have been imposed in the past five years that were still in effect during the five year period or are still in effect?

☐ NO ☐ YES

If yes, list and explain; such list must include disbarments and suspensions of officers, principals, partners, members, and employees of your organization:

12. Has your organization had any other reason that precludes your organization or any officer, principal, partner, member, or employees thereof from bidding on a contract in Connecticut or any other jurisdiction?

☐ NO ☐ YES

If yes, list and explain:

13. Has your organization had any willful or serious violations of any Occupational Safety and Health Act (OSHA) or of any standard, order or regulation promulgated pursuant to such act, during the three-year period preceding the bid, provided such violations were cited in accordance with the provisions of any State Occupational Safety and Health Act or Occupational Safety and Health Act of 1970?

☐ NO ☐ YES

If yes, list and explain; indicate whether these were abated within the time fixed by the citation or whether the citation was appealed. If appealed, what is the status or disposition?

14. Has your organization had any criminal convictions related to the injury or death of any employee in the three-year period preceding the bid?

☐ NO ☐ YES

If yes, list and explain any such convictions:

15. Have there been any changes in your company's financial condition or business organization, which might affect your company's ability to successfully complete this contract?

☐ NO ☐ YES

If yes, list and explain:

SECTION 00030
GENERAL CONTRACTOR
BIDDER'S QUALIFICATION STATEMENT
PAGE 4 OF 4

Dated at _____

Signed this _____ day of _____ 20 _____

Name of Organization: _____

_____

_____

Signature _____

(Print Name) _____

Title _____

Notary Statement:

Mr./Mrs./Ms. _____ being duly sworn

Deposes and says that he/she is the _____ of
(Position or Title)

_____ , and that the answers to the foregoing
(Firm Name)

Questions and all statements therein contained are true and correct.

Subscribed and sworn before me this _____ day of _____ , 20 _____

Notary Public _____

My Commission Expires _____ , 20 _____

END OF SECTION

SECTION 00100
NOTICE TO BIDDERS
PAGE 1 OF 11

1. Bid Proposal Form

   Attention is directed to the fact that this Project includes a copy of the Bid Proposal Form.

2. Preparation of Bid

   a. Bids shall be submitted on the Bid Proposal Form, which is furnished as part of this Project Manual.

   b. Spaces are provided in the Bid Proposal Form for Base Bid and various supplemental and unit bid prices if applicable. The Bidder shall fill in all such spaces on typewriter or in ink. Where both written words and numerical figures are given, the written words will govern in the event of conflict.

3. Submission of Bids

   a. Bids must be submitted in a sealed envelope, clearly marked with the appropriate project number, date, time of bid opening, and name and address of bidder. In no event will bids, changes in bids by telephone, facsimile or other communication technology be accepted.

   b. Bidders must submit a **gift affidavit** for contracts with a value of **$50,000 or more**. This affidavit should be completed and submitted when a bidder submits a bid of **$50,000 or more**. This affidavit and instructions "General Advice for Filling out Affidavits and Resolutions/Certificate of Authority" can be found at http://www.ct.gov/dpw. You can also find at this website an "Introduction" to the affidavits that explains the applicability of the various affidavits.

   c. Envelopes containing bids shall be mailed or delivered, and addressed as follows:

      State Military Department
      Hartford Armory
      Procurement/Contracts Administration
      360 Broad Street – Room #143
      Hartford, CT 06105

4. Bid Closing Date

   Bids will be received at the time and place set forth in the Invitation to Bid, at the location indicated above. All bids will be opened at the stipulated time and place and any bidder who wishes to do so is invited to attend. Late bids will not be accepted and will be returned to bidder unopened. Extensions will not be granted.

5. Examination of Documents, and Conditions

   Bidders shall thoroughly examine and be familiar with the drawings and the specifications. The failure or omission of any Bidder to receive or examine any form, instrument, or document shall in no way relieve the Bidder from any obligation with respect to his bid.

6. Interpretation of Documents

   No oral interpretations will be made to any Bidder as to the meaning of the drawings and specifications. Every request for such an interpretation shall be made in writing and addressed and forwarded to the State of Connecticut, Military Department Project Manager. No inquiry received within 5 days of the date fixed for opening of bids will be given consideration. Every interpretation made to a Bidder will be in the form of an Addendum to the Contract Documents which, if issued, will be sent as promptly as is practicable to all persons to whom the Contract Documents have been issued. All such Addenda shall become part of the Contract Documents.

7. Withdrawal of Bids

Bids may be withdrawn by written request received from Bidders prior to the time fixed for bid opening.

8. Rejection of Bids

The State reserves the right to reject any and all bids, and to waive any minor irregularity in bids. Every bid which is conditional or obscure, or which contains any addition not called for, shall be invalid, and the awarding authority shall reject every such bid.

9. Supplemental Bids

Occasionally, the State may request "Supplemental Bids" to a special project. When listed on the Bid Proposal Form, each bidder is required to bid on each Supplemental Bid as described.

10. Discrepancy in Amounts

In the event of any discrepancy between the amount written in words and the amount written in numerical figures, the amount written in words will be controlling. In case of error in the extension of prices in the bid, the unit price will govern.

11. Bid Security, Prevailing Wages and Annual Adjustments to Prevailing Wages

Bid security in the type and amount stated in the Invitation to Bid shall accompany the bid. Each bid must be accompanied by a certified check made payable to "Treasurer, State of Connecticut," or the bid must be accompanied by a bid bond, in the form required by the awarding authority, having as surety thereto such surety company or companies acceptable to the Commissioner of the State Military Department and as are authorized to do business in this State, for an amount not less than 10 percent of the bid. All checks submitted by unsuccessful bidders shall be returned to them after the contract has been awarded.

Failure of the successful bidder to execute a contract in accordance with its bid shall result in the forfeiture of the bid bond or certified check.

Each contractor who is awarded a contract on or after October 1, 2002 shall be subject to provisions of the Connecticut General Statutes, Section 31-53 as amended by Public Act 02-69, "An Act Concerning Annual Adjustments to Prevailing Wages."

In determining bid price, consideration should be given to Section 31-53 of the General Statutes of Connecticut as amended by Public Act 02-69, "An Act Concerning Annual Adjustments to Prevailing Wages." Such prevailing wage adjustment shall not be considered a matter for any contract amendment.

At the time of bidding, the bidder agrees to accept the current prevailing wage scale, as well as the annual adjustment to the prevailing wage scale, as provided by the Connecticut Department of Labor.

12. Small Contractor Set-Aside Program

a. The enclosed solicitation for bid may be limited to participation by certified "Set-Aside Contractors." If the enclosed solicitation for bid is limited to participation by certified "Set-Aside Contractors" it will be indicated on the top of the first page of the Invitation to Bid and at the top of the first page of Section 00020 Bid Proposal Form.

b. The enclosed solicitation for bid may also include certified "Minority Business Enterprise (MBE/WBE)" participation. If MBE/WBE participation is needed, a percentage will be filled out in the box on the first page of the **Invitation to Bid** alongside the words "MBE/WBE participation."

The General Contractor on this project shall be required to award not less than **6.25 %** of the total Contract Sum to Minority Business Enterprise contractors who are certified and eligible to participate under The State of

Connecticut Set-Aside Program for small contractors, in accordance with Connecticut General Statutes Section 4a-60g. This requirement must be met even if the General Contractor is certified and eligible to participate in the Small Business Set-Aside Program or a good faith effort..

c. Certified Set-Aside contractors and Minority Business Enterprise contractors have been approved by, and registered with the Connecticut Department of Administrative Services, or, have an active application for certification pending with the Department of Administrative Services as of the "Date of Invitation" shown on the invitation sheet of this specification. **A copy of the bidder's certification must be submitted with bid.**

d. For Information Regarding the Set-Aside Program Including List of Certified Vendors, contact:

The State of Connecticut
Department of Administrative Services
Business CONNections Unit
165 Capitol Avenue, 5th Floor South
Hartford, Connecticut 06106
Telephone: (860) 713-5228
Fax: (860) 713-7457
Website: www.ct.gov/das/busopp.asp
E-mail: WeServeYou.das@po.state.ct.us
Program Director: Meg Yetishefsky

e. The bidder agrees and warrants that he/she has made good faith efforts to employ minority business enterprises as subcontractors and suppliers of materials under contract and shall provide the Commission on Human Rights and Opportunities with such information as is requested by the Commission concerning the bidder's employment practices and procedures as they relate to the provisions of the General Statutes governing contract requirements.

13. Start Date

All work is to be started in accordance with the Order to Commence Work.

14. Award of Contract

The contract will be awarded to the lowest responsible and qualified bidder on the basis of low bid and accepted Supplemental Bids. If you are awarded a contract with a value of $50,000 or more, a Consulting Affidavit must be completed and submitted at the time of contract execution. This affidavit and instructions "General Advice for Filling out Affidavits and Resolutions/Certificate of Authority" can be found at http://www.ct.gov/dpw. You can also find at this website an "Introduction" to the affidavits that explains the applicability of the various affidavits.

In the event that a bidder or vendor refuses to submit the affidavit required under subsection (b) of section 51 of Public Act 05-287, such bidder shall be disqualified and the award shall be made to the next lowest responsible qualified bidder or new bids or proposals shall be sought.

15. Connecticut Sales and Use Tax

All contractors shall familiarize themselves with the current regulations of the Department of Revenue Service. The tax on materials or supplies exempted by such regulations shall not be included as part of the contractor's bid.

16. Executive Orders**:**

This contract is subject to Section 6 and 10 of Executive Order No. 7B of Governor M. Jodi Rell, promulgated November 16, 2005, concerning contracting reforms; the provisions of Executive Order No. Three of Governor Thomas J Meskill, promulgated June 16, 1971, concerning labor employment practices;

Executive Order No. Seventeen of Governor Thomas J. Meskill, promulgated February 15, 1973, concerning the listing of employment openings; and Executive Order No. Sixteen of Governor John G. Rowland, promulgated August 4, 1999, concerning violence in the workplace, all of which are incorporated into, and are made a part of this contract as "Executive Orders," Division 0:

1. The parties agree to abide by such Executive Orders.

2. The State Contracting Standards Board may review this contract and recommend termination of the contract for a violation of the State Ethics Code (Chapter 10 of the general statutes) or section 4a-100 of the general statutes, or wanton or reckless disregard of any state contracting and procurement process by any person substantially involved in such contract or state contracting agency.

3. This contract may be canceled, terminated or suspended by State Military Department or the State Labor Commissioner for violation of or noncompliance with Executive Orders No. Three or Seventeen or any State or federal law concerning nondiscrimination, notwithstanding that the State Labor Commissioner is not party to this contract. The State Labor Commissioner shall have continuing jurisdiction regarding contract performance concerning nondiscrimination and listing all employment openings with the Connecticut State Employment Service until the contract is completed or until the contract is terminated prior to completion.

4. The contractor agrees, as part consideration hereof, that this contract is subject to the Guidelines and Rules issued by the State Labor Commissioner to implement Executive Order No. Three, and that the contractor will not discriminate in its employment practices or policies, will file all reports as required, and will fully cooperate with the State of Connecticut and the State Labor Commissioner.

5. This contract may be canceled, terminated, or suspended by State Military Department or the State for violation of or noncompliance with Executive Order Sixteen. In addition, the contractor agrees to include a copy of Executive Order Sixteen, and the requirement to comply with said order, in all contracts with its contractors, subcontractors, consultants, subconsultants and vendors.

Executive Order No. Three (Thomas J. Meskill)

WHEREAS, sections 4-61d(b) and 4-114a of the 1969 supplement to the general statutes require nondiscrimination clauses in state contracts and subcontracts for construction on public buildings, other public works and goods and services, and

WHEREAS, section 4-61e(c) of the 1969 supplement to the general statutes requires the labor department to encourage and enforce compliance with this policy by both employers and labor unions, and to promote equal employment opportunities, and

WHEREAS, the government of this state recognizes the duty and desirability of its leadership in providing equal employment opportunity, by implementing these laws,

NOW, THEREFORE, I, THOMAS J. MESKILL, Governor of the State of Connecticut, acting by virtue of the authority vested in me under section twelve of article fourth of the constitution of the state, as supplemented by section 3-1 of the general statutes, do hereby ORDER and DIRECT, as follows, by this Executive Order:

I. The labor commissioner shall be responsible for the administration of this Order and shall adopt such regulations as he deems necessary and appropriate to achieve the purposes of this Order. Upon the promulgation of this Order, the commissioner of finance and control shall issue a directive forthwith to all state agencies, that henceforth all state contracts and subcontracts for construction on public buildings, other public works and goods and services shall contain a provision rendering such contract or subcontract subject to this Order, and that such contract or subcontract may be canceled, terminated or suspended by the labor commissioner for violation of or noncompliance with this Order or state or federal laws concerning nondiscrimination, notwithstanding that the labor commissioner is not a party to such contract or subcontract.

II. Each contractor having a contract containing the provisions prescribed in section 4-114a of the 1969 supplement to the general statutes, shall file, and shall cause each of his subcontractors to file, compliance reports with the contracting agency or the labor commissioner, as may be directed. Such reports shall be filed within such times and shall contain such information as to employment policies and statistics of the contractor and each subcontractor, and shall be in such form as the labor commissioner may prescribe. Bidders or prospective contractors or subcontractors may be required to state whether they have participated in any previous contract subject to the provisions of this Order or any preceding similar Order, and in that event to submit on behalf of themselves and their proposed subcontractors compliance reports prior to or as an initial part of their bid or negotiation of a contract.

III. Whenever the contractor or subcontractor has a collective bargaining agreement or other contract or understanding with a labor organization or employment agency as defined in section 31-122 of the general statutes, the compliance report shall identify the said organization or agency and the contracting agency or the labor commissioner may require a compliance report to be filed with the contracting agency or the labor commissioner, as may be directed, by such organization or agency, signed by an authorized officer or agent of such organization or agency, with supporting information, to the effect that the signer's practices and policies, including but not limited to matters concerning personnel, training, apprenticeship, membership, grievance and representation, and upgrading, do not discriminate on grounds of race, color, religious creed, age, sex or national origin, or ancestry of any individual, and that the signer will either affirmatively cooperate in the implementation of the policy and provisions of this Order, or that it consents and agrees that recruitment, employment and the terms and conditions of employment under the proposed contract shall be in accordance with the purposes and provisions of the Order.

IV. The labor commissioner may by regulation exempt certain classes of contracts, subcontracts or purchase orders from the implementation of this Order, for standard commercial supplies or raw materials, for less than specified amounts of money or numbers of workers or for subcontractors below a specified tier. The labor commissioner may also provide by regulation for the exemption of facilities of a contractor which are in all respects separate and distinct from activities of the contractor related to the performance of the state contract, provided only that such exemption will not interfere with or impede the implementation of this Order, and provided further, that in the absence of such an exemption, all facilities shall be covered by the provisions of this Order.

V. Each contracting agency shall be primarily responsible for obtaining compliance with the regulations of the labor commissioner with respect to contracts entered into by such agency or its contractors. All contracting agencies shall comply with the regulations of the labor commissioner in discharging their primary responsibility for securing compliance with the provisions of contracts and otherwise with the terms of this Order and of the regulations of the labor commissioner issued pursuant to this Order. They are directed to cooperate with the labor commissioner and to furnish the labor commissioner such information and assistance as he may require in the performance of his functions under this Order. They are further directed to appoint or designate from among the personnel of each agency, compliance officers, whose duty shall be to seek compliance with the objectives of this Order by conference, conciliation, mediation, or persuasion.

VI. The labor commissioner may investigate the employment practices and procedures of any state contractor or subcontractor and the practices and policies of any labor organization or employment agency hereinabove described, relating to employment under the state contract, as concerns nondiscrimination by such organization or agency as hereinabove described, or the labor commissioner may initiate such investigation by the appropriate contract agency, to determine whether or not the contractual provisions hereinabove specified or statutes of the state respecting them have been violated. Such investigation shall be conducted in accordance with the procedures established by the labor commissioner and the investigating agency shall report to the labor commissioner any action taken or recommended.

VII. The labor commissioner shall receive and investigate or cause to be investigated complaints by employees or prospective employees of a state contractor or subcontractor or members or applicants

for membership or apprenticeship or training in a labor organization or employment agency hereinabove described, which allege discrimination contrary to the contractual provisions specified hereinabove or state statutes requiring nondiscrimination in employment opportunity. If this investigation is conducted for the labor commissioner by a contracting agency, that agency shall report to the labor commissioner what action has been taken or is recommended with regard to such complaints.

VIII. The labor commissioner shall use his best efforts, directly and through contracting agencies, other interested federal, state and local agencies, contractors and all other available instrumentalities, including the commission on human rights and opportunities, the executive committee on human rights and opportunities, ad the apprenticeship council under its mandate to provide advice and counsel to the labor commissioner in providing equal employment opportunities to all apprentices and to provide training, employment and upgrading opportunities for disadvantages workers, in accordance with section 31-51(d) of the 1969 supplement to the general statutes, to cause any labor organization or any employment agency whose members are engaged in work under government contracts or referring workers or providing supervising apprenticeship or training for or in the course of work under a state contract or subcontract to cooperate in the implementation of the purposes of this Order. The labor commissioner shall in appropriate cases notify the commission on human rights and opportunities or other appropriate state or federal agencies whenever it has reason to believe that the practices of any such organization or agency violate equal employment opportunity requirements of state or federal law.

IX. The labor commissioner or any agency officer or employee in the executive branch designated by regulation of the labor commissioner may hold such hearings, public or private, as the labor commissioner may deem advisable for compliance, enforcement or educational purposes under this Order.

X. (a) The labor commissioner may hold or cause to be held hearings, prior to imposing ordering or recommending the imposition of penalties and sanctions under this Order. No order for disbarment of any contractor from further state contracts shall be made without affording the contractor an opportunity for a hearing. In accordance with such regulations as the labor commissioner may adopt, the commissioner or the appropriate contracting agency may

1. Publish or cause to be published the names of contractors or labor organizations or employment agencies as hereinabove described which it has concluded have complied or failed to comply with the provisions of this Order or the regulations of the labor commissioner in implementing this Order.

2. Recommend to the commission on human rights and opportunities that in cases in which there is substantial or material violation or threat thereof of the contractual provision or related state statutes concerned herein, appropriate proceedings be brought to enforce them, including proceedings by the commission on its own motion under chapter 563 of the general statutes and the enjoining, within the limitations of applicable law, of organizations, individuals or groups who prevent directly or indirectly compliance with the provisions of this Order.

3. Recommend that criminal proceedings be brought under chapter 939 of the general statutes.

4. Cancel, terminate, suspend or cause to be canceled, terminated, or suspended in accordance with law any contract or any portion or portions thereof for failure of the contractor or subcontractor to comply with the nondiscrimination provisions of the contract. Contracts may be canceled, terminated, suspended absolutely or their continuance conditioned upon a program for future compliance approved by the contracting agency.

5. Provide that any contracting agency shall refrain from entering into any further contracts or extensions or modifications of existing contracts with any contractor until he has satisfied the labor commissioner that he has established and will carry out personnel and employment policies compliant with this Order.

6. Under regulations prescribed by the labor commissioner each contracting agency shall make reasonable efforts with a reasonable period of time to secure compliance with the contract provisions of this Order by methods of conference, conciliation, mediation or persuasion, before other proceedings shall be instituted under this Order or before a state contract shall be canceled or terminated in whole or in part for failure of the contractor or subcontractor to comply with the contract provisions of state statute and this Order.

(b) Any contracting agency taking any action authorized by this Order, whether on its own motion or as directed by the labor commissioner or pursuant to his regulations shall promptly notify him of such action. Whenever the labor commissioner makes a determination under this Order, he shall promptly notify the appropriate contracting agency and other interested federal, state and local agencies of the action recommended. The state and local agency or agencies shall take such action and shall report the results thereof to the labor commissioner within such time as he shall specify.

XI. If the labor commissioner shall so direct, contracting agencies shall not enter into contracts with any bidder or prospective contractor unless he has satisfactorily complied with the provisions of this Order, or submits a program for compliance acceptable to the labor commissioner, or if the labor commissioner so authorizes, to the contracting agency.

XII. Whenever a contracting agency cancels or terminates a contract, or a contractor has been disbarred from further government contracts because of noncompliance with the contract provisions with regard to nondiscrimination, the labor commissioner or the contracting agency shall rescind such disbarment, upon the satisfaction of the labor commissioner that the contractor has purged himself of such noncompliance and will thenceforth carry out personnel and employment policies of nondiscrimination in compliance with the provision of this Order.

XIII. The labor commissioner may delegate to any officer; agency or employee in the executive branch any function or duty of the labor commissioner under this Order except authority to promulgate regulations of a general nature.

XIV. This Executive Order supplements the Executive Order issued on September 28, 1967. All regulations, orders, instructions, designations and other directives issued heretofore in these premises, including those issued by the heads of various departments or agencies under or pursuant to prior order or statute, shall remain in full force and effect, unless and until revoked or superceded by appropriate authority, to the extent that they are not inconsistent with this Order.

Executive Order No. Seventeen (Thomas J. Meskill)

WHEREAS, Section 31-237 of the General Statutes of Connecticut as amended requires the maintaining of the established free services of the Connecticut State Employment Service to both employers and prospective employees and

WHEREAS, Section 31-5 of the General Statutes of Connecticut requires that no compensation or fee shall be charged or received directly or indirectly for the services of the Connecticut State Employment Service and

WHEREAS, large numbers of our citizens who have served in the Armed Forces of our nation are returning to civilian life in our state and seeking employment in civilian occupations and

WHEREAS, we owe a duty as well as gratitude to these returning veterans including the duty to find suitable employment for them and

WHEREAS, many of our handicapped citizens are fully capable of employment and are entitled to be placed in suitable employment and

WHEREAS, many of the citizens of our state who are unemployed are unaware of the job openings and employment opportunities which do in fact exist in our state and

WHEREAS, notwithstanding the free services of the Connecticut State Employment Service, many of our Connecticut employers do not use its free services or do not avail themselves fully of all the services offered,

NOW, THEREFORE, I, THOMAS J. MESKILL, Governor of the State of Connecticut, acting by virtue of the authority vested in me under the fourth article of the Constitution of the State and in accordance with Section 3-1 of the General Statutes, do hereby ORDER and direct, as follows, by this Executive Order:

I. The Labor Commissioner shall be responsible for the administration of this Order and shall do all acts necessary and appropriate to achieve its purpose. Upon promulgation of this Order, the Commissioner of Finance and Control shall issue a directive forthwith to all state agencies, that henceforth all state contracts and subcontracts for construction on public buildings, other public works and goods and services shall contain a provision rendering such contract or subcontract subject to this Order, and that such contract or subcontract may be canceled, terminated or suspended by the Labor Commissioner for violation of or noncompliance with this Order, notwithstanding that the Labor Commissioner is not a party to such contract or subcontract.

II. Every contractor and subcontractor having a contract with the state or any of its agencies, boards, commissions, or departments, every individual partnership, corporation, or business entity having business with the state or who or which seeks to do business with the state, and every bidder or prospective bidder who submits a bid or replies to an invitation to bid on any state contract shall list all employment openings with the office of the Connecticut State Employment Service in the area where the work is to be performed or where the services are to be rendered.

III. All state contracts shall contain a clause which shall be a condition of the contract that the contractor and any subcontractor holding a contract directly under the contractor shall list al employment openings with the Connecticut State Employment Service. The Labor Commissioner may allow exceptions to listings of employment openings which the contractor proposes to fill from within its organization from employees on the rolls of the contractor on the date of publication of the invitation to bid or the date on which the public announcement was published or promulgated advising of the program concerned.

IV. Each contracting agency of the state shall be primarily responsible for obtaining compliance with this Executive Order. Each contracting agency shall appoint or designate from among its personnel one or more persons who shall be responsible for compliance with the objectives of this Order.

V. The Labor Commissioner shall be and is hereby empowered to inspect the books, records, payroll and personnel data of each individual or business entity subject to this Executive Order and may hold hearings or conferences, formal or informal, in pursuance of the duties and responsibilities hereunto delegated to the Labor Commissioner.

VI. The Labor Commissioner or any agency officer or employee in the executive branch designated by regulation of the Labor Commissioner may hold such hearings, public or private, as the Labor Commissioner may deem advisable for compliance, enforcement or educational purposes under this Order.

VII. (a) The Labor Commissioner may hold or cause to be held hearings, prior to imposing, ordering, or recommending the imposition of penalties and sanctions under this Order. In accordance herewith, the Commissioner or the appropriate contracting agency may suspend, cancel, terminate, or cause to be suspended, canceled, or terminated in accordance with law any contract or portion or portions thereof for failure of the contractor or subcontractor to comply with the listing provisions of the contract. Contracts may be canceled, terminated, suspended absolutely or their continuance conditioned upon a program for future compliance approved by the contracting agency.

(b) Any contracting agency taking any action authorized by this Order, whether on its own motion or as directed by the Labor Commissioner, shall promptly notify him of such action. Whenever the Labor Commissioner makes a determination under this Order, he shall promptly notify the appropriate contracting

agency of the action recommended. The agency shall report the results to the Labor Commissioner promptly.

VIII. If the Labor Commissioner shall so direct, contracting agencies shall not enter into contracts with any bidder or prospective contractor unless he has satisfactorily complied with the provisions of this Order.

Executive Order No. 16 (John G. Rowland)

WHEREAS, the State of Connecticut recognizes that workplace violence is a growing problem that must be addressed; and

WHEREAS, the State is committed to providing its employees a reasonably safe and healthy working environment, free from intimidation, harassment, threats, and /or violent acts; and

WHEREAS, violence or the threat of violence by or against any employee of the State of Connecticut or member of the public in the workplace is unacceptable and will subject the perpetrator to serious disciplinary action up to and including discharge and criminal penalties.

NOW, THEREFORE, I, John G. Rowland, Governor of the State of Connecticut, acting by virtue of the authority vested in me by the Constitution and by the statutes of this state, do hereby ORDER and DIRECT:

1. That all state agency personnel, contractors, subcontractors, and vendors comply with the following **Violence in the Workplace Prevention Policy**:

   The State of Connecticut adopts a statewide zero tolerance policy for workplace violence.

   Therefore, except as may be required as a condition of employment¾

   - No employee shall bring into any state worksite any weapon or dangerous instrument as defined herein.
   - No employee shall use, attempt to use, or threaten to use any such weapon or dangerous instrument in a state worksite.
   - No employee shall cause or threaten to cause death or physical injury to any individual in a state worksite.

   Weapon means any firearm, including a BB gun, whether loaded or unloaded, any knife (excluding a small pen or pocket knife), including a switchblade or other knife having an automatic spring release device, a stiletto, any police baton or nightstick or any martial arts weapon or electronic defense weapon.

   Dangerous instrument means any instrument, article, or substance that, under the circumstances, is capable of causing death or serious physical injury.

   Violation of the above reasonable work rules shall subject the employee to disciplinary action up to and including discharge.

2. That each agency must prominently post this policy and that all managers and supervisors must clearly communicate this policy to all state employees
3. That all managers and supervisors are expected to enforce this policy fairly and uniformly.
4. That any employee who feels subjected to or witnesses violent, threatening, harassing, or intimidating behavior in the workplace immediately report the incident or statement to their supervisor, manager, or human resources office.
5. That any employee who believes that there is a serious threat to their safety or the safety of others that requires immediate attention notify proper law enforcement authorities and his or her manager or supervisor
6. That any manager or supervisor receiving such a report shall immediately contact their human resources office to

evaluate, investigate and take appropriate action.

7. That all parties must cooperate fully when questioned regarding violations of this policy.

8. That all parties be advised that any weapon or dangerous instrument at the worksite will be confiscated and that there is no reasonable expectation of privacy with respect to such items in the workplace.

9. That this order applies to all state employees in the executive branch.

10. That each agency will monitor the effective implementation of this policy.

11. That this order shall take effect immediately.

Excerpted portion of Executive Order No. 7B (M. Jodi Rell)

…NOW, THEREFORE, I, M. Jodi Rell, Governor of the State of Connecticut, acting by virtue of the authority vested in me by the Constitution and by the statutes of this state, do hereby **ORDER** and **DIRECT** that: …

6. (a) Each contract entered into on or after October 1, 2005 shall provide that the Board may review the contract and recommend to the state contracting agency termination of the contract for cause. The state contracting agency shall consider the recommendations and act as required or permitted in accordance with the contract and applicable law. The Board shall provide the results of its review, together with its recommendations, to the state contracting agency and any other affected party in accordance with the notice provisions in the contract no later than fifteen (15) days after the Board finalizes its recommendation. For the purpose of this Section, "for cause" means: (1) a violation of the State Ethics Code (Chapter 10 of the general statutes) or section 4a-100 of the general statutes or (2) wanton or reckless disregard of any state contracting and procurement process by any person substantially involved in such contract or state contracting agency. Notwithstanding the October 1, 2005 date, any procurement currently in progress that has not yet resulted in a fully executed contract can continue to proceed to contract without this provision, provided that no later than December 31, 2005 the parties execute an amendment or other appropriate contract modification to add this provision.

   (b) For purposes of this Section, "contract" shall not include real property transactions involving less than a fee simple interest or financial assistance comprised of state or federal funds, the form of which may include but is not limited to grants, loans, loan guarantees, and participation interests in loans, equity investments and tax credit programs. Notwithstanding the foregoing, the Board shall not have any authority to recommend the termination of a contract for the sale or purchase of a fee simple interest in real property following transfer of title.

10. (a) Notwithstanding the contract value listed in sections 4-250 and 4-251 of the Connecticut General Statutes, all procurements between state agencies and private entities with a value of $50,000 or more in a calendar or fiscal year shall comply with the gift affidavit requirements of said sections. Certifications by agency officials or employees required by section 4-252 of the Connecticut General Statutes shall not be affected by this section.

    This affidavit and instructions "General Advice for Filling out Affidavits and Resolutions/Certificate of Authority" can be found at http://www.ct.gov/dpw. You can also find at this website an "Introduction" to the affidavits that explains when in the process they are applicable.

17. Sexual Harassment Policy Statement

This contract will be subject to the provisions of the State Military Department Sexual Harassment Policy ("Policy") and, as such, the contract may be canceled, terminated, or suspended by the State Military Department for violation of or noncompliance with said Policy. This policy entitled, "Sexual Harassment

Statement" and "Sexual Harassment Narrative" is found at the State Military Department's website: http://www.ct.gov/mil/lib/mil/MDHandbookFeb2007.pdf and made a part hereof.

18. Standard Conditions

a. Bid Security

Bid security in the form of a certified check, bank check, or bid bond in an amount equal to 10% of the bid is required on all bids in excess of $50,000.00. Checks should be made payable to: "Treasurer, State of Connecticut".

b. Security for Faithful Performance

Performance Bond and Labor and Material Bond in the amount of 100% of the purchase order price must be filed by the successful low bidder prior to the start of construction if bid is in excess of $100,000.00.

c. Insurance is required in the exact amounts specified in Section 00300, Certificate of Insurance (refer to Article 35, Section 00700, General Conditions of the Contract for Construction).

d. Contractor shall commence work within fourteen (14) calendar days after receiving the Order to Commence Work form and continue for thirty (30) calendar days for completion of the project, unless otherwise specified or agreed.

e. Project Manager: Billy Applewhite, Design Dept

Prevailing Wage Bid Package

- Section 31-53b: Construction safety and Health Course. Proof of completion required for employees on public building projects. (PDF, 10KB)
  - Informational Bulletin - The 10-Hour OSHA Construction Safety and Health Course (PDF, 20KB)
- Notice For All Mason Contractors (PDF, 5KB)
- CT General Statute 31-55a
- Contracting Agency Certification Form (PDF, 89KB)
- Contractor's Wage Certification Form (PDF, 11KB)
- Payroll Certification - Public Works Projects
- Occupational Classification Bulletin
- Footnotes (PDF, 31KB) **UPDATED**

Published by the Connecticut Department of Labor, Project Management Office
Last Updated: April 22, 2010

Sec. 31-53b. Construction safety and health course. New miner training program. Proof of completion required for mechanics, laborers and workers on public works projects. Enforcement. Regulations. Exceptions. (a) Each contract for a public works project entered into on or after July 1, 2009, by the state or any of its agents, or by any political subdivision of the state or any of its agents, described in subsection (g) of section 31-53, shall contain a provision requiring that each contractor furnish proof with the weekly certified payroll form for the first week each employee begins work on such project that any person performing the work of a mechanic, laborer or worker pursuant to the classifications of labor under section 31-53 on such public works project, pursuant to such contract, has completed a course of at least ten hours in duration in construction safety and health approved by the federal Occupational Safety and Health Administration or, has completed a new miner training program approved by the Federal Mine Safety and Health Administration in accordance with 30 CFR 48 or, in the case of telecommunications employees, has completed at least ten hours of training in accordance with 29 CFR 1910.268.

(b) Any person required to complete a course or program under subsection (a) of this section who has not completed the course or program shall be subject to removal from the worksite if the person does not provide documentation of having completed such course or program by the fifteenth day after the date the person is found to be in noncompliance. The Labor Commissioner or said commissioner's designee shall enforce this section.

(c) Not later than January 1, 2009, the Labor Commissioner shall adopt regulations, in accordance with the provisions of chapter 54, to implement the provisions of subsections (a) and (b) of this section. Such regulations shall require that the ten-hour construction safety and health courses required under subsection (a) of this section be conducted in accordance with federal Occupational Safety and Health Administration Training Institute standards, or in accordance with Federal Mine Safety and Health Administration Standards or in accordance with 29 CFR 1910.268, as appropriate. The Labor Commissioner shall accept as sufficient proof of compliance with the provisions of subsection (a) or (b) of this section a student course completion card issued by the federal Occupational Safety and Health Administration Training Institute, or such other proof of compliance said commissioner deems appropriate, dated no earlier than five years before the commencement date of such public works project.

(d) This section shall not apply to employees of public service companies, as defined in section 16-1, or drivers of commercial motor vehicles driving the vehicle on the public works project and delivering or picking up cargo from public works projects provided they perform no labor relating to the project other than the loading and unloading of their cargo.

(P.A. 06-175, S. 1; P.A. 08-83, S. 1.)

History: P.A. 08-83 amended Subsec. (a) by making provisions applicable to public works project contracts entered into on or after July 1, 2009, replacing provision re total cost of work with reference to Sec. 31-53(g), requiring proof in certified payroll form that new mechanic, laborer or worker has completed a 10-hour or more construction safety course and adding provision re new miner training program, amended Subsec. (b) by substituting "person" for "employee" and adding "or program", amended Subsec. (c) by adding "or in accordance with Federal Mine
Safety and Health Administration Standards" and setting new deadline of January 1, 2009, deleted former Subsec. (d) re "public building", added new Subsec. (d) re exemptions for public service company employees and delivery drivers who perform no labor other than delivery and made conforming and technical changes, effective January 1, 2009.

Informational Bulletin

THE 10-HOUR OSHA CONSTRUCTION SAFETY AND HEALTH COURSE

(applicable to public building contracts entered into *on or after July 1, 2007,* where the total cost of all work to be performed is at least $100,000)

(1) This requirement was created by Public Act No. 06-175, which is codified in Section 31-53b of the Connecticut General Statutes (pertaining to the prevailing wage statutes);

(2) The course is required for public building construction contracts (projects funded in whole or in part by the state or any political subdivision of the state) entered into on or after July 1, 2007;

(3) It is required of private employees (not state or municipal employees) and apprentices who perform manual labor for a general contractor or subcontractor on a public building project where the total cost of all work to be performed is at least $100,000;

(4) The ten-hour construction course pertains to the ten-hour Outreach Course conducted in accordance with federal OSHA Training Institute standards, and, for telecommunications workers, a ten-hour training course conducted in accordance with federal OSHA standard, 29 CFR 1910.268;

(5) The internet website for the federal OSHA Training Institute is http://www.osha.gov/fso/ote/training/edcenters/fact_sheet.html;

(6) The statutory language leaves it to the contractor and its employees to determine who pays for the cost of the ten-hour Outreach Course;

(7) Within 30 days of receiving a contract award, a general contractor must furnish proof to the Labor Commissioner that all employees and apprentices performing manual labor on the project will have completed such a course;

(8) Proof of completion may be demonstrated through either: (a) the presentation of a *bona fide* student course completion card issued by the federal OSHA Training Institute; *or* (2) the presentation of documentation provided to an employee by a trainer certified by the Institute pending the actual issuance of the completion card;

(9) Any card with an issuance date more than 5 years prior to the commencement date of the construction project shall not constitute proof of compliance;

(10) Each employer shall affix a copy of the construction safety course completion card to the certified payroll submitted to the contracting agency in accordance with Conn. Gen. Stat. § 31-53(f) on which such employee's name first appears;

(11) Any employee found to be in non-compliance shall be subject to removal from the worksite if such employee does not provide satisfactory proof of course completion to the Labor Commissioner by the fifteenth day after the date the employee is determined to be in noncompliance;

(12) Any such employee who is determined to be in noncompliance may continue to work on a public building construction project for a maximum of fourteen consecutive calendar days while bringing his or her status into compliance;

(13) The Labor Commissioner may make complaint to the prosecuting authorities regarding any employer or agent of the employer, or officer or agent of the corporation who files a false certified payroll with respect to the status of an employee who is performing manual labor on a public building construction project;

(14) The statute provides the minimum standards required for the completion of a safety course by manual laborers on public construction contracts; any contractor can exceed these minimum requirements; and

(15) Regulations clarifying the statute are currently in the regulatory process, and shall be posted on the CTDOL website as soon as they are adopted in final form.

(16) Any questions regarding this statute may be directed to the Wage and Workplace Standards Division of the Connecticut Labor Department via the internet website of http://www.ctdol.state.ct.us/wgwkstnd/wgemenu.htm; or by telephone at (860)263-6790.

THE ABOVE INFORMATION IS PROVIDED EXCLUSIVELY AS AN EDUCATIONAL RESOURCE, AND IS NOT INTENDED AS A SUBSTITUTE FOR LEGAL INTERPRETATIONS WHICH MAY ULTMATELY ARISE CONCERNIG THE CONSTRUCTION OF THE STATUTE OR THE REGULATIONS.

November 29, 2006

Notice

To All Mason Contractors and Interested Parties Regarding Construction Pursuant to Section 31-53 of the Connecticut General Statutes (Prevailing Wage)

The Connecticut Labor Department Wage and Workplace Standards Division is empowered to enforce the prevailing wage rates on projects covered by the above referenced statute.

Over the past few years the Division has withheld enforcement of the rate in effect for workers who operate a forklift on a prevailing wage rate project due to a potential jurisdictional dispute.

The rate listed in the schedules and in our Occupational Bulletin (see enclosed) has been as follows:

Forklift Operator:

- **Laborers (Group 4) Mason Tenders** - operates forklift solely to assist a mason to a maximum height of nine feet only.

- **Power Equipment Operator (Group 9)** - operates forklift to assist any trade and to assist a mason to a height over nine feet.

The U.S. Labor Department conducted a survey of rates in Connecticut but it has not been published and the rate in effect remains as outlined in the above Occupational Bulletin.

Since this is a classification matter and not one of jurisdiction, effective January 1, 2007 the Connecticut Labor Department will enforce the rate on each schedule in accordance with our statutory authority.

Your cooperation in filing appropriate and accurate certified payrolls is appreciated.

Statute 31-55a

- Special Notice -

To All State and Political Subdivisions,Their Agents, and Contractors

Connecticut General Statute 31-55a - Annual adjustments to wage rates by contractors doing state work.

Each contractor that is awarded a contract on or after October 1, 2002, for (1) the construction of a state highway or bridge that falls under the provisions of section 31-54 of the general statutes, or (2) the construction, remodeling, refinishing, refurbishing, rehabilitation, alteration or repair of any public works project that falls under the provisions of section 31-53 of the general statutes shall contact the Labor Commissioner on or before July first of each year, for the duration of such contract, to ascertain the prevailing rate of wages on an hourly basis and the amount of payment or contributions paid or payable on behalf of each mechanic, laborer or worker employed upon the work contracted to be done, and shall make any necessary adjustments to such prevailing rate of wages and such payment or contributions paid or payable on behalf of each such employee, effective each July first.

- The prevailing wage rates applicable to any contract or subcontract awarded on or after October 1, 2002 are subject to annual adjustments each July 1st for the duration of any project which was originally advertised for bids on or after October 1, 2002.
- Each contractor affected by the above requirement shall pay the annual adjusted prevailing wage rate that is in effect each July 1st, as posted by the Department of Labor.
- It is the ***contractor's*** responsibility to obtain the annual adjusted prevailing wage rate increases directly from the Department of Labor's Web Site. The annual adjustments will be posted on the Department of Labor Web page: www.ctdol.state.ct.us. For those without internet access, please contact the division listed below.
- The Department of Labor will continue to issue the initial prevailing wage rate schedule to the Contracting Agency for the project. All subsequent annual adjustments will be posted on our Web Site for contractor access.

Any questions should be directed to the Contract Compliance Unit, Wage and Workplace Standards Division, Connecticut Department of Labor, 200 Folly Brook Blvd., Wethersfield, CT 06109 at (860)263-6790.

◀-- Workplace Laws

Published by the Connecticut Department of Labor, Project Management Office
Last Updated: April 22, 2010

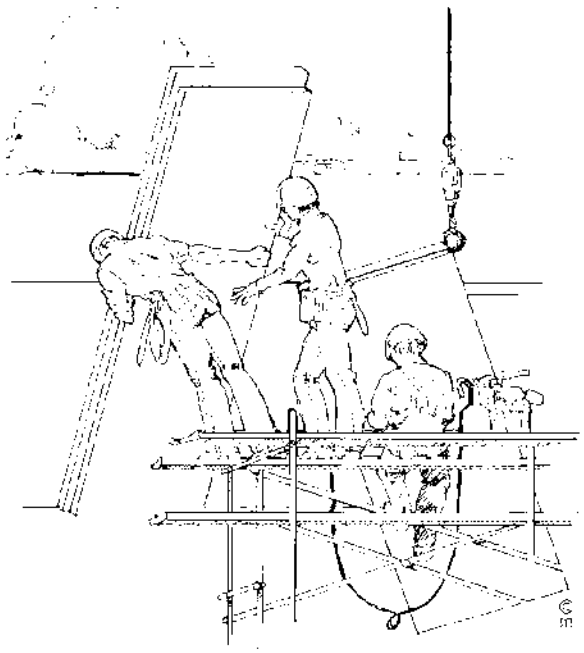
~NOTICE~

TO ALL CONTRACTING AGENCIES

Please be advised that Connecticut General Statutes Section 31-53, requires the contracting agency to certify to the Department of Labor, the total dollar amount of work to be done in connection with such public works project, regardless of whether such project consists of one or more contracts.

Please find the attached "Contracting Agency Certification Form" to be completed and returned to the Department of Labor, Wage and Workplace Standards Division, Public Contract Compliance Unit.

✎ Inquiries can be directed to (860)263-6543.



CONNECTICUT DEPARTMENT OF LABOR
WAGE AND WORKPLACE STANDARDS DIVISION
CONTRACT COMPLIANCE UNIT

CONTRACTING AGENCY CERTIFICATION FORM

I, _____, acting in my official capacity as _____,
authorized representative title

for _____, located at _____,
contracting agency address

do hereby certify that the total dollar amount of work to be done in connection with

_____, located at _____,
project name and number address

shall be $_____, which includes all work, regardless of whether such project

consists of one or more contracts.

CONTRACTOR INFORMATION

Name:_____

Address:_____
Authorized Representative:_____
Approximate Starting Date: _____

Approximate Completion Date:_____

_____ _____
Signature Date

Return To: Connecticut Department of Labor
Wage & Workplace Standards Division
Contract Compliance Unit
200 Folly Brook Blvd.
Wethersfield, CT 06109

Date Issued: _____

CONNECTICUT DEPARTMENT OF LABOR
WAGE AND WORKPLACE STANDARDS DIVISION

CONTRACTORS WAGE CERTIFICATION FORM

I,_____ of _____
Officer, Owner, Authorized Rep. Company Name

do hereby certify that the _____
Company Name

_____
Street

_____
City

and all of its subcontractors will pay all workers on the

_____
Project Name and Number

_____
Street and City

the wages as listed in the schedule of prevailing rates required for such project (a copy of which is attached hereto).

_____
Signed

Subscribed and sworn to before me this _____ day of _____,_____.

_____
Notary Public

Return to:

Connecticut Department of Labor
Wage & Workplace Standards Division
200 Folly Brook Blvd.
Wethersfield, CT 06109

Rate Schedule Issued (Date): _____

Certified Payroll Form WWS - CPI

In accordance with Connecticut General Statutes, 31-53 Certified Payrolls with a statement of compliance shall be submitted monthly to the contracting agency.

Note: Once you have downloaded these forms and are ready to print them out, set the print function on your PC to the horizontal print orientation.

Note2: Please download both the Payroll Certification for Public Works Projects **and** the Certified Statement of Compliance for a complete package. The Certified Statement of Compliance appears on the same page as the Fringe Benefits Explanation page.

Announcement: The Certified Payroll Form WWS-CPI can now be completed on-line!

- Certified Payroll Form WWS-CPI (PDF, 727KB)
- Sample Completed Form (PDF, 101KB)

Published by the Connecticut Department of Labor, Project Management Office
Last Updated: April 22, 2010

[New] In accordance with Section 31-53b(a) of the C.G.S. each contractor shall provide a copy of the OSHA 10 Hour Construction Safety and Health Card for each employee, to be attached to the first certified payroll on the project.

In accordance with Connecticut General Statutes, 31-53 Certified Payrolls with a statement of compliance shall be submitted monthly to the contracting agency.

PAYROLL CERTIFICATION FOR PUBLIC WORKS PROJECTS

WEEKLY PAYROLL

Connecticut Department of Labor
Wage and Workplace Standards Division
200 Folly Brook Blvd.
Wethersfield, CT 06109

CONTRACTOR NAME AND ADDRESS:
APPENDIX 1

SUBCONTRACTOR NAME & ADDRESS
PROJECT #11MIL217-2401

WORKER'S COMPENSATION INSURANCE CARRIER
MILITARY DEPARTMENT
POLICY # PROJECT #11MIL217-2401
EFFECTIVE DATE: APPENDIX 2
EXPIRATION DATE: MILITARY DEPARTMENT

PAYROLL NUMBER | Week-Ending Date | PROJECT NAME & ADDRESS

PERSON/WORKER, ADDRESS and SECTION	APPR RATE %	MALE/ FEMALE AND RACE*	WORK CLASSIFICATION Trade License Type & Number - OSHA 10 Certification Number	DAY AND DATE S	M	T	W	TH	F	S	Total ST Hours Total O/T Hours	BASE HOURLY RATE TOTAL FRINGE BENEFIT PLAN CASH	TYPE OF FRINGE BENEFITS Per Hour 1 through 6 (see back)	GROSS PAY FOR ALL WORK PERFORMED THIS WEEK	TOTAL DEDUCTIONS FICA	FEDERAL WITH-HOLDING	STATE WITH-HOLDING	LIST OTHER	GROSS PAY FOR THIS PREVAILING RATE JOB	CHECK # AND NET PAY
				HOURS WORKED EACH DAY																
											S-TIME	$ Base Rate	1. $ 2. $ 3. $							
											O-TIME	$ Cash Fringe	4. $ 5. $ 6. $							
											S-TIME	$ Base Rate	1. $ 2. $ 3. $							
											O-TIME	$ Cash Fringe	4. $ 5. $ 6. $							
											S-TIME	$ Base Rate	1. $ 2. $ 3. $							
											O-TIME	$ Cash Fringe	4. $ 5. $ 6. $							
											S-TIME	$ Base Rate	1. $ 2. $ 3. $							
											O-TIME	$ Cash Fringe	4. $ 5. $ 6. $							

7/13/2009
WWS-CP1

*IF REQUIRED

*SEE REVERSE SIDE

PAGE NUMBER _____OF

OSHA 10 ~ATTACH CARD TO 1ST CERTIFIED PAYROLL

***FRINGE BENEFITS EXPLANATION (P):**

Bona fide benefits paid to approved plans, funds or programs, except those required by Federal or State Law (unemployment tax, worker's compensation, income taxes, etc.).

Please specify the type of benefits provided:

1) Medical or hospital care _____ 4) Disability_____

2) Pension or retirement _____ 5) Vacation, holiday_____

3) Life Insurance _____ 6) Other (please specify) _____

CERTIFIED STATEMENT OF COMPLIANCE

For the week ending date of _____,

I, _____of _____, (hereafter known as

Employer) in my capacity as _____ (title) do hereby certify and state:

Section A:

1. All persons employed on said project have been paid the full weekly wages earned by them during the week in accordance with Connecticut General Statutes, section 31-53, as amended. Further, I hereby certify and state the following:

a) The records submitted are true and accurate;

b) The rate of wages paid to each mechanic, laborer or workman and the amount of payment or contributions paid or payable on behalf of each such employee to any employee welfare fund, as defined in Connecticut General Statutes, section 31-53 (h), are not less than the prevailing rate of wages and the amount of payment or contributions paid or payable on behalf of each such employee to any employee welfare fund, as determined by the Labor Commissioner pursuant to subsection Connecticut General Statutes, section 31-53 (d), and said wages and benefits are not less than those which may also be required by contract;

c) The Employer has complied with all of the provisions in Connecticut General Statutes, section 31-53 (and Section 31-54 if applicable for state highway construction);

d) Each such employee of the Employer is covered by a worker's compensation insurance policy for the duration of his employment which proof of coverage has been provided to the contracting agency;

e) The Employer does not receive kickbacks, which means any money, fee, commission, credit, gift, gratuity, thing of value, or compensation of any kind which is provided directly or indirectly, to any prime contractor, prime contractor employee, subcontractor, or subcontractor employee for the purpose of improperly obtaining or rewarding favorable treatment in connection with a prime contract or in connection with a prime contractor in connection with a subcontractor relating to a prime contractor; and

f) The Employer is aware that filing a certified payroll which he knows to be false is a class D felony for which the employer may be fined up to five thousand dollars, imprisoned for up to five years or both.

2. OSHA~The employer shall affix a copy of the construction safety course, program or training completion document to the certified payroll required to be submitted to the contracting agency for this project on which such employee's name first appears.

_____	_____	_____
(Signature)	(Title)	Submitted on (Date)

Section B: Applies to CONNDOT Projects ONLY

That pursuant to CONNDOT contract requirements for reporting purposes only, all employees listed under Section B who performed work on this project are not covered under the prevailing wage requirements defined in Connecticut General Statutes Section 31-53.

_____	_____	_____
(Signature)	(Title)	Submitted on (Date)

Note: CTDOL will assume all hours worked were performed under Section A unless clearly delineated as Section B WWS-CP1 as such. Should an employee perform work under both Section A and Section B, the hours worked and wages paid must be segregated for reporting purposes.

*****THIS IS A PUBLIC DOCUMENT*****

*****DO NOT INCLUDE SOCIAL SECURITY NUMBERS*****

Weekly Payroll Certification For Public Works Projects (Continued)

PAYROLL CERTIFICATION FOR PUBLIC WORKS PROJECTS

Week-Ending Date:

Contractor or Subcontractor Business Name:

WEEKLY PAYROLL

PERSON/WORKER, ADDRESS and SECTION	APPR RATE %	MALE/ FEMALE AND RACE*	WORK CLASSIFICATION Trade License Type & Number - OSHA 10 Certification Number	DAY AND DATE S	M	T	W	TH	F	S HOURS WORKED EACH DAY	Total ST Hours Total O/T Hours	BASE HOURLY RATE TOTAL FRINGE BENEFIT PLAN CASH	TYPE OF FRINGE BENEFITS Per Hour 1 through 6 (see back)	GROSS PAY FOR ALL WORK PERFORMED THIS WEEK	TOTAL DEDUCTIONS FICA	FEDERAL WITH-HOLDING	STATE WITH-HOLDING	LIST OTHER	GROSS PAY FOR THIS PREVAILING RATE JOB	CHECK # AND NET PAY
											S-TIME $ Base Rate	1. $ 2. $ 3. $							
											O-TIME $ Cash Fringe	4. $ 5. $ 6. $							
											S-TIME $ Base Rate	1. $ 2. $ 3. $							
											O-TIME $ Cash Fringe	4. $ 5. $ 6. $							
											S-TIME $ Base Rate	1. $ 2. $ 3. $							
											O-TIME $ Cash Fringe	4. $ 5. $ 6. $							
											S-TIME $ Base Rate	1. $ 2. $ 3. $							
											S-TIME $ Cash Fringe	4. $ 5. $ 6. $							
											S-TIME $ Base Rate	1. $ 2. $ 3. $							
											S-TIME $ Cash Fringe	4. $ 5. $ 6. $							

*IF REQUIRED

7/13/2009

WWS-CP2

NOTICE: THIS PAGE MUST BE ACCOMPANIED BY A COVER PAGE (FORM # WWS-CP1)

PAGE NUMBER _____OF

[New] In accordance with Section 31-53b(a) of the C.G.S. each contractor shall provide a copy of the OSHA 10 Hour Construction Safety and Health Card for each employee, to be attached to the first certified payroll on the project.

In accordance with Connecticut General Statutes, 31-53
Certified Payrolls with a statement of compliance
shall be submitted monthly to the contracting agency.

PAYROLL CERTIFICATION FOR PUBLIC WORKS PROJECTS

WEEKLY PAYROLL

Connecticut Department of Labor
Wage and Workplace Standards Division
200 Folly Brook Blvd.
Wethersfield, CT 06109

CONTRACTOR NAME AND ADDRESS:
Landon Corporation, 15 Connecticut Avenue, Northford, CT 06472

SUBCONTRACTOR NAME & ADDRESS
XYZ Corporation
2 Main Street
Yantic, CT 06389

WORKER'S COMPENSATION INSURANCE CARRIER
Travelers Insurance Company
POLICY # #BAC8888928
EFFECTIVE DATE: 1/1/09
EXPIRATION DATE: 12/31/09

PAYROLL NUMBER: 1
Week-Ending Date: 9/26/09
PROJECT NAME & ADDRESS: DOT 105-296, Route 82

PERSON/WORKER, ADDRESS and SECTION	APPR RATE %	MALE/ FEMALE AND RACE*	WORK CLASSIFICATION / Trade License Type & Number - OSHA 10 Certification Number	DAY AND DATE: S	M	T	W	TH	F	S	Total ST Hours / Total O/T Hours	BASE HOURLY RATE / TOTAL FRINGE BENEFIT PLAN CASH	TYPE OF FRINGE BENEFITS Per Hour 1 through 6 (see back)	GROSS PAY FOR ALL WORK PERFORMED THIS WEEK	TOTAL DEDUCTIONS: FICA	FEDERAL WITH-HOLDING	STATE WITH-HOLDING	LIST OTHER	GROSS PAY FOR THIS PREVAILING RATE JOB	CHECK # AND NET PAY
				20	21	22	23	24	25	26										
				HOURS WORKED EACH DAY																
Robert Craft 81 Maple Street Willimantic, CT 06226		M/C	Electrical Lineman E-1 1234567 Owner OSHA 123456		8	8	8	8	8		S-TIME 40 O-TIME	$ 30.75 Base Rate $ 8.82 Cash Fringe	1. $ 5.80 2. $ 3. $ 2.01 4. $ 5. $ 6. $	$1,582.80				P-xxxx	$1,582.80	#123 $ xxx.xx
Ronald Jones 212 Elm Street Norwich, CT 06360	65%	M/B	Electrical Apprentice OSHA 234567		8	8	8	8	8		S-TIME 40 O-TIME	$ 19.99 Base Rate $ 16.63 Cash Fringe	1. $ 2. $ 3. $ 4. $ 5. $ 6. $	$1,464.80	xx.xx	xxx.xx	xx.xx	G-xxx	$1,464.80	#124 $xxx.xx
Franklin T. Smith 234 Washington Rd. New London, CT 06320 SECTION B		M/H	Project Manager			8					S-TIME 8 O-TIME	$ Base Rate $ Cash Fringe	1. $ 2. $ 3. $ 4. $ 5. $ 6. $	$1,500.00	xx.xx	xx.xx	xx.xx	M-xx.x		#125 xxx.xx
											S-TIME O-TIME	$ Base Rate $ Cash Fringe	1. $ 2. $ 3. $ 4. $ 5. $ 6. $							

7/13/2009
WWS-CP1

*IF REQUIRED

*SEE REVERSE SIDE

PAGE NUMBER 1 OF 2

OSHA 10 ~ATTACH CARD TO 1ST CERTIFIED PAYROLL

***FRINGE BENEFITS EXPLANATION (P):**

Bona fide benefits paid to approved plans, funds or programs, except those required by Federal or State Law (unemployment tax, worker's compensation, income taxes, etc.).

Please specify the type of benefits provided:

1) Medical or hospital care Blue Cross 4) Disability _____

2) Pension or retirement _____ 5) Vacation, holiday _____

3) Life Insurance Utopia 6) Other (please specify) _____

CERTIFIED STATEMENT OF COMPLIANCE

For the week ending date of 9/26/09,

I, Robert Craft of XYZ Corporation, (hereafter known as

Employer) in my capacity as Owner (title) do hereby certify and state:

Section A:

1. All persons employed on said project have been paid the full weekly wages earned by them during the week in accordance with Connecticut General Statutes, section 31-53, as amended. Further, I hereby certify and state the following:

a) The records submitted are true and accurate;

b) The rate of wages paid to each mechanic, laborer or workman and the amount of payment or contributions paid or payable on behalf of each such employee to any employee welfare fund, as defined in Connecticut General Statutes, section 31-53 (h), are not less than the prevailing rate of wages and the amount of payment or contributions paid or payable on behalf of each such employee to any employee welfare fund, as determined by the Labor Commissioner pursuant to subsection Connecticut General Statutes, section 31-53 (d), and said wages and benefits are not less than those which may also be required by contract;

c) The Employer has complied with all of the provisions in Connecticut General Statutes, section 31-53 (and Section 31-54 if applicable for state highway construction);

d) Each such employee of the Employer is covered by a worker's compensation insurance policy for the duration of his employment which proof of coverage has been provided to the contracting agency;

e) The Employer does not receive kickbacks, which means any money, fee, commission, credit, gift, gratuity, thing of value, or compensation of any kind which is provided directly or indirectly, to any prime contractor, prime contractor employee, subcontractor, or subcontractor employee for the purpose of improperly obtaining or rewarding favorable treatment in connection with a prime contract or in connection with a prime contractor in connection with a subcontractor relating to a prime contractor; and

f) The Employer is aware that filing a certified payroll which he knows to be false is a class D felony for which the employer may be fined up to five thousand dollars, imprisoned for up to five years or both.

2. OSHA~The employer shall affix a copy of the construction safety course, program or training completion document to the certified payroll required to be submitted to the contracting agency for this project on which such employee's name first appears.

Robert Craft (Signature) owner (Title) 10/2/09 Submitted on (Date)

Section B: Applies to CONNDOT Projects ONLY
That pursuant to CONNDOT contract requirements for reporting purposes only, all employees listed under Section B who performed work on this project are not covered under the prevailing wage requirements defined in Connecticut General Statutes Section 31-53.

Robert Craft (Signature) owner (Title) 10/2/09 Submitted on (Date)

Note: CTDOL will assume all hours worked were performed under Section A unless clearly delineated as Section B WWS-CP1 as such. Should an employee perform work under both Section A and Section B, the hours worked and wages paid must be segregated for reporting purposes.

*****THIS IS A PUBLIC DOCUMENT*****
*****DO NOT INCLUDE SOCIAL SECURITY NUMBERS*****

Information Bulletin
Occupational Classifications

The Connecticut Department of Labor has the responsibility to properly determine "job classification" on prevailing wage projects covered under C.G.S. Section 31-53.

Note: This information is intended to provide a sample of some occupational classifications for guidance purposes only. It is not an all-inclusive list of each occupation's duties. This list is being provided only to highlight some areas where a contractor may be unclear regarding the proper classification.

Below are additional clarifications of specific job duties performed for certain classifications:

- ***ASBESTOS WORKERS***

Applies all insulating materials, protective coverings, coatings and finishes to all types of mechanical systems.

- ***ASBESTOS INSULATOR***

Handle, install apply, fabricate, distribute, prepare, alter, repair, dismantle, heat and frost insulation, including penetration and fire stopping work on all penetration fire stop systems.

- ***BOILERMAKERS***

Erects hydro plants, incomplete vessels, steel stacks, storage tanks for water, fuel, etc. Builds incomplete boilers, repairs heat exchanges and steam generators.

- ***BRICKLAYERS, CEMENT MASONS, CEMENT FINISHERS, MARBLE MASONS, PLASTERERS, STONE MASONS, PLASTERERS. STONE MASONS, TERRAZZO WORKERS, TILE SETTERS***

Lays building materials such as brick, structural tile and concrete cinder, glass, gypsum, terra cotta block. Cuts, tools and sets marble, sets stone, finishes concrete, applies decorative steel, aluminum and plastic tile, applies cements, sand, pigment and marble chips to floors, stairways, etc.

- ***CARPENTERS, MILLWRIGHTS. PILEDRIVERMEN. LATHERS. RESILEINT FLOOR LAYERS, DOCK BUILDERS, DIKERS, DIVER TENDERS***

Constructs, erects, installs and repairs structures and fixtures of wood, plywood and wallboard. Installs, assembles, dismantles, moves industrial machinery. Drives piling into ground to provide foundations for structures such as buildings and bridges, retaining walls for earth embankments, such as cofferdams. Fastens wooden, metal or rockboard lath to walls, ceilings and partitions of buildings, acoustical tile layer, concrete form builder. Applies firestopping materials on fire resistive joint systems only. Installation of curtain/window walls only where attached to wood or metal studs. Installation of insulated material of all types whether blown, nailed or attached in other ways to walls, ceilings and floors of buildings. Assembly and installation of modular furniture/furniture systems. Free-standing furniture is not covered. This includes free standing: student chairs, study top desks, book box desks, computer furniture, dictionary stand, atlas stand, wood shelving, two-position information access station, file cabinets, storage cabinets, tables, etc.

- **CLEANING LABORER**

• The clean up of any construction debris and the general cleaning, including sweeping, wash down, mopping, wiping of the construction facility, washing, polishing, dusting, etc., prior to the issuance of a certificate of occupancy falls under the *Labor classification.*

- **DELIVERY PERSONNEL**

• If delivery of supplies/building materials is to one common point and stockpiled there, prevailing wages are not required. If the delivery personnel are involved in the distribution of the material to multiple locations within the construction site then they would have to be paid prevailing wages for the type of work performed: laborer, equipment operator, electrician, ironworker, plumber, etc.
• An example of this would be where delivery of drywall is made to a building and the delivery personnel distribute the drywall from one "stockpile" location to further sub-locations on each floor. Distribution of material around a construction site is the job of a laborer/tradesman and not a delivery personnel.

- **ELECTRICIANS**

Install, erect, maintenance, alteration or repair of any wire, cable, conduit, etc., which generates, transforms, transmits or uses electrical energy for light, heat, power or other purposes, including the Installation or maintenance of telecommunication, LAN wiring or computer equipment, and low voltage wiring. ****License required per Connecticut General Statutes: E-1,2 L-5,6 C-5,6 T-1,2 L-1,2 V-1,2,7,8,9.***

- ***ELEVATOR CONSTRUCTORS***

Install, erect, maintenance and repair of all types of elevators, escalators, dumb waiters and moving walks. ****License required by Connecticut General Statutes: R-1,2,5,6.***

- ***FORK LIFT OPERATOR***

Laborers Group 4) Mason Tenders - operates forklift solely to assist a mason to a maximum height of nine (9) feet only.

Power Equipment Operator Group 9 - operates forklift to assist any trade, and to assist a mason to a height over nine (9) feet.

- ***GLAZIERS***

Glazing wood and metal sash, doors, partitions, and 2 story aluminum storefronts. Installs glass windows, skylights, store fronts and display cases or surfaces such as building fronts, interior walls, ceilings and table tops and metal store fronts. Installation of aluminum window walls and curtain walls is the "joint" work of glaziers and ironworkers which requires either a blended rate or equal composite workforce.

- ***IRONWORKERS***

Erection, installation and placement of structural steel, precast concrete, miscellaneous iron, ornamental iron, metal curtain wall, rigging and reinforcing steel. Handling, sorting, and installation of reinforcing steel (rebar). Metal bridge rail (traffic), metal bridge handrail, and decorative security fence installation. Installation of aluminum window walls and curtain walls is the "joint" work of glaziers and ironworkers which requires either a blended rate or equal composite workforce. Insulated metal and insulated composite panels are still installed by the Ironworker.

- ***INSULATOR***

• Installing fire stopping systems/materials for "Penetration Firestop Systems": transit to cables, electrical conduits, insulated pipes, sprinkler pipe penetrations, ductwork behind radiation, electrical cable trays, fire rated pipe penetrations, natural polypropylene, HVAC ducts, plumbing bare metal, telephone and communication wires, and boiler room ceilings. Past practice using the applicable licensed trades, Plumber, Sheet Metal, Sprinkler Fitter, and Electrician, is not inconsistent with the Insulator classification and would be permitted.

- ***LABORERS***

Acetylene burners, asphalt rakers, chain saw operators, concrete and power buggy operator, concrete saw operator, fence and guard rail erector (except metal bridge rail (traffic), metal bridge handrail, and decorative security fence

installation.), hand operated concrete vibrator operator, mason tenders, pipelayers (installation of storm drainage or sewage lines on the street only), pneumatic drill operator, pneumatic gas and electric drill operator, powermen and wagon drill operator, air track operator, block paver, curb setters, blasters, concrete spreaders.

- ***PAINTERS***

Maintenance, preparation, cleaning, blasting (water and sand, etc.), painting or application of any protective coatings of every description on all bridges and appurtenances of highways, roadways, and railroads. Painting, decorating, hardwood finishing, paper hanging, sign writing, scenic art work and drywall hhg for any and all types of building and residential work.

- ***LEAD PAINT REMOVAL***

• Painter's Rate

1. Removal of lead paint from bridges.
2. Removal of lead paint as preparation of any surface to be repainted.
3. Where removal is on a Demolition project prior to reconstruction.

• Laborer's Rate

1. Removal of lead paint from any surface NOT to be repainted.
2. Where removal is on a *TOTAL* Demolition project only.

- ***PLUMBERS AND PIPEFITTERS***

Installation, repair, replacement, alteration or maintenance of all plumbing, heating, cooling and piping. ****License required per Connecticut General Statutes: P-1,2,6,7,8,9 J-1,2,3,4 SP-1,2 S-1,2,3,4,5,6,7,8 B-1,2,3,4 D-1,2,3,4.***

- ***POWER EQUIPMENT OPERATORS***

Operates several types of power construction equipment such as compressors, pumps, hoists, derricks, cranes, shovels, tractors, scrapers or motor graders, etc. Repairs and maintains equipment. ****License required, crane operators only, per Connecticut General Statutes.***

- ***ROOFERS***

Covers roofs with composition shingles or sheets, wood shingles, slate or asphalt and gravel to waterproof roofs, including preparation of surface. (tear-off and/or removal of any type of roofing and/or clean-up of any and all areas where a roof is to be relaid)

- ***SHEETMETAL WORKERS***

Fabricate, assembles, installs and repairs sheetmetal products and equipment in such areas as ventilation, air-conditioning, warm air heating, restaurant equipment, architectural sheet metal work, sheetmetal roofing, and aluminum gutters. Fabrication, handling, assembling, erecting, altering, repairing, etc. of coated metal material panels and composite metal material panels when used on building exteriors and interiors as soffits, facia, louvers, partitions, wall panel siding, canopies, cornice, column covers, awnings, beam covers, cladding, sun shades, lighting troughs, spires, ornamental roofing, metal ceilings, mansards, copings, ornamental and ventilation hoods, vertical and horizontal siding panels, trim, etc. The sheet metal classification also applies to the vast variety of coated metal material panels and composite metal material panels that have evolved over the years as an alternative to conventional ferrous and non-ferrous metals like steel, iron, tin, copper, brass, bronze, aluminum, etc. Insulated metal and insulated composite panels are still installed by the Iron Worker. Fabrication, handling, assembling, erecting, altering, repairing, etc. of architectural metal roof, standing seam roof, composite metal roof, metal and composite bathroom/toilet partitions, aluminum gutters, metal and composite lockers and shelving, kitchen equipment, and walk-in coolers.

- ***SPRINKLER FITTERS***

Installation, alteration, maintenance and repair of fire protection sprinkler systems.
****License required per Connecticut General Statutes: F-1,2,3,4.***

- ***TILE MARBLE AND TERRAZZO FINISHERS***

Assists and tends the tile setter, marble mason and terrazzo worker in the performance of their duties.

- **TRUCK DRIVERS**

~~How to pay truck drivers delivering asphalt is under REVISION~~

Truck Drivers are requires to be paid prevailing wage for time spent "working" directly on the site. These drivers remain covered by the prevailing wage for any time spent transporting between the actual construction location and facilities (such as fabrication, plants, mobile factories, batch plant, borrow pits, job headquarters, tool yards, etc.) dedicated exclusively, or nearly so, to performance of the contract or project, which are

so located in proximity to the actual construction location that it is reasonable to include them. ***License required, drivers only, per Connecticut General Statutes.***

For example:

• Material men and deliverymen are not covered under prevailing wage as long as they are not directly involved in the construction process. If, they unload the material, they would then be covered by prevailing wage for the classification they are performing work in: laborer, equipment operator, etc.
• Hauling material off site is not covered provided they are not dumping it at a location outlined above.
• Driving a truck on site and moving equipment or materials on site would be considered covered work, as this is part of the construction process.

➢ *Any questions regarding the proper classification should be directed to:*
Public Contract Compliance Unit
Wage and Workplace Standards Division
Connecticut Department of Labor
200 Folly Brook Blvd, Wethersfield, CT 06109
(860) 263-6543.

Connecticut Department of Labor
Wage and Workplace Standards Division
FOOTNOTES

Please Note: If the "Benefits" listed on the schedule for the following occupations includes a letter(s) (+ a or + a+b for instance), refer to the information below.

Benefits to be paid at the appropriate prevailing wage rate for the listed occupation.

If the "Benefits" section for the occupation lists only a dollar amount, disregard the information below.

Bricklayers, Cement Masons, Cement Finishers, Concrete Finishers (including caulking), Stone Masons

(Building Construction) and

(Residential- Hartford, Middlesex, New Haven, New London and Tolland Counties)

a. Paid Holiday: Employees shall receive 4 hours for Christmas Eve holiday provided the employee works the regularly scheduled day before and after the holiday. Employers may schedule work on Christmas Eve and employees shall receive pay for actual hours worked in addition to holiday pay.

Bricklayer (Residential- Fairfield County)

a. Paid Holiday: If an employee works on Christmas Eve until noon he shall be paid for 8 hours.

Electricians

Fairfield County: West of the Five Mile River in Norwalk

a. $2.00 per hour not to exceed $14.00 per day.

Elevator Constructors: Mechanics

a. Paid Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Veterans' Day, Thanksgiving Day, Christmas Day, plus the Friday after Thanksgiving.

b. Vacation: Employer contributes 8% of basic hourly rate for 5 years or more of service or 6% of basic hourly rate for 6 months to 5 years of service as vacation pay credit.

Glaziers

a. Paid Holidays: Labor Day and Christmas Day.

Power Equipment Operators
(Heavy and Highway Construction & Building Construction)

a. Paid Holidays: New Year's Day, Good Friday, Memorial day, Independence Day, Labor Day, Thanksgiving Day and Christmas Day, provided the employee works 3 days during the week in which the holiday falls, if scheduled, and if scheduled, the working day before and the working day after the holiday. Holidays falling on Saturday may be observed on Saturday, or if the employer so elects, on the preceding Friday.

Ironworkers

a. Paid Holiday: Labor Day provided employee has been on the payroll for the 5 consecutive work days prior to Labor Day.

Laborers (Tunnel Construction)

a. Paid Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day and Christmas Day. No employee shall be eligible for holiday pay when he fails, without cause, to work the regular work day preceding the holiday or the regular work day following the holiday.

Roofers

a. Paid Holidays: July 4th, Labor Day, and Christmas Day provided the employee is employed 15 days prior to the holiday.

Sprinkler Fitters

a. Paid Holidays: Memorial Day, July 4th, Labor Day, Thanksgiving Day and Christmas Day, provided the employee has been in the employment of a contractor 20 working days prior to any such paid holiday.

Truck Drivers
(Heavy and Highway Construction & Building Construction)

a. Paid Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Christmas day, and Good Friday, provided the employee has at least 31 calendar days of service and works the last scheduled day before and the first scheduled day after the holiday, unless excused.

Project: Replace Boiler For The Enfield Armory

Minimum Rates and Classifications for Building Construction

B 15437

Connecticut Department of Labor
Wage and Workplace Standards Division

By virtue of the authority vested in the Labor Commissioner under provisions of Section 31-53 of the General Statutes of Connecticut, as amended, the following are declared to be the prevailing rates and welfare payments and will apply only where the contract is advertised for bid within 20 days of the date on which the rates are established. Any contractor or subcontractor not obligated by agreement to pay to the welfare and pension fund shall pay this amount to each employee as part of his/her hourly wages.

Project Number: 11MIL217-2401 Project Town Enfield
State#: FAP#:

Project: Replace Boiler For The Enfield Armory

CLASSIFICATION	Hourly Rate	Benefits
1a) Asbestos Worker/Insulator (Includes application of insulating materials, protective coverings, coatings, & finishes to all types of mechanical systems; application of firestopping material for wall openings & penetrations in walls, floors, ceilings - Last updated 7/21/11	36.86	25.51
1b) Asbestos/Toxic Waste Removal Laborers: Asbestos removal and encapsulation (except its removal from mechanical systems which are not to be scrapped), toxic waste removers, blasters.**See Laborers Group 7**		
2) Boilermaker	34.94	19.00

As of: **Tuesday, July 26, 2011**

Project: Replace Boiler For The Enfield Armory

3a) Bricklayer, Cement Mason, Concrete Finisher (including caulking), Stone Masons	32.50	23.16 + a
3b) Tile Setter	32.00	21.44
3c) Terrazzo Mechanics and Marble Setters	31.69	22.35
3d) Tile, Marble & Terrazzo Finishers	25.50	18.43
3e) Plasterer	32.50	23.16

------LABORERS------

As of: **Tuesday, July 26, 2011**

Project: Replace Boiler For The Enfield Armory

4) Group 1: Laborers (common or general), acetylene burners, carpenter tenders, concrete specialists, wrecking laborers, fire watchers.	25.75	15.60
4a) Group 2: Mortar mixers, plaster tender, power buggy operators, powdermen, fireproofer/mixer/nozzleman, fence erector.	26.00	15.60
4b) Group 3: Jackhammer operators, mason tender (brick) and mason tender (cement/concrete)	26.25	15.60
4c) **Group 4: Pipelayers (Installation of water, storm drainage or sewage lines outside of the building line with P6, P7 license) (the pipelayer rate shall apply only to one or two employees of the total crew who primary task is to actually perform the mating of pipe sections)[If using this classification call the Labor Department for clarification]	26.00	15.60
4d) Group 5: Air track operators, Sand blasters	26.50	15.60
4e) Group 6: Nuclear toxic waste removers, blasters	28.75	15.60

As of: **Tuesday, July 26, 2011**

Project: Replace Boiler For The Enfield Armory

4f) Group 7: Asbestos removal and encapsulation (except it's removal from mechanical systems which are not to be scrapped)	26.75	15.60
4g) Group 8: Bottom men on open air caisson, cylindrical work and boring crew	26.25	15.60
4h Group 9: Top men on open air caisson, cylindrical work and boring crew	25.75	15.60
4i) Group 10: Traffic Control Signalman	16.00	15.60
5) Carpenter, Acoustical Ceiling Installation, Soft Floor/Carpet Laying, Metal Stud Installation, Form Work and Scaffold Building, Drywall Hanging, Modular-Furniture Systems Installers, Lathers, Piledrivers, Resilient Floor Layers.	29.11	20.29
5a) Millwrights	30.01	20.18

Project: Replace Boiler For The Enfield Armory

6) Electrical Worker (including low voltage wiring) (Trade License required: E1,2 L-5,6 C-5,6 T-1,2 L-1,2 V-1,2,7,8,9)	36.40	21.31
7a) Elevator Mechanic (Trade License required: R-1,2,5,6)	44.82	21.785+a+b
-----LINE CONSTRUCTION----		
Groundman	23.80	3% + 13.70
Linemen/Cable Splicer	43.28	3% + 13.70
8) Glazier (Trade License required: FG-1,2)	32.73	16.35 + a

As of: **Tuesday, July 26, 2011**

Project: Replace Boiler For The Enfield Armory

9) Ironworker, Ornamental, Reinforcing, Structural, and Precast Concrete Erection	33.00	26.58 + a
----OPERATORS----		
Group 1: Crane handling or erecting structural steel or stone, hoisting engineer 2 drums or over, front end loader (7 cubic yards or over); work boat 26 ft. and over. (Trade License Required)	35.05	19.40 + a
Group 2: Cranes (100 ton rate capacity and over); Backhoe/Excavator over 2 cubic yards; Piledriver ($3.00 premium when operator controls hammer). (Trade License Required)	34.73	19.40 + a
Group 3: Excavator; Backhoe/Excavator under 2 cubic yards; Cranes (under 100 ton rated capacity), Grader/Blade; Master Mechanic; Hoisting Engineer (all types of equipment where a drum and cable are used to hoist or drag material regardless of motive power of operation), Rubber Tire Excavator (Drott-1085 or similar);Grader Operator; Bulldozer Fine Grade. (slopes, shaping, laser or GPS, etc.).	33.99	19.40 + a
Group 4: Trenching Machines; Lighter Derrick; Concrete Finishing Machine; CMI Machine or Similar; Koehring Loader (Skooper).	33.60	19.40 + a

As of: **Tuesday, July 26, 2011**

Project: Replace Boiler For The Enfield Armory

Group 5: Specialty Railroad Equipment; Asphalt Paver; Asphalt Reclaiming Machine; Line Grinder; Concrete Pumps; Drills with Self Contained Power Units; Boring Machine; Post Hole Digger; Auger; Pounder; Well Digger; Milling Machine (over 24" Mandrell)	33.01	19.40 + a
Group 5 continued: Side Boom; Combination Hoe and Loader; Directional Driller; Pile Testing Machine.	33.01	19.40 + a
Group 6: Front End Loader (3 up to 7 cubic yards); Bulldozer (rough grade dozer).	32.70	19.40 + a
Group 7: Asphalt roller, concrete saws and cutters (ride on types), vermeer concrete cutter, Stump Grinder; Scraper; Snooper; Skidder; Milling Machine (24" and under Mandrell).	32.36	19.40 + a
Group 8: Mechanic, grease truck operator, hydroblaster; barrier mover; power stone spreader; welding; work boat under 26 ft.; transfer machine.	31.96	19.40 + a
Group 9: Front end loader (under 3 cubic yards), skid steer loader regardless of attachments, (Bobcat or Similar): forklift, power chipper; landscape equipment (including Hydroseeder).	31.53	19.40 + a

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Project: Replace Boiler For The Enfield Armory

Group 10: Vibratory hammer; ice machine; diesel and air, hammer, etc.	29.49	19.40 + a
Group 11: Conveyor, earth roller, power pavement breaker (whiphammer), robot demolition equipment.	29.49	19.40 + a
Group 12: Wellpoint operator.	29.43	19.40 + a
Group 13: Compressor battery operator.	28.85	19.40 + a
Group 14: Elevator operator; tow motor operator (solid tire no rough terrain).	27.71	19.40 + a
Group 15: Generator Operator; Compressor Operator; Pump Operator; Welding Machine Operator; Heater Operator.	27.30	19.40 + a

Project: Replace Boiler For The Enfield Armory

Group 16: Maintenance Engineer/Oiler.	26.65	19.40 + a
Group 17: Portable asphalt plant operator; portable crusher plant operator; portable concrete plant operator.	30.96	19.40 + a
Group 18: Power safety boat; vacuum truck; zim mixer; sweeper; (Minimum for any job requiring a CDL license).	28.54	19.40 + a
------PAINTERS (Including Drywall Finishing)------		
10a) Brush and Roller	29.17	16.35
10b) Taping Only/Drywall Finishing	29.92	16.35

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Project: Replace Boiler For The Enfield Armory

10c) Paperhanger and Red Label	29.67	16.35
10e) Blast and Spray	32.17	16.35
11) Plumber (excluding HVAC pipe installation) (Trade License required: P-1,2,6,7,8,9 J-1,2,3,4 SP-1,2)	38.67	24.46
12) Well Digger, Pile Testing Machine	33.01	19.40 + a
13) Roofer (composition)	30.48	14.96
14) Roofer (slate & tile)	30.98	14.96

As of: **Tuesday, July 26, 2011**

Project: Replace Boiler For The Enfield Armory

15) Sheetmetal Worker (Trade License required for HVAC and Ductwork: SM-1,SM-2,SM-3,SM-4,SM-5,SM-6)	32.27	29.33
16) Pipefitter (Including HVAC work) (Trade License required: S-1,2,3,4,5,6,7,8 B-1,2,3,4 D-1,2,3,4, G-1, G-2, G-8 & G-9)	38.67	24.46
------TRUCK DRIVERS------		
17a) 2 Axle	27.88	15.71 + a
17b) 3 Axle, 2 Axle Ready Mix	27.98	15.71 + a
17c) 3 Axle Ready Mix	28.03	15.71 + a

As of: **Tuesday, July 26, 2011**

Project: Replace Boiler For The Enfield Armory

17d) 4 Axle, Heavy Duty Trailer up to 40 tons	28.08	15.71 + a
17e) 4 Axle Ready Mix	28.13	15.71 + a
17f) Heavy Duty Trailer (40 Tons and Over)	28.33	15.71 + a
17g) Specialized Earth Moving Equipment (Other Than Conventional Type on-the-Road Trucks and Semi-Trailers, Including Euclids)	28.13	15.71 + a
18) Sprinkler Fitter (Trade License required: F-1,2,3,4)	40.50	16.85 + a
19) Theatrical Stage Journeyman	22.22	6.53

As of: **Tuesday, July 26, 2011**

Project: Replace Boiler For The Enfield Armory

Welders: Rate for craft to which welding is incidental.

**Note: Hazardous waste removal work receives additional $1.25 per hour for truck drivers.*

***Note: Hazardous waste premium $3.00 per hour over classified rate*

Crane with 150 ft. boom (including jib) - $1.50 extra
Crane with 200 ft. boom (including jib) - $2.50 extra
Crane with 250 ft. boom (including jib) - $5.00 extra
Crane with 300 ft. boom (including jib) - $7.00 extra
Crane with 400 ft. boom (including jib) - $10.00 extra

All classifications that indicate a percentage of the fringe benefits must be calculated at the percentage rate times the "base hourly rate".

Apprentices duly registered under the Commissioner of Labor's regulations on "Work Training Standards for Apprenticeship and Training Programs" Section 31-51-d-1 to 12, are allowed to be paid the appropriate percentage of the prevailing journeymen hourly base and the full fringe benefit rate, providing the work site ratio shall not be less than one full-time journeyperson instructing and supervising the work of each apprentice in a specific trade.

The Prevailing wage rates applicable to this project are subject to annual adjustments each July 1st for the duration of the project.

Each contractor shall pay the annual adjusted prevailing wage rate that is in effect each July 1st, as posted by the Department of Labor.

It is the contractor's responsibility to obtain the annual adjusted prevailing wage rate increases directly from the Department of Labor's website.

The annual adjustments will be posted on the Department of Labor's Web page: www.ct.gov/dol

The Department of Labor will continue to issue the initial prevailing wage rate schedule to the Contracting Agency for the project.

All subsequent annual adjustments will be posted on our Web Site for contractor access.

As of: **Tuesday, July 26, 2011**

Project: Replace Boiler For The Enfield Armory

Effective October 1, 2005 - Public Act 05-50: any person performing the work of any mechanic, laborer, or worker shall be paid prevailing wage

All Person who perform work ON SITE must be paid prevailing wage for the appropriate mechanic, laborer, or worker classification.

All certified payrolls must list the hours worked and wages paid to All Persons who perform work ON SITE regardless of their ownership i.e.: (Owners, Corporate Officers, LLC Members, Independent Contractors, et. al)
Reporting and payment of wages is required regardless of any contractual relationship alleged to exist between the contractor and such person.

~~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 clause (29 CFR 5.5 (a) (1) (ii)).

Please direct any questions which you may have pertaining to classification of work and payment of prevailing wages to the Wage and Workplace Standards Division, telephone (860)263-6790.

As of: **Tuesday, July 26, 2011**

Project: Hot Water System Replacement At The Norwalk Armory

Minimum Rates and Classifications for Building Construction

B 15438

Connecticut Department of Labor
Wage and Workplace Standards Division

By virtue of the authority vested in the Labor Commissioner under provisions of Section 31-53 of the General Statutes of Connecticut, as amended, the following are declared to be the prevailing rates and welfare payments and will apply only where the contract is advertised for bid within 20 days of the date on which the rates are established. Any contractor or subcontractor not obligated by agreement to pay to the welfare and pension fund shall pay this amount to each employee as part of his/her hourly wages.

Project Number: 11MIL217-2401 Project Town Norwalk
State#: FAP#:

Project: Hot Water System Replacement At The Norwalk Armory

CLASSIFICATION	Hourly Rate	Benefits
1a) Asbestos Worker/Insulator (Includes application of insulating materials, protective coverings, coatings, & finishes to all types of mechanical systems; application of firestopping material for wall openings & penetrations in walls, floors, ceilings - Last updated 7/21/11	36.86	25.51
1b) Asbestos/Toxic Waste Removal Laborers: Asbestos removal and encapsulation (except its removal from mechanical systems which are not to be scrapped), toxic waste removers, blasters.**See Laborers Group 7**		
2) Boilermaker	34.94	19.00

As of: **Tuesday, July 26, 2011**

Project: Hot Water System Replacement At The Norwalk Armory

3a) Bricklayer, Cement Mason, Concrete Finisher (including caulking), Stone Masons	32.50	24.19 + a
3b) Tile Setter	32.00	21.44
3c) Terrazzo Mechanics and Marble Setters	31.69	22.35
3d) Tile, Marble & Terrazzo Finishers	25.50	18.43
3e) Plasterer	32.50	23.16

------LABORERS------

As of: **Tuesday, July 26, 2011**

Project: Hot Water System Replacement At The Norwalk Armory

4) Group 1: Laborers (common or general), acetylene burners, carpenter tenders, concrete specialists, wrecking laborers, fire watchers.	25.75	15.60
4a) Group 2: Mortar mixers, plaster tender, power buggy operators, powdermen, fireproofer/mixer/nozzleman, fence erector.	26.00	15.60
4b) Group 3: Jackhammer operators, mason tender (brick) and mason tender (cement/concrete)	26.25	15.60
4c) **Group 4: Pipelayers (Installation of water, storm drainage or sewage lines outside of the building line with P6, P7 license) (the pipelayer rate shall apply only to one or two employees of the total crew who primary task is to actually perform the mating of pipe sections)[If using this classification call the Labor Department for clarification]	26.00	15.60
4d) Group 5: Air track operators, Sand blasters	26.50	15.60
4e) Group 6: Nuclear toxic waste removers, blasters	28.75	15.60

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4f) Group 7: Asbestos removal and encapsulation (except it's removal from mechanical systems which are not to be scrapped)	26.75	15.60
4g) Group 8: Bottom men on open air caisson, cylindrical work and boring crew	26.25	15.60
4h Group 9: Top men on open air caisson, cylindrical work and boring crew	25.75	15.60
4i) Group 10: Traffic Control Signalman	16.00	15.60
5) Carpenter, Acoustical Ceiling Installation, Soft Floor/Carpet Laying, Metal Stud Installation, Form Work and Scaffold Building, Drywall Hanging, Modular-Furniture Systems Installers, Lathers, Piledrivers, Resilient Floor Layers.	29.11	20.29
5a) Millwrights	30.01	20.18

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6) Electrical Worker (including low voltage wiring) (Trade License required: E1,2 L-5,6 C-5,6 T-1,2 L-1,2 V-1,2,7,8,9)	35.30	18.52
7a) Elevator Mechanic (Trade License required: R-1,2,5,6)	44.82	21.785+a+b
-----LINE CONSTRUCTION----		
Groundman	23.80	3% + 13.70
Linemen/Cable Splicer	43.28	3% + 13.70
8) Glazier (Trade License required: FG-1,2)	32.73	16.35 + a

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9) Ironworker, Ornamental, Reinforcing, Structural, and Precast Concrete Erection	33.00	26.58 + a
----OPERATORS----		
Group 1: Crane handling or erecting structural steel or stone, hoisting engineer 2 drums or over, front end loader (7 cubic yards or over); work boat 26 ft. and over. (Trade License Required)	35.05	19.40 + a
Group 2: Cranes (100 ton rate capacity and over); Backhoe/Excavator over 2 cubic yards; Piledriver ($3.00 premium when operator controls hammer). (Trade License Required)	34.73	19.40 + a
Group 3: Excavator; Backhoe/Excavator under 2 cubic yards; Cranes (under 100 ton rated capacity), Grader/Blade; Master Mechanic; Hoisting Engineer (all types of equipment where a drum and cable are used to hoist or drag material regardless of motive power of operation), Rubber Tire Excavator (Drott-1085 or similar);Grader Operator; Bulldozer Fine Grade. (slopes, shaping, laser or GPS, etc.).	33.99	19.40 + a
Group 4: Trenching Machines; Lighter Derrick; Concrete Finishing Machine; CMI Machine or Similar; Koehring Loader (Skooper).	33.60	19.40 + a

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Group 5: Specialty Railroad Equipment; Asphalt Paver; Asphalt Reclaiming Machine; Line Grinder; Concrete Pumps; Drills with Self Contained Power Units; Boring Machine; Post Hole Digger; Auger; Pounder; Well Digger; Milling Machine (over 24" Mandrell)	33.01	19.40 + a
Group 5 continued: Side Boom; Combination Hoe and Loader; Directional Driller; Pile Testing Machine.	33.01	19.40 + a
Group 6: Front End Loader (3 up to 7 cubic yards); Bulldozer (rough grade dozer).	32.70	19.40 + a
Group 7: Asphalt roller, concrete saws and cutters (ride on types), vermeer concrete cutter, Stump Grinder; Scraper; Snooper; Skidder; Milling Machine (24" and under Mandrell).	32.36	19.40 + a
Group 8: Mechanic, grease truck operator, hydroblaster; barrier mover; power stone spreader; welding; work boat under 26 ft.; transfer machine.	31.96	19.40 + a
Group 9: Front end loader (under 3 cubic yards), skid steer loader regardless of attachments, (Bobcat or Similar): forklift, power chipper; landscape equipment (including Hydroseeder).	31.53	19.40 + a

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Group 10: Vibratory hammer; ice machine; diesel and air, hammer, etc.	29.49	19.40 + a
Group 11: Conveyor, earth roller, power pavement breaker (whiphammer), robot demolition equipment.	29.49	19.40 + a
Group 12: Wellpoint operator.	29.43	19.40 + a
Group 13: Compressor battery operator.	28.85	19.40 + a
Group 14: Elevator operator; tow motor operator (solid tire no rough terrain).	27.71	19.40 + a
Group 15: Generator Operator; Compressor Operator; Pump Operator; Welding Machine Operator; Heater Operator.	27.30	19.40 + a

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Group 16: Maintenance Engineer/Oiler.	26.65	19.40 + a
Group 17: Portable asphalt plant operator; portable crusher plant operator; portable concrete plant operator.	30.96	19.40 + a
Group 18: Power safety boat; vacuum truck; zim mixer; sweeper; (Minimum for any job requiring a CDL license).	28.54	19.40 + a
------PAINTERS (Including Drywall Finishing)------		
10a) Brush and Roller	29.17	16.35
10b) Taping Only/Drywall Finishing	29.92	16.35

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10c) Paperhanger and Red Label	29.67	16.35
10e) Blast and Spray	32.17	16.35
11) Plumber (excluding HVAC pipe installation) (Trade License required: P-1,2,6,7,8,9 J-1,2,3,4 SP-1,2)	38.67	24.46
12) Well Digger, Pile Testing Machine	33.01	19.40 + a
Roofer: Cole Tar Pitch	36.50	12.75 + a
Roofer: Slate, Tile, Composition, Shingles, Singly Ply and Damp/Waterproofing	35.00	12.75 + a

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15) Sheetmetal Worker (Trade License required for HVAC and Ductwork: SM-1,SM-2,SM-3,SM-4,SM-5,SM-6)	41.81	30.25
16) Pipefitter (Including HVAC work) (Trade License required: S-1,2,3,4,5,6,7,8 B-1,2,3,4 D-1,2,3,4, G-1, G-2, G-8 & G-9)	38.67	24.46
------TRUCK DRIVERS------		
17a) 2 Axle	27.88	15.71 + a
17b) 3 Axle, 2 Axle Ready Mix	27.98	15.71 + a
17c) 3 Axle Ready Mix	28.03	15.71 + a

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17d) 4 Axle, Heavy Duty Trailer up to 40 tons	28.08	15.71 + a
17e) 4 Axle Ready Mix	28.13	15.71 + a
17f) Heavy Duty Trailer (40 Tons and Over)	28.33	15.71 + a
17g) Specialized Earth Moving Equipment (Other Than Conventional Type on-the-Road Trucks and Semi-Trailers, Including Euclids)	28.13	15.71 + a
18) Sprinkler Fitter (Trade License required: F-1,2,3,4)	40.50	16.85 + a
19) Theatrical Stage Journeyman	22.22	6.53

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Welders: Rate for craft to which welding is incidental.

**Note: Hazardous waste removal work receives additional $1.25 per hour for truck drivers.*

***Note: Hazardous waste premium $3.00 per hour over classified rate*

Crane with 150 ft. boom (including jib) - $1.50 extra
Crane with 200 ft. boom (including jib) - $2.50 extra
Crane with 250 ft. boom (including jib) - $5.00 extra
Crane with 300 ft. boom (including jib) - $7.00 extra
Crane with 400 ft. boom (including jib) - $10.00 extra

All classifications that indicate a percentage of the fringe benefits must be calculated at the percentage rate times the "base hourly rate".

Apprentices duly registered under the Commissioner of Labor's regulations on "Work Training Standards for Apprenticeship and Training Programs" Section 31-51-d-1 to 12, are allowed to be paid the appropriate percentage of the prevailing journeymen hourly base and the full fringe benefit rate, providing the work site ratio shall not be less than one full-time journeyperson instructing and supervising the work of each apprentice in a specific trade.

The Prevailing wage rates applicable to this project are subject to annual adjustments each July 1st for the duration of the project.

Each contractor shall pay the annual adjusted prevailing wage rate that is in effect each July 1st, as posted by the Department of Labor.

It is the contractor's responsibility to obtain the annual adjusted prevailing wage rate increases directly from the Department of Labor's website.

The annual adjustments will be posted on the Department of Labor's Web page: www.ct.gov/dol

The Department of Labor will continue to issue the initial prevailing wage rate schedule to the Contracting Agency for the project.

All subsequent annual adjustments will be posted on our Web Site for contractor access.

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Effective October 1, 2005 - Public Act 05-50: any person performing the work of any mechanic, laborer, or worker shall be paid prevailing wage

All Person who perform work ON SITE must be paid prevailing wage for the appropriate mechanic, laborer, or worker classification.

All certified payrolls must list the hours worked and wages paid to All Persons who perform work ON SITE regardless of their ownership i.e.: (Owners, Corporate Officers, LLC Members, Independent Contractors, et. al)
Reporting and payment of wages is required regardless of any contractual relationship alleged to exist between the contractor and such person.

~~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 clause (29 CFR 5.5 (a) (1) (ii)).

Please direct any questions which you may have pertaining to classification of work and payment of prevailing wages to the Wage and Workplace Standards Division, telephone (860)263-6790.

As of: **Tuesday, July 26, 2011**

Non-Discrimination and Affirmative Action Provisions for State Contracts

Section 1) CHRO – Contract Compliance Regulations Notification to Bidders

The contract to be awarded is subject to contract compliance requirements mandated by Sections 4a-60 and 4a-60a of the Connecticut General Statutes; and, when the awarding agency is the State, Sections 46a-71(d) and 46a-81i(d) of the Connecticut General Statutes. There are Contract Compliance Regulations codified at Section 46a-68j-21 through 43 of the Regulations of Connecticut State Agencies, which establish a procedure for awarding all contracts covered by Sections 4a-60 and 46a-71(d) of the Connecticut General Statutes.

According to Section 46a-68j-30(9) of the Contract Compliance Regulations, every agency awarding a contract subject to the contract compliance requirements has an obligation to "aggressively solicit the participation of legitimate minority business enterprises as bidders, contractors, subcontractors and suppliers of materials." "Minority business enterprise" is defined in Section 4a-60 of the Connecticut General Statutes as a business wherein fifty-one percent or more of the capital stock, or assets belong to a person or persons: "(1) Who are active in daily affairs of the enterprise; (2) who have the power to direct the management and policies of the enterprise; and (3) who are members of a minority, as such term is defined in subsection (a) of Section 32-9n." "Minority" groups are defined in Section 32-9n of the Connecticut General Statutes as "(1) Black Americans . . . (2) Hispanic Americans . . . (3) persons who have origins in the Iberian Peninsula . . . (4)Women . . . (5) Asian Pacific Americans and Pacific Islanders; (6) American Indians . . ." An individual with a disability is also a minority business enterprise as provided by Section 4a-60g of the Connecticut General Statutes. The above definitions apply to the contract compliance requirements by virtue of Section 46a-68j-21(11) of the Contract Compliance Regulations.

The awarding agency will consider the following factors when reviewing the bidder's qualifications under the contract compliance requirements:

(a) the bidder's success in implementing an affirmative action plan;
(b) the bidder's success in developing an apprenticeship program complying with Sections 46a-68-1 to 46a-68-17 of the regulations of Connecticut State Agencies, inclusive;
(c) the bidder's promise to develop and implement a successful affirmative action plan;
(d) the bidder's submission of employment statistics contained in the "Employment Information Form", indicating that the composition of its workforce is at or near parity when compared to the racial and sexual composition of the workforce in the relevant labor market area; and
(e) the bidder's promise to set aside a portion of the contract for legitimate minority business enterprises. See Section 46a-68j-30(10)(E) of the Contract Compliance Regulations.

Section 2) Non-Discrimination and other Contract Compliance Requirements

Pursuant to CONN. GEN. STAT. § 4a-60 and §4a-60a and, the Regulations of Connecticut State Agencies Sections 46a-68j-21 to 46a-68j-43, a contractor agrees to the following:

1) Not to discriminate or permit discrimination against any person or group of persons on the grounds of race, color, religious creed, age, marital status, national origin, ancestry, sex, sexual orientation, mental retardation, or physical disability including, but not limited to, blindness (unless it is shown that such disability prevents performance of the work involved) in the performance of a contract, in any manner prohibited by the federal and Connecticut anti-discrimination and contract compliance laws;
2) To undertake affirmative action which will insure that applicants with job-related qualifications are employed and that employees are treated, when employed, without regard to whether they belong to any of the groups identified in Paragraph # 1) above;
3) To include a statement that the contractor is an "affirmative action-equal opportunity employer", in all solicitations or advertisements for employees placed by or on behalf of the contractor;
4) To provide each labor union or representative of workers with which such contractor has a collective bargaining agreement and each vendor with which such contractor has a contract, a notice advising them of the contractor's commitments under CONN. GEN. STAT. § 4a-60 and §4a-60a. The notice is available by contacting the Commission on Human Rights and Opportunities (the Commission);
5) To post copies of the notice referred to in item 4) in conspicuous places available to employees and applicants;
6) To provide the Commission with such information requested by said agency, permit access to pertinent books, records, and accounts, concerning the employment practices and procedures of the contractor as relate to the provisions of CONN. GEN. STAT. § 4a-60, §4a-60a and § 46a-56 and, cooperate fully with the Commission; and,
7) To include the language of CONN. GEN. STAT. § 4a-60 (a) and §4a-60a (a) in every subcontract or purchase order executed to fulfill any obligation of the contract with DPW.

Section 3) "Good Faith Efforts" to Include Minority Business Enterprises as Subcontractors

In addition to, or in the absence of, any other subcontractor requirements included in this project, contractors are required to make "good faith efforts" to include minority business enterprises in the work of this project as subcontractors (for services and/or material suppliers). For purpose of identifying minority business enterprises, a minority business enterprise shall be a subcontractor which has a valid certification as such from the Department of Administrative Services (DAS) and/or a subcontractor for which an affidavit has been submitted by the contractor attesting that the subcontractor named as a minority business enterprise meets the minority business enterprise criteria set out in CONN. GEN. STAT. § 4a-60(b).

For purposes of identifying a minority business enterprise who is not certified by DAS, and in order to recognize the contractor's "good faith efforts" to include minority business enterprises in the work of the project, a contractor who becomes the apparent low bidder will be requested by the awarding agency (DPW) to submit an Affidavit for Certification of Subcontractors as Minority Business Enterprises (MBE), prior to the award of a contract.

For purposes of identifying any small contractor and/or minority business enterprise which will participate on the project as a "set-aside" subcontractor, only a subcontractor which has a valid certification issued by DAS shall be acceptable.

"Good faith effort" means "that degree of diligence which a reasonable person would exercise in the performance of legal duties and obligations" and includes, but is not limited to, the following factors: the

contractor's employment and subcontracting policies and practices; affirmative advertising, recruitment, training, technical assistance activities and such other reasonable activities or efforts as the Commission may recommend to ensure the participation of minority business enterprises in state projects.

Section 4) Special Provision – Small Contractor and Minority Business Enterprise Contract "Set-Aside" Provisions

This contract may be subject to the provisions the Set-Aside Program for Small Contractors found at CONN. GEN. STAT. § 4a-60g and may be awarded only to a contractor certified as a small and/or minority business enterprise by DAS. The notification as to this special provision will be found in the Invitation to Bid for this contract. The listing of eligible "Set-Aside" contractors is found on DAS' web site. (www.das.state.ct.us/purchase/setaside/index.html) In the event that the Set-Aside Program for Small Contractors applies to this contract, the following special provisions will also apply:

4.1 Amount of Work Required to Be Done by "Set-Aside" Contractors

A contractor awarded a contract on a project pursuant to the provisions of CONN. GEN. STAT. § 4a-60g shall be required to perform not less than fifteen (15) per cent of the work with his/her own forces and shall ensure that not less than twenty-five (25) per cent of the work be performed by contractors or subcontractors who are certified as small contractors or minority business enterprises pursuant to CONN. GEN. STAT. § 4a-60g.

4.2 Alternate Bonding Available to "Set Aside" Contractors

In lieu of a performance, bid, labor and materials or other required bond, a contractor or subcontractor awarded a contract under CONN. GEN. STAT. § 4a-60g may provide to the awarding authority (DPW) and the awarding authority shall accept a "Letter of Credit". Any such "Letter of Credit" shall be in an amount equal to ten (10) per cent of the contract for any contract that is less than one hundred thousand ($100,000) dollars, and in the amount of twenty-five (25) per cent for any contract that is one hundred thousand ($100,000) dollars or more.

4.3 Procedures to Follow Regarding Substitution of Named Project "Set-Aside" Subcontractors

The awarding authority (DPW) may also require the contractor to set aside a portion of the contract for subcontractors who are eligible for set aside contracts. The awarding authority shall not permit substitution of a subcontractor for one named in accordance with the provisions of CONN. GEN. STAT. § 4b-95 or substitution of a subcontractor for any designated sub-trade work bid to be performed by the contractor's own forces, except for good cause.

Pursuant to CONN. GEN. STAT. § 4b-95, the term "good cause" includes but is not limited to a subcontractor's or, where appropriate, a general contractor's:

1) Death or physical disability, if the listed subcontractor is an individual;
2) Dissolution, if a corporation or partnership;
3) Bankruptcy;
4) Inability to furnish any performance and payment bond shown on the bid form;

5) Inability to obtain, or loss of, a license necessary for the performance of the particular category of work;
6) Failure or inability to comply with a requirement of law applicable to contractors and subcontractors, or to subcontracts for construction, alteration, or repair projects;
7) Failure to perform his/her agreement to execute a subcontract under CONN. GEN. STAT. § 4b-96.

Any general contractor who violates any provision of CONN. GEN. STAT. § 4b-95 shall be disqualified from bidding on other contracts that are subject to the provisions of Chapter 60 (Construction and Alterations of State Buildings) of the Connecticut General Statutes, for a period not to exceed twenty-four (24) months, commencing from the date on which the violation is discovered, for each violation.

Section 5) Contract Monitoring and Reporting

The Commission has the authority to monitor state contractors pursuant to CONN. GEN. STAT. § 46a-68e and 46a-68f and Section 46a-68j-23(3) of the Administrative Regulations of Connecticut State Agencies. The contractor may be required to compile and submit a Quarterly Small Contractor and Minority Business Enterprise payment Status Report (form chro: cc-258) to report on the participation of small contractors or minority business enterprises identified to participate on the project. The report, when required, must be submitted to the contract awarding agency (DPW) and to the Commission by the 15th day following the end of each calendar quarter during the term of the on-site construction work of the project.

NOTE: Bidders and state contractors may review the full text of the before referenced Connecticut General Statutes by accessing either the State Law Library's web site (http://www.cslib.org/statutes/index.htm) or, the State Legislature's web site (http://prdbasis.cga.state.ct.us/BASIS/TSPBKCP/LIN1/PUB/MSF).
The full text of the Regulations of Connecticut State Agencies Sections 46a-68j-21 through 46a-68j-43 may be reviewed by accessing the Commission's web site (http://www.state.ct.us/chro/) In the alternative, bidders or state contractors may request a copy of these state statutes and regulations by contacting the Commission at (860) 541-3400 (in Hartford) or 1 (800) 477-5737.

END OF SECTION

APPENDIX 1

COMMISSION ON HUMAN RIGHTS AND OPPORTUNITIES
CONTRACT COMPLIANCE REGULATIONS
NOTIFICATION TO BIDDERS

(Revised 09/17/07)

The contract to be awarded is subject to contract compliance requirements mandated by Sections 4a-60 and 4a-60a of the Connecticut General Statutes; and, when the awarding agency is the State, Sections 46a-71(d) and 46a-81i(d) of the Connecticut General Statutes. There are Contract Compliance Regulations codified at Section 46a-68j-21 through 43 of the Regulations of Connecticut State Agencies, which establish a procedure for awarding all contracts covered by Sections 4a-60 and 46a-71(d) of the Connecticut General Statutes.

According to Section 46a-68j-30(9) of the Contract Compliance Regulations, every agency awarding a contract subject to the contract compliance requirements has an obligation to "aggressively solicit the participation of legitimate minority business enterprises as bidders, contractors, subcontractors and suppliers of materials." "Minority business enterprise" is defined in Section 4a-60 of the Connecticut General Statutes as a business wherein fifty-one percent or more of the capital stock, or assets belong to a person or persons: "(1) Who are active in daily affairs of the enterprise; (2) who have the power to direct the management and policies of the enterprise; and (3) who are members of a minority, as such term is defined in subsection (a) of Section 32-9n." "Minority" groups are defined in Section 32-9n of the Connecticut General Statutes as "(1) Black Americans . . . (2) Hispanic Americans . . . (3) persons who have origins in the Iberian Peninsula . . . (4)Women . . . (5) Asian Pacific Americans and Pacific Islanders; (6) American Indians . . ." An individual with a disability is also a minority business enterprise as provided by Section 4a-60g of the Connecticut General Statutes. The above definitions apply to the contract compliance requirements by virtue of Section 46a-68j-21(11) of the Contract Compliance Regulations.

The awarding agency will consider the following factors when reviewing the bidder's qualifications under the contract compliance requirements:

(a) the bidder's success in implementing an affirmative action plan;
(b) the bidder's success in developing an apprenticeship program complying with Sections 46a-68-1 to 46a-68-17 of the Administrative Regulations of Connecticut State Agencies, inclusive;
(c) the bidder's promise to develop and implement a successful affirmative action plan;
(d) the bidder's submission of employment statistics contained in the "Employment Information Form", indicating that the composition of its workforce is at or near parity when compared to the racial and sexual composition of the workforce in the relevant labor market area; and
(e) the bidder's promise to set aside a portion of the contract for legitimate minority business enterprises. See Section 46a-68j-30(10)(E) of the Contract Compliance Regulations.

INSTRUCTIONS AND OTHER INFORMATION

The following BIDDER CONTRACT COMPLIANCE MONITORING REPORT must be completed in full, signed, and submitted with the bid for this contract. The contract awarding agency and the Commission on Human Rights and Opportunities will use the information contained thereon to determine the bidders compliance to Sections 4a-60 and 4a-60a CONN. GEN. STAT., and Sections 46a-68j-23 of the Regulations of Connecticut State Agencies regarding equal employment opportunity, and the bidder's good faith efforts to include minority business enterprises as subcontractors and suppliers for the work of the contract.

1) Definition of Small Contractor

Section 4a-60g CONN. GEN. STAT. defines a small contractor as a company that has been doing business under the same management and control and has maintained its principal place of business in Connecticut for a one year period immediately prior to its application for certification under this section, had gross revenues not exceeding ten million dollars in the most recently completed fiscal year, and at least fifty-one percent of the ownership of which is held by a person or persons who are active in the daily affairs of the company, and have the power to direct the management and policies of the company, except that a nonprofit corporation shall be construed to be a small contractor if such nonprofit corporation meets the requirements of subparagraphs (A) and (B) of subdivision 4a-60g CONN. GEN. STAT.

2) Description of Job Categories (as used in Part IV Bidder Employment Information) (Page 2)

MANAGEMENT: Managers plan, organize, direct, and control the major functions of an organization through subordinates who are at the managerial or supervisory level. They make policy decisions and set objectives for the company or departments. They are not usually directly involved in production or providing services. Examples include top executives, public relations managers, managers of operations specialties (such as financial, human resources, or purchasing managers), and construction and engineering managers.

BUSINESS AND FINANCIAL OPERATIONS: These occupations include managers and professionals who work with the financial aspects of the business. These occupations include accountants and auditors, purchasing agents, management analysts, labor relations specialists, and budget, credit, and financial analysts.

MARKETING AND SALES: Occupations related to the act or process of buying and selling products and/or services such as sales engineer, retail sales workers and sales representatives including wholesale.

LEGAL OCCUPATIONS: In-House Counsel who is charged with providing legal advice and services in regards to legal issues that may arise during the course of standard business practices. This category also includes assistive legal occupations such as paralegals, legal assistants.

COMPUTER SPECIALISTS: Professionals responsible for the computer operations within a company are grouped in this category. Examples of job titles in this category include computer programmers, software engineers, database administrators, computer scientists, systems analysts, and computer support specialists

ARCHITECTURE AND ENGINEERING: Occupations related to architecture, surveying, engineering, and drafting are included in this category. Some of the job titles in this category include electrical and electronic engineers, surveyors, architects, drafters, mechanical engineers, materials engineers, mapping technicians, and civil engineers.

OFFICE AND ADMINISTRATIVE SUPPORT: All clerical-type work is included in this category. These jobs involve the preparing, transcribing, and preserving of written communications and records; collecting accounts; gathering and distributing information; operating office machines and electronic data processing equipment; and distributing mail. Job titles listed in this category include telephone operators, bill and account collectors, customer service representatives, dispatchers, secretaries and administrative assistants, computer operators and clerks (such as payroll, shipping, stock, mail and file).

BUILDING AND GROUNDS CLEANING AND MAINTENANCE: This category includes occupations involving landscaping, housekeeping, and janitorial services. Job titles found in this category include supervisors of landscaping or housekeeping, janitors, maids, grounds maintenance workers, and pest control workers.

CONSTRUCTION AND EXTRACTION: This category includes construction trades and related occupations. Job titles found in this category include boilermakers, masons (all types), carpenters, construction laborers, electricians, plumbers (and related trades), roofers, sheet metal workers, elevator installers, hazardous materials removal workers, paperhangers, and painters. Paving, surfacing, and tamping equipment operators; drywall and ceiling tile installers; and carpet, floor and tile installers and finishers are also included in this category. First line supervisors, foremen, and helpers in these trades are also grouped in this category..

INSTALLATION, MAINTENANCE AND REPAIR: Occupations involving the installation, maintenance, and repair of equipment are included in this group. Examples of job titles found here are heating, ac, and refrigeration mechanics and installers; telecommunication line installers and repairers; heavy vehicle and mobile equipment service technicians and mechanics; small engine mechanics; security and fire alarm systems installers; electric/electronic repair, industrial, utility and transportation equipment; millwrights; riggers; and manufactured building and mobile home installers. First line supervisors, foremen, and helpers for these jobs are also included in the category.

MATERIAL MOVING WORKERS: The job titles included in this group are Crane and tower operators; dredge, excavating, and lading machine operators; hoist and winch operators; industrial truck and tractor operators; cleaners of vehicles and equipment; laborers and freight, stock, and material movers, hand; machine feeders and offbearers; packers and packagers, hand; pumping station operators; refuse and recyclable material collectors; and miscellaneous material moving workers.

PRODUCTION WORKERS: The job titles included in this category are chemical production machine setters, operators and tenders; crushing/grinding workers; cutting workers; inspectors, testers sorters, samplers, weighers; precious stone/metal workers; painting workers; cementing/gluing machine operators and tenders; etchers/engravers; molders, shapers and casters except for metal and plastic; and production workers.

3) Definition of Racial and Ethnic Terms (as used in Part IV Bidder Employment Information) (Page 3)

White (not of Hispanic Origin)- All persons having origins in any of the original peoples of Europe, North Africa, or the Middle East. Black(not of Hispanic Origin)- All persons having origins in any of the Black racial groups of Africa. Hispanic- All persons of Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish culture or origin, regardless of race.	Asian or Pacific Islander- All persons having origins in any of the original peoples of the Far East, Southeast Asia, the Indian subcontinent, or the Pacific Islands. This area includes China, India, Japan, Korea, the Philippine Islands, and Samoa. American Indian or Alaskan Native- All persons having origins in any of the original peoples of North America, and who maintain cultural identification through tribal affiliation or community recognition.

BIDDER CONTRACT COMPLIANCE MONITORING REPORT

PART I - Bidder Information

Company Name Street Address City & State Chief Executive	Bidder Federal Employer Identification Number_____ Or Social Security Number_____
Major Business Activity (brief description)	Bidder Identification (response optional/definitions on page 1) -Bidder is a small contractor. Yes__ No__ -Bidder is a minority business enterprise Yes__ No__ (If yes, check ownership category) Black___ Hispanic___ Asian American___ American Indian/Alaskan Native___ Iberian Peninsula___ Individual(s) with a Physical Disability___ Female___
Bidder Parent Company (If any)	- Bidder is certified as above by State of CT Yes__ No__
Other Locations in Ct. (If any)	- DAS Certification Number _____

PART II - Bidder Nondiscrimination Policies and Procedures

1. Does your company have a written Affirmative Action/Equal Employment Opportunity statement posted on company bulletin boards? Yes__ No__	7. Do all of your company contracts and purchase orders contain non-discrimination statements as required by Sections 4a-60 & 4a-60a Conn. Gen. Stat.? Yes__ No__
2. Does your company have the state-mandated sexual harassment prevention in the workplace policy posted on company bulletin boards? Yes__ No__	8. Do you, upon request, provide reasonable accommodation to employees, or applicants for employment, who have physical or mental disability? Yes__ No__
3. Do you notify all recruitment sources in writing of your company's Affirmative Action/Equal Employment Opportunity employment policy? Yes__ No__	9. Does your company have a mandatory retirement age for all employees? Yes__ No__
4. Do your company advertisements contain a written statement that you are an Affirmative Action/Equal Opportunity Employer? Yes__ No__	10. If your company has 50 or more employees, have you provided at least two (2) hours of sexual harassment training to all of your supervisors? Yes__ No__ NA__
5. Do you notify the Ct. State Employment Service of all employment openings with your company? Yes__ No__	11. If your company has apprenticeship programs, do they meet the Affirmative Action/Equal Employment Opportunity requirements of the apprenticeship standards of the Ct. Dept. of Labor? Yes__ No__ NA__
6. Does your company have a collective bargaining agreement with workers? Yes__ No__ 6a. If yes, do the collective bargaining agreements contain non-discrim ination clauses covering all workers? Yes__ No__ 6b. Have you notified each union in writing of your commitments under the nondiscrimination requirements of contracts with the state of Ct? Yes__ No__	12. Does your company have a written affirmative action Plan? Yes__ No__ If no, please explain. 13. Is there a person in your company who is responsible for equal employment opportunity? Yes__ No__ If yes, give name and phone number. _____ _____

Part III - Bidder Subcontracting Practices (Page 4)

1. Will the work of this contract include subcontractors or suppliers? Yes__ No__

1a. If yes, please list all subcontractors and suppliers and report if they are a small contractor and/or a minority business enterprise. (defined on page 1 / use additional sheet if necessary)

1b. Will the work of this contract require additional subcontractors or suppliers other than those identified in 1a. above? Yes__ No__

PART IV - Bidder Employment Information Date:

JOB CATEGORY *	OVERALL TOTALS	WHITE (not of Hispanic origin)		BLACK (not of Hispanic origin)		HISPANIC		ASIAN or PACIFIC ISLANDER		AMERICAN INDIAN or ALASKAN NATIVE	
		Male	Female	Male	Female	Male	Female	Male	Female	male	female
Management											
Business & Financial Ops											
Marketing & Sales											
Legal Occupations											
Computer Specialists											
Architecture/Engineering											
Office & Admin Support											
Bldg/ Grounds Cleaning/Maintenance											
Construction & Extraction											
Installation , Maintenance & Repair											
Material Moving Workers											
Production Occupations											
TOTALS ABOVE											
Total One Year Ago											
FORMAL ON THE JOB TRAINEES (ENTER FIGURES FOR THE SAME CATEGORIES AS ARE SHOWN ABOVE)											
Apprentices											
Trainees											

*NOTE: JOB CATEGORIES CAN BE CHANGED OR ADDED TO (EX. SALES CAN BE ADDED OR REPLACE A CATEGORY NOT USED IN YOUR COMPANY)

PART V - Bidder Hiring and Recruitment Practices (Page 5)

1. Which of the following recruitment sources are used by you? (Check yes or no, and report percent used)				2. Check (X) any of the below listed requirements that you use as a hiring qualification (X)		3. Describe below any other practices or actions that you take which show that you hire, train, and promote employees without discrimination
SOURCE	YES	NO	% of applicants provided by source			
State Employment Service					Work Experience	
Private Employment Agencies					Ability to Speak or Write English	
Schools and Colleges					Written Tests	
Newspaper Advertisement					High School Diploma	
Walk Ins					College Degree	
Present Employees					Union Membership	
Labor Organizations					Personal Recommendation	
Minority/Community Organizations					Height or Weight	
Others (please identify)					Car Ownership	
					Arrest Record	
					Wage Garnishments	

Certification (Read this form and check your statements on it CAREFULLY before signing). I certify that the statements made by me on this BIDDER CONTRACT COMPLIANCE MONITORING REPORT are complete and true to the best of my knowledge and belief, and are made in good faith. I understand that if I knowingly make any misstatements of facts, I am subject to be declared in non-compliance with Section 4a-60, 4a-60a, and related sections of the CONN. GEN. STAT.

(Signature)	(Title)	(Date Signed)	(Telephone)

Affidavit for Certification of Subcontractors as Minority Business Enterprises (MBE)

(to be completed only for subcontractors not certified as MBE's by the Department of Administrative Services)

To document the Agood faith efforts@ of the below named state contractor to include minority business enterprises as subcontractors (for services and/or material suppliers) on the state contract also identified below, I certify that the following subcontractors meet the criteria for minority business enterprises set forth in CONN. GEN. STAT. § 4a-60(b). I attest that each named minority business enterprise will be contracted by the named state contractor to participate on the identified state contract as a subcontractor.

The subcontractors being identified to be bona fide minority business enterprises are:

Subcontractor Name	Complete Address	Subcontractor's Principal Officer's Name

(use additional sheets as necessary)

I further certify and affirm that I have read and understand the contract compliance requirements codified at CONN. GEN. STAT. Sections 4a-60 & 46a-71(d), and the Contract Compliance Regulations codified at Sections 46a-68j-21 through 43 of the Administrative Regulations of Connecticut State Agencies. I also understand that any false statements made herein are punishable by law.

_____ state contractor legal name

_____ type full printed name and title of official submitting this affidavit on behalf of contractor

_____ state contract number

_____ signature of official

_____ state contract awarding agency

_____ date of affidavit

Subscribed and sworn to before me, this_____ day of _____ 20_____

_____
Notary Public/Commissioner of the Superior Court
My Commission expires_____

STATE OF CONNECTICUT
COMMISSION ON HUMAN RIGHTS AND OPPORTUNITIES

NOTICE CONCERNING CONTRACT COMPLIANCE RESPONSIBILITIES

TO ALL LABOR UNIONS, WORKER=S REPRESENTATIVES AND VENDORS:

Any contract this contractor has with the State of Connecticut or political subdivisions of the state other than municipalities shall be performed in accordance with CONN. GEN. STAT. Section 4a-60 and Section 4a-60a.

This means that this contractor:

1. Agrees to provide the Commission on Human Rights and Opportunities (CHRO) with any information concerning this contractor=s employment practices and procedures which relates to our responsibilities under CONN. GEN. STAT. Sections 4a-60 or 46a-56 or Section 4a-60a.; and

2. Agrees to include the provisions of CONN. GEN. STAT. Section 46a-60(a) and Section 4a-60a in each and every subcontract and purchase order and to take whatever action the CHRO deems necessary to enforce these provisions.

WITH REGARD TO RACE, COLOR, RELIGIOUS CREED, AGE, MARITAL STATUS, NATIONAL ORIGIN, ANCESTRY, SEX, MENTAL RETARDATION OR PHYSICAL DISABILITY, this means that this contractor:

1. Shall not discriminate or permit discrimination against anyone;

2. Shall take affirmative action so that persons applying for employment are hired on the basis of job-related qualifications and that employees once hired are treated without regard to their race, color, religious creed, age, marital status, national origin, ancestry, sex, mental retardation or physical disability, unless the contractor can show that the disability prevents performance of the work involved;

3. Shall state in all advertisements for employees that it is an Aaffirmative action-equal opportunity employer@;

4. Shall comply with CONN. GEN. STAT. Sections 4a-60, 46a-68e and 46a-68f and with each regulation or relevant order issued by the CHRO under CONN. GEN. STAT. Sections 46a-56, 46a-68e and 46a-68f; and

5. Shall make, if the contract is a public works contract, good faith efforts to employ minority business enterprises as subcontractors and suppliers of materials.

WITH REGARD TO SEXUAL ORIENTATION, WHICH INCLUDES HOMOSEXUALITY, BISEXUALITY AND HETEROSEXUALITY:

1. The contractor will not discriminate or permit discrimination against anyone, and employees will be treated without regard to their sexual orientation once employed; and

2. The contractor agrees to fully comply with Section 4a-60a and each regulation or relevant order issued by the CHRO under CONN. GEN. STAT. Section 46a-56.

Persons having questions about this notice or their rights under the law are urged to contact the:

COMMISSION ON HUMAN RIGHTS AND OPPORTUNITIES
DIVISION OF AFFIRMATIVE ACTION, MONITORING & CONTRACT COMPLIANCE

21 Grand Street
Hartford, Connecticut 06106
(860) 541-3400

COPIES OF THIS NOTICE SHALL BE POSTED IN CONSPICUOUS PLACES
AVAILABLE TO ALL EMPLOYEES AND APPLICANTS FOR EMPLOYMENT

CHRO Monthly Reporting Compliance
For The General Contractor

Project Name – Project Location
Project Start Date – MM/DD/YYYY

Subcontractors, Suppliers & Service Providers Monthly Reporting Instructions:

- Reports are due at the General Contractor by the 15th of each month.
- Forms must contain original signatures, printed names & titles of persons signing.
- A copy must be kept at the Subcontractor, Supplier or Service Provider's office for reference when filing Form 257b.

The General Contractor Monthly Reporting Instructions:

- Form 257 (Monthly Employment Utilization Report)
  - Fill out every month from the date that the project started.(Job started MM/DD/YYYY).
  - For the months employee(s) did not work on the project site, fill out one form for each month & check the box marked "Did not perform work on this project for this month" which is located at the bottom of the form.
  - If employee(s) then returned to the project site and began working after the months they were not working at the project site, fill out a Form 257, one for each month.
    Ex: If employee(s) did not work in Jan. fill out a Form 257 for the month of Jan. & check the "Did not perform work on this project for this month" box.
    If employee(s) worked Feb & Mar fill out a Form 257, one for each month, indicating the hours these employees work during those months.
  - The last month any of the employee(s) worked on the job (i.e. the month the company walked off the project site) fill out a Form 257 & write at the bottom of the form in BIG BOLD letters **"FINAL".**

- Form 257a (Monthly Employment Utilization Report)
  - Fill out every month from the date that the project started if "On Site Personnel (Other than Trade Workers)" worked on the job.
  - Follow instructions above for Form 257 when a non-trade worker employee is on the site.
  - If no non-trade worker employee(s) are on the site, do not submit Form 257a.

- Form 257b (Cumulative Employment Utilization Report)
  - The last month any of the employee(s) worked at the project site, the fill out a Form 257b (as well as the FINAL Form 257 mentioned above) & write at the bottom of the form in BIG BOLD letters **"FINAL".**
  - Form 257b is a total of all the work hours the employees have worked on the project. Therefore, if you add up all of the hours for each of the Form 257's that have been filed for this project, that number should correspond with the number of total work hours reported on the Form 257b.

- Punch List Items or Other Events
  - If an employee returns to the job to do punch list items or other events after filling out FINAL filings a Revised FINAL Form 257 for the months that they worked on the punch list items, as well as a Revised FINAL Form 257b must be filed.
  - These revised reports should be marked in BIG BOLD letters "REVISED MM/DD/YYYY."

The General Contractor Quarterly Reports to be sent to CHRO:

- Form 258 (Quarterly Small Contractor and Minority Business Enterprise Payment Status Report).
- Form 257 & Form 257a (Monthly Employment Utilization Report) from subcontractors.
- Form 257 & Form 257a (Monthly Employment Utilization Report) from the General Contractor .
- Form 257b (Cumulative Employment Utilization Report) from subcontractors & the General Contractor.
- Form 259 (Monthly Materials Consumption Report) from Material Suppliers & Service Providers.

Commission on Human Rights and Opportunities Contract Compliance Unit 21 Grand Street Hartford, CT 06106	1. MONTHLY EMPLOYMENT UTILIZATION REPORT ***(FORM chro cc–257)***	PROJECT AREA (MSA): _____ 2. EMPLOYERS FEIN NO.	3. PROJECT AAP GOALS MINORITY: _____ FEMALE:_____	4. REPORTING PERIOD FROM:_____ TO:_____
PROJECT NAME: CONTRACT NUMBER:	NAME AND LOCATION OF CONTRACTOR (submitting report):		STATE AWARDING AGENCY:	

5. CONSTRUCTION TRADE (please identify)	CLASSIFICATION	6. **WORK HOURS OF TRADE WORKERS EMPLOYED ON PROJECT**										7. MINORITY PERCENT	8. FEMALE PERCENT	9. TOTAL NUMBER OF EMPLOYEES		10. TOTAL NUMBER OF MINORITY EMPLOYEES	
		6a. TOTAL HOURS BY TRADE		6b. BLACK (Not of Hispanic Origin)		6c. HISPANIC		6d. ASIAN OR PACIFIC ISLANDERS		6e. AMERICAN INDIAN OR ALASKAN NATIVE							
		M	F	M	F	M	F	M	F	M	F			M	F	M	F
	Journey Worker Apprentice Trainee SUB-TOTAL																
	Journey Worker Apprentice Trainee SUB-TOTAL																
	Journey Worker Apprentice Trainee SUB-TOTAL																
	Journey Worker Apprentice Trainee SUB-TOTAL																
	Journey Worker Apprentice Trainee SUB-TOTAL																
TOTAL JOURNEY WORKERS TOTAL APPRENTICES TOTAL TRAINEES GRAND TOTAL																	

11. COMPANY OFFICIALS SIGNATURE , PRINTED NAME, AND PRINTED TITLE	12. TELEPHONE NUMBER (Including area code)	13. DATE SIGNED	PAGE _____OF_____

☐ **Did not perform work on this project for this month (Please place an "X" in the box if your company did not perform work on this project for this month only.)**

Form CHRO 257-REVISED APRIL 2009

Commission on Human Rights and Opportunities Contract Compliance Unit 21 Grand Street Hartford, CT 06106	1. MONTHLY EMPLOYMENT UTILIZATION REPORT ***(FORM chro cc–257A)***	PROJECT AREA (MSA): 2. EMPLOYER FEIN NO.	3. PROJECT AAP GOALS MINORITY: _____ FEMALE:_____	4. REPORTING PERIOD FROM:_____ TO:_____
PROJECT NAME: CONTRACT NUMBER:	NAME AND LOCATION OF CONTRACTOR (submitting report):			STATE AWARDING AGENCY:

5. ON SITE PERSONNEL (OTHER THAN TRADE WORKERS) ***(please identify specific job title)***	6. **WORK HOURS OF WORKERS *(OTHER THAN TRADE WORKERS)* EMPLOYED ON PROJECT**												9. TOTAL NUMBER OF EMPLOYEES		10. TOTAL NUMBER OF MINORITY EMPLOYEES	
		6a. TOTAL HOURS BY TRADE		6b. BLACK (Not of Hispanic Origin)		6c. HISPANIC		6d. ASIAN OR PACIFIC ISLANDERS		6e. AMERICAN INDIAN OR ALASKAN NATIVE		7. MINORITY PERCENT	8. FEMALE PERCENT				
		M	F	M	F	M	F	M	F	M	F			M	F	M	F
GRAND TOTAL WORKERS																	

11. COMPANY OFFICIALS SIGNATURE, PRINTED NAME, AND PRINTED TITLE	12. TELEPHONE NUMBER (Including area code)	13. DATE SIGNED	PAGE _____OF_____

☐ **Did not perform work on this project for this month (Please place an "X" in the box if your company did not perform work on this project for this month only.)**

Form CHRO 257a – REVISED APRIL 2009

Commission on Human Rights and Opportunities Contract Compliance Unit 21 Grand Street Hartford, CT 06106	1. **CUMULATIVE EMPLOYMENT UTILIZATION REPORT** (FORM chro cc–257b)	PROJECT AREA (MSA): _____ 2. EMPLOYERS FEIN NO.	3. PROJECT PLAN GOALS MINORITY: _____ FEMALE:_____	4. PROJECT DURATION START DATE:_____ END DATE :_____

PROJECT NAME: CONTRACT NUMBER:	NAME AND LOCATION OF CONTRACTOR (submitting report):	STATE AWARDING AGENCY:

5. CONSTRUCTION TRADE (please identify)	CLASSIFICATION	6. **CUMULATIVE WORK HOURS OF TRADE WORKERS EMPLOYED ON PROJECT**												9. CUMULATIVE NUMBER OF EMPLOYEES		10. CUMULATIVE NUMBER OF MINORITY EMPLOYEES	
		6a. CUMULATIVE HOURS BY TRADE		6b. BLACK (Not of Hispanic Origin)		6c. HISPANIC		6d. ASIAN OR PACIFIC ISLANDERS		6e. AMERICAN INDIAN OR ALASKAN NATIVE		7. CUMULATIVE MINORITY PERCENT	8. CUMULATIVE FEMALE PERCENT				
		M	F	M	F	M	F	M	F	M	F			M	F	M	F
	Journey Worker Apprentice Trainee CUMULATIVE TOTAL																
	Journey Worker Apprentice Trainee CUMULATIVE TOTAL																
	Journey Worker Apprentice Trainee CUMULATIVE TOTAL																
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	Journey Worker Apprentice Trainee CUMULATIVE TOTAL																
CUMULATIVE TOTAL JOURNEY WORKERS CUMULATIVE TOTAL APPRENTICES CUMULATIVE TOTAL TRAINEES CUMULATIVE GRAND TOTAL																	

11. COMPANY OFFICIALS SIGNATURE, PRINTED NAME AND PRINTED TITLE	12. TELEPHONE NUMBER (Including area code)	13. DATE SIGNED	PAGE _____OF_____

**** NOTE: The purpose of this report is to be a CUMULATIVE Employment Utilization Report (257b); cumulative meaning the total sum of all the 257s filed by your company throughout the duration of this project. Please submit this *Cumulative Employment Utilization Report* (257b) with your *FINAL 257* filing. If punch list items or other events require your company to return to the project after such filings, than please submit a *Revised 257b* with your *Revised FINAL 257*.**

MONTHLY SMALL CONTRACTOR AND MINORITY BUSINESS ENTERPRISE PAYMENT STATUS REPORT

Month Ending _____

1) General Contractor Name

2) State Contract Number

3) State Contract Award Agency

4) Project Name 5) Estimated Completion Date ____

6) Project Value (Include all change orders) 7) Percent Completed to Date ____

8) Listing of all small contractors and minority business enterprise contractors on the project to comply with contractual small business set aside provisions:

Company Name	Total Contract Amount (Include & Attach All Change Orders)	Total Payment this Month	Total Payment to Date

_____ _____

Signature of Company Official Date of Report

_____

Printed Name & Title of Person Signing

Original to: 1) CHRO, 21 Grand Street, Hartford, CT 06106
Copies to: 2) Awarding Agency
3) Contractor's Company File

Form CHRO 258a (for projects less than 12 months or as directed by CHRO).
Revised April 2009

QUARTERLY SMALL CONTRACTOR AND MINORITY BUSINESS ENTERPRISE PAYMENT STATUS REPORT

Quarter Ending _____

1) General Contractor Name

2) State Contract Number

3) State Contract Award Agency

4) Project Name 5) Estimated Completion Date ____

6) Project Value (Include all change orders) 7) Percent Completed to Date ____

8) Listing of all small contractors and minority business enterprise contractors on the project to comply with contractual small business set aside provisions:

Company Name	Total Contract Amount (Include & Attach all Change Orders)	Total Payment this Quarter	Total Payment to Date

_____ _____
Signature of Company Official Date of Report

_____
Printed Name & Title of Person Signing

Original to: 1) CHRO, 21 Grand Street, Hartford, CT 06106
Copies to: 2) Awarding Agency
3) Contractor's Company File

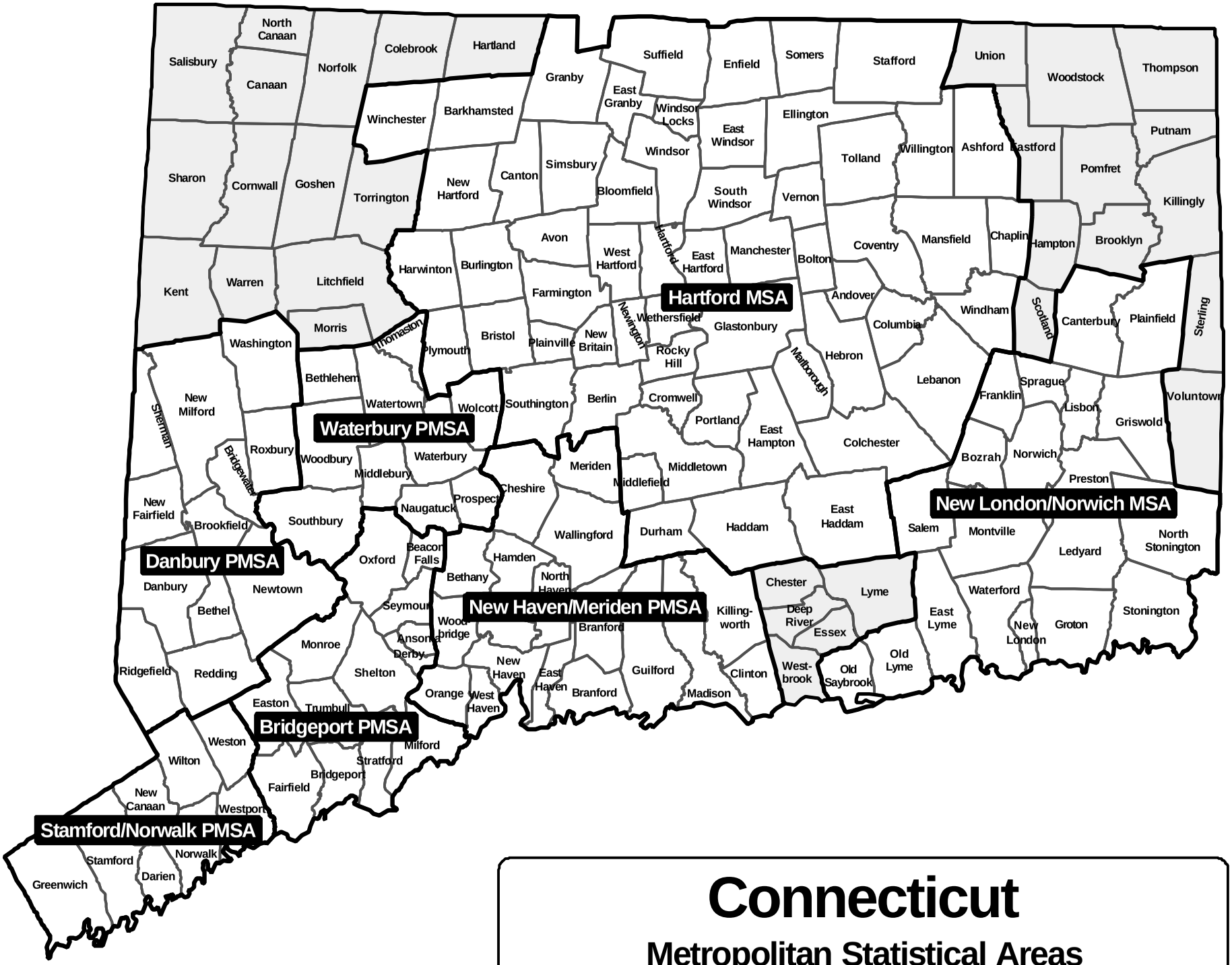
Form CHRO 258- Revised April 2009

MONTHLY MATERIALS CONSUMPTION REPORT

(CHRO FORM–259)

REVISED APRIL 2009

The State of Connecticut Commission on Human Rights and Opportunities Affirmative Action/Contract Compliance Unit Central Office 21 Grand Street, 4th FL Hartford, CT 06106	**MONTHLY MATERIALS CONSUMPTION REPORT** **(CHRO FORM–259)*** * TO BE FILLED OUT BY SBE/MBE/WBE/DIS CONTRACTORS/VENDORS WHOSE SOLE ROLE IN THE CONTRACT DESCRIBED BELOW IS THAT OF A "SUPPLIER OF MATERIALS."
NAME AND ADDRESS OF SBE/MBE/WBE/DIS CONTRACTOR/VENDOR (submitting report): _____ _____ _____ _____	STATE CONTRACT NUMBER:_____ PROJECT NAME:_____ STATE AWARDING AGENCY_____ REPORTING PERIOD FROM:_____ TO:_____
The SBE/MBE/WBE/DIS Contractor / Vendor, submitting this report, ***DID SUPPLY MATERIALS*** to the General Contractor, or its Subcontractors, for the monthly reporting period listed above and for use in the aforesaid contract. I Agree:_____ Signature of President/C.E.O. of Company Date: _____ Printed Name: _____ Printed Title: _____	The SBE/MBE/WBE/DIS Contractor / Vendor, submitting this report, ***DID NOT SUPPLY MATERIALS*** to the General Contractor or its Subcontractors, for the monthly reporting period listed above and for use in the aforesaid contract. I Agree:_____ Signature of President/C.E.O. of Company Date: _____ Printed Name: _____ Printed Title: _____



Connecticut

Metropolitan Statistical Areas

General Conditions of the Contract for Construction
STATE MILITARY DEPARTMENT
State of Connecticut

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ARTICLE 1
DEFINITIONS

WHENEVER THE FOLLOWING TERMS, OR PRONOUNS IN PLACE OF THEM, ARE USED THE INTENT AND MEANING SHALL BE AS FOLLOWS:

1.1 ADDITIONAL OR DELETED WORK: Work required by the Department that, in the judgment of the Commissioner, involves any addition to, deduction from, or modification of the Work required by the Contract Documents.

1.2 AGENCY: The (User) Agency of the State of Connecticut having administrative authority of the facility in which the Work is being performed.

1.3 APPLICATION FOR PAYMENT, PARTIAL PAYMENT OR REQUISITION: Contractor's certified request for payment for completed portions of the Work and, if the Contract so provides, for materials or equipment suitably stored pending their incorporation into the Work.

1.4 ARCHITECT OR ENGINEER: A sole proprietor, partnership, firm, corporation or other business organization under contract with the Owner, commissioned to prepare Contract Drawings and specifications, to advise the Owner and in certain cases, to perform regular inspections during construction and when authorized to perform the duties of the Construction Administrator.

1.5 AS-BUILT DRAWINGS: Construction Drawings revised by the Contractor to show all significant Modifications made during the construction process.

1.6 BASE BID: Monetary value stated in the Bid Proposal form as the sum for which the bidder offers to perform the Work described in the Bidding Documents, exclusive of adjustments for Supplemental Bids.

1.7 BID BOND: Form of bid security executed by the Bidder as Principal and by a Surety to guarantee that the Bidder will enter into a Contract within a specified time and furnish any required bond as mandated by Connecticut General Statute Section 4b-92.

1.8 BIDDER: A sole proprietor, partnership, firm, corporation or other business organization submitting a Bid on the Bid Proposal Form for the Work contemplated.

1.9 BIDDING DOCUMENTS: Collectively, the Bidding Requirements and the proposed Contract Documents, including any addenda issued prior to receipt of Bids.

1.10 BID OR BID PROPOSAL FORM: A complete and duly signed proposal to perform Work (or a designated portion thereof) for a stipulated sum submitted in accordance with the Bidding Documents.

1.11 BID SECURITY: Certified check or Bid Bond submitted with Bid Proposal Form, which provides that the Bidder, if awarded the Contract, will execute such Contract in accordance with the requirements of the Bidding Documents.

1.12 BUILDER'S RISK INSURANCE: A specialized form of property insurance which provides coverage for loss or damage to the Work pursuant to the Contract Documents.

1.13 CASH ALLOWANCE: An amount established in the Contract Documents for inclusion in the Contract Sum to cover the cost of prescribed items not specified in detail, and as shown in the Allowance Schedule.

1.14 CERTIFICATE OF COMPLETION: A document issued by the Construction Administrator to the Owner stating that the Contractor has met all contractual obligations.

1.15 CERTIFICATE OF COMPLETION and ACCEPTANCE: A document issued by the Owner to the Contractor stating that all Work has been completed and that the Work is accepted by the Owner.

1.16 CERTIFICATE OF COMPLIANCE: A document is-sued to the Owner by the design professional stating that for the portion of the project completed, either the design portion or the construction portion, has been performed in substantial compliance with all applicable building codes

1.17 CERTIFICATE OF OCCUPANCY: Document issued by the authority having jurisdiction certifying that all or a designated portion of a building is approved for its designated use.

1.18 CERTIFICATE OF SUBSTANTIAL COMPLETION: A document prepared by the Architect and approved by the Owner on the basis of an inspection stating :

1.18.1 that the Work, or a designated portion thereof, is determined to be Substantially Complete;
1.18.2 the date of Substantial Completion;
1.18.3 the responsibilities of the Owner and the Contractor for security maintenance, heat, utilities, damage to the Work and insurance; and
1.18.4 the time within which the Contractor shall complete the remaining work.

1.19 CHANGE ORDER: Written authorization signed by the Owner, authorizing a modification in the Work, an adjustment in the Contract Sum, or an adjustment in the Contract Time.

1.20 COMMISSIONER: The State of Connecticut, Military Department Commissioner acting directly or through specifically authorized State Military Department personnel or agent(s) having authority to perform duties defined in Article 25.

1.21 CONSTRUCTION ADMINISTRATOR: A sole proprietor, partnership, firm, corporation or other business organization, under contract or employed by the Owner commissioned and/or authorized to oversee the fulfillment of all requirements of the Contract Documents. The authorized Construction Administrator may be a State Military Department Assistant Project Manager, State Military Department Project Manager, a Clerk of the Works, an Architect, a Consulting Architect, a Consulting Construction Administrator, a Consulting Engineer etc. or any other designee as authorized and identified by the Owner.

1.22 CONSTRUCTION CHANGE DIRECTIVE: A written authorization signed by the Owner, directing a modification in the Work and stating a proposed basis for adjustment, if any, in the Contract Sum, Contract Time or both.

1.23 CONTRACT DOCUMENTS OR CONTRACT: The Agreement between Owner and Contractor, Conditions of the Contract (General Conditions, Supplementary Conditions, General Requirements and other Conditions), Drawings, Specifications, and Addenda issued prior to execution of the Contract, other documents listed in the Agreement and Modifications issued after execution of the Contract, all of which shall constitute the Contract.

1.24 CONTRACTOR OR GENERAL CONTRACTOR: A sole proprietor, partnership, firm or Corporation, under direct contract with the State Military Department, responsible for performing the Work under the Contract Documents. Whenever the words "Contractor" or "General Contractor" are used it shall be understood to mean Contractor.

1.25 CONTRACTOR'S LIABILITY INSURANCE: Insurance purchased and maintained by the Contractor that insures the Contractor for claims for property damage, bodily injury or death.

1.26 CONTRACT START DATE OR DATE OF COMMENCEMENT OF THE WORK: The date, specified by the Owner in the Notice to Proceed, on which the Contractor is required to start the Work.

1.27 CONTRACT SUM: The sum stated in the Contract, which is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents.

1.28 CONTRACT TIME: The period of time allotted in the Contract Documents for Substantial Completion of the Work, including authorized adjustments thereto. The days specified, calendar or working days, are stipulated in the Bidding Documents.

1.29 DAY: Whenever the word "Day" is used it shall be understood to mean calendar day or working day as stated on the Bidding Documents, unless stated otherwise.

1.30 STATE MILITARY DEPARTMENT PROJECT MANAGER: The individual employed by the Owner, designated and authorized by the Commissioner, to be responsible for the overall management and oversight of the Project, and to represent the (User) Agency.

1.31 EQUAL (S):: A replacement for the specified material, device, procedure, equipment, etc., which has been determined by the Architect and the Owner to be substantially identical to the first listed manufacturer or first listed procedure specified in terms of cost, quality and performance for the Project. The Equal does not constitute a modification in the scope of Work, the Schedule or Architect/Engineer's design intent of the specified material, device, procedure, equipment, etc.

1.32 FINAL ACCEPTANCE: The Owner's written approval and acceptance of the Work issued to the Contractor upon written certification by the Architect of Final Completion.

1.33 FINAL COMPLETION: A written statement by the Architect to the Owner that the work has been completed in accordance with the terms and conditions of the Contract Documents.

1.34 FINAL INSPECTION: Review of the Work by the Architect and Owner to determine whether Final Completion has been achieved.

1.35 FINAL PAYMENT: The last payment made by the Owner to the Contractor, made after notice of the Final Acceptance. Payment shall include the entire unpaid balance of the Contract Sum as adjusted by Modifications.

1.36 GENERAL CONDITIONS: The General Conditions of the Contract for Construction, part of Division 0 of the Specifications.

1.37 GENERAL REQUIREMENTS: That part of the Contract Documents entitled General Requirements, which is Division 1 of the Specifications.

1.38 GUARANTEE: See Warrantee.

1.39 LIQUIDATED DAMAGES: A sum established in a Contract, usually as a fixed sum per day, as the predetermined measure of damages to be paid to the Owner due to the Contractor's failure to complete the Work within the Contract Time.

1.40 LUMP SUM: An item or category priced as a whole rather than broken down into its elements.

1.41 MINOR CHANGES IN THE WORK: Changes in the Work not involving an adjustment in the Contract Sum or an extension of the Contract Time and not inconsistent with the intent of the Contract Documents, which shall be affected by written order issued by the Architect.

1.42 MODIFICATION OR AMENDMENT:

1.42.1 A written change to the Contract Documents.
1.42.2 A Change Order.
1.42.3 A Construction Change Directive.
1.42.4 Supplemental Instructions for minor changes in the Work and/or additional instructions to the Work.

1.43 NOTICE TO BIDDER: A notice contained in the Bidding Document informing prospective Bidders of the opportunity to submit Bids on a Project.

1.44 NOTICE TO PROCEED: Written notice, issued by the Commissioner or the Commissioner's authorized representative, to the Contractor authorizing the Contractor to proceed with the Work and establishing the date for commencement of the Contract Time.

1.45 OWNER OR DEPARTMENT: The State of Connecticut, Military Department acting through its Commissioner or specifically authorized Department personnel or agent.

1.46 PAYMENT BOND, LABOR BOND OR MATERIAL BOND: A bond in which the Contractor and the Contractor's surety guarantee to the Owner that the Contractor will pay for labor and materials furnished for use in the performance of the Contract, as required by Connecticut General Statutes Section 49-41.

1.47 PERFORMANCE BOND OR SURETY BOND: A bond in which the Contractor and the Contractor's surety guarantee to the Owner that the Work will be performed in accordance with the Contract Documents, as required by Connecticut General Statutes Section 41.

1.48 PERFORMANCE SPECIFICATION: A description of the desired results or performance of a product, material, assembly, procedure, or a piece of equipment with criteria for identifying the standard.

1.49 PLANS OR DRAWINGS: All drawings or reproductions of drawings pertaining to the construction of the Work contemplated and its appurtenances.

1.50 PROJECT: The total construction of which the Work performed under the Contract Documents may be the whole or a part.

1.51 PROJECT MANUAL: The set of documents assembled for the Work which includes, but is not limited to, Contract Documents, Bidding Requirements, Sample Forms, Conditions of the Contract, General Requirements and the Specifications.

1.52 PROPRIETARY SPECIFICATION: A specification that describes a product, procedure, function, material, assembly, or piece of equipment by trade name and/or by naming the manufacturer(s) or manufacturer's procedure, exact model number, item, etc., of those products acceptable to the Owner.

1.53 RETAINAGE: A percentage of each Application for Payment and a percentage of the total contract sum retained by the Owner.

1.54 SCHEDULE: A Critical Path Method (CPM) or Construction Schedule as required by the Contract Documents which shall be a diagram, graph or other pictorial or written schedule showing all events expected to occur and operations to be performed and indicating the contract time, start dates, durations and finish dates and their relationship to Substantial Completion and Final Completion of the Work, rendered in a form permitting determination of the optimum sequence and duration of each operation.

1.55 SCHEDULE OF VALUES: A document furnished by the Contractor to the Architect and Owner stating the portions of the Contract Sum allocated to the various portions of

the Work, which is to be used for reviewing the Contractor's Applications for Payment.

1.56 SECONDARY SUBCONTRACTOR: A sole proprietor, partnership, firm or Corporation under direct contract with the Subcontractor to the General Contractor.

1.57 SHOP DRAWINGS: Drawings provided to Architect and Owner by a Contractor that illustrate construction, materials, dimensions, installation, and other pertinent information for the incorporation of an element or item into the construction as detailed Contract Documents.

1.58 SPECIFICATIONS: The description, provisions and other requirements pertaining to the method and manner of performing the Work and/or to the quantities and quality of materials to be furnished under the Contract.

1.59 SUBCONTRACTOR: A sole proprietor, partnership, corporation or other business organization under direct contract with the Contractor supplying labor and/or materials for the Work at the site of the Project.

1.60 SUBMITTALS: Documents including, but not limited to, samples, manufacturer's data, shop drawing, or other such items submitted to the Owner and Architect by the Contractor for the purpose of approval or other action, as required by the Contract Documents.

1.61 SUBSTANTIAL COMPLETION: The stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so the Owner can occupy or utilize the Work for its intended use.

1.62 SUBSTITUTION: A material, device, procedure, equipment, etc., which has been determined by the Architect and the Owner to be not an Equal to the first manufacturer or procedure listed in the Specification in terms of cost, quality and performance but which may be used in place of that item specified. . The Substitution constitutes a modification in the Work, the Schedule or the Architect/Engineer's design intent of the specified material, device, procedure, equipment, etc.

1.62 SUPERINTENDENT: The Contractor's representative at the site who is responsible for continuous field supervision, coordination, completion, completion of the work, and, unless another person is designated in writing by the contractor to the owner and the construction administrator, for the prevention of accidents.

1.63 SUPPLEMENTAL BID: The monetary value stated in the Bid to be added to the amount of the Base Bid if the corresponding Work, as described in the Bidding Documents, is accepted.

1.64 SUPPLEMENTARY CONDITIONS: An extension of the General Conditions applicable to any and all portions of Work under the Contract Documents.

1.65 THRESHOLD LIMIT BUILDING: Any proposed (new) structures or additions as defined by the Connecticut General Statutes Section 29-276b.

1.66 UNIT PRICE: The monetary value stated by the Owner or the Contractor, as a price per unit of measure for materials or services as described in the Contract Documents and/or Bidding Documents.

1.67 WORK: The construction and services required by the Contract Documents, and including all labor, materials, equipment and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project.

1.68 WARRANTEE: A written, legally enforceable assurance of specified quality or performance of a product or work or of the duration of satisfactory performance.

ARTICLE 2
CONDITIONS OF WORK

2.1 The Contractor shall carefully examine and study the conditions under which the Work is to be performed and the site of the Work, and compare the Contract Documents with each other and to information furnished by the Owner including but not limited to the plans and specifications, the form of the Contract, General Conditions, Supplementary Conditions, General Requirements, Bonds and all other Contract Documents associated with the Work.

2.2 The Contractor shall report to the Construction Administrator all errors, inconsistencies or omissions discovered. The Contractor shall not be liable to the Owner for damage resulting from errors, inconsistencies or omissions in the Contract Documents unless the Contractor recognized such errors, inconsistencies or omission and failed to report it to the Construction Administrator. If the Contractor performs any actions or construction activity knowing it involves an error, inconsistency or omission in the Contract Documents without notice to the Construction Administrator, the Contractor shall assume responsibility for such performance and related costs for the correction and shall not be allowed to submit any claim related to error, inconsistencies or omission.

2.3 The Contractor shall take field measurements and verify field conditions and shall carefully compare such field measurements and conditions and other information known to the Contractor with the Contract Documents before commencing activities. Errors, inconsistencies or omissions discovered shall be reported to the Construction Administrator at once; and it will be assumed that the Contractor has been satisfied as to all requirements of the Contract Documents. Any deterrent conditions at the site of the Work which are obvious and apparent upon examination of the site but are not indicated on the plans shall be corrected by the Contractor without additional compensation.

2.4 In performing the Work, the Contractor must employ such methods or means as will not cause any interruption of or interference with the Work of any other Contractor, nor any inordinate disruption with the normal routine of the Owner, Institution or Agency operating at the site.

2.5 No claims for additional compensation will be considered when additional costs result from conditions made known to, discovered by, or which should have been discovered by, the Contractor prior to Contract signing.

2.6 The Contractor shall perform the Work in accordance with the Contract Documents and approved submittals pursuant to Article 5.

ARTICLE 3
CORRELATION OF CONTRACT DOCUMENTS

3.1 The Contract Documents are complementary, and what is called for by any one shall be as binding as if called for by all. Where discrepancies of conflict occur in the Contract Documents the following order of precedence shall be utilized:

3.1.1 Amendments and addenda shall take precedence over previously issued Contract Documents.
3.1.2 The General Requirements take precedence over the Supplementary Conditions.
3.1.3 The Supplementary Conditions take precedence over the General Conditions.
3.1.4 The General Requirements take precedence over the General Conditions.
3.1.5 The Specifications shall take precedence over the Plans.
3.1.6 Stated dimensions shall take precedence over scaled dimensions.
3.1.7 Large-scale detail drawings shall take precedence over small-scale drawings.
3.1.8 The schedules contained in the Contract Documents shall take precedence over other data on the Plans.

3.2 Neither party to the Contract shall take advantage of any obvious error or apparent discrepancy in the Contract Documents. The Contractor shall give immediate written notification of any error or discrepancy discovered to the Construction Administrator, who shall take the necessary actions to obtain such corrections and interpretations as may be deemed necessary for the completion of the Work in a satisfactory and acceptable manner. The Contractor shall then promptly proceed under the direction of the Owner and the provisions of Article 13. The Contractor's failure to provide immediate notice shall mean the Contractor will not be entitled to any additional compensation, either monetary or contract time adjustment, with respect to any discrepancy.

3.3 Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become familiar with local conditions under which the Work is to be performed and correlated personal observations with requirements of the Contract Documents.

3.4 Organization of the Specifications into divisions, sections and articles, and arrangement of drawings, shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade.

3.5 Unless otherwise stated in the Contract Documents, words which have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

ARTICLE 4
COMMENCEMENT AND PROGRESS OF WORK

4.1 The Work shall start upon the date given in the Notice to Proceed. The Contractor shall complete all the Work necessary for Final Completion, including but not limited to Substantial Completion, Contract close-out, testing and demonstration of all systems as required for acceptance, punchlist Work, training and submission of Record Documents, manuals, guarantees and warranties as stated in the Bidding Document.

4.2 Time is of the essence with respect to the Contract Time. By executing the Contract, the Contractor confirms and agrees that the Contract Time is a reasonable period to perform the Work. The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time. The Contractor may, at his discretion, plan to complete the work and achieve Substantial Completion in less time than the Contract Time.

4.3 The Contractor's early completion schedule notwithstanding, the Owner reserves the right to order Modifications to the Work in accordance with Article 13 at any time during the Contract Time.

4.4 The Contractor shall not be entitled to costs for delay due to Owner ordered Modifications or any other circumstances for the period of time between the Contractor's elected early completion and the end of the Contract Time. Costs include, but are not limited to, delays extended home or field office costs, supervisory and management costs incurred in performance of the Work. Early completion of the Work shall not merit additional compensation.

4.5 If the Contractor is delayed at any time in the progress of Work by acts of God such as fire or flood or any action, injunction or stop order issued by any court, judge or officer of the court or any other court action beyond the Owner's control, then the Contract Time may be extended by Change Order for such reasonable time as demonstrated by the Contractor's Schedule and as the Owner may determine that such event has delayed the Work. In any event, the granting of an extension of time shall be solely within the discretion of the Owner.

4.6 Except as otherwise may be provided herein, extensions of time shall be the Contractor's sole remedy for such delay. No payment or compensation of any kind shall be made to the Contractor for damages because of hindrance in the orderly progress of Work caused by the aforesaid causes.

4.7 The Contractor acknowledges that the Contract amount includes and anticipates any and all delays, whether avoidable or unavoidable, from said orders, which may issue from any court, judge, court officer, or act of God, and that such delays shall not, under any circumstances, be construed as compensable delays.

4.8 Any extension of the Contract Time shall be by Change Order pursuant to Article 13.

4.9 The Contractor shall employ a competent superintendent and necessary assistants who will be in attendance at the project site, during the performance of the work, for the duration of the contract. The superintendent shall represent the Contractor, and communications given to the superintendent shall be binding as if given to the Contractor. All Communications from the Contractor concerning proposed changes to the Contact Sum, Contract Time, or Work, shall be in writing.

ARTICLE 5
SUBMITTALS, PRODUCT DATA, SHOP DRAWINGS AND SAMPLES

5.1 Contractor shall review, approve and submit to the Construction Administrator all submittals including but not limited to Product Data, Shop Drawing and Sample Manufacturers, with such promptness as to cause no delay in the Work.

5.2 Correction or approval of such submittals, Shop Drawings, Product Data sample will be made with reasonable promptness by the Architect. Approval will be general only and shall not relieve the Contractor from responsibility for errors in dimensions, for construction and field coordination of the Work or for any departure from the Contract Documents unless such departure has received the Owner's written approval.

5.3 No Work governed by such drawings, schedules or samples shall be fabricated, delivered or installed until approved by the Architect.

5.4 No damages for delays or time extensions will be granted even if approvals deviate from the approved Schedule.

ARTICLE 6
SEPARATE CONTRACTS

6.1 The Owner reserves the right to perform Work in connection with the Contract with the Owner's own forces, or to let separate contracts relating to the Contract (Project) site or in connection with work on adjoining sites. In such cases, the Contractor shall afford such parties reasonable opportunity for storage of materials and equipment and coordinate and connect the Work with the work on adjoining sites or other projects, and shall fully cooperate with such parties in the matter required under Article 7 herein.

6.2 Contractors working in the same vicinity shall cooperate with one another and, in case of dispute; decision of the Owner shall be final and binding to all Contractors involved, including Contractors under separate Contracts.

6.3 The Contractor shall assume all liability, financial or otherwise, in connection with this Contract and shall protect and hold harmless the Owner from any and all damages or claims that may arise because of inconvenience or delay which the Contractor may cause other Contractors. If the Contractor experiences a loss because of the presence and operations of other Contractors working adjacent to or within

the limits of the same project, then as between the Owner and the Contractor, the Contractor shall bear such loss.

6.4 Insofar as possible, the Contractor shall arrange the Work and shall place and dispose of the materials being used so as not to interfere with the operations of other Contractors adjacent to or within the limits of the same project. The Contractor shall join its Work with that of others in an acceptable manner, and perform the Work in proper accordance with that of the others.

6.5 In no event shall the Owner be responsible for any claim or damages that are the result of the Contractor's failure to coordinate the work with any Contractor or Subcontractor.

ARTICLE 7
COOPERATION OF TRADES

7.1 The Contractor shall be responsible for and shall control all activities of their Subcontractors. The Subcontractors shall consult and cooperate with one another. Each Subcontractor shall furnish all necessary information to other Subcontractors and shall lay out and install their own Work so as to avoid any delays or interference with the Work of others.

7.2 Any cost or changes, cutting and/or repairing, made necessary by the failure to observe the above requirements shall be borne by the party or parties responsible for such failure or neglect or their faulty Work installed.

ARTICLE 8
DAMAGES

8.1 The Liquidated Damages, provided in the Bidding Documents, will be assessed for each day beyond the date given for Substantial Completion of the Contract according to the Contract Time.

8.2 The Liquidated Damages or any portion thereof may be waived at the sole discretion of the Commissioner.

8.3 No payment by the Owner, either partial or final, shall be construed to waive the Owner's right to seek liquidated damages.

8.4 In the event a court determines that the contract herein is null and void for any reason, Contractor agrees that Contractor will not seek or pursue any lawsuit or claim for damages, including, but not limited to, claims for loss of overhead or anticipated profits, against the Owner and the Owner shall not be liable for any damages which Contractor may incur as a result of such decision. In addition, if the court enjoins the Owner from entering into or proceeding with the contract herein, the Owner shall not be liable for any damages arising out of or relating to the award of such contract which Contractor may have incurred as a result of the injunction.

ARTICLE 9
MINIMUM WAGE RATES

9.1 In accordance with the provisions of the Connecticut General Statutes Section 31-53, the following applies:

"The wages paid on an hourly basis to any mechanic, laborer or workman employed upon the work herein contracted to be done and the amount of payment or contribution paid or payable on behalf of each such employee to any employee welfare fund, as defined in subsection (h) of section 31-53 of the general statutes, shall be at a rate equal to the rate customary or prevailing for the same work in the same trade or occupation in the town in which such public works project is being constructed. Any contractor who is not obligated by agreement to make payment or contribution on behalf of such employees to any such employee welfare fund shall pay to each employee as part of his wages the amount of payment or contribution for his classification on each pay day."

9.2 Each contractor who is awarded a contract on or after October 1, 2002 shall be subject to provisions of the Connecticut General Statutes, Section 31-53 as amended by Public Act 02-69, "An Act Concerning Annual Adjustments to Prevailing Wages."

No wage adjustment will be made to the Contract for any wage increase under this Article.

ARTICLE 10
POSTING MINIMUM WAGE RATES

10.1 The Contractor shall post at conspicuous points on the site of the Contract a Schedule showing all determined wage rates for all trades and all authorized deductions, if any, from wages to be paid.

10.2 The Contractor shall provide weekly certified payrolls to the Owner for all persons working on the site.

ARTICLE 11
CONSTRUCTION SCHEDULES

11.1 Unless otherwise specified in the Contract Docu-

ments, within **twenty-one (21)** calendar days from the contract start date, the Contractor shall submit the following to the Owner for approval:

11.1.1 A comprehensive schedule of Submittals required by the Specifications. Said schedule shall include Submittal dates, required approval dates and date material must be on site.

11.1.2 The Contractor shall allow a minimum of two weeks for the Owner and its agents' review of Submittals. No extension of the Contract Time shall be granted for revisions and resubmission. Further, the Contractor shall allow a minimum of eight weeks for testing and acceptance of the Work by the Owner and its agents.

11.1.3 When the Contract Documents specify a "CPM Schedule" a detailed Critical Path Method Schedule is required using software approved by the Owner with as many activities as necessary to make the Schedule an effective tool for planning and monitoring the progress of the Work. The Contractor shall show all pertinent activities requiring coordination between trades.

11.1.4 When the Contract Documents specify a "Construction Schedule" a detailed Construction Schedule is required using software approved by the Owner as a horizontal bar chart with a separate bar for each major portion of the Work or operation to make the Schedule an effective tool for planning and monitoring the progress of the Work.

11.2 Unless otherwise specified under the Contract Documents, the Contractor shall provide a monthly update of the CPM Schedule or Construction Schedule in the format required by the Owner as well as a disk of the updated Schedule and program. If, in the opinion of the Owner, the Work is falling behind Schedule, the Contractor shall submit a revised Schedule demonstrating a recovery plan to ensure Substantial Completion of the Work within the Contract Time.

11.3 Requisitions for partial payment will not be processed until the Contractor has complied with this requirement.

ARTICLE 12
PREFERENCE IN EMPLOYMENT

12.1 Should this Contract be for the construction or repair of any building, then in the employment of labor to perform the Work specified herein, preference shall be given to citizens of the United States, who are, and continuously for at least three (3) months prior to the date hereof, have been residents of the labor market area, as established by the State of Connecticut Labor Commissioner, in which such Work is to be done, and if no such qualified person is available, then to citizens who have continuously resided in the county in which the Work is to be performed for at least three (3) months prior to the date hereof, and then to citizens of the state who have continuously resided in the State at least three months prior to the date hereof.

12.2 Should this Contract be for a public works project other than for the construction, remodeling or repairing of public buildings covered by Connecticut General Statutes Section 31-52, then in the employment of mechanics, laborers or workmen to perform the Work specified herein, preference will be given to residents of the state who are, and continuously for at least six (6) months prior to the date hereof have been residents of this State, and if not such person is available then to residents of other states.

12.3 The provisions of this Article shall not apply where the state or any sub-division thereof may suffer the loss of revenue granted or to be granted from any agency or department of the federal government as a result of this Article or regulations related thereto.

ARTICLE 13
COMPENSATION FOR CHANGES IN THE WORK

13.1 At any time, without invalidating the Contract and by a written order and without notice to the sureties, the Owner, through the Construction Administrator, may order modifications in the Work consisting of additions, deletions or other revisions. Upon request, the Contractor shall supply the Construction Administrator promptly with a detailed proposal for the same, showing quantities of and unit prices for the Work and that of any Subcontractor involved.

13.2 Modifications to the Work will be authorized by a written Change Order, or if necessary to expedite the Work, a written Construction Change Directive, issued by the Owner as provided for in Article 26. Change Orders and Construction Change Directives shall be processed in accordance with the terms of the Contract Documents. Upon receipt of the written Change Order, the Contractor shall proceed with the Work when and as directed.

13.3 If such Change Orders make the Work less expensive for the Contractor, the proper deductions shall be made from the Contract Sum, said deductions to be computed in accordance with the provisions listed in this Article 13.

13.4 The Contractor and the Owner agree that the Contract Time specified for the performance of the Contract shall include not only the Work of the original Contract but also any Additional Work ordered by the Owner by Change Order. No extension of time will be granted if it is the opinion of the Owner that the additional Work can be performed concurrently with the original Work.

13.5 The Contractor may request, and the Owner may grant additional contract time when, in the opinion of the Owner, the Contractor has demonstrated that such additional work cannot be performed concurrently with the original Work.

13.6 The amount of compensation to be paid to the Contractor for any Additional or Deleted Work that results in a Change Order shall be determined in one of the following manners:

13.6.1 AMOUNT OF COMPENSATION FOR CHANGE ORDER COSTS: LABOR, EQUIPMENT, BENEFITS AND MATERIAL

13.6.1.1 Unit Price: As stated in the Contract Documents.

13.6.1.2 Unit Price: As subsequently agreed upon by the Contractor and Owner.

13.6.1.3 Lump Sum: Agreed upon sum by the Owner and the Contractor. The Lump Sum must be based upon the following itemized costs:

13.6.1.3.1 Labor (Contractor's or Subcontractor's own forces)

13.6.1.3.2 Material (Used by Contractor's or Subcontractor's own forces).

13.6.1.3.3 Benefits: (The established rates of the following benefit costs inherent to the particular labor involved):

13.6.1.3.3.1 Workers Compensation.

13.6.1.3.3.2 Federal Social Security.

13.6.1.3.3.3 Connecticut Unemployment Compensation.

13.6.1.3.3.4 Fringe Benefits.

13.6.1.4 Rented Equipment (Used directly on the Work and by the Contractor's or Subcontractor's own forces).

13.6.1.5 Owned Equipment (Used directly on the Work and by the Contractor's or Subcontractor's own forces). Daily rate is not to exceed 3% of the monthly rental rate as identified by a nationally recognized construction cost estimating guide or service. Trade related equipment, hand tools and power tools, normally supplied with the labor are not compensable.

13.6.2 OVERHEAD AND PROFIT PERCENTAGES: (Maximum allowable percentages applied to labor, equipment, benefits and material)

13.6.2.1 Contractor's markup for Work performed by their own forces:

Change Order Amount	Overhead and Profit
$0 to $ 5,000	20%
$5,001 to $15,000	17%
$15,001 to $25,000	15%
$25,000 and greater	12%

13.6.3 OVERHEAD AND PROFIT PERCENTAGES: (Maximum allowable percentages applied to labor, equipment, benefits and material)

13.6.3.1 Contractor's markup for Work performed by their Subcontractors forces.:

Change Order Amount	Overhead and Profit
$0 and greater	6%

13.6.4 OVERHEAD AND PROFIT PERCENTAGES: (Maximum allowable percentages applied to labor, equipment, benefits and material)

13.6.4.1 Subcontractor's markup for Work performed by their own forces:

Change Order Amount	Overhead and Profit
$0 to $ 5,000	20%
$5,001 to $15,000	17%
$15,001 to $25,000	15%
$25,000 and greater	12%

13.6.5 OVERHEAD AND PROFIT PERCENTAGES: (Maximum allowable percentages applied to labor, equipment, benefits and material)

13.6.5.1 Subcontractor's markup for Work performed by their Secondary Subcontractor's forces.

Change Order Amount	Overhead and Profit
$0 and greater	6%

13.7 Actual additional bonding costs associated with the value of the Change Order will be compensable only when supported by a written documentation by the bonding company that the Change Order requires an increase to the original Performance, Payment, Labor or Material Bond.

13.8 On Work performed by a Secondary Subcontractor, the Owner recognizes no markup by the Secondary Subcontractor.

13.9 If Unit Prices are not applicable and the parties cannot agree upon a lump sum, then the Commissioner, through the Construction Administrator, may at the option of the Commissioner take the following action(s):

13.9.1 Issue a Construction Change Directive for the Additional or deleted Work. The amount of compensation shall be computed by the actual net costs to the Contractor based upon the following:

13.9.1.1 Labor (Contractor's or Subcontractor's own forces)

13.9.1.2 Material (Used by Contractor's or Subcontractor's own forces).

13.9.1.3 Benefits: (The established rates of the following benefit costs inherent to the particular labor involved):

13.9.1.3.1 Workers Compensation.

13.9.1.3.2 Federal Social Security.

13.9.1.3.3 Connecticut Unemployment Compensation.

13.9.1.3.4 Fringe Benefits.

13.9.1.4 Rented Equipment (Used directly on the Work and by the Contractor's or Subcontractor's own forces).

13.9.1.5 Owned Equipment (Used directly on the Work and by the Contractor's or Subcontractor's own forces). Daily rate is not to exceed 3% of the monthly rental rate that can be identified by a nationally recognized construction cost estimating guide or service.

13.9.2 Issue a Change Order adjusting the Contract Sum in the amount as determined by the Commissioner.

13.10 For any Change Order or Construction Change Directive the Contractor shall, when requested, promptly furnish in a form satisfactory to the Construction Administrator and the Owner a complete detailed accounting of all costs relating to the Additional Work, including but not limited to certified payrolls and copies of accounts, bills and vouchers to substantiate actual costs. Further, the Owner reserves the right to access and make copies of the Contractor's records at any time upon written request from the Commissioner.

13.11 If the Contractor wishes to make a claim for an increase in the Contract Sum for any damages sustained as a result of Additional Work, then the Contractor shall give the Owner, through the Construction Administrator, written notice thereof within seven (7) calendar days after the occurrence of the event giving rise to such claims.

13.12 No such claims shall be valid if the written notice is submitted after the required seven (7) calendar days. In addition, the Contractor shall file with the Owner through the Construction Administrator daily or weekly itemized statements of the details and cost of such Work performed or damage sustained as may be required by the Owner.

13.13 Failure of the Contractor to negotiate in good faith issues of time and costs and failure to provide requested documentation within (14) fourteen calendar days, or a time period accepted by the Commissioner, shall constitute a waiver by the Contractor of any claim. In such cases the Owner may elect to issue a unilateral Change Order in an amount deemed to be fair and equitable by the Commissioner. The provisions hereof shall not affect the power of the Contractor to act in case of emergency, threatened injury to persons, or damage to Work on any adjoining property. In this case the Commissioner, through the Construction Administrator, shall issue a written order for such amount as the Commissioner finds to be reasonable cost of such Work.

ARTICLE 14
DELETED WORK

14.1 Without invalidating any of the terms of the Contract, the Commissioner may order deleted from the Contract any items or portions of the Work deemed necessary by the Commissioner.

14.2 The compensation to be deducted from the Contract Sum for such deletions shall be determined in the manner provided for under the provisions of Article 13 or in the event none of the provisions of Article 13 are applicable than by the value as estimated by the Owner.

ARTICLE 15
MATERIALS: STANDARDS

15.1 Unless otherwise specifically provided for in the Specifications, all equipment, materials and articles incorporated in the Work are to be new and of the best grade of their respective kinds for the purposes. Wherever in the Contract Documents a particular brand, make of material, device, or equipment is shown or specified, the first manufacturer listed in the specification section is to be regarded as the standard. When the specification is proprietary and only one manufacturer is listed, the Contractor shall use the named manufacturer and no Substitutions or Equals will be allowed.

15.2 Any other brand, make of material, device, equipment, procedure, etc. which is a deviation from the specified requirement is prohibited from use but may be considered by the Owner for approval as an Equal or Substitution. The Contractor is to adhere to the specific requirements of the Contract Documents. Substitutions are discouraged and are only approved by the Commissioner as an exception.

15.3 Each request for an Equal or Substitution shall be submitted, with the appropriate documentation, as detailed in the Contract Documents, to the Construction Administrator. All requests will be compared to the first manufacturer or first procedure listed in the specific Specification section with reference to all of the following areas: the substance and function considering quality, workmanship, economy of operation, durability and suitability for purposes intended including the size, rating and cost. All submissions must include all the required data for the first listed manufacturer or procedure as specified, as well as the proposed Equal or Substitution. The submission of all Equals or Substitutions to those specified must be made within the days listed below after the contract start date. After that time period, the Contractor shall provide what is specified unless otherwise allowed within the sole discretion of the Commissioner.

15.3.1 30 days for projects having a Contract Time duration of 180 days or less

15.3.2 60 days for projects having a Contract Time duration of 181 days to 360 days

15.3.3 90 days for projects having a Contract Time duration of 361 days or greater

15.4 Contractor shall submit each request for Equal or Substitution to the Architect who shall review each request and make the following recommendations to the Owner:

15.4.1 Acceptance or non-acceptance of the adequacy of the submission and required back-up,

15.4.2 Determination of the category of the request for Substitution or Equal, and

15.4.3 Overall recommendation for approval or rejection of the Substitution or Equal. The determination of the category as a Substitution may be grounds for an immediate rejection by the Owner.

15.5 Approval of the Owner, for each Equal or Substitution shall be obtained before the Contractor proceeds with the Work. The decision of the Commissioner, in this regard, shall be final and binding on the Contractor.

15.6 No extension of time will be allowed for the time period required for consideration of any Substitution or Equal. No extension of time will be allowed and no responsibility will be assumed by the Owner when a Contractor submits a request for Substitution or Equal, whether such request be approved or denied.

15.7 If the Contractor submits any request for an Equal or a Substitution, he shall bear the burden of proof that such requested Equal or Substitution meets the requirements of the plans and specifications.

15.8 The Contractor shall purchase no materials or supplies for the Work which are subject to any chattel mortgage or which are under a conditional sale or other agreement by which an interest is retained by the seller. The Contractor warrants that the Contractor has good title to all materials and supplies used by him in the Work.

15.9 All Products and systems supplied to the State as result of a purchase by a contractor shall be certified that, to the best of the supplier's knowledge there are no materials that are classified as hazardous materials being used within the assembly. Hazardous materials include, but are not limited to, products such as asbestos, lead and other materials that have proven to cause a health risk by their presence.

ARTICLE 16
INSPECTION AND TESTS

16.1 The purpose of the inspections will be to assure that the Work is performed in accordance with the Contract Documents. These inspections shall include, but not be limited to all inspections and testing as required by the Owner, and any authorities have jurisdiction.

16.2 All material and workmanship, if not otherwise designated by the Specifications, shall be subject to inspection, examination and test by the Commissioner at any and all times during manufacture and/or construction and at any and all places where such manufacture and/or construction is carried on. The Contract Documents additionally identify the parties responsible for performing and paying for the required testing and inspections. All required tests performed in a laboratory will be obtained and paid for by the Owner except when the tests show the Work to be defective. The Contractor shall pay for all the costs associated with re-tests and re-inspections for all tests and inspections which fail. The Owner will issue a deduct Change Order to recover said retesting costs from the Contractor. All other tests, unless otherwise specified, shall be made at the Contractor’s expense. Notice of the time of all tests to be made at the site shall be given to all interested parties, including the Owner.

16.3 Without additional cost to the Owner, the Contractor shall promptly furnish facilities, labor and materials necessary to coordinate and perform operational tests and checkout of the Work. The Contractor shall furnish promptly all reasonable facilities, labor and materials necessary to make all such testing safe and convenient.

16.4 If, at any time before Final Completion and Final Acceptance of the Work, the Commissioner considers it nec-

essary or advisable to examine of any portion of the Work already completed by removing or tearing out the same, the Contractor shall, upon request, furnish promptly all necessary facilities, labor and materials. If such Work is found to be defective in any material respect, as determined by the Owner, because of a fault of the Contractor or any of the Contractor's Subcontractors, or if any Work shall have been covered without the approval or consent of the Commissioner (whether or not it is found to be defective), the Contractor shall be liable for testing costs and all costs of correction, including removal and/or demolition of the defective work, including labor, material, and testing, including labor, material, re-testing or re-inspecting, services of required consultants, additional supervision, the Commissioner's and the Construction Administrator's administrative costs, and other costs for services of other consultants.

ARTICLE 17
ROYALTIES AND PATENTS

17.1 If the Contractor desires to use any design, device, material or process covered by a patent or copyright, the Contractor shall provide for such use by suitable legal agreement with the holder of said patent or copyright. The Contractor shall furnish a copy of this legal agreement to the Owner.

17.2 The Contractor shall indemnify and hold harmless the Owner and Construction Administrator for any costs, expenses and damage which it may be obliged to pay by reason of any infringement of a patent or a copyright, at any time during the prosecution or after the Final Completion of the Work.

ARTICLE 18
SURVEYS, PERMITS AND REGULATIONS

18.1 Unless otherwise provided for, the Contractor shall furnish surveys necessary for the execution of the Work. The Owner will furnish the Contractor with two base lines and a benchmark.

18.2 The Contractor shall obtain and pay for permits and licenses necessary for the execution of the Work and the occupancy and use of the completed Work.

18.3 The Contractor shall give all notices and comply with all laws, ordinances, rules and regulations including building and fire safety codes relating to the performance of the Work.

18.4 If underground utilities may be involved in part of the Work the Contractor is required to request "Call-Before-You-Dig" to verify the location of underground utilities at least (3) Working Calendar Days prior to the start of any excavation. The Contractor shall also notify the Owner and Agency at least (3) Working Calendar Days prior to the start of any excavation. If "Call-Before-You-Dig" fails or refuses to respond to the Contractor's request, then the Contractor shall obtain the services of a qualified underground utility locating firm, at no additional cost to the Owner, to verify locations of underground utilities prior to the start of any excavation. The Contractor shall be held responsible for providing safety, protecting the Work and protecting workmen as necessary to perform the Work. The Contractor shall be responsible for maintaining and protecting all original utility mark-out at no additional cost to the Owner.

ARTICLE 19
PROTECTION OF THE WORK, PERSONS AND PROPERTY

19.1 The Contractor shall continuously and adequately protect the Work against damage from any cause, and shall protect materials and supplies furnished by the Contractor or Subcontractors, whether or not incorporated in the Work, and shall make good any damage unless it be due directly to errors in the Contract Documents or is caused by agents or employees of the Owner.

19.2 To the extent required by law, by public authority, or made necessary in order to safeguard the health and welfare of the personnel or occupants of any of the state institutions, the Contractor shall adequately protect adjacent property and persons, and provide and maintain all facilities, including but not limited to passageways, guard fences, lights, and barricades necessary for such protection.

19.3 The Contractor shall take all necessary precautions for the safety of employees on the Work and shall comply with applicable provisions of federal and state safety laws and building codes to prevent accidents or injury to persons on, about or adjacent to the premises where the Work is being performed. The Contractor shall also comply with the applicable provisions of the Associated General Contractors' "Manual of Accident Prevention in Construction", the standards of the Connecticut Labor Department and Occupational Safety and Hazard Association (OSHA).

19.4 The Contractor shall erect and properly maintain at all times, as required by the conditions and progress of the Work, all necessary safeguards for the protection of employ-

ees of the State and the public, and shall post danger signs warning against any dangerous condition or hazard created by such things as protruding nails, well holes, elevator hatchways, scaffolding, window openings, excavations, tripping hazards or slipping, stairways and falling materials.

19.5 The Contractor shall designate a qualified and responsible on site staff person, whose duty shall be the prevention of accidents. The name and position of the designated person shall be reported to the Owner by the Contractor at the commencement of the Contract.

19.6 The Contractor shall at all times protect excavation, trenches, buildings and all items of Work from damage by rain, water from melted snow or ice, surface water run off and subsurface water usual for the vicinity at the time of operations; and provide all pumps and equipment and enclosures to insure such protection.

19.7 The Contractor shall construct and maintain all necessary temporary drainage and do all pumping necessary to keep excavation, basements, footings and foundations free of water.

19.8 The Contractor shall remove all snow and ice as may be required for access to the site and proper protection and prosecution of the Work.

19.9 The Contractor shall install bracing, shoring, sheathing, sheet piling, caissons and any other underground facilities as required for safety and proper execution of the Work, and shall remove this portion of the Work when no longer necessary.

19.10 During cold weather the Contractor shall protect all Work from damage. If low temperature makes it impossible to continue operations safely in spite of cold weather precautions, the Contractor may cease Work upon the written approval of the Commissioner.

ARTICLE 20
TEMPORARY UTILITIES

20.1 Unless expressly provided for otherwise in the Contract Documents, the Contractor shall include in the bid the costs of all temporary utilities required for project completion and protection of the Work. Said temporary utilities include but are not limited to lighting, heating, cooling, electrical power, water, telephone, sanitary facilities, and potable water.

ARTICLE 21
CORRECTION OF WORK

21.1 The Contractor shall promptly and without expense to the Owner remove from the premises all materials rejected by or unacceptable to the Commissioner as failing to conform to the Contract Documents, whether incorporated in the Work or not.

21.2 The Contractor shall promptly and without expense to the Owner replace any such materials which do not conform to the Contract Documents, and shall bear the expense of making good all Work of other Contractors or Subcontractors destroyed or damaged by such removal or replacement.

21.3 If the Contractor, after receipt of notice from the Owner, shall fail to remove such rejected or unacceptable materials within a reasonable time as fixed in said notice, the Owner may remove and store such materials at the expense of the Contractor.

21.4 Such action shall not affect the obligation of the Contractor to replace and complete assembly and installation of the Work and to bear the expenses referred to above. Prior to the correction of rejected or unacceptable Work or if the Commissioner deems it inexpedient or undesirable to correct any portion of the Work which was rejected, deemed unacceptable or not done in accordance with the Contract Documents, the Contract sum shall be reduced by such amount as, in the judgment of the Commissioner, shall be equitable.

21.5 No extension of time will be given to the Contractor for correction of rejected or unacceptable Work. All significant punchlist Work shall be completed before Substantial Completion is determined. The remaining minor punchlist Work, as determined by the Commissioner, shall be completed within 60 days of established Substantial Completion date.

21.6 Final Payment shall not relieve the Contractor of responsibility for the defects in material or workmanship.

21.7 Unless expressly provided for otherwise in the Contract Documents, the Contractor shall remedy any rejected or unacceptable Work, and any Work found to be not conforming to the Contract Documents which is discovered within 18 Months after the date of Substantial Completion. The Contractor shall pay for any damage to other Work caused by such nonconforming Work or any damage created in correcting the nonconforming Work.

ARTICLE 22
GUARANTEES and WARRANTIES

22.1 Unless expressly provided for otherwise in the Contract Documents, the Contractor shall provide a warranty on the Work for an 18-Month period from the date of Substantial Completion. The Contractor shall warrant that the equipment, materials and workmanship are of good quality and new, unless permitted elsewhere by the Contract Documents, and that the Work shall be free from defects not inherent in the quality required or permitted and that the Work conforms to the Contract Documents.

22.2 Disclaimers and limitations from manufactures, Subcontractors, suppliers or installers to the Contractor shall not relieve the Contractor of the Warranty on the Work. The Contract Documents detail the related damages, reinstatement of warranty, replacement cost and Owner's recourse.

ARTICLE 23
CUTTING, FITTING, PATCHING AND DIGGING

23.1 The Contractor will perform or will cause the Subcontractors to perform all cutting, fitting or patching of the portion(s) of the Work that may be required to make the several parts thereof joined and coordinated in a manner satisfactory to the Commissioner and in accordance with the Plans and Specifications.

23.2 The responsibility for defective or ill-timed Work shall be with the Contractor, but such responsibility shall not in any way relieve the Subcontractor who performed such Work. Except with the consent of the Commissioner, neither the Contractor nor any of its Subcontractors shall cut or alter the Work of any other Contractor or Subcontractor.

ARTICLE 24
CLEANING UP

24.1 The Contractor shall, on a daily basis, keep the premises free from accumulations of waste material or rubbish.

24.2 Prior to Final Completion of the Work, the Contractor shall remove from and about the site of the Work, all rubbish and all temporary structures, tools, scaffolding and surplus materials, supplies and equipment which may have been used in the performance of the Work. If the Commissioner in his sole discretion determines that the Contractor has failed to clean the work site, the Owner may remove the rubbish and charge the cost of such removal to the Contractor. A deduct Change Order will be issued by the Owner to recover such cost.

ARTICLE 25
ALL WORK SUBJECT TO CONTROL OF THE COMMISSIONER

25.1 The Commissioner hereby declares that the State Military Department Project Manager is the Commissioner's only authorized representative to act in matters involving the Owner's or Architect's ability to revoke, alter, enlarge or relax any requirement of the Contract Documents; to settle disputes between the Contractor and the Construction Administrator; and act on behalf of the Commissioner. In all such matters, the provisions of ARTICLES 13 and 14 herein shall guide the Project Manager.

25.2 In no event may the Contractor act on any instruction of the Agency without written consent of the Owner. In the event the Contractor acts without such consent, he does so at his own risk and at his own expense, not only for the Work performed, but for the removal of such Work as determined necessary by the Commissioner.

25.3 In the performance of the work, The Contractor shall abide by all orders, directions, and requirements of the Commissioner at such time and places and by such methods and in such manner and sequence as the Commissioner may require.

25.4 The Commissioner shall determine the amount, quality, acceptability and fitness of all parts of the work, shall interpret the plans, specifications, Contract Documents and extra work orders and shall decide all other questions in connection with the Work.

25.5 The Contractor shall employ no plant, equipment, materials, methods or persons to which the Commissioner objects and shall remove no plant materials, equipment or other facilities from the site of the Work without the permission of the Commissioner. Upon request, the Commissioner shall confirm in writing any oral order, direction, requirement or determination.

25.6 In accordance with Section 4b-24 and 4b-23 of the Connecticut General Statutes, the public auditors of the State of Connecticut and the auditors or accountants of the Commissioner of Public Works shall have the right to audit and make copies *of* the books of any contractor employed by the Commissioner.

ARTICLE 26
AUTHORITY OF THE CONSTRUCTION ADMINISTRATOR

26.1 The Construction Administrator employed by the Commissioner is authorized to inspect all Work for conformance to the Contract Documents. The Construction Administrator is authorized to reject all Work found to be defective, unacceptable and nonconforming to the Contract Documents. Such inspections and rejections may extend to all or any part of the Work, and to the preparation or manufacture of the material to be used.

26.2 The Construction Administrator is not empowered to revoke, alter, enlarge or relax any requirements of the Contract Documents, or to issue instructions contrary to the Contract Documents. The Construction Administrator shall in no case act as foreman or perform other duties for the Contractor, nor shall the Construction Administrator interfere with the management of the Work by the Contractor. Any advice, which the Construction Administrator may give the Contractor, shall in no way be construed as binding the Commissioner or Owner in any way, nor releasing the Contractor from the fulfillment of the terms of the Contract.

26.3 In any dispute arising between the Contractor and the Construction Administrator with reference to inspection and rejection of the Work, the Construction Administrator may suspend work on the non-compliant portion of the Work until the dispute can be referred to and decided by the Commissioner.

ARTICLE 27
SCHEDULE OF VALUES, APPLICATION FOR PAYMENT

27.1 Immediately after the signing of the Contract, the Contractor shall furnish for the use of the Commissioner as a basis for estimating partial payments, a certified Schedule of Values, totaling the contract sum and broken down into quantities and unit costs, as outlined in the Contract Documents and as directed by the Owner. The Schedule of Values must reflect true costs and be in sufficient detail to be an effective tool for monitoring the progress of the Work. Upon request of the Commissioner, the Contractor shall supply copies of signed Contracts, vendor quotations, etc. as back up to the Schedule of Values.

27.2 Approval of the Schedule of Values by the Commissioner is required prior to any payment by the Owner.

27.3 The Schedule of Values shall include a breakdown of the Contractor's general condition costs.

27.3.1 Non-recurring costs, (i.e. Mobilization costs, utility hook-ups, temporary heat) will be paid at the time of occurrence.

27.3.2 Reoccurring costs will be paid in proportion to the percent of completion of the project.

27.4 The Schedule of Values shall include a breakdown of Contract closeout costs including systems certification testing and acceptance, training, warranties, guarantees, as-builts and attic stock**.**

27.5 The Contractor shall make periodic applications for payment, which shall be subdivided into categories corresponding with the approved Schedule of Values and shall be in such numbers of copies as may be designated by the Commissioner.

ARTICLE 28
PARTIAL PAYMENTS

28.1 The Commissioner will examine the Contractor's Applications For Payments to determine, in the opinion of the Commissioner, the amounts that properly represent the value of the Work completed and for the materials suitably stored on the site.

28.2 In making such Application For Payment for the Work, there shall be deducted (10%) ten percent of the amount of each Application for Payment to be retained by the Owner as Retainage until Final Completion.

28.3 Retainage withheld at Final Payment shall not be more than ten percent (10%) of the Contract Sum.

28.2.1 The Commissioner has the sole discretion in the determination of reduction in Retainage. At (50%) fifty percent completion of the Work the State Military Department Project Manager may issue a "Contractor's Performance Evaluation". If the Contractor receives a performance evaluation score of "Good" or better then the Retainage withheld may be reduced by (50%) fifty percent of the Retainage. All subsequent Applications for Payment shall be subject to the Retainage amount as determined at the sole discretion of the Commissioner. In the event of a reduction in Retainage the minimum Retainage withheld at Final Payment shall not be less than five percent (5%) of the Contract Sum.

28.2.2 A "Good" Contractor's Performance Evaluation score shall be defined as a minimum total score of (60) sixty units and with no individual evaluation items rated (0) zero.

28.3 The decision of the Commissioner to reduce the Retainage rate will be based upon the Contractor's Performance Evaluation score for completed portions of the Work as set out above and other factors that the Commissioner may find appropriate as follows:

28.3.1 The Contractor's timely submission of an appropriate and complete CPM Schedule or Construction Schedule and Schedule of Values, in compliance with the Contract requirements and the prompt resolution of the Owner's and/or Architect's comments on the submitted material resulting in an appropriate basis for progress of the Work.

28.3.2 The Contractor's timely and proper submission of all Contract Document required submissions: including but not limited to shop drawings, material certificates and material samples and the prompt resolution of the Owners and/or Architect's comments on the submitted material resulting in an appropriate progress of the Work.

28.3.3 The Contractor's provision of proper and adequate supervision and home office support of the Project and any Subcontractor Work resulting in coordinated progress and proper quality control for the Work.

28.3.4 The Work completed to date has been installed or finished in a manner acceptable to the Owner.

28.3.5 The progress of the Work is consistent with the approved CPM Schedule or Construction Schedule.

28.4 No payments will be made for improperly stored or protected materials or unacceptable Work.

28.5 At his sole discretion, the Commissioner may allow to be included in the monthly requisitions payment requests for materials and equipment stored off the site.

28.5.1 In the event the Commissioner allows the Contractor to include in his requisitions payment requests for materials and equipment stored off the site, the Contractor shall also submit any additional bonds and/or insurance certificates relating to off-site stored materials and equipment, and follow such other procedures as may be required by the State to obtain the Commissioner's approval of such requests.

28.5.2 The Architect or Construction Administrator shall have inspected said materials and equipment and recommended payment therefor. The Contractor shall pay for the cost of the Architect's or Construction Administrator time and expense in performing these inspection services.

ARTICLE 29
DELIVERY OF STATEMENT SHOWING AMOUNTS DUE FOR WAGES, MATERIALS AND SUPPLIES

29.1 For each Application for Payment under this Contract, the Owner reserves the right to require the Contractor and every Subcontractor to submit a written verified statement, in a form satisfactory to the Owner, showing in detail all amounts then due and unpaid by such Contractor or Subcontractor for daily or weekly wages to all laborers employed by him for the performance of the Work or to other persons for materials, equipment or supplies delivered at the site.

29.2 The term laborers as used herein shall include workmen, workwomen, and mechanics.

29.3 Failure to comply with this requirement may result in the Owner withholding the application for payment pursuant to Article 28.

ARTICLE 30
COMPLETION AND ACCEPTANCE

30.1 Substantial Completion:

30.1.1 When the Contractor considers that the Work, or a portion thereof is Substantially Complete, the Contractor shall request an inspection of said Work to the Construction Administrator.

30.1.2 Upon receipt of the request, the Architect, Construction Administrator and Owner, will make an inspection to determine if the Work or designated portion thereof is Substantially Complete. If the inspection discloses any item, whether or not included on the inspection list, which is not in accordance with the requirements of the Contract Documents, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item.

30.1.3 The Contractor shall then submit a request for another inspection. The determination of Substantial Completion is solely within the discretion of the Owner.

30.1.4 When the Work or designated portion thereof is determined to be Substantially Complete, the Contractor will be provided a Certificate of Substantial Completion from the Owner. The Certificate of Substantial Comple-

tion, shall establish the date when the responsibilities of the Contractor for security, maintenance, heat, utilities, damage to the Work and insurance, are transferred to the Owner and shall fix the time within which the Contractor shall finish all items on the inspection list accompanying the Certificate.

30.1.5 The Certificate of Substantial Completion shall be signed by the Construction Administrator, Owner, and Architect.

30.1.6 Upon Substantial Completion of the Work or designated portion thereof and upon application by the Contractor and certification by the Construction Administrator and Architect, the Owner shall make payment reflecting adjustment in Retainage, if any, for such Work or portion thereof as provided in the Contract Documents.

30.2 Final Completion:

30.2.1 Upon Final Completion of the Work, the Contractor shall forward to the Construction Administrator a written notice that the Work is ready for Final Inspection and Acceptance and shall also forward to the Construction Administrator, a Final Application for Payment.

30.2.2 When the Work has been completed in accordance with terms and conditions of the Contract Documents a Certificate of Completion shall be issued to be signed by the Contractor.

ARTICLE 31
FINAL PAYMENT

31.1 The Owner reserves the right to retain for a period of thirty (30) days after filing of the Certificate of Completion and Acceptance the amount therein stated less all prior payments and advances whatsoever to or for the account of the Contractor.

31.2 All prior estimates and payments, including those relating to extra or additional Work, shall be subject to correction by the Final Payment.

31.3 No Application for Payment, Final or Partial, shall act as a release to the Contractor or the Contractor's sureties from any obligations under this Contract.

31.4 The Architect and Construction Administrator will promptly issue the Certificate for Payment, stating that to the best of their knowledge, information and belief, and on the basis of their observations and inspections, the Work has been completed in accordance with terms and conditions of the Contract Documents and that the entire balance found to be due the Contractor and noted in said Final Payment is due and payable.

31.5 Final Payment shall not be released until a Certificate of Completion and Acceptance and a Certificate of Compliance have been issued.

31.6 Neither Final Payment nor any Retainage shall become due until the Contractor submits to the Owner the following:

31.6.1 An affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied.

31.6.2 A certificate evidencing that insurance required by the Contract Documents to remain in force after Final Payment is currently in effect and will not be canceled or allowed to expire without at least 30 days prior written notice to the Owner.

31.6.3 A written statement that the Contractor knows of no substantial reason that the insurance will not be renewable to cover the period required by the Contract Documents.

31.6.4 Written consent of surety, if any, to Final Payment.

31.6.5 If required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts, releases and waivers of liens, claims, security interests or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien. If such lien remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging such lien, including all costs and reasonable attorney's fees.

31.6.6 If, after Substantial Completion of the Work, Final Completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting Final Completion and the Construction Administrator and Architect so confirm, the Owner shall, upon application by the Contractor and certification by the Construction Administrator and Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance for Work not fully completed or corrected is less than Retainage withheld, and if bonds have been furnished, the written consent of surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contrac-

tor to the Owner prior to Final Payment. Such payment shall be made under terms and conditions governing Final Payment, except that it shall not constitute a waiver of Claims.

ARTICLE 32
OWNER'S RIGHT TO WITHHOLD PAYMENTS

32.1 The Commissioner may withhold a portion of any Payment due the Contractor that may, in the judgment of the Commissioner, be necessary:

32.1.1 To assure the payment of just claims then due and unpaid to any persons supplying labor or materials for the Work.

32.1.2 To protect Owner from loss due to defective, unacceptable or non-conforming Work not remedied by the Contractor.

32.1 To protect the Owner from loss due to injury to persons or damage to the Work or property of other Contractors, Subcontractors, or others caused by the act or neglect of the Contractor or any of its Subcontractors.

32.2 The Owner shall have the right to apply any amount withheld under this section as the Owner may deem proper to satisfy protection from claims. The amount withheld shall be considered a payment to the Contractor.

32.3 The Owner has the right to withhold payment if the Contractor fails to provide accurate submissions of submittals, up date the status including but not limited to the following: as-built documents, request for information (RFI) log, Schedule, submittal log, change order log, certified payrolls and daily reports and all other requirement of the Contract Documents.

32.4 Neither Final Payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect through the Construction Administrator:

32.4.1 An affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied,

32.4.2 A certificate evidencing that insurance required by the Contract Documents to remain in force after Final Payment is currently in effect and will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner,

32.4.3 A written statement that the Contractor knows of no substantial reason that the insurance will not be renewable to cover the period required by the Contract Documents,

32.4.4 Consent of surety, if any, to Final Payment and

32.4.5 If required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts, releases and waivers of liens, claims, security interests or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner.

32.5 If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien. If such lien remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging such lien, including all costs and reasonable attorney's fees.

ARTICLE 33
OWNER'S RIGHT TO STOP WORK OR TERMINATE CONTRACT

33.1 The Commissioner shall have the authority to suspend the Work wholly or in part, for such period or periods as the Commissioner considers to be in the best interests of the State, or in the interests of public necessity, convenience or safety. During such periods the Contractor shall store all materials and equipment, in such a manner to prevent the materials and equipment from being damaged in any way, and the Contractor shall take precautions to protect the Work from damage.

33.1.1 If the Commissioner, in writing, orders the performance of all or any portion of the Work to be suspended or delayed for an unreasonable period of time (i.e. not originally anticipated, customary, or inherent in the construction industry) and the Contractor believes that additional compensation and/or Contract Time is due as a result of such suspension or delay, the Contractor shall submit to the Commissioner in writing a request for a Contract adjustment within 7 calendar days of receipt of the notice to resume Work. The request shall set forth the specific reasons and support for said adjustment.

33.1.2 The Commissioner shall evaluate any such requests received. If the Commissioner agrees that the cost and/or time required for the performance of the Contract has increased as a result of such suspension and that the suspension was caused by conditions beyond the control of and not the fault of the Contractor, its suppliers, or Subcontractors, and was not caused by weather, then the Commissioner will make a reasonable adjustment, excluding profit, of the Contract terms. The Commissioner will notify the Contractor of the determination as to what adjustments of the Contract, if any, that the Commissioner deems warranted.

33.1.3 No Contract adjustment will be made unless the Contractor has submitted the request for adjustment within the time prescribed.

33.1.4 No contract adjustment will be made under this Article to the extent that performance would have been suspended or delayed by any other cause within the Contractor's control or by any factor for which the Contractor is responsible under the Contract; or that such an adjustment is provided for or excluded under other term or condition of this Contract.

33.2 Notwithstanding any provision or language in the Contract to the contrary, the State may terminate the Contract whenever the Commissioner determines at his sole discretion that such termination is in the best interests of the State. Any such termination shall be effected by delivery to the Contractor of a written Notice of Termination specifying the extent to which performance of Work under the Contract is terminated, and the date upon which such termination shall be effective.

33.2.1 In the event of such termination, the Contractor shall be entitled to reasonable compensation as determined by the Commissioner, however, no claim for lost overhead or profits shall be allowed.

33.2.2 Materials obtained by the Contractor for the Work that have been inspected, tested as required, and accepted by the Commissioner, and that are not incorporated into the Work, shall, at the option of the Commissioner, be purchased from the Contractor at actual cost as shown by receipted bills. To this cost shall be added all actual costs for delivery at such points of delivery as may be designated by the Commissioner, as shown by actual cost records.

33.2.3 Termination of the Contract shall not relieve the Contractor or its Surety of their responsibilities for the completed Work, nor shall it relieve the Contractor's Surety of its obligations to ensure completion of the Work and to pay legitimate claims arising out of Work.

ARTICLE 34
SUBLETTING OR ASSIGNING OF CONTRACT

34.1 The Contract or any portion thereof, or the Work provided for therein, or the right, title or interest of the Contractor therein may not be sublet, sold, transferred, assigned, or otherwise disposed of to any person, firm or corporation without the written consent of the Commissioner.

34.2 No person, firm or corporation other than the Contractor to whom the Contract was awarded shall be permitted to commence Work at the site of the Contract until such consent has been granted.

ARTICLE 35
CONTRACTOR'S INSURANCE

35.1 The Contractor shall not start Work under the Contract until they have obtained insurance as stated in SECTIONS 00300 CERTIFICATE OF INSURANCE and 00020 BID PROPOSAL FORM, subsections 4.4.2 and 4.4.3, of this Project Manual and until the insurance has been approved by the Owner. The Contractor shall not allow any Subcontractor to start Work until the same insurance has been obtained by the Subcontractor and approved by the Owner or the Contractor's insurance provides coverage on behalf of the Subcontractor. The Contractor shall send Certificates of Liability Insurance to the Purchasing Dept/Contracts Unit, State Military Department, 360 Broad Street, Room 143, Hartford, CT 06105 unless otherwise directed in writing. Presented below is a narrative summary of the insurance required.

35.1.1 Commercial General Liability insurance including contractual liability, products/completed operations, broad form property damage and independent Contractors. The limits shall be no less than $1,000,000 each occurrence and $2,000,000 annual aggregate. Coverage for hazards of explosion, collapse and underground (X-C-U) and for asbestos abatement when applicable to this Contract must also be included when applicable to the Work to be performed. The State of Connecticut, Military Department, and their respective officers, agents, and employees shall be named as an Additional Insured. This coverage shall be provided on a primary basis.

35.1.2 Owner's and Contractor's Protective Liability insurance providing a total limit of $1,000,000 for all damages arising out of bodily injury or death of persons in any one accident or occurrence and for all damages arising out of injury or destruction of property in any one accident or occurrence and subject to a total (aggregate) limit of $2,000,000 for all damages arising out of bodily injury to or death of persons in all accidents or occurrences and out of injury to or destruction of property during the policy period. This coverage shall be for and in the name of the State of Connecticut.

35.1.3 The operation of all motor vehicles including those owned, non-owned and hired or used in connection with the Contract shall be covered by Automobile Liability insurance providing for a total limit of $1,000,000 for all damages arising out of bodily injuries to or death of all persons in any one accident or occurrence and for all damages arising out of injury to or destruction of property in

any one accident or occurrence. In cases where an insurance policy shows an aggregate limit as part of the automobile liability coverage, the aggregate limit must be at least $2,000,000. This coverage shall be provided on a primary basis. Should the Contractor not own any automobiles, the automobile & liability requirement shall be amended to allow the Contractor to maintain only hired and non-owned liability.

35.1.4 Excess Liability (Other than Umbrella Form) insurance in the amount of $5,000,000 for bids of $1,000,000 - $10,000,000 and in the amount of $10,000,000 for bids of $10,000,001 - $20,000,000. Refer to Section 00900 Amendments of the Project Manual for Excess Liability insurance requirements for bids exceeding $20,000,000.

35.1.5 Workers' Compensation and Employer's Liability as required by Connecticut Law and **Employers' Liability** with a limit of not less than $100,000 per occurrence, $500,000 disease policy limit and $100,000 disease each employee. When Work is on or contiguous to navigable bodies of waterways and ways adjoining, the Contractor shall include Federal Act endorsement for U.S. Longshoremen's and Harbor Workers Act.

35.1.6 Special Hazards insurance, if required, will be stated in SECTION 00020 BID PROPOSAL FORM, subsection 4.4.2 of this Project Manual. This includes coverage for explosion, collapse or underground damage and for asbestos abatement when applicable when applicable to this Contract and shall be no less than $1,000,000 each occurrence.

35.1.7 Builder's Risk insurance, if required, will be stated in Section 00020 Bid Proposal Form, subsection 4.4.3 of this Project Manual.

35.1.8 Inland Marine/Transit Insurance: With respect to property with values in excess of $100,000 which is rigged, hauled or situated at the site pending installation, the Contractor shall maintain inland marine/transit insurance provided the coverage is not afforded by a Builder's Risk policy.

35.1.9 When required to be maintained, the Builder's Risk and Inland Marine/Transit Insurance policy shall endorse the State of Connecticut as a Loss Payee and the policy shall state it is for the benefit of and payable to the State of Connecticut.

35.2 Satisfying Limits Under an Umbrella Policy: If necessary, the Contractor may satisfy the minimum limits required above for either Commercial General Liability, Automobile Liability, and Employer's Liability coverage under an Umbrella or Excess Liability policy. The underlying limits may be set at the minimum amounts required by the Umbrella or Excess Liability policy provided the combined limits meet at least the minimum limit for each required policy. The Umbrella or Excess Liability policy shall have an Annual Aggregate at a limit not less than two (2) times the highest per occurrence minimum limit required above for any of the required coverages. The State of Connecticut shall be specifically endorsed as an Additional Insured on the Umbrella or Excess Liability policy, unless the Umbrella or Excess Liability policy provides continuous coverage to the underlying policies on a complete "Follow-Form" basis.

35.3 Not used

35.4 Moved to 35.1.9

35.5 The Contractor shall, at its sole expense, maintain in full force and effect at all times during the life of the Contract or the performance of Work hereunder, insurance coverage as described herein. Certificates shall include a minimum thirty (30) day endeavor to notify requirement to the Owner prior to any cancellation or non-renewal.

35.6 The Contractor shall be fully and solely responsible for any costs or expenses as a result of a coverage deductible, coinsurance penalty, or self-insured retention, including any loss not covered because of the operation of such deductible, coinsurance penalty, or self-insured retention.

35.7 The requirement contained herein as to types and limits of insurance coverage to be maintained by the Contractor are not intended to and shall not in any manner limit or qualify the liabilities and obligations assumed by the Contractor.

35.8 Hold Harmless Provisions: The Contractor shall at all times indemnify and save harmless the State of Connecticut, the State Military Department, and their respective officers, agents, and employees, on account of any and all claims, damages, losses, litigation, expenses, counsel fees and compensation arising out of injuries (including death) sustained by or alleged to have been sustained by the officers, agents, and employees of said State or Department, or of the Contractor, his Subcontractor, or materialmen and from injuries (including death) sustained by or alleged to have been sustained by the public, any or all persons on or near the Work, or by any other person or property, real or personal (including property of said State or Department) caused in whole or in part by the acts, omissions, or neglect or the Contractor including but not limited to any neglect in safeguarding the Work or through the use of unacceptable

materials in constructing the Work of the Contractor, any Subcontractor, materialman, or anyone directly employed by them or any of them while engaged in the performance of the Contract, including the entire elapsed time from the date of the Notice to Proceed or the actual commencement of the Work whichever occurs first until its completion as certified by the State Military Department.

ARTICLE 36
FOREIGN MATERIALS

36.1 Preference shall be given to articles or materials manufactured or produced in the United States, Canada, and Mexico, the members of North American Free Trade Agreement (NAFTA), and the products shall meet all of the referenced standards and specifications for conditions of performance, quality and price with duty being equal.

36.2 Only articles or materials manufactured or produced in the United States Canada, and Mexico, the members of North American Free Trade Agreement (NAFTA), will be allowed. The foregoing provisions shall not apply to foreign articles or materials required by the Contract Documents.

ARTICLE 37
HOURS OF WORK

37.1 No person shall be employed to work or be permitted to work more than eight (8) hours in any day or more than forty (40) hours in any week for any Work provided in the Contract, in accordance with Connecticut General Statute Section 31-57.

37.2 The operation of such limitation of hours of work may be suspended during an emergency, upon the approval of the Commissioner, in accordance with Connecticut General Statute Section 31-57.

ARTICLE 38
DAYS OF WORK

38.1 Working Calendar Days include all days that the Contractor is permitted to execute the Work or employ any person to execute the Work within the Contract Time.

38.2 Non-working Calendar Days include all Saturdays, Sundays, Legal State Holidays and any other days identified in the Contract Documents that the Contractor is not permitted to execute the Work or employ any person to execute the Work. The restriction of non-working Calendar Days may be suspended upon the approval or direction of the Commissioner.

ARTICLE 39
CONTRACT TIME

39.1 The Contract Time is the number of calendar days, allotted in the Bidding Documents, for execution and Substantial Completion of the Work, including authorized adjustments thereto. The Contract Time is the sum of all working and non-working calendar days.

39.2 If weather conditions prevent the Contractor from executing the Work, the Contract Time may be extended by Change Order, for such reasonable time as may be determined by the Owner.

ARTICLE 40
CALENDAR DAY

40.1 This is each day of the calendar.

END

The State Military Department is required to insert the substance of Article VIII of each Master Cooperative Agreement (MCA), MCCA or Appendix in all contracts utilizing federal funds issued under the CA, unless State/Territory laws or regulations offer more protection. The following sections are made a part of this bid/contract/purchase order:

ARTICLE VIII - REPRESENTATIONS AND CERTIFICATIONS

Section 801. Applicable Law.

This MCA is incidental to the implementation of a Federal program. Accordingly, this MCA shall be governed by and construed according to Federal law as it may affect the rights, remedies, and obligations of the United States.

Section 802. Governing Regulations.

To the extent not inconsistent with the express terms of this Agreement, the provisions of 32 CFR Part 33, Uniform Administrative Requirements for Grants and Cooperative Agreements, DoD Grant and Agreement Regulations (DoDGARs) (DoD 3210.6-R) dated 13 Apr 98, OMB Circular A-87, and NGR 5-1/ANGI 63-101, which Circular and Regulations are hereby incorporated into this MCA by reference as if fully set forth herein, shall govern this Agreement.

Section 803. Nondiscrimination.

The Contractor/Vendor agrees that no person shall be denied benefits of, or otherwise be subjected to discrimination in connection with the Contractor/Vendor's performance under this MCA, on the ground of race, religion, color, national origin, sex or handicap. Accordingly and to the extent applicable, the Contractor/Vendor covenants and agrees to comply with the following:

a. Title VII of the Civil Rights Act of 1964 (42 U.S.C. § 2000d et seq.), and DOD regulations (32 CFR Part 300) issued thereunder;

b. Executive Order 11246 and Department of Labor regulations issued thereunder (41 CFR Part 60);

c. Section 504 of the Rehabilitation Act of 1973 (29 U.S.C. § 794) and DOD Regulations issued there under (32 CFR Part 56); and,

d. The Age Discrimination Act of 1975 (42 U.S.C. § 6101 et seq.) and regulations issued there under (45 CFR Part 90).

Section 804. Lobbying.

a. The Contractor/Vendor agrees that it will not expend any funds appropriated by Congress to pay any person for influencing or attempting to influence an officer or employee of any agency, or 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; and, the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

b. The Final Rule, New Restrictions on Lobbying, issued by the Office of Management and Budget and the Department of Defense (32 CFR Part 28) to implement the provisions of section 319 of Public Law 101-121 (31 U.S.C. § 1352) is incorporated by reference.

Section 805. Drug-Free Work Place.

a. The Contractor/Vendor agrees that it will comply with the provisions of the Drug-Free Work Place Act of 1988 (Public Law 100-690, Title V, Subtitle D; 41 U.S.C. § 701 et seq.) and maintain a drug-free workplace.

b. The Final Rule, Government-Wide Requirements for Drug-Free Workplace (Grants), issued by the Office of Management and Budget and the Department of Defense (32 CFR Part 28, Subpart f) to implement the provisions of the Drug-Free Work Place Act of 1988 is incorporated by reference and the Contractor/Vendor covenants and agrees to comply with all the provisions thereof, including any amendments to the Final Rule that may hereafter be issued.

Section 806. Environmental Standards.

a. The Contractor/Vendor agrees that its performance under this contract shall comply with: the requirements of Section 114 of the Clean Air Act (42 U.S.C. § 7414) and Section 308 of the Federal Water Pollution Control Act (33 U.S.C. § 1318), that relate generally to inspection, monitoring, entry reports, and information, and with all regulations and guidelines issued thereunder; the Resources Conservation and Recovery Act (RCRA); the Comprehensive Environmental Response,

Compensation and Liabilities Act (CERCLA); the National Environmental Policy Act (NEPA); and any applicable Federal, Contractor/Vendor or Local environmental regulation.

b. The Contractor/Vendor shall insure that no facility used in its performance under this contract is listed on the Environmental Protection Agency (EPA) list of violating facilities pursuant to 40 CFR Part 15 without the concurrence of State. The Contractor/Vendor shall notify State of the receipt of any communication from EPA indicating that a facility to be or being used in its performance under this contract is under consideration for listing on the EPA list of violating facilities.

c. For the purposes of this section, State agrees that the Contractor/Vendor's obligations in Paragraphs a. and b. of this section above shall not apply to any armory, base, training site, or other facility or portion thereof, the operation and maintenance of which is funded under this contract, that is currently listed as a violating facility, on the effective date of this contract, pursuant to 40 CFR Part 15; nor, shall such listing be the basis for State's termination for cause of this contract or for State's disallowance of any cost otherwise allowable under this contract. The Contractor/Vendor and State agree to cooperate to remediate, as expeditiously as possible, for any facility the operation and maintenance of which is within the scope of this contract, the condition giving rise to the listing of any such facility as a violating facility according to applicable statutes, regulations, or other agreements subject to the availability of funds.

Section 807. Preference for U.S. Flag Carriers.

The State agrees to comply with 46 U.S.C. § 1241(b) and regulations issued thereunder (46 CFR Part 381) as follows:

a. To use privately-owned United States flag commercial vessels to ship at least 50 percent of the gross tonnage (computed separately for dry bulk carriers, dry cargo liners, and tankers) of any equipment, materials, or commodities that are both (1) procured, contracted for, or otherwise obtained with funds made available by State under this contract, and (2) transported by ocean vessel, to the extent such vessels are available at fair and reasonable rates;

b. To furnish within 20 working days following the date of loading for shipments originating within the United States or within 30 working days following the date of loading for shipments originating outside the United States, a legible copy of a rated, "on-board" commercial ocean bill-of-lading in English for each shipment of cargo described in paragraph (a) above to both State and to the Division of National Cargo, Office of Market Development, U.S. Maritime Administration, Washington, D.C. 20590; and,

c. Subject to existing contracts, to insert the substance of the provisions of this section in all contracts issued pursuant to this to contract, and to cause such provisions to be inserted in all subcontracts issued pursuant to this contract, where the contract or subcontract is for $100,000 or more and where there is a possibility of ocean transportation of procured equipment or materials.

Section 808. Debarment and Suspension.

a. Contractor/Vendor shall not make any award or permit any award (subgrant or contract) at any tier to any party which is debarred or suspended or is otherwise excluded from or ineligible for participation in Federal assistance programs under Executive Order 12549, "Debarment and Suspension".

b. The Final Rule, Government wide Debarment and Suspension (Nonprocurement), issued by the Office of Management and Budget and the Department of Defense (32 CFR Part 25) to implement the provisions of Executive Order 12549, "Debarment and Suspension" is incorporated by reference and the Contractor/Vendor covenants and agrees to comply with all the provisions thereof, including any amendments to the Final Rule that may hereafter be issued.

Section 809. National Historic Preservation.
(Any construction, acquisition, modernization, or other activity that may impact a historic property.)

The Contractor/Vendor agree to identify to the awarding agency any property listed or eligible for listing on the National Register of Historic Places that will be affected by this award, and to provide any help the awarding agency may need, with respect to this award, to comply with Section 106 of the National Historic Preservation Act of 1966 (16 U.S.C. 470, et seq.), as implemented by the Advisory Council on Historic Preservation regulations at 36 CFR Part 800 and Executive Order 11593 (3 CFR, 1971-1975 Comp., p. 559).

(36 CFR Part 800 requires Grants Officers to get comments from the Advisory Council on Historic Preservation before proceeding with Federally assisted projects that may affect properties listed on or eligible for listing on the National Register of Historic Places.)

Section 810. Hatch Act.

The Contractor/Vendor agrees to comply with the Hatch Act (5 U.S.C. 1501 - 1508 and 7324 - 7328),

as implemented by the Office of Personnel Management
at 5 CFR Part 151, which limits political activity of employees or officers of State or local governments whose employment is connected to an activity financed in whole or part with Federal funds.

Section 811. Equal Employment Opportunity.
(All construction contracts awarded in **excess of $10,000** by grantees and their contractors or subgrantees.)

Compliance with Executive Order 11246 of September 24, 1965 entitled "Equal Employment Opportunity," as amended by Department of Labor regulations (41 CFR Chapter 60).

Section 812. Cargo Preference.
(Any agreement under which international air travel may be supported by U.S. Government funds.)

Travel supported by U.S. Government funds under this agreement shall use U.S.-flag air carriers (air carriers holding certificates under 49 U.S.C. 41102) for international air transportation of people and property to the extent that such service is available, in accordance with the International Air Transportation Fair Competitive Practices Act of 1974 (49 U.S.C. 40118) and the interpretative guidelines issued by the Comptroller General of the United States in the March 31, 1981, amendment to Comptroller General Decision B138942.

Section 813. Buy American Act.

The Contractor/Vendor agrees that it will not expend any funds appropriated by Congress without complying with The Buy American Act (41 U.S.C. 10). The Buy American Act gives preference to domestic end products and domestic construction material. In addition, the Memorandum of Understanding between the United States of America and the European Economic Community on Government Procurement, and the North American Free Trade Agreement (NAFTA), provide that EC and NAFTA end products and construction materials are exempted from application of the Buy American Act.

Section 814. Relocation and Real Property Acquisition.

The Contractor/Vendor agrees that it will comply with the provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (42 U.S.C. § 4601 et seq.) and regulations issued there under (49 CFR Part 24).

Section 815. Copeland "Anti-Kickback" Act.

The Contractor/Vendor agrees that it will comply with the Copeland "Anti-Kickback" Act (18 U.S.C. 874) as supplemented in Department of Labor regulations (29 CFR Part 3). As applied to this agreement, the Copeland "Anti-Kickback" Act makes it unlawful to induce, by force, intimidation, threat or procuring dismissal from employment, or otherwise, any person employed in the construction or repair of public buildings or public works, financed in whole or in part by the United States, to give up any pat of the compensation to which that person is entitled under a contract of employment.

Section 816. Contract Work Hours and Safety Standards Act.

The Contractor/Vendor agrees that it will comply with Sections 103 and 107 of the Contract Work Hours and Safety Standards (40 U.S.C. 327-330) as supplemented by Department of Labor regulations (29 CFR Part 5). As applied to this agreement, the Contract Work Hours and Safety Standards Act specifies that no laborer or mechanic doing any part of the work contemplated by this agreement shall be required or permitted to work more than 40 hours in any workweek unless paid for all additional hours at not less than 1 1/2 times the basic rate of pay. This Act is applicable to any construction contract awarded in excess of $2,000, and in excess of $2,500 for other contracts which involve the employment of mechanics or laborers.

Section 817. DavisBacon Act.

The Contractor/Vendor agrees that it will comply with the DavisBacon Act (40 U.S.C. 276a to a7) as supplemented by U.S. Department of Labor regulations (29 CFR Part 5). All rulings and interpretations of the DavisBacon Acts contained in 29 CFR Part 5 are incorporated by reference in this agreement. As applied to this agreement, the Davis-Bacon Act (40 U.S.C. 276a276a7) provides that contracts in excess of $2,000 to which the Federal Government provides assistance funding for construction, alteration, or repair (including painting and decorating) of public buildings or public works within the United States, shall contain a provision that no laborer or mechanic employed directly upon the site of the work shall receive less than the prevailing wage rates as determined by the U.S. Secretary of Labor.

From the US Department of Labor web site:
http://www.dol.gov/ESA/WHD/contracts/dbra.htm
Davis Bacon and Related Acts Overview
The Davis-Bacon and Related Acts, apply to contractors and subcontractors performing on federally funded or assisted contracts in excess of $2,000 for the construction, alteration, or repair (including painting and decorating) of public buildings or public works. Davis-Bacon Act and Related Act contractors and subcontractors must pay their laborers and mechanics employed under the contract no less than the locally prevailing wages

and fringe benefits for corresponding work on similar projects in the area. The Davis-Bacon Act directs the Department of Labor to determine such locally prevailing wage rates. The Davis-Bacon Act applies to contractors and subcontractors performing work on federal or District of Columbia contracts.

The Davis-Bacon Act prevailing wage provisions apply to the "Related Acts," under which federal agencies assist construction projects through grants, loans, loan guarantees, and insurance.

For prime contracts in excess of $100,000, contractors and subcontractors must also, under the provisions of the Contract Work Hours and Safety Standards Act, as amended, pay laborers and mechanics, including guards and watchmen, at least one and one-half times their regular rate of pay for all hours worked over 40 in a workweek. The overtime provisions of the Fair Labor Standards Act may also apply to DBA-covered contracts

~END OF SECTION 00700a~

APPENDIX 1

Environmental Management System – EMS

EMS Essentials:

EMS is the management system the Connecticut Army National Guard (CTARNG) uses to implement the Adjutant General's Environmental Policy. This policy outlines our commitment to:

- Pollution Prevention
- Compliance with all applicable regulations & standard operating procedures
- Continual improvement in managing environmental issues

Contractor's Role in CTARNG EMS

The Connecticut Army National Guard is committed to ensuring sustainable practices while maintaining mission ready troops.

As a contractor performing work for the CTARNG, please strive to reduce negative impacts to the environment wherever possible. This includes:

- Utilizing "green" products where possible
- minimizing water and energy usage
- employing pollution prevention practices
- recycling

Should you have any questions regarding the CTARNG EMS, please contact the Environmental Office at (860) 548-3204.

01000 WORK COVERED BY CONTRACT DOCUMENTS

A. Project Number 11MIL217-2401 Agency Tracking number **ZZ1101** is entitled Boiler & Hot Water Heater Upgrades. It is to be located in Enfield and Norwalk, Connecticut. It is to be completed and ready for use by the Owner and Agency within the Contract Time specified in Section 00020 Bid Proposal Form.

B. The Project Description:

1. Replacement of Boiler and Hot Water Heater and accessories with high efficiency gas units.

3. This Project **does not Exceed** the Threshold Limits as defined by the Connecticut General Statutes.

C. Project Location: The Connecticut Army National Guard Armory, 1635 King Street, located in Enfield, Connecticut 06082 and The Connecticut Army National Guard Armory, 290 New Canaan Avenue, located in Norwalk, Connecticut 06850.

01001 OWNER AND AGENCY

A. Owner: The Owner and Agency is Military Department, State of Connecticut.

1. The authorized representative for the Owner and Agency, Mr. Ed Fulton Project Manager. The Agency Representative is located 360 Broad Street, Hartford, CT, 06105. Phone: 860-548-3274; Fax: 860-524-4937; E-mail: ed.fulton@us.army.mil.

2. The Representative has the administrative authority for the facility and or site where the work is being performed but does not have the authority to change the contract documents or direct the contractor.

01002 ENGINEER:

A. The Engineering Firm is BVH Integrated Services, Inc. and is located at 50 Griffin Road South, Bloomfield, Connecticut. The Engineer representing the firm for this project is Alan Aldag. Phone: 860 286-9171; Fax: 860 242-0236; E-mail: alanr@bvhis.com.

1. The Engineer or their accredited representative is referred to in the Contract Documents as "Engineer" or "Engineers" or by pronouns which imply them. As information for the Contractor or Engineer's status is defined as follows:

   a. The Engineer will not make interpretations or decisions directly to the Contractor. Where Construction Administrator is mentioned it this document substitute it with Engineer.

   b. The Engineer is responsible for review of shop drawings, materials, and equipment intended for the work, in accordance with the "General Conditions", and the "Supplementary Conditions".

2. Wherever the Engineer is mentioned in the documents in connection with an administrative function, it shall include the Construction Administrator in that function except for shop drawings.

01003 CONSTRUCTION ADMINISTRATOR:

A. The Construction Administrator is Mr. James A. Cavanna, AIA CBO, Construction Specialist, and is located at 360 Broad Street, Hartford 06105. Phone: 860-548-3279; Fax: 860-548-3260; E-mail: james.cavanna@us.army.mil

1. The Construction Administrator is referred to in the Contract Documents as "Construction Administrator" or "Construction Manager" or by pronouns which imply it. All communications concerning the project will be directed through the Construction Administrator or a designated representative(s).
2. As information to the Contractor, the Construction Administrator's status is defined as follows:
    a. The Construction Administrator is the Owner's Agent who will, among other thing's, monitor the General Contractor's performance, scheduling and construction, process shop drawings, material, and equipment submittals, review and process periodic billings, review and recommend cost changes.
    b. The Construction Administrator will process all requests for information, interpretations and decisions regarding the meaning and intent of the Contract Documents, consulting with appropriate parties prior to rendering the interpretations or decisions to the Contractor. All such requests and replies shall be in writing.

01010 SUMMARY OF WORK

A. Summary of Work includes but is not limited to the following:

1 ***Electrical and Mechanical equipment upgrades***

B. The Contractor will include in his bid, all items required in order to carry out the intent of the work as described, shown and implied in the Contract Documents.

C. It shall be the Contractor's responsibility upon discovery to immediately notify the Construction Administrator, in writing, of errors, omissions, discrepancies, and instances of noncompliance with applicable codes and regulations within the documents, and of any work which will not fit or properly function if installed as indicated on the Contract Documents. Any additional costs arising from the Contractor's failure to provide such notification shall be borne by the Contractor.

D. NOTE: Identify type of contract for this project as state in the Bid proposal Form.

E. The Work will be constructed under a single lump.

F. Work Sequence - Phase(s):

1. The Project shall be constructed in **Three** Phases as follows:
    a) Demolition;
    b) Installation of Hot Water Heaters and restoration of hot water to the facility;
    c) Installation of boiler(s) and project completion.

All Phases shall be substantially complete within 8 weeks after receipt of Notice to Proceed.

01011 EXAMINATION OF SITES

A. It is not the intent of the Documents to show all existing conditions. All contractors are advised to visit and examine the site with the Construction Administrator prior to submitting bids.

B. Contractors should investigate and satisfy themselves as to the conditions affecting the work, including but no restricted to those bearing upon transportation, disposal, handling and storage of materials, availability of labor, water, electric power, uncertainties of weather, roads or similar physical conditions of the ground, the character of equipment, and facilities needed preliminary to and during the prosecution of the Work. The Contractor should further satisfy himself as to the character, quality, and quantity of surface and subsurface materials or obstacles to be encountered insofar as this information is reasonably ascertainable from an inspection of the sites, as well as from information presented by the Contract Documents. Any failure by the Contractor to acquaint himself with the available information shall not relieve him from the responsibility for estimating properly the difficulty and cost of successfully performing the Work.

C. Pre-Bid Conference:

1. A Pre-Bid Conference and tour of the site will be conducted as scheduled in the Invitation to Bid. This scheduled conference is the only official opportunity for the bidders to tour the site with the Owner, Engineer, Engineer, Construction Administrator, and Agency.

01012 PROJECT DOCUMENTS

A. The Specifications and Drawings are intended to describe and illustrate the materials and labor necessary for the work of this Project.

B. Throughout the Technical Specifications, the Connecticut Department of Transportation Standard Specifications for Roads, Bridges, and Incidental Construction Form 814A, current addition including any interim and supplemental specifications are referenced. Where so referenced the requirements set forth therein are applicable and made a part hereof Copies of Form 814A are available from the Connecticut Department of Transportation at a nominal charge.

01013 DOCUMENTS FURNISHED

A. The General Contractor will be given **5** sets of the Contract Documents on or about the time of execution of Contract, free of charge. If additional copies are wanted, they will be available at the direct additional cost of their reproduction, to the contractor.

01014 CONTRACTOR'S USE OF PREMISES

A. The Contractor shall confine his operations, including storage of apparatus, equipment and materials to the contract limit lines as directed by the Construction Administrator.

B. The areas and/or spaces, including their access, shall be maintained free and clear throughout the contract term.

C. Parking for Contractor's employees will be limited to an area (or areas) designated by the Construction Administrator. The Contractor may be required to provide identification stickers for employees' cars.

01015 OCCUPANCY REQUIREMENTS

A. Full Agency Occupancy During Construction: The Agency will occupy the site and existing building during the entire construction period. Cooperate with the Agency during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with the Agency's operations.

1. Provide adequate building and fire code egress from the buildings during the renovation process. The Contractor will be responsible to maintain and protect egress ways during the construction sequence per the design as supplied by the Engineer. Contractor shall be responsible for preparing egress plans for Owner approval and for Office of State Building Official and Office of State Fire Marshal for approval if required.

B. Partial Agency Occupancy: The Agency reserves the right to occupy and to place and install equipment in completed areas of the building prior to Substantial Completion, provided such occupancy does not interfere with completion of the Work. Such placing of equipment and partial occupancy shall not constitute acceptance of the total Work.

1. Should it become necessary or advisable, as the work nears final completion, for the Agency to occupy a portion of the building prior to final acceptance, the Contractor shall cooperate in completing such areas and making same accessible.
2. The Construction Administrator will determine whether such occupancy or use is possible and, if so, will make arrangements for holding a job inspection with the Project Manager, Agency Representative, Engineer and General Contractor.
3. A comprehensive list of items to be completed or corrected as issued by the General Contractor, together with the status of completion and terms of occupancy, will be forwarded to the Project Manager and the Engineer by the Construction Administrator. A letter will be issued by the Project Manager and Engineer to Construction Administrator granting such occupancy and will state the terms and conditions of occupancy.
4. Prior to partial Agency occupancy, mechanical and electrical systems shall be fully operational. Required inspections and tests shall have been successfully completed. Upon occupancy, the Agency will operate and maintain mechanical and electrical systems serving occupied portions of the building.
5. The Engineer will prepare a “Certificate of Substantial Completion” for each specific portion of the Work to be occupied prior to Agency occupancy. Use the “Certificate of Substantial Completion” form as required by the Owner.
6. The Project Manager will request a signed “Certificate of Compliance” from the Engineer, and Contractor, if required, or for projects that exceed the Threshold limit:
7. A letter from the Project Manager to the Agency Representative with copy to the General Contractor granting occupancy will state the terms and conditions of occupancy and that fire insurance coverage has been requested, the effective date of which will indicate to the Contractor that he may cancel fire insurance coverage for that portion of the project.
8. Upon occupancy, the Agency will assume responsibility for maintenance and custodial service for occupied portions of the building.
9. Work after Partial Agency Occupancy:
    a. For all work to complete the area occupied, warranty work, the balancing and commissioning of systems, repair of latent defects and adjustments after partial

occupancy, the contractor is responsible for all costs associated with working in occupied buildings.

01019 CONTRACT CONSIDERATIONS

A. Allowances:

1. The Contractor's costs for unloading and handling, labor, installation costs, storage, insurance, overhead and profit and other expense related to the Allowance item shall be included in the Lump Sum Bid Amount and not in the Allowance unless stated otherwise is the Allowance Schedule of this section.
2. Engineer:
    a. Consult with Contractor for consideration of Products, suppliers and installers.
    b. Select Products in consultation with the Project Manager and Agency Representatives and transmit decision to Construction Administrator.
    c. Prepare Change Order.
3. Construction Administrator Responsibilities:
    a. Consult with Engineer, Contractor, Project Manager and Agency Representatives for consideration of Products, suppliers and installers.
    b. Select Products in consultation with Engineer/Engineer, Project Manager and Agency Representatives and transmit decision to Contractor
    c. Prepare Change Order.
4. Contractor Responsibilities:
    a. File applications and obtain **ALL** required permits for the Project.
    b. Assist Engineer and Construction Administrator in selection of Products and Suppliers.
    c. Obtain proposals from Suppliers and offer recommendations.
    d. On notification of selection by Construction Administrator execute purchase agreement with designated supplier.
    e. Arrange for and process shop drawings, product data, and samples. Arrange for delivery.
    f. If the actual cost of an Allowance item is more or less than the given amount, the Contract Sum will be adjusted by Change Order.

01027 APPLICATION FOR PAYMENT

A. **Schedule of Values**: Submit the “Schedule of Values” to the Construction Administrator at the earliest possible date but no later than (21) twenty-one Calendar Days after the Contract Start Date. A separate "Schedule of Values" shall be provided for each Phase of the Project identified in Section 01010 Summary of Work, Work Sequence - Phase(s).

1. Format and Content: Use the Project Manual Table of contents as a guide to establish the format for the “Schedule of Values”. Provide at least one line item for each of the Specification Section on electronic media printout.
2. Identification: Project identification on the Schedule of Values shall include, but not be limited to, the following:

a. Owner

b. Project Number

c. Project Name

d. Project Location

e. ***Contractor's name and address.***

3. Arrange the "Schedule of Values" in tabular format as required by the Owner, containing separate columns including, but not limited to, the following Items:

a. Item Number.

b. Description of Work with Related Specification Section or Division Number.

c. Scheduled Values broken down by description number, type material, units of each material.

d. Name of subcontractor.

e. Name of manufacturer or fabricator.

f. Name of supplier.

g. Retainage.

h. Contract sum in sufficient detail.

4. Percentage of Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.

5. Provide a breakdown of the Contract Sum in sufficient detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents. Break principal subcontract amounts down into several line items.

6. Round amounts to nearest whole dollar; the total shall equal the Contract Sum.

7. Unit-Cost Allowances: Show the line-item value of unit-cost allowances, as a product of the unit cost, multiplied by the measured quantity. Estimate quantities from the best indication in the Contract Documents.

8. General Conditions: Show line items for indirect costs and margins on actual costs only when such items are listed individually in Applications for Payment. Each item in the Schedule of Values and Applications for Payment shall be complete. Include the total cost and proportionate share of general overhead and profit margin for each item.

   a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the Schedule of Values or distributed as general overhead expense, at the Contractor's option.

B. **Applications for Payment - General:** Each Application for Payment shall be consistent with previous applications and payments as certified by the Engineer and Construction Administrator and paid for by the Owner.

1. The initial "Application for Payment", the "Application for Payment", at time of "Substantial Completion", and the final "Application for Payment", involve additional requirements.

2. Payment-Application Terms: The Owner will process monthly progress payments. The Contractor may submit applications for payment on a monthly basis.

3. Payment-Application Forms: Use the "Application for Payment" form as required by the Owner. Present the required information on electronic media printout or approved Owner Form, multiple pages should be used if required.
4. For each item, provide a column including but not limited to the following items:
    a. Item Number.
    b. Description of Work and Related Specification Section or Division.
    c. Scheduled Value, break down by units of material and units of labor.
    d. Work completed from previous application.
    e. Work completed this period.
    f. Materials presently stored.
    g. Total completed and stored to date of application.
    h. Percentage of Completion.
    i. Balance to Finish.
    j. Retainage
5. Application Preparation: Complete every entry on the Application form. At the time of Final Payment only, include an executed Application form by a person authorized to sign legal documents on behalf of the Contractor. The Construction Administrator will return incomplete Applications without action.
    a. Entries shall match data on the "Schedule of Values".
    b. Include amounts of Change Orders issued prior to the last day of the construction period covered by the application.

~~6.~~ Transmittal: Except for final payment, submit to the Construction Administrator by a method ensuring receipt within forty-eight (**48**) hours. One (**1**) complete, signed and notarized original of each Application for Payment, including lien waivers and similar attachments when required, along with six (**6**) copies. For Final Payment, nine (**9**) complete, signed and notarized copies shall be submitted.

a. Transmit each copy with a transmittal form listing attachments and recording appropriate information related to the application, in a manner acceptable to the Engineer.

7. Applications for Payment: Administrative actions and submittals, that must precede or coincide with submittal of the first Application for Payment and all subsequent Application for Payments including, but not limited to, the following items:
    a. List of subcontractors and suppliers' name, FEIN/Social Security numbers, and Connecticut Tax Registration Numbers.
    b. List of principal suppliers and fabricators.
    c. Schedule of Values.
    d. Contractor's Construction Schedule (preliminary if not final).
    e. Schedule of principal products.
    f. Submittal Schedule (preliminary if not final).
    g. List of Contractor's staff assignments.
    h. List of Contractor's principal consultants.

i. Copies of all applicable permits.

j. Copies of authorizations and licenses from governing authorities for performance of the Work.

k. Proof that as-built documents are updated as required by Section 01700 “Contract Closeout”.

l. Initial as-built survey and damage report, if required.

C. **Application for Payment at Substantial Completion**: Following issuance of the Certificate of Substantial Completion submit an Application for Payment form, use the form as required by the Owner. Present the required information on electronic media printout.

1. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
2. Administrative actions and submittals that shall precede or coincide with this application include, but are not limited to, the following:
    a. Occupancy permits and similar approvals.
    b. Warranties (guarantees) and maintenance agreements.
    c. Test/adjust/balance records.
    d. Maintenance instructions.
    e. Meter readings.
    f. Startup performance reports.
    g. Changeover information related to Owner's occupancy, use, operation, and maintenance.
    h. Final cleaning.
    i. Application for reduction of retainage and consent of surety.
    j. Final progress photographs.
    k. List of incomplete Work, recognized as exceptions to Engineer's Certificate of Substantial Completion.

D. **Final Payment Application:** Administrative actions and submittals that must precede or coincide with submittal of the final Application for Payment include, but are not limited, to the following:

1. Completion of Project Closeout requirements.
2. Completion of list of items remaining to be completed as indicated on the attachment to the Certificate of Substantial Completion.
3. Ensure that unsettled claims will be settled.
4. Ensure that incomplete Work is not accepted and will be completed without undue delay.
5. Transmittal of required Project construction records to the Owner (including as-built documents Reference Section 01700 “Contract Closeout”.)
6. Proof that taxes, fees, and similar obligations were paid.
7. Removal of temporary facilities and services.
8. Removal of surplus materials, rubbish, and similar elements.
9. Change of door locks to Owner's access.

10. The requirements of the General Conditions and Supplementary Conditions for Final Acceptance, Final Completion, Final Inspection, and Final Payment.
11. Asbestos, Lead or other hazardous material manifests.
12. Completion of "Building Contractor Reporting Form" as supplied by Department of Public Works, for all Contractors, Subcontractors, Vendors, Suppliers, etc. who work on the Contract. The form includes the following information:
    a. Contractor/Subcontractor name.
    a. FEIN/Social Security Numbers
    b. Connecticut Tax Registration Numbers
    c. Type of work
    d. Name of business and address
    e. Remittance address.

01030 SUPPLEMENTAL BIDS

NOT USED

01035 MODIFICATION PROCEDURES

A. **Summary:** This Section specifies administrative and procedural requirements for handling and processing contract modifications.

B. **Requests for Information:**

1. In the event that the contractor or subcontractor, at any tier, determines that some portion of the drawings, specifications, or other contract documents requires clarification or interpretation by the Engineer, the contractor shall submit a "Request for Information" in writing to the Engineer via Construction Administrator. "Requests for Information" may only be submitted by the contractor and shall only be submitted on the "Request for Information" forms as required by the owner. In the "Request for Information", the contractor shall clearly and concisely set forth the issue for which clarification or interpretation is sought and why a response is needed from the Engineer.
    a. In the "Request for Information", the contractor shall set forth an interpretation or understanding of the requirement along with reasons why such an understanding was reached.
    b. The owner acknowledges that this is a complex project. Based upon the owner's past experience with projects of similar complexity, the owner anticipates that there will probably be some "Requests for Information" on this project.
    c. The Engineer will review all "Requests for Information" to determine whether they are "Requests for Information" within the meaning of this term. If it is determined that the document is not a "Request for Information", it will be returned to the contractor, unreviewed as to content, for resubmittal on the proper form and in the proper manner.
    d. "Requests for Information Response" shall be issued within seven (7) Working Calendar Days of receipt of the request from the contractor unless the owner determines that a longer time is necessary to provide an adequate response. If a longer time is determined necessary by the owner, the owner will, within seven (7)

Working Calendar Days of receipt of the request, notify the contractor of the anticipated response time. If the contractor submits a "Request for Information" on an activity with seven (7) Working Calendar Days or less of float on the current project schedule, the contractor shall not be entitled to any time extension due to the time it takes the Engineer to respond to the request provided that the Engineer responds within the seven (7) Working Calendar Days set forth above.

e. "Requests for Information Response" from Engineer will not change any requirement of the contract documents. In the event the contractor believes that the "Requests for Information Response" will cause a change to the requirements of the contract document, the contractor shall immediately give written notice to the Construction Administrator stating that the contractor believes the "Requests for Information Response" will result in "Change Order" and the Contractor intends to submit a "Change Order Proposal" request. Failure to give such written notice immediately shall waive the contractor's right to seek additional time or cost under the requirement these Requirements.

C. **Minor Changes in the Work**

1. The Engineer, through the Construction Administrator, will issue supplemental instruction authorizing minor changes in the Work, not involving adjustment to the Contract Sum or Contract time, on the "Supplemental Instructions" form as required by the Owner.

D. **Proposal Request:**

1. Engineer/Owner-Initiated Requests For Proposals: The Engineer or Owner will issue a detailed description of proposed changes in the Work via the Construction Administrator that will require adjustment to the Contract Sum or Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications. Such requests shall be on a "Proposal Request" form as required by the owner.
2. "Proposal Request" is issued for information only. Do not consider them as an instruction either to stop work in progress or to execute the proposed change.
3. Within Fourteen (14) Working Calendar Days of receipt of a "Proposal Request", submit a "Change Order Proposal" with the required information necessary to execute the change to the Construction Administrator for the Engineer's/Owner's review.
4. Include a list of quantities of products required and unit costs, with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.
    a. Indicate applicable delivery charges, equipment rental, and amounts of trade discounts.
    b. Include a statement indicating the effect the proposed change in the Work will have on the Contract Time.
    c. The Agency is tax exempt. All Contractor and Subcontractor services provided under your contract with the State of Connecticut may not be exempt from taxes. The Department of Revenue Services can guide you as to which services are exempt and which are not. Please contact the State of Connecticut, Department of Revenue Services at 1-800-382-9463 or 860 541-3280.
    d. Dollar values shown on the Schedule of Values shall not be the governing (or deciding) final amounts for change orders involving either additional charges or deletions.

E. **Change Order Proposal:**

1. When either a "Request for Information" from the Contractor or a "Proposal Request" from the Engineer or Owner results in conditions that may require modifications to the Contract, the Contractor may propose changes by submitting a request for a "Change Order Proposal" to the Engineer via the Construction Administrator on forms as required by the Owner. These forms shall also include "Change Order Proposal Worksheets" as required by the Owner.
    a. Include statements outlining the reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and Contract Time.
    b. Include a list of quantities of products required and unit costs, with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities as directed by Article 13 "Compensation for Changes in the Work" of the General Conditions of the Contract for Construction.
    c. Indicate applicable delivery charges, equipment rental, and amounts of trade discounts.
    d. Comply with requirements in Section 01631 "Equals and Substitutions" if the proposed change requires an equal or substitution of one product or system for a product or system specified.
2. The State of Connecticut construction contract has the following tax exemptions:
    a. Purchasing of materials which will be physically incorporated and become a permanent part of the project.
    b. Tools, supplies and equipment used in fulfilling the construction contract are not exempt.
    c. Services that are resold by the contractor are exempt, i.e. if a General Contractor hires a plumber, carpenter or electrician, a resale certificate may be issued to the subcontractor because these services are considered to be integral and inseparable component parts of the building contract
3. "Change Order Request" Forms: Use "Change Order Proposal" and "Change Order Proposal Worksheets" forms as required by Owner.
4. "Change Order Proposal" cannot be submitted without the Contractor either prior submission of a "Request for Information" from the Contractor or as a response to a "Proposal Request" submitted by the Engineer or Owner.
5. Any "Change Order Request " submitted without a prior submittal of a "Request for Information" or as a response to a "Proposal Request" will be immediately rejected and returned to the Contractor.

F. **Construction Change Directive:**

1. "Construction Change Directive": When the Owner and the Contractor disagree on the terms of a "Change Order Proposal" resulting from either a "Request for Information" or "Proposal Request", then the Engineer through the Construction Administrator may issue a "Construction Change Directive" on a "Construction Change Directive" as authorized by the Owner on the form required by the Owner. The "Construction Change Directive" instructs the Contractor to proceed with a change in the Work, for subsequent inclusion in a "Change Order".

a. The "Construction Change Directive" contains a complete description of the change in the Work. It also designates the method to be followed to determine change in the Contract Sum or Contract Time.

2. Documentation: The Contractor shall maintain detailed records on a time and material basis of work required by the "Construction Change Directive".

a. After completion of the change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

b. The final value shall be negotiated based on the supporting data to determine the value of the work.

G. **Change Order Procedures:**

1. Upon the Owner's approval of a Contractor's "Change Order Proposal", the Construction Administrator will issue a "Change Order" for signatures of the Engineer, Owner and the Contractor on "Change Order" form as required by the Owner.

01040 COORDINATION

A. Construction Administrator:

1. The Construction Administrator is identified in Division 1 Section 01003 "Construction Administrator".

2. Construction Mobilization:

a. Cooperate with the Construction Administrator in the allocation of mobilization areas of the site, for field offices and sheds, for agency facility access, traffic, and parking facilities.

b. During Construction, coordinate use of site and facilities through the Construction Administrator.

c. Comply with Construction Administrators procedures for intra-project communications; submittals, reports and records, schedules, coordination drawings, and recommendations; and resolution of ambiguities and conflicts.

d. Comply with instructions of the Construction Administrator for use of temporary utilities and construction facilities.

e. Coordinate field engineering layout as specified in Section 01050 "Field Engineering" for work under the instructions of the Construction Administrator.

B. Coordinate construction operations included in various Sections of these Specifications to assure efficient and orderly installation of each part of the Work. Coordinate construction operations included under different Sections that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in the sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.

2. Coordinate installation of different components to assure maximum accessibility for required maintenance, service, and repair.

3. Make provisions to accommodate items scheduled for later installation.

C. Where necessary, prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and attendance at meetings.

1. Prepare similar memoranda for the Construction Administrator, Owner and separate contractors where coordination of their work is required.

D. **Administrative Procedures**: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and assure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of schedules.
2. Installation and removal of temporary facilities.
3. Delivery and processing of submittals.
4. Progress meetings.
5. Project closeout activities.

E. General Coordination Provisions:

1. Inspection of Conditions: Require the Installer of each major component to inspect both the substrate and conditions under which Work is to be performed and coordinate such inspections with the Construction Administrator and authorities having jurisdictions. If unsatisfactory conditions exist notify the Construction Administrator immediately. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.
2. The Contractor shall coordinate temporary enclosures with required inspections and tests to minimize the necessity of uncovering completed construction for that purpose.
3. Coordination Drawings: NOT USED
4. The Construction Administrator will meet with the Contractor on all major items of coordination.
5. See also General Conditions Article 7 “Cooperation of Trades”.

01045 CUTTING AND PATCHING

A. Openings and chases may not be shown on the Drawings. It is the responsibility of the Contractor to examine the Electrical, Heating, Cooling, Ventilating and Plumbing Drawings and to provide chases, channels or openings where needed.

B. The Contractor shall install sleeves, inserts and hangers furnished by the trades needing same.

C. After installing work into openings, channels and/or chases, the Contractor shall close same. If finishes are to be restored, the new work shall match the original and shall be done by the trade customarily responsible for the particular kind of work.

D. Permission shall be obtained from the Construction Administrator before cutting beams, arches, lintels or other structural members.

E. Requirements for Structural Work: Do not cut and patch structural elements in a manner that would change their load-carrying capacity or load-deflection ratio.

1. Obtain approval from the Engineer of the cutting and patching proposal before cutting and patching the following structural elements:

a. Structural decking.

b. Equipment supports.

c. Piping, ductwork, vessels, and equipment.

F. Do cutting and patching to integrate all elements of the work. Provide penetrations of existing surfaces. Provide samples for testing. Seal penetrations through floors, walls, ceilings and roofs, as applicable; restore or preserve fire-rated and smoke-barrier construction. All penetrations shall be coordinated with the manufacturer and/or warranty holder in accordance with appropriate specifications. Construction and finishes shall match original work.

G. The Contractor shall verify dimensions for built-in work and/or work adjoining that of other trades before ordering any material or doing any work. Discrepancies shall be submitted to the Construction Administrator before proceeding with the work.

H. Existing Warranties: Replace, patch, and repair material and surfaces cut or damaged by methods and with materials in such a manner as not to void any warranties required or existing.

I. See also General Conditions Article 23 “Cutting, Fitting, Patching and Digging”.

01050 FIELD ENGINEERING

NOT USED

01095 REFERENCE STANDARDS & DEFINITIONS

A. For products specified by association or trade standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. References to standard specifications and codes refer to the editions current at the bid due date. An exception is, buildings exceeding the threshold limit must be in substantial compliance with the requirements of the effective code at the time of receipt of completed application to the Office of State Building Inspector (OSBI). References include their addenda and errata, if any, and shall be considered a part of these specifications as if they were printed herein in full.

C. The manufacturers' standard warranties or guarantees shall apply when their products are used on this project.

D. Flame Spread Ratings - all materials that are required of obligated to meet specified standards shall be submitted to the owner for their records as part of the shop drawing submittal process for their construction records.

01120 RENOVATION/DEMOLITION PROJECT PROCEDURES

A. Products For Patching And Extending Work:

1. New materials: As specified in product sections; match existing Products and Work .for patching and extending Work.
2. Type and Quality of Existing Products: Determine by inspecting and testing Products where necessary, referring to existing Work as a standard.

B. Inspection- General:

1. Verify that demolition is complete and areas are ready for installation of new Work.
2. Beginning of restoration Work means acceptance of existing conditions.

C. Project Procedures for Work Involving Lead Containing Material (LBP):

1. Exposure levels for lead in the construction industry are regulated by 29 CFR 1926.62. Construction activities disturbing surfaces containing lead-based paint (LBP) which are likely to be employed, such as sanding, grinding, welding, cutting and burning, have been known to expose workers to levels of lead in excess of the Permissible Exposure Limit (PEL). Conduct demolition and removal Work specified in the technical sections of this specification in conformance with these regulations. In addition, construction debris/waste may be classified as hazardous waste. Disposal of hazardous waste material shall be in accordance with 40 CFR Parts 260 through 271 and Connecticut Hazardous Waste Management Regulations Section 22a-209-1; 22a-209-8(c); 22a-449(c)-11; and 22a-449(c)-100 through 110.
2. The Contractor's Work shall be based on a child under the age of six (6) in residence; the Work shall also be in accordance with Connecticut Regulations Section 19a-111-1 through 11.
3. This facility was constructed prior to 1978 and is likely to have painted surfaces containing lead-based paint.
4. Testing for lead-based paint has been conducted at the facility scheduled for renovation, demolition, reconstruction, alteration, remodeling, or repair. Results of the LBP testing are for information purposes only. The testing results are in a separate Volume of this Project Manual. Under no circumstance shall this information be the sole means used by the Contractor for determining the extent of LBP. The Contractor shall be responsible for verification of all field conditions affecting performance of the Work.

D. Project Procedures for Work Involving Asbestos Containing Material (ACM):

1. The Contractor is responsible for abating all ACM that is within the boilers, and is identified in Asbestos Inspection Reports, within the mechanical rooms. This is to be accomplished as part of the project. In demolition portion, every attempt should be made by the Contractor to remove all ACM.
2. If the Contractor should encounter any material suspect or known to contain ACM, he should immediately notify the Construction Administrator of same. It is the Contractor's responsibility to have the material tested and abated (if necessary).
3. Testing for asbestos has been conducted at the facility scheduled for renovation, demolition, reconstruction, alteration, remodeling, or repair. The asbestos testing results are for information purposes only are included in this Project Manual. Under no circumstance shall this information be the sole means used by the Contractor for determining the extent of asbestos. The Contractor shall be responsible for verification of all field conditions affecting performance of the Work.
4. See also General Conditions Article 23 "Cutting, Fitting, Patching and Digging".

E. **Project Procedures for Work Involving Products Containing Persistent Bioaccumulative Toxic Chemicals" (PBT's) such as Polychlorinated Biphenols (PCB's), Di-2-ethylhexyl Phthalate (DEHP), and Mercury:**

1. The Contractor is responsible for abating all PCB's, DEHP, and mercury prior to the start any work involving construction, renovation or demolition (if necessary).
2. Exposure Levels for Products Containing Persistent Bioaccumulative Toxic Chemicals (PBT's) such as PCB's. DEHP, and mercury in the construction industry is regulated by 29CFR1910.1200 and 29CFR1926.28 et. al. Construction, renovation or demolition activities disturbing Products Containing Persistent Bioaccumulative Toxic Chemicals"

(PBT's) such as PCB's and DEHP which are likely to be employed. These materials include but are not limited to fluorescent light fixture & exit sign, ballast's, high density discharge (HID) lamps , and certain types of construction products containing vinyl, and mercury containing electrical switches and thermostats. These activities may expose workers in excess of the respective Permissible Exposure Limit (PEL). Conduct demolition and removal Work specified in the technical sections of these specifications in conformance with these regulations. In addition construction debris/waste may be classified as hazardous waste. Disposal of all hazardous materials shall be in accordance with but not limited to 40CRF Parts 761 Subpart K, 761, and 761.65 and the Connecticut General Hazardous Waste Statute Sec. 22a-454.

3. A Survey for Products Containing Persistent Bioaccumulative Toxic Chemicals (PBT's) such as PCB's, DEHP and Mercury has NOT been conducted at the facility. Examples include but are not limited to fluorescent light fixture & exit sign, ballast's, high density discharge(HID) lamps , and certain types of construction products containing vinyl, and mercury containing electrical switches and thermostats. It is the Contractors responsibility for verification of all material and field conditions prior to construction, renovation, and demolition that may affect the performance of their Work.

F. Preparation:

1. Cut, move, or remove items as are necessary for access to alterations and renovation Work. Replace and restore at completion.
2. Remove unsuitable material not marked for salvage, such as rotted wood, corroded metals, and deteriorated masonry and concrete. Replace materials as specified for finished Work.
3. Remove debris and abandoned items from area and from concealed spaces.
4. Prepare surface and remove surface finishes to provide for proper installation of new Work and finishes.
5. Close openings in exterior surfaces to protect existing Work and salvage items from weather and extremes of temperature and humidity. Insulate ductwork and piping to prevent condensation in exposed areas.

G. Installation:

1. Coordinate Work of alterations and renovations to expedite completion and if required sequence Work to accommodate Owner occupancy.
2. Remove, cut and patch Work in a manner to minimize damage and to provide restoring Products and finishes to original and or specified condition in accordance with Section 01045 "Cutting and Patching".
3. Refinish visible existing surfaces to remain in renovated rooms and spaces, to specified condition for each material, with neat transition to adjacent finishes in accordance with Section 01045 "Cutting and Patching".
4. In addition to specified replacement of ***equipment*** and ***fixtures***, restore existing ***plumbing, heating, ventilation, air conditioning, electrical***, systems to full operational condition.
5. Recover and refinish Work that exposes mechanical and electrical Work exposed accidentally during the Work.
6. Install Products as specified in individual sections.

H. Transitions:

1. Where new Work abuts or aligns with existing, perform a smooth and even transition. Patch work to match existing adjacent Work in texture and appearance.
2. When finished surfaces are cut so that a smooth transition with new Work is not possible, terminate existing surface along a straight line at a natural line of division and make recommendation to Engineer.

I. Adjustments:

1. Where removal of partitions or walls result in adjacent spaces becoming one, rework floors, walls, and ceilings to a smooth plane without breaks, steps, or bulkheads.
2. Where a change of plane of ¼ inch in **12 inches** or more occurs, request recommendation from Engineer for providing a smooth transition.
3. Trim existing doors as necessary to clear new floor finish. Refinish trim as required.
4. Fit Work at penetrations of surfaces as specified in Section 01045 "Cutting and Patching".

J. Repair of Damaged Surfaces:

1. Patch or replace portions of existing surfaces that are damaged, lifted, discolored, or showing imperfections.
2. Repair substrate prior to patching finish.

K. Finishes:

1. Finish surfaces as specified in individual Product sections.
2. Finish patches to produce uniform finish and texture over entire area. When finish cannot be matched, refinish entire surface to nearest intersections.

L. Cleaning:

1. In addition cleaning specified in Section 01700 "Project Closeout", clean Agency occupied areas of Work

01121 SALVAGEABLE MATERIALS

NOT USED

01200 PROJECT MEETINGS

A. Pre-construction Conference:

1. The Contractor will attend a Pre-construction Conference before starting construction, as scheduled by the Construction Administrator convenient to the Owner, the Construction Administrator, Engineer, and Contractor. This meeting will take place within fourteen (14) Calendar Days after the written Notice to Proceed and before the Contract Start Date. Hold the conference at the Project Site or another convenient location as directed by the Construction Administrator. The Construction Administrator shall conduct the Pre-construction Conference to review the Contractor and Subcontractor responsibilities and personnel assignments.
2. Attendees: Authorized representatives of the Construction Administrator, Owner, Engineer, and their consultants; the Contractor and its superintendent; major subcontractors; agency; and other concerned parties shall attend the conference. All

participants at the conference shall be familiar with the Project and authorized to conclude matters relating to the Work.

3. Agenda: Discuss items of significance that could affect progress, including the following:
    - ***a. Tentative construction schedule.***
    - ***b. Critical work sequencing.***
    - ***c. Progress meeting schedule.***
    - ***d. Designation of responsible personnel.***
    - ***e. Procedures for processing field decisions and Change Orders.***
    - ***f. Procedures for processing Applications for Payment.***
    - ***g. Distribution of Contract Documents.***
    - ***h. Submittal of Shop Drawings, Product Data, and Samples.***
    - ***i. Preparation of record documents.***
    - ***j. Use of the premises.***
    - ***k. Parking availability.***
    - ***l. Office, work, and storage areas.***
    - ***m. Equipment deliveries and priorities.***
    - ***n. Safety procedures.***
    - ***o. First aid.***
    - ***p. Security.***
    - ***q. Housekeeping.***
    - ***r. Working hours.***
    - s. ***Coordination with Audio-Visual and Telecommunications.***

B. Progress Meetings:

1. The Construction Administrator will conduct progress meetings, bi-weekly, at the Project Site or at regular intervals as agreed upon at the Pre-construction Conference. The Construction Administrator will notify the Owner, the Engineer, and the Contractor of the scheduled Progress Meeting dates. Coordinate dates of Progress Meetings with preparation of Application for Payment requests.
2. Attendees: In addition to representatives of the Contractor, Construction Administrator, Owner and the Engineer, subcontractor, supplier, or other entity concerned with current progress or involved in planning, coordination, or performance of future activities may be requested to attend these meetings on an as needed basis. All participants at the meeting shall be familiar with the Project and authorized to conclude matters relating to the Work. The Contractor shall include the site superintendent as a minimum.
3. Agenda: Progress Meetings shall review and correct or approve minutes of the previous Progress Meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to the status of the Project.
    a. Construction Schedule: Review progress since the last Progress Meeting. Determine where each activity is in relation to the required Contractor's "Construction Schedule" and whether each activity is on time or ahead or behind

Schedule. Determine how Work that is behind Schedule will be expedited; secure commitments from parties involved to do so. Discuss whether Schedule revisions are required to insure that current and subsequent activities will be completed within the Contract Time.

b. Review the present and future needs of each entity present

4. Reporting: The Construction Administrator will distribute minutes of the meeting to each party present, promptly and before the next scheduled meeting, and to parties who should have been present.
5. A schedule of regular Project Meetings will be established at the Pre-construction Conference.

01300 SUBMITTALS

A. **SUMMARY**

1. This Section includes administrative and procedural requirements for submittals required for performance of the Work, including but not limited to the following:
   a. Submittal Procedures.
   b. Submittal schedule.
   c. Daily Construction reports.
   d. Shop Drawings.
   e. Shop Drawings for Fire Protection Systems.
   f. Product Data.
   g. Samples.
   h. Quality assurance submittals.
   i. Engineers Action.
   j. Submittals shall comply with all requirements in Division 1 Section 01631 “Equals and Substitutions”.
   k. Submittals shall comply with all requirements in Division 1 Section 01740 “Warrantees and Bonds”.
   l. Submittals shall comply with all requirements in Division 1 Section 01040 “Coordination”.
   m. Submittals shall comply with all requirements in Division 1 Section 01730 “Operation & Maintenance Manuals”.

B. **Administrative Submittals**: Refer to other Division 1 Sections and other Contract Documents for requirements for administrative submittals. Such submittals include, but are not limited to, the following:

1. Permits.
2. Applications for Payment.
3. Performance and payment bonds.
4. Contractor’s construction schedule.
5. Daily construction reports.
6. Construction Photographs.

7. Insurance certificates.
8. List of subcontractors.
9. Subcontractors***/Suppliers FEIN #'s and Connecticut tax registration #.***

C. **Related Sections**: The following Sections contain requirements that relate to this Section:

1. Division 1 Section 01027 "Application for Payment" specifies requirements for submittal of the Schedule of Values.
2. Division 1 Section 01040 "Coordination" specifies requirements governing preparation and submittal of required Coordination Drawings.
3. Division 1 Section 01200 "Project Meetings" specifies requirements for submittal and distribution of meeting and conference minutes.
4. Division 1 Section 01310 "Construction Schedules".
5. Division 1 Section 01380 "Construction Photographs" specifies requirements for submittal of periodic construction photographs.
6. Division 1 Section 01400 "Quality Control" specifies requirements for submittal of inspection and test reports.
7. Division 1 Section 01631 "Equals and Substitutions" specifies requirements for submittal of requests to use products other than those specified.
8. Division 1 Section 01700 "Contract Closeout" specifies requirements for submittal of Project Record Documents and warranties at project closeout.
9. Division 1 Section 01740 "Warranties and Bonds".

D. DEFINITIONS

1. Coordination Drawings show the relationship and integration of different construction elements that require careful coordination during fabrication or installation to fit in the space provided or to function as intended and as identified in the Specification Division 2 through 16.
2. Preparation of Coordination Drawings is specified in Division 1 Section "Coordination" and may include components previously shown in detail on Shop Drawings or Product Data.
3. Field samples are full-size physical examples erected on-site to illustrate finishes, coatings, or finish materials. Field samples are used to establish the standard by which the Work will be judged.
4. Mockups are full-size assemblies for review of construction, coordination, testing, or operation; they are not Samples.

E. SUBMITTAL PROCEDURES

1. Coordination: Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.
2. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
3. Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review submittals concurrently for coordination.

a. The Engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until all related submittals are received.

b. The Engineer reserves the right to reject incomplete submitted packages.

4. Processing: To avoid the need to delay installation as a result of the time required to process submittals, allow sufficient time for submittal review, including time for resubmittals.

a. Allow (2) two weeks for initial review. Allow additional time if the Engineer must delay processing to permit coordination with subsequent submittals.

b. If an intermediate submittal is necessary, process the same as the initial submittal.

c. Allow (2) two weeks for reprocessing each submittal.

d. No extension of Contract Time will be authorized because of failure to transmit submittals to the Engineer sufficiently in advance of the Work to permit processing.

F. **Submittal Preparation:** Place a permanent label, title block or 8-1/2 inches x 11 inches cover page approved by the Engineer, on each submittal for identification. Indicate the name of the entity that prepared each submittal on the label or title block.

1. The minimum number of copies required for each submittal shall be at a minimum 7 copies or as determine otherwise at the pre-construction conference or by the Construction Administrator.

2. Provide a space approximately 4 inches by 5 inches on the label, beside the title block or on the cover page on Shop Drawings to record the Contractor's review and approval markings and the action taken.

3. Include the following information on the label for processing and recording action taken.

a. Project Name and State of Connecticut Project Number.

b. Date.

c. Name and address of the Engineer, Construction Administrator, and Owner Representative.

d. Name and address of the Contractor.

e. Name and address of the subcontractor.

f. Name and address of the supplier.

g. Name of the manufacturer.

h. Number and title of appropriate Specification Section.

i. Drawing number and detail references, as appropriate.

j. Indicate either initial or resubmittal.

k. Indicate deviations from Contract Documents.

l. Indicate if "equal" or "substitution".

G. **Submittal Transmittal:** Package each submittal appropriately for transmittal and handling. Transmit each submittal from the Contractor to the Engineer using a transmittal form. Copy the Construction Administrator on the transmittal. The Engineer will return all submittals to the Contractor after action is taken with a complete copy of the submittal package and one complete copy of the submittal package. The Engineer will not accept submittals received from sources other than the Contractor.

1. On the transmittal, record relevant information and requests for data. On the form, or separate sheet, record deviations from Contract Document requirements, including variations and limitations. Include Contractor's certification that information complies with Contract Document requirements.

H. Submittal Schedule:

1. After development and review by the Owner and Engineer acceptance of the Contractor's Construction or CPM schedule prepare a complete schedule of submittals. Submit the schedule to the Construction Administrator within 30 days of Contract Award.
2. Coordinate Submittal Schedule with the list of subcontracts, Schedule of Values, and the list of products as well as the contractor's Construction or CPM Schedule.
3. Prepare the schedule in chronological order. Provide the following information:
   a. Schedule date for the initial submittal.
   b. Related section number.
   c. Submittal category (Shop Drawings, Product Data, or Samples).
   d. Name of Subcontractor.
   e. Description of the part of Work covered.
   f. Scheduled date for resubmittal.
   g. Scheduled date for the Engineer's final release of approval.

I. **Distribution:** Following response to the initial submittal, print and distribute copies to the Construction Administrator, Engineer, Owner, subcontractors, and other parties required to comply with submittal dates indicated. Post copies in the Project meeting room and field office.

1. When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in construction activities.

J. Schedule Updating: Revise the schedule after each meeting or activity where revisions have been recognized or made. Issue the updated schedule concurrently with the report of each meeting.

K. DAILY CONSTRUCTION REPORTS

1. Prepare a daily construction report recording the following information concerning events at the site, and submit duplicate copies to the Construction Administrator at weekly intervals:
   a. List of subcontractors at the site.
   b. Approximate count of personnel at the site.
   c. High and low temperatures, general weather conditions.
   d. Accidents and unusual events.
   e. Meetings and significant decisions.
   f. Stoppages, delays, shortages, and losses.
   g. Meter readings and similar recordings.
   h. List of equipment on site and identify if idle or in use.
   i. Orders and requests of governing authorities.

j. Change Orders received, start and end dates.

k. Services connected, disconnected.

l. Equipment or system tests and startups.

m. Partial Completion's, occupancies.

n. ***Substantial Completion's authorized.***

o. ***Equals or Substitutions approved or rejected.***

L. SHOP DRAWINGS

1. Submit newly prepared information drawn accurately to scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project is not a Shop Drawing.
2. Shop Drawings include fabrication and installation Drawings, setting diagrams, schedules, patterns, templates and similar Drawings. Include the following information:
   a. Dimensions.
   b. Identification of products and materials included by sheet and detail number.
   c. Compliance with specified standards.
   d. Notation of coordination requirements.
   e. Notation of dimensions established by field measurement.
   f. Sheet Size: Except for templates, patterns and similar full-size Drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 36 by 48 inches.
   g. Submit one (1) reproducible media and seven (7) prints as directed by the Construction Administrator. The Contractor's submittal shall identify the specification section and/or drawing number applicable to the submittal.
   h. Details shall be large scale and/or full size.
3. The Contractor shall review the Shop Drawings, stamp with this approval, and submit them with reasonable promptness and in orderly sequence so as to cause no delay in his Work or in the Work of any subcontractor. Shop Drawings shall be properly identified as specified for item, material, workmanship, and project number. At the submission, the Contractor shall inform the Engineer, in writing of any deviation in the shop drawings from the requirements of the Contract Documents.
4. The Engineer will review and comment on shop drawings with reasonable promptness so as to cause no delay, but only for conformance with the design concept of the project and with the information given in the Contract Documents. Refer to Article 5 of General Conditions. Shop Drawings received by the Engineer that indicate insufficient study of drawings and specifications, illegible portions or gross errors, will be rejected outright. Such rejections shall not constitute an acceptable reason for granting the Contractor additional time to perform the work.
5. The Contractor shall make any corrections required by the Engineer and shall resubmit the required number of corrected copies of shop drawings until fully reviewed.

6. Upon final review submit four (4) additional prints, same as submitted, to the Construction Administrator for his use.
7. The Engineer's review and comments on shop drawings shall not relieve the Contractor of responsibility for any deviation from the requirements of the Contract Documents.
8. Only final reviewed shop drawings are to be used on the project site.
9. The Work installed shall be reviewed in accordance with the shop drawings and the drawings and specifications. Final Review of the shop drawings by the Engineer shall constitute acceptance by the State and the Engineer of a variation or departure that is clearly identified. Final reviewed shop drawings shall not replace or be used as a vehicle to issue or incorporate change orders.

M. PRODUCT DATA

1. Collect Product Data into a single submittal for each element of construction or system. Product Data includes printed information, schedules, such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams, and performance curves.
2. Mark each copy to show applicable choices and options. Where printed Product Data includes information on several products that are not required, mark copies to indicate the applicable information. Include the following information:
   - ***a. Manufacturer's printed recommendations.***
   - ***b. Compliance with trade association standards.***
   - ***c. Compliance with recognized testing agency standards.***
   - ***d. Application of testing agency labels and seals.***
   - ***e. Notation of dimensions verified by field measurement.***
   - ***f. Notation of coordination requirements.***
3. Do not submit Product Data until compliance with requirements of the Contract Documents has been confirmed.
4. Preliminary Submittal: Submit a preliminary single copy of Product Data where selection of options is required.
5. Submittals: Submit 7 copies of each required submittal; submit 5 copies where required for maintenance manuals. The Engineer will retain one and will return the other marked with action taken and corrections or modifications required.
   a. Unless noncompliance with Contract Document provisions is observed, the submittal may serve as the final submittal.
6. Distribution: Furnish copies of final submittal to installers, subcontractors, suppliers, manufacturers, fabricators, and others required for performance of construction activities. Show distribution on transmittal forms.
   a. Do not proceed with installation until a copy of Product Data is in the Installer's possession.
   b. Do not permit use of unmarked copies of Product Data in connection with construction.

N. QUALITY ASSURANCE SUBMITTALS

1. Submit quality-control submittals, including design data, certifications, manufacturer's instructions, manufacturer's field reports, and other quality-control submittals as required under other Sections of the Specifications.
2. Certifications: Where other Sections of the Specifications require certification that a product, material, or installation complies with specified requirements, submit a notarized certification from the manufacturer certifying compliance with specified requirements.
   a. Signature: Certification shall be signed by an officer of the manufacturer or other individual authorized to sign documents on behalf of the company.
3. Inspection and Test Reports: Requirements for submittal of inspection and test reports from independent testing agencies are specified in Division 1 Section "Quality Control."

O. ENGINEER'S ACTION

1. Except for submittals for the record or information, where action and return is required, the Engineer will review each submittal, mark to indicate action taken, and return promptly.
   a. Compliance with specified characteristics is the Contractor's responsibility.

2. Action Stamp: The Engineer will stamp each submittal with a uniform, action stamp. The Engineer will mark the stamp appropriately to indicate the action taken, as follows:
   a. Final Unrestricted Release: When the Engineer marks a submittal "Approved for fabrication," the Work covered by the submittal may proceed provided it complies with requirements of the Contract Documents. Final payment depends on that compliance.
   b. Final-But-Restricted Release: When the Engineer marks a submittal "Incorporate Notations," the Work covered by the submittal may proceed provided it complies with notations or corrections on the submittal and requirements of the Contract Documents. Submit corrected copies for record. Final payment depends on that compliance.
   c. Returned for Resubmittal: When the Engineer marks a submittal "Rejected, or Revise and Resubmit," do not proceed with Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal according to the notations; resubmit without delay. Repeat if necessary to obtain different action mark.
      1) Do not use, or allow others to use, submittals marked "Rejected, or Revise and Resubmit" at the Project Site or elsewhere where Work is in progress.
      2) Other Action: Where a submittal is for information or record purposes or special processing or other activity, the Engineer will return the submittal marked "Action Not Required."
   d. Unsolicited Submittals: The Engineer will discard unsolicited submittals without action.

01310 CONSTRUCTION SCHEDULE

A. **Definitions**:

1. Construction Schedule: A method of planning and scheduling a construction project utilizing a horizontal bar chart with a separate bar for each major portion of the Work

or operation to make the schedule an effective tool for planning and monitoring the progress of the work.

B. Quality Assurance: The Contractor's Consultant: Retain a consultant to provide planning, evaluating, and reporting by CPM scheduling.

1. In-house Option: The Owner may waive the requirement to retain a consultant if the Contractor can demonstrate that:
    a. The Contractor has the computer equipment required to produce construction schedules.
    b. The Contractor employs skilled personnel with experience in construction scheduling and reporting techniques.
2. **Program**: Use **"Microsoft Project**", latest version.
3. Standards: Comply with procedures contained in AGC's "Construction Planning & Scheduling."

C. Construction Schedule Format:

1. Format: Utilize a horizontal bar chart (gantt) with a separate bar for each major portion of the Work or operation, identifying first work day of each week.
2. Program: Use **Microsoft Project**, latest version.
3. Sequence of Listings: Utilize the Table of Contents of this Project Manual and the chronological order of the start of each item of work.
4. Scale and Spacing: Provide space for notations and revisions.
5. Sheet Size: To be coordinated with Construction Administrator.

D. Content:

1. Show complete sequence of construction by activity, with dates beginning and completion of each element of construction.
2. Identify each item by specification section number.
3. Identify work of separate phases other and other logically grouped activities.
4. Show accumulated percentages of completion of each item, and total percentage of Work completed, as of the first day of each month.
5. Provide separate schedule of submittal dates for shop drawings, product data, and samples, Owner/Agency furnished products and any products identified as under Allowances, and dates reviewed submittals will be required from Engineer/Engineer. Indicate decision dates for selection of finishes.
6. Indicate delivery dates for Owner/Agency furnished products and any products identified as under Allowances.
7. Coordinate content with Schedule of Values specified in Section 01027 "Application for Payment".
8. Indicate critical path with original baseline indicated.

E. Submittals And Revisions To Schedules:

1. Indicate progress of each activity to date of submittal, and projected completion date of each activity.
2. Identify activities modified since previous submittal, major changes in scope, and other identifiable changes.

3. Provide narrative report to define problem areas, anticipated delays, and impact on Schedule. Report corrective action taken, or proposed, and its effect.
4. An initial bar graph (gantt) schedule is to be prepared by the General Contractor and submitted to the Construction Administrator within seven (7) Working calendar days of award of contract. This schedule is to cover all items of work from the start of the project up to the completion of the project. After review, resubmit required revised data within five (5) Working calendar days. This schedule must be revised monthly and when the actual schedule of significant items varies more than seven (7) Calendar days from the proposed schedule. The critical path with baseline must be indicated.
5. Submit revised Construction Schedules each Application for Payment.
6. Submit four (4) copies of the Construction Schedule to the Construction Administrator.

F. Distribution:

1. Distribute copies of the Construction Schedules to Construction Administrator, Engineer, Owner, Subcontractors, suppliers, and other concerned parties.
2. Instruct recipients to promptly report, in writing, problem anticipated by projections indicated in schedules.

01380 CONSTRUCTION PHOTOGRAPHS

Not Used

01400 QUALITY CONTROL

A. Contractor Responsibilities: Unless otherwise indicated as the responsibility of another identified entity, the Owner, through the Construction Administrator, shall provide Fire Alarm Acceptance testing, inspections, tests, and other quality-control services specified elsewhere in the Contract Documents and required by authorities having jurisdiction. All tests required by the individual specification sections are required to be scheduled and notification given to the Construction Administrator twenty-four (24), forty-eight (48) hours in advance to the test/inspection as applicable. Costs for these services are not included in the Contract Sum.

1. Where individual Sections specifically indicate that certain inspections, tests, and other quality-control services are the Contractor's responsibility, the Contractor shall employ and pay a qualified independent testing agency to perform quality-control services. Costs for these services are included in the Contract Sum.
2. Where individual Sections specifically indicate that certain inspections, tests, and other quality-control services are the Owner's responsibility, the Owner will employ and pay a qualified independent testing agency to perform those services.
    a. Such services include Special Inspections as required by the latest adoption of the “Connecticut State building Code”.
    b. Where the Owner has engaged a testing agency for testing and inspecting part of the Work, and the Contractor is also required to engage an entity for the same or related element, the Contractor shall not employ the entity engaged by the Owner. The Owner will engage the services of a qualified Special Inspector for this project. The Special Inspector, as a representative of the Owner, shall

document and confirm compliance with the provisions of the Connecticut State Building Code for Special Inspections.

c. Materials and assemblers for this project will be tested and construction operations inspected as the work progresses. Failure to detect any defective work or material shall not in any way prevent later rejection when such defect is discovered nor shall it obligate the State for final acceptance.

d. The Owner use of testing and inspection services shall in no way relieve the contractor of the responsibility to furnish materials and finished construction in full compliance with the Contract Documents and the Connecticut State Building Codes.

B. **Retesting:** The Contractor is responsible for retesting where results of inspections, tests, or other quality-control services prove unsatisfactory and indicate noncompliance with Contract Document requirements, regardless of whether the original test was Contractor's responsibility.

1. The cost of retesting construction, revised or replaced by the Contractor, is the Contractor's responsibility where required tests performed on original construction indicated noncompliance with Contract Document requirements.
2. The Owner will issue a credit change order to cover all costs incurred related to all re-tests/re-inspection due to non-compliance to the contract documents, including but not limited to the Owners costs and the Consultants costs.

C. **Associated Services:** Cooperate with agencies performing required inspections, tests, and similar services, and provide reasonable auxiliary services as requested. Notify the agency sufficiently in advance of operations to permit assignment of personnel. Auxiliary services required include, but are not limited to, the following:

1. Provide access to the Work.
2. Furnish incidental labor and facilities necessary to facilitate inspections and tests.
3. Take adequate quantities of representative samples of materials that require testing or assist the agency in taking samples.
4. Provide facilities for storage and curing of test samples.
5. Deliver samples to testing laboratories.
6. Provide an approved design mix proposed for use for material mixes that require control by the testing agency.
7. Provide security and protection of samples and test equipment at the Project Site.

D. **Duties of the Testing Agency:** The independent testing agency engaged to perform inspections, sampling, and testing of materials and construction specified in individual Sections shall cooperate with the Construction Administrator, Engineer and the Contractor in performance of the testing agency's duties. The testing agency shall provide qualified personnel to perform required inspections and tests.

1. The testing agency shall notify the Construction Administrator and the Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. The testing agency is not authorized to release, revoke, alter, or enlarge requirements of the Contract Documents or approve or accept any portion of the Work.
3. The testing agency shall not perform any duties of the Contractor.

E. Owner will pay for the services of an independent testing agency laboratory to perform inspections, tests and other services required by the Specifications except as noted below, listed for which the Owner will issue a deduct change order to cover the cost associated with these tests:

1. When the Contractor notifies the Construction Administrator and/or Testing Agency less than twenty-four (24) hours before the expected time of testing.
2. When the Contractor requires testing for his own convenience.
3. When the Contractor schedules a test and is not ready for the required test.

F. Reports of test that are part of the submittal requirements which indicate compliance or non-compliance with the specified standard.

G. See also General Conditions Article 16 “Inspections and Tests”.

H. Submittals:

1. Unless the Contractor is responsible for this service, the independent testing agency shall submit a certified written report, in duplicate, of each inspection, test, or similar service to the Construction Administrator. If the Contractor is responsible for the service, submit a certified written report, in duplicate, of each inspection, test, or similar service through the Contractor.
2. Submit additional copies of each written report directly to the governing authority, when the authority so directs.
3. Report Data: Written reports of each inspection, test, or similar service include, but are not limited to, the following:
    a. Date of issue.
    b. Project title and number.
    c. Name, address, and telephone number of testing agency.
    d. Dates and locations of samples and tests or inspections.
    e. Names of individuals making the inspection or test.
    f. Designation of the Work and test method.
    g. Identification of product and Specification Section.
    h. Complete inspection or test data.
    i. Test results and an interpretation of test results.
    j. Ambient conditions at the time of sample taking and testing.
    k. Comments or professional opinion on whether inspected or tested Work complies with Contract Document requirements.
    l. Name and signature of laboratory inspector.
    m. Recommendations on re-testing.

I. Quality Assurance:

1. Qualifications for Service Agencies: Engage inspection and testing service agencies, including independent testing laboratories, that are pre-qualified as complying with the National Voluntary Laboratory Accreditation Program and that specialize in the types of inspections and tests to be performed.

a. Each independent inspection and testing agency engaged on the Project shall be authorized by authorities having jurisdiction to operate in the state where the Project is located.

J. Repair and Protection:

1. General: Upon completion of inspection, testing, sample taking and similar services, repair damaged construction and restore substrates and finishes. Comply with Contract Document requirements for Division 1 Section "Cutting and Patching."
2. Protect constructions exposed by or for quality-control service activities, and protect repaired construction.
3. Repair and protection is Contractor's responsibility, regardless of the assignment of responsibility for inspection, testing, or similar services.

01505 TEMPORARY ELECTRICITY AND LIGHTING

NOT USED

01510 TEMPORARY HEATING, COOLING AND VENTILATING AND LIGHTING

NOT USED

01515 TEMPORARY TELEPHONE

A. General Contractor shall use a cellular phone. All calls will be paid by the Contractor.

01520 TEMPORARY WATER

NOT USED

01525 TEMPORARY SANITARY FACILITIES

A. Designated existing toilets may be used during construction. It is the responsibility of the Contractor to maintain the facilities in a clean and sanitary condition and return them to their original condition after use. No loitering or smoking will be permitted in these areas.

01530 FIRE PROTECTION

A. The Contractor, during construction, shall be responsible for loss or damage by fire to the work of the Contract until completion. Any fire used within the structure for working purposes shall be extinguished when not in use. Bitumen or tar shall be melted on the ground only. No flammable material shall be stored in the structure in excess of amounts allowed by the authorities. No gasoline shall be stored in or close to the building at any time. The Contractor shall assign a responsible employee to be in charge of fire protection measures.

B. If an EPDM or other single-ply roof is included in the work that requires cleaning of mating surfaces of laps with gasoline, limit amount of gasoline on roof to 2 gallons which shall be in U.L. listed containers. Also provide one 30 B:C fire extinguisher within 75 feet of any point on the roof.

01535 CONSTRUCTION EQUIPMENT

A. The Contractor shall furnish tools, apparatus and appliances, hoists and/or cranes and power for same, scaffolding, runways, ladders, temporary supports and bracing and similar work or material necessary to insure convenience and safety in the execution of the Contract except where this is otherwise specified in any Specification Section. All such items shall meet the approval of the Department of Public Works but responsibility for design, strength and safety shall remain with the Contractor. All such items shall comply with Federal OSHA regulations and applicable codes, statutes, rules and regulations, including compliance with the requirements of the current edition of the "Manual of Accident Prevention in Construction" published by the A.G.C. and the standards of the State Labor Department.

B. Staging, exterior and interior, required for the execution of this Contract, shall be furnished, erected, relocated if necessary and removed by the General Contractor. Staging shall be maintained in a safe condition without charge to and for the use of all trades as needed.

01540 BARRIERS AND ENCLOSURES

NOT USED

01545 PROTECTION

A. Protect buildings, equipment, furnishings, grounds and plantings from damage. Any damage shall be repaired or otherwise made good at no expense to the State.

B. Provide protective coverings and barricades to prevent damage. The Contractor shall be held responsible for, and must make good at his own expense, any water or other type of damage due to improper coverings. Protect the public and building personnel from injury.

C. Provide temporary protection for installed products.

D. Provide protective coverings for walls, projections, jambs, sills and soffits of openings. Protect finished floors and stairs from traffic, movement of heavy objects and storage.

E. See also General Conditions Article 19 “Protection of the Work, Persons and Property”.

01550 SECURITY

A. The Contractor shall be solely responsible for damage, loss or liability due to theft or vandalism.

01555 TRAFFIC WAYS

NOT USED

01560 TEMPORARY CONTROLS

NOT USED

01565 STORM WATER CONTROL

NOT USED

01570 CLEANING

A. Maintain areas under Contractor's control free of waste materials, debris and rubbish. Maintain in a clean and orderly condition.

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces and other closed or remote spaces before closing the space.

C. Periodically clean interior areas before start of surface finishing and continue cleaning on an as-needed basis.

D. Control cleaning operations so that dust and other particulates will not adhere to wet or newly-coated surfaces.

E. Remove waste materials, debris and rubbish from site daily and dispose of legally off-site. No scrap/debris shall remain inside the building or anywhere on site upon final acceptance of the project.

F. See also General Conditions Article 24 “Cleaning Up”.

01575 PROJECT SIGNS

NOT USED

01580 FIELD OFFICES AND SHEDS

NOT USED

01585 IDENTIFICATION BADGES

NOT USED

01600 MATERIALS AND EQUIPMENT CONTROLS

A. Materials and Equipment: Shall be delivered, stored and handled to prevent intrusion of foreign matter and damage by weather or breakage. Packaged materials shall be delivered and stored in original, unbroken packages.

1. Promptly inspect shipments to assure that products comply with requirements, that quantities are correct and products are undamaged.
2. Packages, materials and equipment showing evidence of damage will be rejected and replaced at no additional cost to the Owner.

B. Storage and Protection:

1. Store products in accordance with manufacturers' instructions with seals and labels intact and legible. Store sensitive products in weathertight enclosures; maintain within temperature and humidity range required by manufacturer.
2. For exterior storage of fabricated products, place on sloped supports above ground. Cover products subject to deterioration with impervious sheet covering; provide ventilation to avoid condensation.
3. Store loose granular material on solid surfaces in a well-drained area; prevent mixing with foreign matter.
4. Arrange storage to provide access for inspection. Periodically inspect to insure products are undamaged and are maintained under required conditions. Keep log showing date, time and problems, if any.
5. Stone, masonry units and similar materials shall be stored on platforms or dry skids and shall be adequately covered and protected against damage.
6. The Contractor shall prepare, as directed by the Owner, one area or space in the building for storage of State-owned equipment.

01631 EQUALS AND SUBSTITUTIONS

A. Definitions: Definitions in this Article do not change or modify the meaning of other terms used in the Contract Documents.

1 Equals or Substitutions General: Changes in products, materials, equipment, and methods of construction required by the Contract Documents proposed by the Contractor after award of the Contract.

2 Equal: Any deviation from the specification which is defined as follows: A replacement for the specified material, device, procedure, equipment, etc., which is recognized and accepted as substantially equal to the first listed manufacturer or first listed procedure specified, after review, by the Engineer and may be rejected or approved at the sole discretion of the owner. All equals must be substantially equivalent to the first manufacturer or first procedure listed in the Specifications with reference to all of the following areas: the substance and function considering quality, workmanship, economy of operation, durability and suitability for purposes intended; size, rating and cost. The equal does not constitute a modification in the scope of Work, the Schedule or Engineer/Engineer’s design intent of the specified material, device, procedure, equipment, etc.

3 Substitution: Any deviation from the specified requirements, which is defined as follows: A replacement for the specified material, device, procedure, equipment, etc., which is not recognized or accepted as equal to the first manufacturer or procedure listed in the Specification after review by the Engineer and may be rejected or approved by the Owner. The Substitution is not equal to the specified requirement in comparison to the first manufacture or first procedure listed in the Specifications in one or more of the following areas: the substance and function considering quality, workmanship, economy of operation, durability and suitability for purposes intended; size; cost and rating. The Substitution constitutes a modification in the scope of Work, the Schedule or the Engineer/Engineer’s design intent of the specified material, device, procedure, equipment, etc.

4 The following are not considered to be requests for Equals or Substitutions:

a. Revisions to the Contract Documents requested by the Owner or Engineer.

b. Specified options of products and construction methods included in the Contract Documents.

c. The Contractor's determination of and compliance with governing regulations and orders issued by governing authorities having jurisdiction.

B. Submittals:

1. Equals and Substitution Request Submittals: The Owner will consider requests for equals or substitutions if received within time period designated in the General Conditions Article 15 “Materials; Standards”. Requests received more than the days specified in Article 15 after the start date of the contract will be rejected.

a. The Contractor is required to prepare and submit 3 copies of the required data for the first manufacturer listed or procedure listed in the specifications section with reference to all of the following areas: the substance and function considering quality, workmanship, economy of operation, durability and suitability for purposes intended including the size, rating and cost. All submissions must include all the required data for the first listed manufacturer or procedure as specified, as well as the required data for the proposed Equal or Substitution. This will enable the Owner and Engineer to determine that the proposed Equal or Substitution is or is not substantially equal to the first listed manufacturer or procedure.

2. Identify the product or the fabrication or installation method to be replaced in each request. Include related Specification Section and Drawing numbers.

3. Provide complete documentation showing compliance with the requirements for equals or substitutions, and the following information, as appropriate on a “Substitution Request” form as required by the Owner:

a. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by the Owner and separate contractors, that will be necessary to accommodate the proposed Equal or Substitution.

b. A detailed comparison chart of significant qualities of the proposed substitution with those of the Work specified. Significant qualities may include elements, such as performance, weight, size, durability, and visual effect.

c. Product Data, including Shop Drawings and descriptions of products and fabrication and installation procedures.

d. Samples, where applicable or requested.

e. A statement indicating the effect on the Contractor's Construction Schedule or CPM Schedule compared to the schedule without approval of the Equal or Substitution. Indicate the effect on overall Contract Time.

f. Cost information, broken down, including a proposal of the net change, if any in the Contract Sum.

g. The Contractor's certification that the proposed Equal or Substitution conforms to requirements in the Contract Documents in every respect and is appropriate for the applications indicated.

h. The Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of the failure of the Equal or Substitution to perform adequately.

4. Engineer's Action: If necessary, the Engineer will request additional information or documentation for evaluation within one week of receipt of the original request for equal or substitution request. The Engineer will notify the Construction Administrator who will notify the Owner of recommended acceptance or rejection of the proposed equal or substitution, within two (2) weeks of receipt of the request, or one (1) week of receipt of additional information or documentation, whichever is later. The Construction Administrator will give final acceptance or rejection by the Owner not less than one (1) week after notification.

   a. Any request deemed an "Equal" and accepted by the Construction Administrator, Engineer, Owner, and Agency will result in written notification to the Contractor and will not be in the form of a change order for an "Equal".

   b. Any request deemed a "Substitution" and rejected or approved by Construction Administrator, Engineer, and Owner may result in written notification to the Contractor and may be in the form of a change order if the "Substitution" is approved.

C. Equal or Substitutions:

1. Conditions: The Engineer will consider the Contractor's request for Equal or Substitution of a product or method of construction when one or more of the following conditions are satisfied, as determined by the Engineer. If the following conditions are not satisfied, the Engineer will return the requests to the Construction Administrator without action except to record noncompliance with these requirements.

   a. The proposed request does not require extensive revisions to the Contract Documents.

   b. The proposed request is in accordance with the general intent of the Contract Documents.

   c. The proposed request is timely, fully documented, and/or properly submitted.

   d. The proposed request can be provided within the Contract Time. However, the Engineer will not consider the proposed request if it is a result of the Contractor's failure to pursue the Work promptly or coordinate activities properly.

   e. The proposed request will offer the Owner a substantial advantage, in cost, time, energy conservation, or other considerations, after deducting additional responsibilities the Owner must assume. However, if the proposed request requires the Owner to incur additional responsibilities, including but not limited to, additional compensation to the Engineer for redesign and evaluation services, increased cost of other construction by the Owner or similar considerations, then the Owner will have just cause to reject the request for Equal or Substitution.

   f. The proposed request can receive the necessary approvals, in a timely manner, required by governing authorities having jurisdiction.

   g. The proposed request can be provided in a manner that is compatible with the Work as certified by the Contractor.

   h. The proposed request can be coordinated with the Work as certified by the Contractor.

i. The proposed request can uphold the warranties required by the Contract Documents as certified by the Contractor.

2. The Contractor's submission and the Engineer's review of Submittals, including but not limited to, Samples, Manufacturer's Data, Shop Drawings, or other such items, which are not clearly identified as a request for an Equal or Substitution, will not be considered or accepted as a valid request for an Equal or Substitution, nor does it constitute an approval.

01650 STARTING OF SYSTEMS

A. General:

1. Coordinate schedule for start-up of various equipment and systems.
2. Provide written notification the Construction Administrator thirty (30) Calendar Days prior to start-up of each item.
3. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, and control sequence for other conditions that may cause damage.
4. Verify that tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
5. Verify in wiring and support components are complete and tested.
6. Execute the start-up under supervision of manufacturer's representative, in accordance with manufacturer's instructions.
7. When referenced in individual specification sections, require manufacturer to provide an authorized representative to be present at the site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.
8. Submit a written report in accordance Section 01400 "Quality Control" that the equipment or system has been properly installed and is functioning properly.

B. Demonstration and Instructions:

1. Demonstrate operation and maintenance of Products to Owner and Agency Personnel two (2) weeks prior to substantial completion.
2. Demonstrate Project equipment and instruct in a classroom environment at location designated by the Construction Administrator and instructed by a qualified manufacturer's representative who is knowledgeable about the project.
3. For equipment or systems requiring seasonal operation perform demonstration for season within six (6) months.
4. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owner and Agency Personnel in detail to explain all aspects of operation and maintenance.
5. Demonstrate start-up, operation, control, adjustment, troubleshooting, servicing, and maintenance, and shutdown of each item at agreed upon scheduled time and at equipment or designated location.
6. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during demonstration.

01700 CONTRACT CLOSEOUT

A. Substantial Completion:

1. Preliminary Procedures: Before requesting inspection for Certification of Substantial Completion, complete the following. List exceptions in the request.
   a. In the Application for Payment that coincides with, or first follows, the date Substantial Completion is claimed, show 100 percent completion for the portion of the Work claimed as substantially complete.
      1) Include supporting documentation for completion as indicated in these Contract Documents and a statement showing an accounting of changes to the Contract Sum.
      2) If 100 percent completion cannot be shown, include a list of incomplete items, the value of incomplete construction, and reasons the Work is not complete.
   b. Advise the Owner of pending insurance changeover requirements.
   c. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications, and similar documents.
   d. Obtain and submit releases enabling the Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
   e. Submit record drawings, maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.
   f. Deliver tools, spare parts, extra stock, and similar items.
   g. Make final changeover of permanent locks and transmit keys to the Owner. Advise the Owner's personnel of changeover in security provisions.
   h. Demonstration, thru operation and testing, the functions of all systems and/or equipment to the satisfaction of the Owner for compliance to the contract. Complete testing of systems, and instruction of the Owner's operation and maintenance personnel. Discontinue and remove temporary facilities from the site, along with mockups, construction tools, and similar elements.
   i. Complete final cleanup requirements, including touchup painting.
   j. Touch up and otherwise repair and restore marred, exposed finishes.
2. Inspection Procedures: The Contract shall be ready and prepared when they request a Substantial Completion inspection. If the inspection reveals that the work is not complete, there are extensive punchlist items and as the items listed above are not complete, the Construction Administrator, Engineer, and Owner will determine the inspection has failed.
3. The Contractor is responsible for all costs to re-inspect due to a failed inspection. The Owner will issue a deduct change order to cover all costs for re-inspection.
   a. The Engineer will repeat inspection when requested and assured that the Work is substantially complete.
   b. Results of the completed inspection will form the basis of requirements for final acceptance.

B. Final Acceptance:

1. Preliminary Procedures: Before requesting final inspection for certification of final acceptance and final payment, complete the following. List exceptions in the request.
   a. Submit the final payment request with releases and supporting documentation not previously submitted and accepted. Include insurance certificates for products and completed operations where required.
   b. Submit an updated final statement, accounting for final additional changes to the Contract Sum.
   c. Submit a certified copy of the Engineer's final inspection list of items to be completed or corrected, endorsed and dated by the Engineer. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance and shall be endorsed and dated by the Engineer.
   d. Submit final meter readings for utilities, a measured record of stored fuel, and similar data as of the date of Substantial Completion or when the Owner took possession of and assumed responsibility for corresponding elements of the Work.
   e. Submit consent of surety to Final Payment.
   f. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
2. Reinspection Procedure: The Inspection Group will re-inspect the Work upon receipt of notice from the Construction Administrator that the Work, including inspection list items from earlier inspections, has been completed, except for items whose completion is delayed under circumstances acceptable to the Owner.
   a. Upon completion of reinspection, the Construction Administrator will prepare a certificate of final acceptance. If the Work is incomplete, the Construction Administrator will advise the Contractor of Work that is incomplete or of obligations that have not been fulfilled but are required for final acceptance.

C. As Built Document Submittals:

1. General: Do not use record documents for construction purposes. Protect Record Documents from deterioration and loss in a secure, fire-resistant location. Provide access to record documents for the Engineer's reference during normal working hours. Keep documents current; do not permanently conceal any work until required information has been recorded. **Failure to keep documents current is sufficient cause to withhold progress payments.**

   a. The Contractor shall also hire the services of a Surveyor registered in the State of Connecticut to conduct a final survey to determine the location of exterior underground utility lines and to record the results, and update existing electronic media
   b. The record of exterior underground utilities shall be made at the time of installation on Mylar film drawing and AutoCAD (latest version) compatible disks. The drawing shall bear the seal of the Land Surveyor and a statement of accuracy.

2. **As-built Drawings:** The Contractor shall maintain one clean, complete undamaged set of blue or black line white-prints of Contract Drawings and Shop Drawings. Mark the set to show the actual installation where the installation varies substantially from the Work as originally shown. Mark which drawing is most capable of showing conditions fully and accurately. Where Shop Drawings are used, record a cross-reference at the

corresponding location on the Contract Drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date.

a. Mark record sets with erasable pencil to distinguish between variations in separate categories of the Work.

b. Mark all new information that is not shown on Contract Drawings.

c. Note related change-order numbers where applicable.

d. Organize record drawing sheets into manageable sets. Bind sets with durable-paper cover sheets; print suitable titles, dates, and other identification on the cover of each set.

e. Upon completion of the work, the Contractor shall submit Record Drawings to the Construction Administrator for the Owner's Records who will pass them on to the Engineer or Engineer for transferring the changes to the Record Drawing Mylar Tracings.

f. Submit electronic format data of all Coordination Drawings as required by the owner, at no additional cost.

g. Refer to Section 01400 “Quality Control” Section 1.3 for required as built drawings and specifications for fire alarm systems.

3. **Record Specifications:** The Contractor shall maintain one complete copy of the Project Manual, including Addenda. Include with the Project Manual one copy of other written construction documents, such as Change Orders and modifications issued in printed form during construction.

   a. Mark these documents to show substantial variations in actual Work performed in comparison with the text of the Specifications and modifications.

   b. Give particular attention to equals and substitutions and selection of options and information on concealed construction that cannot otherwise be readily discerned later by direct observation.

   c. Note related record drawing information and Product Data.

   d. Upon completion of the Work, submit record Specifications to the Construction Administrator for the Owner's records.

4. **Record Product Data:** The Contractor shall maintain one copy of each Product Data submittal. Note related Change Orders and markup of record drawings and Specifications.

   a. Mark these documents to show significant variations in actual Work performed in comparison with information submitted. Include variations in products delivered to the site and from the manufacturer's installation instructions and recommendations.

   b. Give particular attention to concealed products and portions of the Work that cannot otherwise be readily discerned later by direct observation.

   c. Upon completion of markup, submit complete set of Record Product Data to the Construction Administrator for the Owner's records.

5. **Miscellaneous Record Submittals:** Refer to other Specification Sections for requirements of miscellaneous record keeping and submittals in connection with actual performance of the Work. Immediately prior to the date or dates of Substantial Completion, complete miscellaneous records and place in good order. Identify

miscellaneous records properly and bind or file, ready for continued use and reference. Submit to the Construction Administrator for the Owner's records.

6. **Maintenance Manuals:** Organize operation and maintenance data into suitable sets of manageable size. Bind properly indexed data in individual, heavy-duty, 2-inch, 3-ring, vinyl-covered binders, with pocket folders for folded sheet information. Mark appropriate identification on front and spine of each binder according to section 01730 “Operations & Maintenance Data”. Included but not limited to the following types of information:

   a. Emergency instructions.

   b. Spare parts list.

   c. Copies of warranties.

   d. Wiring diagrams.

   e. Recommended "turn-around" cycles.

   f. Inspection procedures.

   g. Shop Drawings and Product Data.

   h. ***Fixture lamping schedule.***

D. Closeout Procedures:

1. Operation and Maintenance Instructions: Arrange for each Installer of equipment that requires regular maintenance to meet with the Owner's personnel to provide instruction in proper operation and maintenance. Provide instruction by manufacturer's representatives if installers are not experienced in operation and maintenance procedures. Include a detailed review of the following items:

   a. Maintenance manuals.

   b. Record documents.

   c. Spare parts and materials.

   d. Tools.

   e. Lubricants.

   f. Fuels.

   g. Identification systems.

   h. Control sequences.

   i. Hazards.

   j. Cleaning.

   k. Warranties and bonds.

   l. ***Maintenance agreements and similar continuing commitments.***

2. As part of instruction for operating equipment, demonstrate the following procedures:

   a. Startup.

   b. Shutdown.

   c. Emergency operations.

   d. Noise and vibration adjustments.

   e. Safety procedures.

f. Economy and efficiency adjustments.

g. Effective energy utilization.

E. Final Cleaning:

1. **General**: The General Conditions requires general cleaning during construction. Regular site cleaning is included in Division 1 Section 01570 “Cleaning”".

2. Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to the condition expected in a normal, commercial building cleaning and maintenance program. Comply with manufacturer's instructions. Complete the following cleaning operations before requesting inspection for Certification of Substantial Completion and Certification of Occupancy.

3. **Interior:**

   a. Remove labels that are not permanent labels.

   b. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Remove paint spots; wash and polish glass

   c. Clean exposed interior hard-surfaced finishes to a dust-free condition, free of stains, films, and similar foreign substances. Restore reflective surfaces to their original condition. Leave concrete floors broom clean. Vacuum carpeted surfaces.

   d. Wash washable surfaces of mechanical, electrical equipment and fixtures and replace filters, clean strainers on mechanical equipment. Remove excess lubrication and other substances. Clean plumbing fixtures to a sanitary condition. Clean light fixtures and lamps.

   e. Clean and polish finish hardware.

   f. Clean and polish tile and other glazed surfaces.

   g. Clean floors; wax and buff resilient tile. Clean vinyl or rubber base.

   h. Vacuum and/or dust walls, ceilings, lighting fixtures, ceiling diffusers and other wall and ceiling items.

   i. Remove defacements, streaks, fingerprints and erection marks.

4. **Exterior**:

   a. Clean the site, including landscape development areas, of rubbish, litter, and other foreign substances. Sweep paved areas broom clean; remove stains, spills, and other foreign deposits. Rake grounds that are neither paved nor planted, to a smooth, even-textured surface.

   b. Clean exposed exterior hard-surfaced finishes to a dust-free condition, free of stains, films, and similar foreign substances.

   c. Clean roofs, gutters and downspouts.

   d. Remove waste and surplus materials, rubbish and construction equipment and facilities from the site, and deposit it legally elsewhere.

   e. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Remove paint spots; wash and polish glass.

5. **Removal of Protection**: Remove temporary protection and facilities installed for protection of the Work during construction.
6. **Compliance:** Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from the site and dispose of lawfully.
   a. Where extra materials of value remain after completion of associated Work, they become the Owner's property. Dispose of these materials as directed by the Construction Administrator.
   b. Leave building clean and ready for occupancy. If the Contractor fails to clean up, the Owner may do so, with the cost charged to the Contractor. The Owner will issue a credit change order to cover the costs.

01730 OPERATION AND MAINTENANCE DATA

A. The Contractor shall instruct the State's designated personnel in the operation of new equipment and shall provide manuals and if required, provide video tapes of this basic maintenance of the equipment for training purposes. Provide qualified personnel for as long as necessary to instruct the State's personnel.

B. Submit four copies of the manuals in 3-ring, loose-leaf notebooks to the Engineer/Engineer for approval. Manuals may consist of plain paper copies of approved shop drawings and catalog cuts. Upon completion and approval, 3 copies will be forwarded to the State and one copy retained by the Engineer/Engineer.

C. Manuals shall include:
   1. Operating Procedures:
      a. Typewritten procedures for each mode of operation of each piece of equipment. Procedures shall indicate the status of each component of a system in each operating mode.
      b. Procedures shall include names, symbols, valve tags, circuit numbers, schematic wiring diagrams, locations of thermostats, manual starters, control cabinets and other controls of each system.

D. Emergency shut-down procedures for each piece of equipment or system, both automatic and manual, as appropriate.
   1. Maintenance Schedule:
      a. Typewritten schedule describing manufacturers schedule of maintenance and maintenance procedures.
   2. Catalog Cuts:
      a. To illustrate each piece of installed equipment, including options.
      b. Include equipment descriptions including physical, electrical and mechanical; performance characteristics; installation or erection diagrams.
      c. Include spare parts numbers and names, address and phone number of manufacturer; name, address and phone number of local representative or service department.

d. Typewritten list of all subcontractors on the project, including name, address and phone number of local representative or service department.

3. Manuals shall be indexed with dividers indicating each system or piece of equipment.

01740 WARRANTIES AND GUARANTEES

A. **Disclaimers and Limitations**: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products. Manufacturer's disclaimers and limitations on product warranties do not relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.

B. **Related Damages and Losses:** When correcting failed or damaged warranted construction, remove and replace construction that has been damaged as a result of such failure or must be removed and replaced to provide access for correction of warranted construction.

C. **Reinstatement of Warranty:** When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.

D. **Replacement Cost:** Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of the Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefited from use of the Work through a portion of its anticipated useful service life.

E. **Owner's Recourse:** Expressed warranties made to the Owner are in addition to implied warranties and shall not limit the duties, obligations, rights, and remedies otherwise available under the law. Expressed warranty periods shall not be interpreted as limitations on the time in which the Owner can enforce such other duties, obligations, rights, or remedies.

1. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selection to products with warranties not in conflict with requirements of the Contract Documents.

F. Where the Contract Documents require a special warranty, or similar commitment on the Work or part of the Work, the Owner reserves the right to refuse to accept the Work, until the Contractor presents evidence that entities required to countersign such commitments are willing to do so.

G. The Contractor shall guarantee all materials and workmanship for a period of eighteen months from the date of acceptance of the Work. In addition, the Contractor shall furnish the warranties listed below. Submit four copies of each to the Construction Administrator in the supplier's standard form or in the form given below if there is no standard form available.

1. Section 223400 Fuel Fired Domestic Water Heater – 5 Years
2. Section 235216 Condensing Boilers – 10 Years

H. Submit certification that finish materials are fire rated as specified.

I. Form of Guarantees and Warranties:

Commissioner
Military Department
360 Broad Street

February 28, 2011

Hartford, Connecticut 06105
(Project Title and Number)

I (We) hereby guarantee and warranty)

the _____ work on the referenced project for a period of _____ years

from _____, 20___ against failures of workmanship and materials in accordance

with the requirements of Section ____, Page ____, Paragraph ____, of the Specifications.

Signed _____

3) General Contractor _____
(or authorized agent)

J. Bonds shall be by approved Surety Companies, made out to the Commissioner, Military Department on companies' standard form.

K. Guarantees, warranties or bonds supplied by Subcontractors, Suppliers or Manufacturers shall reference the project name, number, and location and be certified by the General Contractor to be for the product and installation on the project and must be countersigned by the General Contractor.

L. **Submittals**:

1. Submit written warranties prior to the date certified for Substantial Completion. If the Engineer's Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, or a designated portion of the Work, submit written warranties upon request of the Engineer.
2. Forms for special warranties are included in this Section. Prepare a written document utilizing the appropriate form, ready for execution by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer. Submit a draft to the Owner, through the Construction Administrator, for approval prior to final execution.
    a. Refer to Divisions 2 through 17 Sections for specific content requirements and particular requirements for submitting special warranties.
3. Form of Submittal: At Final Completion compile 2 copies of each required warranty properly executed by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the Project Manual.
4. Bind warranties and bonds in heavy-duty, commercial-quality, durable 3-ring, vinyl-covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
    a. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product, and the name, address, and telephone number of the Installer.
    b. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project title or name, and name of the Contractor.

c. When warranted construction requires operation and maintenance manuals, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

END OF DIVISION 1- GENERAL REQUIREMENTS

03/07/11

February 28, 2011

SECTION 220010 - GENERAL CONDITIONS FOR MECHANICAL TRADES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. This section is intended to supplement the requirements of Division 01 requirements. For any conflicting requirements for minimum quantities or quality levels between this Section and Division 01, comply with the most stringent requirement.

1.2 SUMMARY

A. This Section includes the following when associated with Divisions 21, 22, and 23 work:

1. Permits and fees, code requirements, work under other contracts.
2. Work restrictions.
3. Specification formats and conventions.
4. Request for information.
5. Coordination.
6. Conflicting requirements.
7. Quality assurance and control.
8. Product delivery, storage, and handling.
9. Product warranties.
10. Submittals.
11. Product selection procedures.
12. General execution of project scope of work.
13. Record drawings.
14. Demonstration and training.

B. Related Sections include the following:

1. Division 01 Sections.

1.3 PERMITS AND FEES

A. Give all necessary notices, obtain all permits; pay all government and state sales taxes and fees where applicable, and other costs, including utility connections or extensions in connection with the Project scope of work. File all necessary drawings, prepare all documents and obtain all necessary approvals of all governmental and state departments having jurisdiction, obtain all required certificates of inspections for Project scope of work and deliver a copy to the Engineer before request for acceptance and final payment for the Project scope of work.

1.4 CODE REQUIREMENTS

A. Project Code: Confirm the codes in effect at the time of permitting.

B. Project Legislative Requirements: Confirm the State and Local Legislations in effect at the time of permitting or those that affect construction.

C. Compliance: Comply with all codes and legislations applicable to the project, including energy related:

1. Means and Methods
2. Equipment and Devices.
3. Materials and Work Product.

1.5 WORK UNDER OTHER CONTRACTS

A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract. Coordinate the Work of this Contract with work performed under separate contracts.

1.6 WORK RESTRICTIONS

A. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services:

1. Notify Construction Manager or Owner not less than 10 days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Construction Manager's or Owner's written permission.

1.7 REQUESTS FOR INFORMATION (RFIs)

A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.

1. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:

1. Project name.
2. Project number.
3. Date.
4. Name of Contractor.
5. Name of Engineer, Architect and Construction Manager.
6. RFI number, numbered sequentially.
7. RFI subject.
8. Specification Section number and title and related paragraphs, as appropriate.
9. Drawing number and detail references, as appropriate.

10. Field dimensions and conditions, as appropriate.
11. Contractor's suggested resolution.
12. Contractor's signature.
13. Attachments: Include sketches, descriptions, measurements, photos, product data, shop drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.

    a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

C. The following RFIs will be returned without action:

1. Requests for approval of submittals.
2. Requests for approval of substitutions.
3. Requests for coordination information already indicated in the Contract Documents.
4. Requests for adjustments in the Contract Time or the Contract Sum.
5. Requests for interpretation of Architect's actions on submittals.
6. Incomplete RFIs or inaccurately prepared RFIs.

D. Action may include a request for additional information, in which case time for response will date from time of receipt of additional information.

1.8 COORDINATION

A. Coordination: Each Contractor shall coordinate its construction operations with those of other Contractors and entities to ensure efficient and orderly installation of each part of the Work. Each Contractor shall coordinate its operations with operations, included in different Sections that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components with other Contractors to ensure maximum performance and accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

B. Contractor shall coordinate all final specific utility requirements.

1.9 CONFLICTING REQUIREMENTS

A. General: If compliance with two or more standards or directives is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Architect/Engineer for a decision before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Engineer for a decision before proceeding.

1.10 MINOR CHANGES IN THE WORK

A. Engineer will issue through the Construction Manager, supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time.

B. Drawings are diagrammatic, the Contractor shall relocate devices a reasonable distance for coordination.
   1. A reasonable distance is considered to be 15 feet at no additional cost.

1.11 QUALITY ASSURANCE AND CONTROL

A. General: Qualifications paragraphs in this Article establish some of the minimum qualification levels required; Division 01 and individual Specification Sections specify additional requirements.

B. Code Compliance: Work and equipment shall comply with all latest applicable codes and legislations.

C. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those required for this Project.

D. Instructor Qualifications: A factory-authorized service representative, complying with requirements in "Quality Requirements," experienced in operation and maintenance procedures and training.

E. Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.

   1. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.

      a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.

   2. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
   3. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

F. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections.

G. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

H. Associated Services: Cooperate with agencies performing required commissioning, tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

   1. Access to the Work.
   2. Incidental labor and facilities necessary to facilitate tests and inspections.

3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.
5. Delivery of samples to testing agencies.
6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
7. Security and protection for samples and for testing and inspecting equipment at Project site.

I. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

J. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, product selected shall be compatible with products previously selected, even if previously selected products were also options.

1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
2. If a dispute arises between contractors over concurrently selectable but incompatible products, Engineer will determine which products shall be used at no additional cost to the project.

K. Acceptance of Work: Failure on the part of the Engineer to reject shop drawings or to reject Work in progress shall not be interpreted as acceptance of Work not in conformance with Code, Legislation, the Drawings and/or Specifications. Correct Work not in conformance whenever non-conformance is discovered.

1.12 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions and generally accepted construction practice.

B. Storage:

1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Store cementitious products and materials on elevated platforms.
5. Store foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
7. Protect stored products from damage and liquids from freezing.
8. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.13 PRODUCT WARRANTIES

A. Refer to Division 01 and individual sections for requirements.

B. The following requirements are supplemental and in addition to those stated in other specific sections and Division 01.

1. Warranty all materials and workmanship under these Specifications and the Contract for a period of one year from the date of final acceptance by the Owner.
2. During this warranty period, correct or replace all defects developing through materials or workmanship immediately as directed by the Engineer without expense to the Owner; make all such repairs or replacements to the Owner's satisfaction.

C. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

D. Warranty Start Date: Date of substantial completion.

1.14 SUBMITTAL PROCEDURES

A. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Product List: Submit a list, in tabular from, showing specified products. Include generic names of products required. Include manufacturer's name and proprietary product names for each product.

1. Initial Submittal: Within 30 days after date of commencement of the Work, submit 3 copies of initial product list. Include a written explanation for omissions of data and for variations from Contract requirements.

C. Substitution Requests: Submit four copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Substitution: A submittal shall be considered a substitution when the Engineer does not accept the product or material as an "equivalent" or where one of the listed manufacturers is not submitted.
2. Substitution Requirements: Substitutions shall meet the requirements of "Comparable Products."
3. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

a. Statement indicating why specified material or product cannot be provided.
b. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
c. Detailed comparison of significant qualities of proposed substitution with those of the Project scope of work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
e. Samples, where applicable or requested.
f. Cost information, including a proposal of change, if any, in the Contract Sum.
g. Contractor's certification that proposed substitution complies with requirements in the Contract Documents and is appropriate for applications indicated.

h. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
i. Statement indicating why the requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations.

1.15 RECORD DRAWINGS

A. Record Drawings: Comply with the following:

1. Number of Copies: Submit copies of Record Drawings as follows:

a. Initial Submittal: Submit one set of plots from corrected Record CAD Drawings and one set of marked-up Record Prints. Engineer will initial and date each plot and mark whether general scope of changes, additional information recorded, and quality of drafting are acceptable. Engineer will return plot for organizing into sets, printing, binding, and final submittal.
b. Final Submittal: Submit three sets of Record CAD Drawing files and one set of Record CAD Drawing plots. Plot and print each Drawing, whether or not changes and additional information were recorded.

1) Electronic Media: CD-R.

B. Qualification Data: For training instructor.

1.16 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, that are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Engineer will make selection.
5. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.
6. Or Equal: Where products are specified by name and accompanied by the term "or equal" or "or approved equal" or "or approved," comply with provisions in "Comparable Products" Article to obtain approval for use of an unnamed product.

B. Product Selection Procedures:

1. Design Basis: The design has been based on the single manufacturer indicated in the contract documents. The Contractor is responsible for verifying prior to submission, that any other manufacturer even though listed complies with dimensional and performance characteristics of the base specified product. Modifications shall be made by the Contractor as part of this contract to accommodate changes to the design basis.

2. Product: Where Specifications name a single product and manufacturer, provide the named product that complies with requirements.
3. Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements.
4. Equivalent Product: Equipment, material or devices submitted for review as an "accepted equivalent" shall meet all of the following requirements:

    a. A product of a listed manufacturer.
    b. The equivalent shall have the same construction features such as, but not limited to:

        1) Material thickness, gauge, weight, density, etc.
        2) Welded, riveted, bolted, etc., construction
        3) Finish, undercoating, corrosion protection

    c. The equivalent shall perform with the same or better operating efficiency.
    d. The equivalent shall have equal or greater reserve capacity.
    e. The equivalent shall be locally represented by the manufacturer for service, parts and technical information.
    f. The equivalent shall bear the same labels of performance certification as is applicable to the specified item, such as UL, AMCA or ARI labels.

PART 2 - PRODUCTS

2.1 SHOP DRAWINGS

A. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed or electronic data.

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:

    a. Identification of products.
    b. Schedules.
    c. Compliance with specified standards.
    d. Notation of coordination requirements.
    e. Notation of dimensions established by field measurement.
    f. Relationship and attachment to adjoining construction clearly indicated.
    g. Seal and signature of professional engineer if specified.

2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 30 by 42 inches.

2.2 RECORD DRAWINGS

A. Record Prints: Maintain one set of black-line white prints of the Contract Drawings and Shop Drawings.

1. Preparation: Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.

a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
b. Accurately record information in an understandable drawing technique.
c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.

2. Content: Types of items requiring marking include, but are not limited to, the following:

a. Revisions to details shown on Drawings.
b. Locations and depths of underground system entities.
c. Revisions to routing of piping.
d. Actual equipment locations.
e. Locations of concealed internal utilities.
f. Changes made by Change Order or Change Directive.
g. Changes made following Engineer's written orders.
h. Details not on the original Contract Drawings.
i. Field records for variable and concealed conditions.
j. Record information on the Project scope of work that is shown only schematically.

3. Mark the Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-reference on the Contract Drawings.
4. Mark record sets with erasable, colored pencil. Use multiple colors to distinguish between changes for different categories of the Work at same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Record CAD Drawings: Immediately before observation for Certificate of Substantial Completion, review marked-up Record Prints with Engineer and Construction Manager. When authorized, prepare a full set of corrected CAD Drawings of the Contract Drawings, as follows:

1. Format: DWG or Revit format of the same version, and operating system as the original Contract Drawings.
2. Incorporate changes and additional information previously marked on Record Prints. Delete, redraw, and add details and notations where applicable.
3. Refer instances of uncertainty to Engineer for resolution.
4. Contractor may request one set of CAD Drawings of the Contract Drawings for use in recording information.

a. Engineer makes no representations as to the accuracy or completeness of CAD Drawings as they relate to the Contract Drawings.

C. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

1. Record Prints: Organize Record Prints and newly prepared Record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Record CAD/Revit Drawings: Organize information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each file.

3. Identification: As follows:

   a. Project name.
   b. Date.
   c. Designation "PROJECT RECORD DRAWINGS."
   d. Name of Engineer, Architect and Construction Manager.
   e. Name of Contractor.

2.3 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and modifications to Project Record Documents as they occur; do not wait until the end of Project.

B. Maintenance of Record Documents and Samples: Store Record Documents and Samples in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Engineer’s reference during normal working hours.

2.4 TRAINING AND INSTRUCTION PROGRAM

A. Program Structure: In addition to Division 01 and individual section requirements, develop an instruction program that includes individual training modules for each system and equipment not part of a system.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. Provide instruction for the following modules.

   1. Basis of System Design and Operational Requirements
   2. Documentation
   3. Emergencies
   4. Adjustments
   5. Troubleshooting
   6. Maintenance
   7. Repairs

C. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

D. Video Record: Training shall be recorded as video.

   1. Format: Standard DVD format.
   2. Quantity: Three discs of each individual DVD.
   3. Labeling: Label each DVD with its library of training sections based on equipment type and system type.

2.5 COMPARABLE PRODUCTS

A. Conditions for Consideration: Engineer will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Engineer may return requests without action, except to record noncompliance with these requirements:

1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning work, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utility and system connections.
2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
3. Existing Utility Information: Furnish information to local utility and Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Acceptance of Conditions: Examine substrates, areas, and conditions, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Written Report: Where a written report listing conditions detrimental to performance of the Project scope of work is required by other Sections, include the following:

a. Description of the Work.
b. List of detrimental conditions, including substrates.
c. List of unacceptable installation tolerances.
d. Recommended corrections.

2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
3. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.

4. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
5. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Existing Utility Information: Furnish information to local utility and Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Engineer. Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents.

3.3 DEMOLITION

A. Work indicated to be removed includes removal of all auxiliary materials, accessories, anchorage, fasteners, and etc., down to bare substrate. No residual materials shall remain from work to be removed. Contractor will use whatever means necessary; including removal of all materials attached or related to those items designated to be removed, as acceptable to Owner and Engineer, to provided complete and thorough removal of existing work.

B. Protect existing equipment and installations indicated to remain. If damaged or disturbed in the course of the Work, remove damaged portions and install new products of equal capacity, quality, and functionality.

C. Accessible Work: Remove exposed equipment and installations, indicated to be demolished, in their entirety.

D. Abandoned Work: Cut and remove buried MEP system materials, equipment, raceways, piping and distribution, indicated to be abandoned in place, 2 inches below the surface of adjacent construction. Cap and patch surface to match existing finish.

E. Remove demolished materials from Project site.

F. Remove, store, clean, reinstall, reconnect, and make operational components indicated for relocation.

G. Field verify all existing MEP system materials, equipment, raceways, piping and distribution to be removed for exact quantities.

H. Remove all existing MEP system materials, equipment, raceways, piping and distribution located above ceilings and in walls that are not being reused.

I. Remove all MEP systems and appurtances, which are to be removed, in their entireties back to the source or source panels.

J. Remove all existing MEP system materials, equipment, raceways, piping and distribution located in walls or ceilings being demolished. Abandon no devices that have been disconnected unless specifically noted.

K. Maintain continuity of all existing MEP devices, and utilization equipment not removed.

L. Remove, store, protect, and reinstall existing work as required to accommodate alteration indicated.

M. The existing work to be removed, in general, is as indicated on the Drawings and in this Section, but also includes any materials or work necessary to permit installation of new materials, as approved by Owner and Engineer.

N. Disconnect, demolish, and remove systems, equipment, and components indicated to be removed, abandoned or as made obsolete by this project.

1. To Be Removed: Remove portion of systems, equipment, and components indicated to be removed and cap or plug remaining with same or compatible material.
2. To Be Abandoned in Place: Drain piping and cap or plug systems, equipment, and components with same or compatible material.
3. Equipment to Be Removed: Disconnect, make safe and cap services and remove equipment.
4. Equipment to Be Removed and Reinstalled: Disconnect, make safe and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
5. Equipment to Be Removed and Salvaged: Disconnect, make safe and cap services and remove equipment and deliver at direction of Owner.

O. If systems, equipment, and components to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

P. In finished areas, all systems, equipment, and components shall be cut back to a concealed location, i.e., within walls, above ceilings, etc., before capping.

3.4 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.
4. Maintain minimum headroom clearance as indicated by Construction Manager in spaces without a suspended ceiling.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Tools and Equipment: Do not use tools or equipment that produces harmful noise levels.

F. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

G. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Engineer and/or to allow for proper access.
2. Allow for building movement, including thermal expansion and contraction.
3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

H. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.5 CUTTING AND PATCHING

A. See Division 01 for additional requirements. The Contractor shall furnish sketches showing the location and sizes of all openings, chases, etc., required for the installation of Work.

B. Work under this Division shall include furnishing, locating and setting inserts and/or sleeves required before the floors and walls are built or be responsible for cutting, drilling or chopping where sleeves and inserts were not installed, where wall or floors are existing or not correctly located. The Contractor shall do all drilling required for the installation of hangers.

C. Exercise extreme caution when core drilling or punching openings in concrete floor slabs in order to avoid cutting or damaging structural members. No structural members or structural slabs/floors shall be cut without the written acceptance of the Structural Engineer and all such cutting shall be done in a manner directed by him.

D. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.6 SCAFFOLDING, RIGGING, HOISTING

A. The Contractor shall furnish all scaffolding, rigging, hoisting and services necessary for erection and delivery into the premises any equipment and apparatus furnished under this Division. Remove same from premises when no longer required.

3.7 EXCAVATION AND BACKFILLING

A. It is the responsibility of the Contractor to coordinate sizes, depths, fill and bedding requirements and any other excavation work required under this Division.

3.8 ACCESSIBILITY AND ACCESS PANELS

A. Locate all equipment which must be serviced, operated or maintained in fully accessible positions. Access doors shall be furnished for accessibility. Minor deviations from the Drawings may be made to allow better accessibility, but changes of magnitude or which involve extra cost shall not be made without the acceptance of the Engineer.

B. Locate all equipment which must be serviced, operated or maintained in fully accessible positions. Equipment shall include, but not be limited to: motors, controllers, coil, valves, switchgear, drain points, etc. Access doors shall be furnished if required for better accessibility. Minor deviations from the Drawings may be made to allow better accessibility, but changes of magnitude or which involve extra cost shall not be made without the acceptance of the Engineer.

C. Access doors in walls, ceilings, floors, etc., shall be field coordinated. It is the responsibility of the Contractor to coordinate and provide information regarding the sizes and quantities of access doors required for his work. The Contractor shall arrange his work in such a manner as to minimize the quantity of access doors required, such as grouping shutoff valves in the same area. Where possible, locate valves in already accessible areas, such as lay-in ceilings, etc.

D. On a clean set of prints, the Contractor shall mark in red pencil the location of each required access door, including its size and fire rating (if any), and shall submit the print to the Architect for review before access doors are purchased or installed.

E. Upon completion of the Project, the Contractor shall physically demonstrate that all equipment and devices installed have been located and/or provided with adequate access panels for repair, maintenance and/or operation. Any equipment not so furnished shall be relocated or provided with additional access panels by the installing Contractor at no additional cost to the Owner.

3.9 STARTING AND ADJUSTING

A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

B. Adjust operating components for proper operation without binding. Adjust equipment for proper operation.

C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Manufacturer's Field Service: Provide a factory-authorized service representative to inspect field-assembled components and equipment installation, comply with qualification requirements in "Quality Requirements."

3.10 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

C. Remove debris from concealed spaces before enclosing the space.

D. Remove liquid spills promptly.

E. Where dust would impair proper execution of the Project scope of work, broom-clean or vacuum the entire work area, as appropriate.

F. Installed Work: Keep installed work clean.

G. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

J. Limiting Exposures: Supervise construction operations to assure that no part of the construction completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.11 CORRECTION OF THE WORK

A. The cost of corrective work shall be included under the contract.

B. Repair or remove and replace defective construction.

1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

C. Restore permanent facilities used during construction to their specified or original condition.

D. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

E. Repair components that do not operate properly. Remove and replace operating components to new condition.

F. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 220010
03/07/11

February 28, 2011

SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following hangers and supports for plumbing system piping and equipment:

1. Steel pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal-hanger shield inserts.
5. Fastener systems.
6. Pipe stands.
7. Pipe positioning systems.
8. Equipment supports.

B. Related Sections include the following:

1. Division 05 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Division 21 Section "Water-Based Fire-Suppression Systems" for pipe hangers for fire-suppression piping.
3. Division 22 Section "Expansion Fittings and Loops for Plumbing Piping" for pipe guides and anchors.
4. Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment" for vibration isolation devices.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.

B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 PERFORMANCE REQUIREMENTS

A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

C. Design seismic-restraint hangers and supports for piping and equipment.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Steel pipe hangers and supports.
2. Thermal-hanger shield inserts.
3. Powder-actuated fastener systems.
4. Pipe positioning systems.

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following:

1. Trapeze pipe hangers. Include Product Data for components.
2. Metal framing systems. Include Product Data for components.
3. Pipe stands. Include Product Data for components.
4. Equipment supports.

C. Welding certificates.

1.6 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.2, "Structural Welding Code--Aluminum."
3. AWS D1.4, "Structural Welding Code--Reinforcing Steel."
4. ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Comply with requirements in Part 3 articles for where materials shall be applied.

2.2 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.3 STEEL PIPE HANGERS AND SUPPORTS

A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.

B. Manufacturers:

1. AAA Technology & Specialties Co., Inc.
2. Bergen-Power Pipe Supports.
3. B-Line Systems, Inc.; a division of Cooper Industries.
4. Carpenter & Paterson, Inc.
5. Empire Industries, Inc.
6. ERICO/Michigan Hanger Co.
7. Globe Pipe Hanger Products, Inc.
8. Grinnell Corp.
9. GS Metals Corp.
10. National Pipe Hanger Corporation.
11. PHD Manufacturing, Inc.
12. PHS Industries, Inc.
13. Piping Technology & Products, Inc.
14. Tolco Inc.

C. Galvanized, Metallic Coatings: Hot dipped after fabrication (ASTM A 123 and ASTM A 153)..

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

E. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.4 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

2.5 METAL FRAMING SYSTEMS

A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.

B. Manufacturers:

1. B-Line Systems, Inc.; a division of Cooper Industries.
2. ERICO/Michigan Hanger Co.; ERISTRUT Div.
3. GS Metals Corp.
4. Power-Strut Div.; Tyco International, Ltd.
5. Thomas & Betts Corporation.
6. Tolco Inc.
7. Unistrut Corp.; Tyco International, Ltd.

C. Coatings: Hot dipped galvanized after fabrication (ASTM A 123 and ASTM A 153).

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.6 THERMAL-HANGER SHIELD INSERTS

A. Description: 100-psig- minimum, compressive-strength insulation insert encased in sheet metal shield.

B. Manufacturers:

1. ERICO/Michigan Hanger Co.
2. PHS Industries, Inc.
3. Shaw Pipe Shields, Inc.
4. Rilco Manufacturing Company, Inc.
5. Tolco Inc.
6. Value Engineered Products, Inc.

C. Insulation-Insert Material for Cold Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass with vapor barrier.

D. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate.

E. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

F. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

G. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.7 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used. Verify suitability use in lightweight concrete slabs and all slabs less than 4 inches thick.

1. Manufacturers:

a. Hilti, Inc.
b. ITW Ramset/Red Head.
c. Powers Fasteners.

B. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used. Verify suitability use in lightweight concrete slabs and all slabs less than 4 inches thick.

1. Manufacturers:

a. Hilti, Inc.
b. ITW Ramset/Red Head.
c. Powers Fasteners.

2.8 PIPE STAND FABRICATION

A. Pipe Stands, General: Shop or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

B. Curb-Mounting-Type Pipe Stands: Shop- or field-fabricated pipe support made from structural-steel shape, continuous-thread rods, and rollers for mounting on permanent stationary roof curb.

2.9 PIPE POSITIONING SYSTEMS

A. Description: IAPMO PS 42, system of metal brackets, clips, and straps for positioning piping in pipe spaces for plumbing fixtures for commercial applications.

B. Manufacturers:

1. C & S Mfg. Corp.
2. HOLDRITE Corp.; Hubbard Enterprises.
3. Samco Stamping, Inc.

2.10 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.11 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with hot-dipped galvanized, metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use padded hangers for piping that is subject to scratching.

F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30.
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F pipes, NPS 4 to NPS 16, requiring up to 4 inches of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24, requiring clamp flexibility and up to 4 inches of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24, if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated stationary pipes, NPS 3/4 to NPS 8.
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2.
10. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 8.
11. Extension Hinged or 2-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 3.
12. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30.
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.
16. Adjustable, Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes, NPS 2-1/2 to NPS 36, if vertical adjustment is required, with steel pipe base stanchion support and cast-iron floor flange.
17. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30, from 2 rods if longitudinal movement caused by expansion and contraction might occur.
18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes, NPS 2-1/2 to NPS 20, from single rod if horizontal movement caused by expansion and contraction might occur.
19. Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42, if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes, NPS 2 to NPS 24, if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes, NPS 2 to NPS 30, if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

G. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.

H. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

I. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Pipe-Covering Protection Saddles (MSS Type 39): For supporting insulated pipe without vapor barrier, fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe with vapor barrier.

J. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections. Provide per Divisions 21, 22 and 23 mechanical vibration and seismic controls sections.

K. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.

L. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.

M. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction. Verify suitability use in lightweight concrete slabs and all slabs less than 4 inches thick.

N. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

3.2 HANGER AND SUPPORT INSTALLATION

A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.

D. Fiberglass Strut System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled fiberglass struts.

E. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping as indicated herein.

F. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
3. Verify suitability of fasteners in lightweight concrete slabs less than 4 inches thick.

G. Pipe Stand Installation:

1. Curb-Mounting-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. Refer to Division 07 Section "Roof Accessories" for curbs. Seismically restrain assembly to structure.

H. Pipe Positioning System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture. Refer to Division 22 Section "Plumbing Fixtures" for plumbing fixtures.

I. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

J. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

K. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

L. Install lateral bracing with pipe hangers and supports to prevent swaying.

M. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

N. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

O. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9 (for building services piping) are not exceeded.

P. Insulated Piping: Comply with the following:

1. Attach clamps and spacers to piping.

    a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    c. Do not exceed pipe stress limits according to ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, galvanized protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, galvanized protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees or per thermal hanger insert manufacturer recommendations.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following or per thermal hanger insert manufacturer recommendations:

    a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
    b. NPS 4: 12 inches long and 0.06 inch thick.

c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.

5. Pipes NPS 8 and Larger: Include wood inserts.
6. Insert Material: Length at least as long as protective shield.
7. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make smooth bearing surface.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.6 PAINTING

A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 220529
03/07/11

February 28, 2011

SECTION 220553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Stencils.
5. Valve tags.
6. Warning tags.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

D. Valve numbering scheme.

E. Valve Schedules: For each piping system to include in maintenance manuals.

1.4 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Thickness: Stainless steel, 0.025-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
4. Fasteners: Stainless-steel self-tapping screws.
5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
2. Letter Color: Black.
3. Background Color: White.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.

B. Letter Color: Black.

C. Background Color: White.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: At least 1-1/2 incheshigh.

2.4 STENCILS

A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; and minimum letter height of 3/4 inch for access panel and door labels, equipment labels, and similar operational instructions.

1. Stencil Material: Fiberboard or metal.
2. Stencil Paint: Exterior, gloss, acrylic enamel black unless otherwise indicated. Paint may be in pressurized spray-can form.
3. Identification Paint: Exterior, acrylic enamel in colors according to ASME A13.1 unless otherwise indicated.

2.5 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.

1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass beaded chain.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

2.6 WARNING TAGS

A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.

1. Size: Approximately 4 by 7 inches.
2. Fasteners: Brass grommet and wire.
3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Color: Yellow background with black lettering.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

A. Manufactured Pipe Labels: Provided on all piping except piping in return air plenums.

B. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. Near major equipment items and other points of origination and termination.
5. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
6. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

C. Pipe Label Color Schedule:

1. Domestic Cold Water Piping:

a. Background Color: Green.
b. Letter Color: White.

2. Domestic Hot Water and Hot Water Return Piping:

a. Background Color: Yellow.
b. Letter Color: Black.

3.4 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

1. Valve-Tag Size and Shape:

a. Cold Water: 1-1/2 inches, round.
b. Hot Water: 1-1/2 inches, round.

3.5 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 220553
03/07/11

February 28, 2011

SECTION 220719 - PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes insulating the following plumbing piping services:

1. Domestic cold-water piping.
2. Domestic hot-water piping.
3. Domestic recirculating hot-water piping.

B. Related Sections:

1. Division 22 Section "Plumbing Equipment Insulation."

1.3 DEFINITIONS

A. ASJ: All-service jacket.

B. Conditioned Space: An area, room, ceiling, space/plenum or space within the building structure being heated or cooled (by direct expansion or chilled water) or both, by directly or indirectly, by equipment or appliance, and is not subject to outdoor ambient conditions.

C. Unconditioned Space: An area, room or space within the building structure not being conditioned and subject to outdoor ambient conditions.

D. Concealed Pipes: Piping not visible within the room it is located, after the project is completed.

E. Exposed Pipes: Piping visible within the room it is located, after the project is completed.

F. Ceiling Space/Plenum: An enclosed portion of the building structure, other than an occupiable space being conditioned, that is designed to allow air movement, and thereby serve as part of an air distribution system.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied, if any).

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.8 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.9 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Comply with requirements in Part 3 articles for where materials shall be applied.

2.2 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide one of the following:

a. CertainTeed Corp.; SoftTouch Duct Wrap.
b. Johns Manville; Microlite.
c. Knauf Insulation; Friendly Feel Duct Wrap.
d. Manson Insulation Inc.; Alley Wrap.
e. Owens Corning; SOFTR All-Service Duct Wrap.

F. Mineral-Fiber, Preformed Pipe Insulation:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Johns Manville; Micro-Lok.
b. Knauf Insulation; 1000-Degree Pipe Insulation.
c. Owens Corning; Fiberglas Pipe Insulation or SSL II.
d. CertainTeed Corp.

2. Type I, 850 Deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
b. Eagle Bridges - Marathon Industries; 225.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.

d. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
b. Eagle Bridges - Marathon Industries; 225.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-20.
d. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. PVC Jacket Adhesive: Compatible with PVC jacket.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Dow Corning Corporation; 739, Dow Silicone.
b. Johns Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
c. P.I.C. Plastics, Inc.; Welding Adhesive.
d. Speedline Corporation; Polyco VP Adhesive.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.
b. Vimasco Corporation; 749.

2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.

3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
5. Color: White.

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10.
b. Eagle Bridges - Marathon Industries; 550.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
d. Mon-Eco Industries, Inc.; 55-50.
e. Vimasco Corporation; WC-1/WC-5.

2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: 60 percent by volume and 66 percent by weight.
5. Color: White.

2.5 TAPES

A. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.

1. Products: Subject to compliance with requirements, provide one of the following:

a. ABI, Ideal Tape Division; 370 White PVC tape.
b. Compac Corporation; 130.
c. Venture Tape; 1506 CW NS.

2. Width: 2 inches.
3. Thickness: 6 mils.
4. Adhesion: 64 ounces force/inch in width.
5. Elongation: 500 percent.
6. Tensile Strength: 18 lbf/inch in width.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Keep insulation materials dry during application and finishing.

G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

H. Install insulation with least number of joints practical.

I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

K. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

L. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

M. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

N. For above-ambient services, do not install insulation to the following:

1. Testing agency labels and stamps.

2. Nameplates and data plates.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

C. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Division 07 Section "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
6. For services not specified to receive a field-applied jacket, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.

7. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

3.6 INSTALLATION OF MINERAL-FIBER INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.7 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Underground piping.
2. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.8 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold Water:

1. NPS 1 and Smaller: Insulation shall be the following:

a. Flexible Elastomeric: 1 inch thick for indoor belowground piping only.
b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

2. NPS 1-1/4 and Larger: Insulation shall be the following:

a. Flexible Elastomeric: 1 inch thick for indoor belowground piping only.
b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 inches thick.

B. Domestic Hot, Tempered and Recirculated Hot Water:

1. NPS 1-1/4 and Smaller: Insulation shall be the following:

a. Flexible Elastomeric: 1 inch thick for indoor belowground piping only.
b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick for 140 deg F and below; 1-1/2 inches thick for above 140 deg F.

2. NPS 1-1/2 and Larger: Insulation shall be the following:

a. Flexible Elastomeric: 1 inch thick for belowground piping only.
b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 inches thick.

END OF SECTION 220719
03/07/11

February 28, 2011

SECTION 221116 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Aboveground domestic water pipes, tubes, fittings, and specialties inside the building.

1.3 SUBMITTALS

A. Product Data: For the following products:

1. Specialty valves.
2. Transition fittings.
3. Dielectric fittings.
4. Sleeves and sleeve seals.

B. Coordination Drawings: For piping in equipment rooms and other congested areas, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:

1. Domestic water piping.
2. HVAC hydronic piping.

C. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 61 for potable domestic water piping and components.

1.5 PROJECT CONDITIONS

A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:

1. Notify Owner no fewer than two days in advance of proposed interruption of water service.

2. Do not proceed with interruption of water service without Owner's written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.

1. Cast-Copper Solder-Joint Fittings: ASME B16.18, pressure fittings.
2. Wrought-Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
3. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
4. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

2.3 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free, unless otherwise indicated; full-face or ring type unless otherwise indicated.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

2.4 SPECIALTY VALVES

A. Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for general-duty metal valves.

B. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves, drain valves, backflow preventers, and vacuum breakers.

2.5 TRANSITION FITTINGS

A. General Requirements:

1. Same size as pipes to be joined.
2. Pressure rating at least equal to pipes to be joined.
3. End connections compatible with pipes to be joined.

B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

2.6 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.

B. Dielectric Unions:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Capitol Manufacturing Company.
b. Central Plastics Company.
c. EPCO Sales, Inc.
d. Hart Industries International, Inc.
e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
f. Zurn Plumbing Products Group; Wilkins Water Control Products.

2. Description:

a. Pressure Rating: 150 psig at 180 deg F.
b. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Nipples:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Perfection Corporation; a subsidiary of American Meter Company.
b. Precision Plumbing Products, Inc.
c. Victaulic Company.

2. Description:

a. Electroplated steel nipple complying with ASTM F 1545.
b. Pressure Rating: 300 psig at 225 deg F.
c. End Connections: Male threaded or grooved.
d. Lining: Inert and noncorrosive, propylene.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Install shutoff valve immediately upstream of each dielectric fitting.

C. Install domestic water piping level without pitch and plumb.

D. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

G. Install piping adjacent to equipment and specialties to allow service and maintenance.

H. Install piping to permit valve servicing.

I. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than system pressure rating used in applications below unless otherwise indicated.

J. Install piping free of sags and bends.

K. Install fittings for changes in direction and branch connections.

L. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

M. Install thermostats in hot-water circulation piping. Comply with requirements in Division 22 Section "Domestic Water Pumps" for thermostats.

3.2 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."

E. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.

F. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.3 VALVE INSTALLATION

A. General-Duty Valves: Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for valve installations.

B. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball valves for piping NPS 2 and smaller. Use butterfly valves for piping NPS 2-1/2 and larger.

C. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping. Drain valves are specified in Division 22 Section "Domestic Water Piping Specialties."

1. Hose-End Drain Valves: At low points in water mains, risers, and branches.

D. Install calibrated balancing valves in each hot-water circulation return branch and discharge side of each pump and circulator. Set calibrated balancing valves partly open to restrict but not stop flow. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for calibrated balancing valves.

3.4 TRANSITION FITTING INSTALLATION

A. Install transition couplings at joints of dissimilar piping.

3.5 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric couplings or nipples.

3.6 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment" for seismic-restraint devices.

1. Vertical Piping: MSS Type 8 or 42, clamps.
2. Individual, Straight, Horizontal Piping Runs:

a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
c. Longer Than 100 Feet If Indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Support vertical piping and tubing at base and at each floor.

C. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.

D. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.

3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
4. NPS 2-1/2: 108 inches with 1/2-inch rod.
5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
6. NPS 6: 10 feet with 5/8-inch rod.
7. NPS 8: 10 feet with 3/4-inch rod.

E. Install supports for vertical copper tubing every 10 feet.

F. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment and machines to allow service and maintenance.

C. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:

1. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
2. Equipment: Cold- and hot-water supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.8 IDENTIFICATION

A. Identify system components. Comply with requirements in Division 22 Section "Identification for Plumbing Piping and Equipment" for identification materials and installation.

3.9 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Piping Inspections:

1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
2. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

    a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
    b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

3. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

C. Piping Tests:

1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
4. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
6. Prepare reports for tests and for corrective action required.

D. Domestic water piping will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.10 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.

    a. Adjust calibrated balancing valves to flows indicated.

5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.11 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:

    a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
    b. Fill and isolate system according to either of the following:

        1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.

2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.

c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.

d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

B. Prepare and submit reports of purging and disinfecting activities.

C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.12 PIPING SCHEDULE

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

C. Aboveground domestic water piping, NPS 2 and smaller, shall be the following:

1. Hard copper tube, ASTM B 88, Type L; cast or wrought copper solder-joint fittings; and soldered joints.

D. Aboveground domestic water piping, NPS 2-1/2 to NPS 4, shall be the following:

1. Hard copper tube, ASTM B 88, Type L; cast or rought copper solder-joint fittings; and soldered joints.

3.13 VALVE SCHEDULE

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use ball valves for piping NPS 2 and smaller. Use butterfly, ball, valves with flanged ends for piping NPS 2-1/2 and larger.
2. Throttling Duty: Use ball or globe valves for piping NPS 2 and smaller. Use butterfly or ball valves with flanged ends for piping NPS 2-1/2 and larger.
3. Hot-Water Circulation Piping, Balancing Duty: Calibrated balancing valves.
4. Drain Duty: Hose-end drain valves.

B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

END OF SECTION 221116
03/07/11

SECTION 221119 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following domestic water piping specialties:

1. Balancing valves.
2. Temperature-actuated water mixing valves.
3. Drain valves.

B. Related Sections include the following:

1. Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers, pressure gages, and flow meters in domestic water piping.
2. Division 22 Section "Domestic Water Piping" for water meters.

1.3 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig, unless otherwise indicated.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. NSF Compliance:

1. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."

PART 2 - PRODUCTS

2.1 BACKFLOW PREVENTERS

A. Intermediate Atmospheric-Vent Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Cash Acme.
b. Conbraco Industries, Inc.
c. FEBCO; SPX Valves & Controls.
d. Watts Industries, Inc.; Water Products Div.
e. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1012.
3. Operation: Continuous-pressure applications.

B. Reduced-Pressure-Principle Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Ames Co.
b. Conbraco Industries, Inc.
c. FEBCO; SPX Valves & Controls.
d. Watts Industries, Inc.; Water Products Div.
e. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1013.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 12 psig maximum, through middle 1/3 of flow range.
5. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
6. Accessories:

a. Valves: Ball type with threaded ends on inlet and outlet ofNPS 2 and smaller; outside screw and yoke gate-type with flanged ends on inlet and outlet of NPS 2-1/2 and larger.
b. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

2.2 BALANCING VALVES

A. Copper-Alloy Calibrated Balancing Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Armstrong International, Inc.

b. ITT Industries; Bell & Gossett Div.
c. Taco, Inc.
d. Watts Industries, Inc.; Water Products Div.

2. Type: Ball valve with two readout ports and memory setting indicator.
3. Body: Bronze.
4. Size: Same as connected piping, but not larger than NPS 2.
5. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

2.3 TEMPERATURE-ACTUATED WATER MIXING VALVES

A. Water-Temperature Limiting Devices:

B. Primary, Thermostatic, Water Mixing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Armstrong International, Inc.
b. Lawler Manufacturing Company, Inc.
c. Leonard Valve Company.
d. Symmons Industries, Inc.

2. Standard: ASSE 1017.
3. Pressure Rating: 125 psig.
4. Accessories: Manual temperature control, check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.

2.4 HOSE BIBBS

A. Hose Bibbs:

1. Standard: ASME A112.18.1 for sediment faucets.
2. Body Material: Bronze.
3. Seat: Bronze, replaceable.
4. Supply Connections: NPS 1/2 or NPS 3/4 threaded or solder-joint inlet.
5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
6. Pressure Rating: 125 psig.
7. Vacuum Breaker: Integral or field-installation, nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
8. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
9. Finish for Service Areas: Chrome or nickel plated.
10. Finish for Finished Rooms: Chrome or nickel plated.
11. Operation for Equipment Rooms: Wheel handle or operating key.
12. Operation for Service Areas: Wheel handle.
13. Operation for Finished Rooms: Operating key.
14. Include operating key with each operating-key hose bibb.
15. Include integral wall flange with each chrome- or nickel-plated hose bibb.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.

1. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction. Note: Local water companies/state health departments have specific requirements regarding installation, access, tags, etc., for these devices. Contractor shall obtain these requirements from these entities prior to installing these devices.Locate backflow preventers in same room as connected equipment or system.
2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.
3. Do not install bypass piping around backflow preventers.

B. Install water regulators with inlet and outlet shutoff valves. Install pressure gages on inlet and outlet.

C. Install water control valves with inlet and outlet shutoff valves and bypass with globe valve. Install pressure gages on inlet and outlet.

D. Install balancing valves in locations where they can easily be adjusted.

E. Install temperature-actuated water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.

1. Install thermometers and water regulators if specified.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties.

B. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

3.3 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:

1. Reduced-pressure-principle backflow preventers.
2. Calibrated balancing valves.
3. Primary, thermostatic, water mixing valves.

B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and prepare test reports:

1. Test each reduced-pressure-principle backflow preventer according to authorities having jurisdiction and the device's reference standard.

B. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

3.5 ADJUSTING

A. Set field-adjustable flow set points of balancing valves.

B. Set field-adjustable temperature set points of temperature-actuated water mixing valves.

END OF SECTION 221119
03/07/11

February 28, 2011

SECTION 221123 - DOMESTIC WATER PUMPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following all-bronze and bronze-fitted centrifugal pumps for domestic cold- and hot-water circulation:

1. Close-coupled, in-line, sealless centrifugal pumps.

1.3 SUBMITTALS

A. Product Data: For each type and size of domestic water pump specified. Include certified performance curves with operating points plotted on curves; and rated capacities of selected models, furnished specialties, and accessories.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Operation and Maintenance Data: For domestic water pumps to include in emergency, operation, and maintenance manuals.

1.4 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of domestic water pumps and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. UL Compliance: Comply with UL 778 for motor-operated water pumps.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Retain shipping flange protective covers and protective coatings during storage.

B. Protect bearings and couplings against damage.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 CLOSE COUPLED, IN-LINE, SEALLESS CENTRIFUGAL PUMPS

A. Manufacturers:

1. Armstrong Pumps Inc.
2. Bell & Gossett Domestic Pump; ITT Industries.
3. Grundfos Pumps Corp.

B. Description: Factory-assembled and -tested, single-stage, close-coupled, in-line, sealless centrifugal pumps as defined in HI 5.1-5.6.

1. Pump and Motor Assembly: Hermetically sealed, replaceable-cartridge-type unit with motor and impeller on common shaft and designed for installation with pump and motor shaft mounted horizontally.
2. Casing: Bronze, with threaded companion-flange connections.
3. Impeller: Corrosion-resistant material.
4. Motor: Single speed, unless otherwise indicated. Comply with requirements in Division 22 Section "Common Motor Requirements for Plumbing Equipment."

C. Capacities and Characteristics: Refer to Equipment Schedules on MEP drawings.

2.3 CONTROLS

A. Thermostats: Electric; adjustable for control of hot-water circulation pump.

1. Manufacturers:

a. Honeywell International, Inc.
b. Square D.
c. White-Rodgers Div.; Emerson Electric Co.

2. Type: Water-immersion sensor, for installation in hot-water circulation piping.
3. Range: 100 to 240 deg F.
4. Operation of Pump: On or off.
5. Transformer: Provide if required.
6. Power Requirement: 120 V, ac.

B. Timers: Electric time clock for control of hot-water circulation pump.

1. Manufacturers:

    a. Honeywell International, Inc.
    b. Intermatic, Inc.
    c. Johnson Controls, Inc.
    d. TORK.

2. Type: Programmable, seven-day clock with manual override on-off switch.
3. Enclosure: Suitable for wall mounting.
4. Operation of Pump: On or off.
5. Transformer: Provide if required.
6. Power Requirement: 120 V, ac.
7. Programmable Sequence of Operation: Up to two on-off cycles each day for seven days.

2.4 BUILDING-AUTOMATION-SYSTEM INTERFACE

A. Provide auxiliary contacts in pump controllers for interface to building automation system. Include the following:

1. On-off status of each pump.
2. Alarm status.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of domestic-water-piping system to verify actual locations of connections before pump installation.

3.2 PUMP INSTALLATION

A. Comply with HI 1.4.

B. Install pumps with access for periodic maintenance including removal of motors, impellers, couplings, and accessories.

C. Independently support pumps and piping so weight of piping is not supported by pumps and weight of pumps is not supported by piping.

D. Install continuous-thread hanger rods and spring hangers with vertical-limit stop of sufficient size to support pump weight. Hanger and support materials are specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

3.3 CONTROL INSTALLATION

A. Install immersion-type thermostats in hot-water return piping.

B. Install timers in a location as directed by the Owner.

3.4 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to pumps to allow service and maintenance.

C. Connect domestic water piping to pumps. Install suction and discharge piping equal to or greater than size of pump nozzles. iping."

D. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

E. Connect thermostats and timers to pumps that they control.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain controls and pumps. Refer to Division 01 for additional requirements.

END OF SECTION 221123
03/07/11

February 28, 2011

SECTION 223400 - FUEL-FIRED DOMESTIC WATER HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following fuel-fired water heaters:

1. Gas fired, tankless water heater.

1.3 DEFINITIONS

A. LP Gas: Liquefied-petroleum fuel gas.

1.4 SUBMITTALS

A. Product Data: For each type and size of water heater indicated. Include rated capacities, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Product Certificates: For gas fired tankless water heater, signed by product manufacturer.

D. Field quality-control test reports.

E. Warranty: Special warranty specified in this Section.

F. Operation and Maintenance Data: For water heaters to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain same type of water heaters through one source from a single manufacturer.

B. Product Options: Drawings indicate size, profiles, and dimensional requirements of water heaters and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. ASME Compliance:

1. Where ASME-code construction is indicated, fabricate and label commercial, water heaters to comply with ASME Boiler and Pressure Vessel Code: Section IV.

E. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9" for all components that will be in contact with potable water.

F. ANSI/ASHRAE/IESNA Standard 90.1-2001 Compliance: Equipment shall meet or exceed the minimum efficiency requirements of the Standard. Equipment shall bear a permanent label installed by the manufacturer stating that the equipment complies with the requirements of ASHRAE Standard 90.1.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of fuel-fired water heaters that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including storage tank and supports.
b. Faulty operation of controls.
c. Deterioration of metals, metal finishes, and other materials beyond normal use.

2. Warranty Period(s): From date of Substantial Completion:

a. Gas Fired Tankless, Water Heaters:

1) Water Heater: Five years.
2) Controls and Other Components: Three years.

PART 2 - PRODUCTS

2.1 GAS-FIRED, TANKLESS WATER HEATERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Rinnai or comparable product by one of the following:

1. Takagi.
2. Bosch Water Heating.

B. Standard: ANSI Z21.102/CSA 4.3 for gas-fired, instantaneous, domestic water heaters for indoor application.

C. Construction: Copper piping or tubing complying with NSF 61 barrier materials for potable water, without storage capacity.

1. Tappings: ASME B1.20.1 pipe thread.
2. Pressure Rating: 150 psig.
3. Heat Exchanger: Copper tubing.
4. Insulation: Comply with ASHRAE/IESNA 90.1.

5. Jacket: metal with enameled finish or plastic.
6. Burner: For use with tankless, domestic water heaters and natural-gas fuel.
7. Automatic Ignition: Manufacturer's proprietary system for automatic, gas ignition.
8. Temperature Control: Adjustable thermostat.

D. Support: Bracket for wall mounting.

E. Capacity and Characteristics:

1. Flow Rate: 11.3 GPM at 55 deg. F temperature rise, flow range of 0.5 GPM to 14.5 GPM.
2. Temperature Setting: 125 deg F.
3. Fuel Gas Demand: 380 CFH.
4. Fuel Gas Input: 380,000.
5. Gas Pressure Regulator:

   a. Capacity: 380 CFH.
   b. Inlet Pressure: 7 – 14 inches water column.
   c. Gas Pressure Required at Burner: 5.0 – 10.5 inches water column.

6. Electrical Characteristics:

   a. Volts: 120.
   b. Phase: Single.
   c. Hertz: 60.

7. Minimum Vent Diameter: 5 inches direct vent flue and 5 inches combustion air inlet with vertical termination kit.
8. Control System: The heater(s) shall be controlled by onboard solid state printed circuit board monitoring incoming and outgoing temperatures with factory installed thermistors, sensing and controlling flow rate to setpoint temperature with control both air and gas mixture inputs to maintain thermal combustion efficiency. Unit also consists of ground fault interrupter, inline fusing, spark ignition and sensor system aluminized stainless steel burners, air-fuel ration rod, high-limit switch, modulating and proportional gas vales, freeze protection sensor and heating block and overhead cut-off fuses.
9. Multiple Water Heater Control:; Computerized control system ("Easy-Link") with cabling to connect four units for rotating master/slave operation and domestic water recirculation pump control.

2.2 WATER HEATER ACCESSORIES

A. Gas Shutoff Valves: ANSI Z21.15/CGA 9.1, manually operated. Furnish for installation in piping.

B. Gas Pressure Regulators: ANSI Z21.18, appliance type. Include pressure rating, capacity, and pressure differential required between gas supply and water heater.

C. Pressure Relief Valves: Include pressure setting less than working-pressure rating of water heater.

1. Gas Water Heaters: ANSI Z21.22/CSA 4.4.

D. Water Heater Mounting Brackets: Water heater manufacturer's factory-fabricated steel bracket for wall mounting and capable of supporting water heater and water.

E. Piping Manifold Kits: Water heater manufacturer's factory-fabricated inlet and outlet piping arrangement for multiple-unit installation. Include piping and valves for field assembly that is capable of isolating each water heater and of providing balanced flow through each water heater.

2.3 SOURCE QUALITY CONTROL

A. Hydrostatically test water heater before shipment to minimum of one and one-half times pressure rating.

B. Prepare test reports.

PART 3 - EXECUTION

3.1 WATER HEATER INSTALLATION

A. Install water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

B. Install gas water heaters according to NFPA 54.

C. Install gas shutoff valves on gas supplies to gas water heaters without shutoff valves.

D. Install gas pressure regulators on gas supplies to gas water heaters without gas pressure regulators if gas pressure regulators are required to reduce gas pressure at burner.

E. Install automatic gas valves on gas supplies to gas water heaters, if required for operation of safety control.

F. Install pressure relief valves in water piping for water heaters without storage. Extend water-heater relief-valve outlet, with drain piping same as domestic water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

G. Install water heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for water heaters that do not have tank drains. Refer to Division 22 Section "Domestic Water Piping Specialties" for hose-end drain valves.

H. Install thermometer on outlet piping of water heaters. Refer to Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers.

I. Assemble and install inlet and outlet piping manifold kits for multiple water heaters. Fabricate, modify, or arrange manifolds for balanced water flow through each water heater. Include shutoff valve and thermometer in each water heater inlet and outlet, and throttling valve in each water heater outlet. Refer to Division 22 Section "General-Duty Valves for Plumbing Piping" for general-duty valves and to Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers.

J. Fill water heaters with water.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to water heaters to allow service and maintenance. Arrange piping for easy removal of water heaters.

C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including connections Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:

1. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, confirm proper operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace water heaters that do not pass tests and inspections and retest as specified above.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain water heaters. Refer to Division 01 for additional requirements.

END OF SECTION 223400
03/07/11

February 28, 2011

SECTION 230010 - HVAC TRADES REFERENCE TO GENERAL CONDITIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. All provisions of Division 22 "General Conditions for Mechanical Trades" apply to this Section.

C. This section is intended to supplement the requirements of Division 01 requirements. For any conflicting requirements for minimum quantities or quality levels between this Section and Division 01, comply with the most stringent requirement.

1.2 SUMMARY

A. This Section includes the following when associated with Division 23 work:

1. Permits and fees, code requirements, work under other contracts.
2. Work restrictions.
3. Specification formats and conventions.
4. Request for information.
5. Coordination.
6. Conflicting requirements.
7. Quality assurance and control.
8. Product delivery, storage, and handling.
9. Product warranties.
10. Submittals.
11. Product selection procedures.
12. Product interoperability requirements.
13. General execution of project scope of work.
14. Record drawings.
15. Demonstration and training.

B. Related Sections include the following:

1. Division 01 Sections.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 230010
03/07/11

February 28, 2011

SECTION 230513 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with requirements in this Section except when stricter requirements are specified in HVAC equipment schedules or Sections.

B. Comply with NEMA MG 1 unless otherwise indicated.

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Energy and premium efficient, as defined in NEMA MG 1.

1. "Energy Efficient" for all motors less than 1 HP.
2. "Premium Efficient" for all motors 1 HP and larger, including those furnished as part of equipment specified in equipment sections. The contractor shall confirm utility company minimum requirements for incentive programs and provide motors with efficiencies that meet or exceed the most stringent between NEMA MG-1 and utility company incentive program requirements. The contractor, at no extra charge to the Owner, shall replace any motor that does not meet the utility company's incentive program. The efficiency and/or "NEMA Premium Efficiency" shall be displayed on the motor nameplate and clearly indicated on the equipment shop drawings submitted for approval.

C. Service Factor: 1.15.

D. Rotor: Random-wound, squirrel cage.

E. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

F. Temperature Rise: Match insulation rating.

G. Insulation: Class F.

H. Code Letter Designation:

1. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.

I. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

J. Motor Controllers:

1. Motor controllers, including variable frequency controllers, shall be furnished with the motor and per Division 26.
2. Overload Protection: Overload protection shall be sized and furnished for the requirements of the specific application.
3. Accessories: Provide accessories coordinated to the specific application and per Division 26.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

A. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
3. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

4. Shaft Voltage and Bearing Current Protection: Shaft Grounding Rings (SGR) as manufactured by AEGIS or equivalent installed per manufacturer's recommendations and in accordance with NEMA MG1 31.4.4.3 to discharge voltages and divert current to protect bearings in attached equipment.

2.5 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.
2. Split phase.
3. Capacitor start, inductor run.
4. Capacitor start, capacitor run.

B. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

C. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION

3.1 MOTORS USED WITH VARIABLE FREQUENCY CONTROLLERS

A. Install shaft grounding rings on all equipment motors using variable speed controllers.

B. Install per manufacturer's instructions.

C. Assure grounding of SGR to motor frame.

END OF SECTION 230513
03/07/11

SECTION 230516 - EXPANSION FITTINGS AND LOOPS FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Slip-joint packed expansion joints.
2. Expansion-compensator packless expansion joints.
3. Grooved-joint expansion joints.
4. Pipe loops and swing connections.
5. Alignment guides and anchors.

1.3 PERFORMANCE REQUIREMENTS

A. Compatibility: Products shall be suitable for piping service fluids, materials, working pressures, and temperatures.

B. Capability: Products to absorb 200 percent of maximum axial movement between anchors.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Delegated-Design Submittal: For each anchor and alignment guide indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Design Calculations: Calculate requirements for thermal expansion of piping systems and for selecting and designing expansion joints, loops, bends, swing connections, anchors and guides.
2. Anchor Details: Locate, size and detail fabrication of each anchor. Show dimensions and methods of assembly and attachment to building structure.
3. Alignment Guide Details: Locate, size and detail field assembly and attachment to building structure for each guide length and maximum spider travel.
4. Schedule: Indicate type, manufacturer's number, size, material, pressure rating, end connections, and location for each expansion joint.

1.5 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Product Certificates: For each type of expansion joint, from manufacturer.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For expansion joints to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 - PRODUCTS

2.1 PACKED EXPANSION JOINTS

A. Slip-Joint Packed Expansion Joints:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Adsco Manufacturing LLC.
b. Advanced Thermal Systems, Inc.

2. Standard: ASTM F 1007.
3. Material: Carbon steel with asbestos-free PTFE packing.
4. Design: With internal guide and injection device for repacking under pressure. Include drip connection if used for steam piping.
5. Configuration: Single joint with base and double joint with base class(es) unless otherwise indicated.
6. End Connections: Flanged or weld ends to match piping system.

2.2 PACKLESS EXPANSION JOINTS

A. Metal, Expansion-Compensator Packless Expansion Joints:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Adsco Manufacturing LLC.
b. Flexicraft Industries.
c. Flex-Weld, Inc.
d. Metraflex, Inc.
e. Senior Flexonics Pathway.

2. Minimum Pressure Rating: 150 psig unless otherwise indicated.
3. Configuration for Copper Tubing: Two-ply, phosphor-bronze bellows with copper pipe ends.

a. End Connections for Copper Tubing NPS 2 and Smaller: Solder joint.
b. End Connections for Copper Tubing NPS 2-1/2 to NPS 4: Threaded.

4. Configuration for Steel Piping: Two-ply, stainless-steel bellows; steel-pipe end connections; and carbon-steel shroud.

a. End Connections for Steel Pipe NPS 2 and Smaller: Threaded.

2.3 GROOVED-JOINT EXPANSION JOINTS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Victaulic Company or comparable product by one of the following:

1. Anvil International, Inc.
2. Shurjoint Piping Products.

B. Description: Factory-assembled expansion joint made of several grooved-end pipe nipples, couplings, and grooved joints.

C. Standard: AWWA C606, for grooved joints.

D. Nipples: Galvanized, ASTM A 53/A 53M, Schedule 40, Type E or S, steel pipe with grooved ends.

E. Couplings: Five, flexible type for steel-pipe dimensions. Include ferrous housing sections, Buna-N gasket suitable for diluted acid, alkaline fluids, and cold and hot water or EPDM gasket suitable for cold and hot water, and bolts and nuts.

2.4 ALIGNMENT GUIDES AND ANCHORS

A. Alignment Guides:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Adsco Manufacturing LLC.
b. Advanced Thermal Systems, Inc.
c. Flexicraft Industries.
d. Flex-Weld, Inc.
e. Metraflex, Inc.
f. Senior Flexonics Pathway.

2. Description: Steel, factory-fabricated alignment guide, with bolted two-section outer cylinder and base for attaching to structure; with two-section guiding spider for bolting to pipe. Determine alignment guide length and maximum spider travel suited for application.

B. Anchor Materials:

1. Steel Shapes and Plates: ASTM A 36/A 36M.
2. Bolts and Nuts: ASME B18.10 or ASTM A 183, steel hex head.
3. Washers: ASTM F 844, steel, plain, flat washers.

4. Mechanical Fasteners: Insert-wedge-type stud with expansion plug anchor for use in hardened portland cement concrete, with tension and shear capacities appropriate for application.

   a. Stud: Threaded, zinc-coated carbon steel.
   b. Expansion Plug: Zinc-coated steel.
   c. Washer and Nut: Zinc-coated steel.

5. Chemical Fasteners: Insert-type-stud, bonding-system anchor for use with hardened portland cement concrete, with tension and shear capacities appropriate for application.

   a. Bonding Material: ASTM C 881/C 881M, Type IV, Grade 3, two-component epoxy resin suitable for surface temperature of hardened concrete where fastener is to be installed.
   b. Stud: ASTM A 307, zinc-coated carbon steel with continuous thread on stud unless otherwise indicated.
   c. Washer and Nut: Zinc-coated steel.

PART 3 - EXECUTION

3.1 EXPANSION-JOINT INSTALLATION

A. Install expansion joints of sizes matching sizes of piping in which they are installed.

B. Install packed-type expansion joints with packing suitable for fluid service.

C. Install rubber packless expansion joints according to FSA-NMEJ-702.

D. Install grooved-joint expansion joints to grooved-end steel piping

3.2 PIPE LOOP AND SWING CONNECTION INSTALLATION

A. Size and install pipe loops as required to partly absorb tension or compression produced during anticipated change in temperature. Loops and bends shall not be cold spring.

B. Connect risers and branch connections to mains with at least five pipe fittings including tee in main.

C. Connect risers and branch connections to terminal units with at least four pipe fittings including tee in riser.

D. Connect mains and branch connections to terminal units with at least four pipe fittings including tee in main.

3.3 ALIGNMENT-GUIDE AND ANCHOR INSTALLATION

A. Install alignment guides to guide expansion and to avoid end-loading and torsional stress.

B. Install two guide(s) on each side of pipe expansion fittings and loops per manufacturer's instructions. Install guides nearest to expansion joint not more than four pipe diameters from expansion joint.

C. Attach guides to pipe and secure guides to building structure.

D. Install anchors at locations to prevent stresses from exceeding those permitted by ASME B31.9 and to prevent transfer of loading and stresses to connected equipment.

E. Anchor Attachments:

1. Anchor Attachment to Steel Pipe: Attach by welding. Comply with ASME B31.9 and ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
2. Anchor Attachment to Copper Tubing: Attach with pipe hangers. Use MSS SP-69, Type 24, U-bolts bolted to anchor.

F. Fabricate and install steel anchors by welding steel shapes, plates, and bars. Comply with ASME B31.9 and AWS D1.1/D1.1M.

1. Anchor Attachment to Steel Structural Members: Attach by welding.
2. Anchor Attachment to Concrete Structural Members: Attach by fasteners. Follow fastener manufacturer's written instructions.

G. Use grout to form flat bearing surfaces for guides and anchors attached to concrete.

3.4 EXPANSION COMPENSATION APPLICATIONS

A. Pipe Bend and Loops: All applications unless noted otherwise.

B. Expansion Compensators: In piping systems 2-1/2 inches and smaller that are installed within enclosures where a pipe bend or loop cannot be applied. This type is not to be used in distribution mains or in systems serving critical or 24-hour operating applications.

C. Packed Slip Expansion Joints: In piping system mains and mains serving critical or 24-hour operating applications that are installed within enclosures where a pipe bend or loop cannot be applied. Single joint up to 12 inches, double joint with intermediate anchor base for 14 inches and above.

END OF SECTION 230516
03/07/11

February 28, 2011

SECTION 230517 - SLEEVES AND SLEEVE SEALS FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Sleeves.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

C. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.

3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint.

3.2 SLEEVE SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Interior Partitions:

a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.

END OF SECTION 230517
03/07/11

February 28, 2011

SECTION 230518 - ESCUTCHEONS FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Escutcheons.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

A. One-Piece, Cast-Brass Type: With polished, chrome-plated and rough-brass finish and setscrew fastener.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.

C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

D. Split-Casting Brass Type: With polished, chrome-plated and rough-brass finish and with concealed hinge and setscrew.

E. Split-Plate, Stamped-Steel Type: With chrome-plated finish, concealed hinge, and spring-clip fasteners.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install escutcheons for piping penetrations of walls.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. Escutcheons for New Piping:

   a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
   b. Chrome-Plated Piping: One-piece, cast-brass type with polished, chrome-plated finish.
   c. Insulated Piping: One-piece, stamped-steel type.
   d. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with rough-brass finish.
   e. Bare Piping in Equipment Rooms: One-piece, cast-brass type with rough-brass finish.

2. Escutcheons for Existing Piping:

   a. Chrome-Plated Piping: Split-casting brass type with polished, chrome-plated finish.
   b. Insulated Piping: Split-plate, stamped-steel type with concealed hinge.
   c. Bare Piping in Unfinished Service Spaces: Split-casting brass type with rough-brass finish.
   d. Bare Piping in Equipment Rooms: Split-casting brass type with rough-brass finish.

3.2 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION 230518
03/07/11

SECTION 230519 - GAGES FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Bimetallic-actuated thermometers.
2. Thermowells.
3. Dial-type pressure gages.
4. Gage attachments.
5. Test plugs.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Product Certificates: For each type of gage, from manufacturer.

C. Operation and Maintenance Data: For gages to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 BIMETALLIC-ACTUATED THERMOMETERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ashcroft Inc.
2. Marsh Bellofram.
3. Trerice, H. O. Co.
4. Weiss Instruments, Inc.
5. WIKA Instrument Corporation - USA.

B. Standard: ASME B40.200.

C. Case: Liquid-filled and sealed type(s); stainless steel with 5-inch nominal diameter.

D. Dial: Nonreflective aluminum with permanently etched scale markings and scales in deg F.

E. Connector Type(s): Union joint, adjustable angle, with unified-inch screw threads.

F. Connector Size: 1/2 inch, with ASME B1.1 screw threads.

G. Stem: 0.25 inch in diameter; stainless steel.

H. Window: Plain glass.

I. Ring: Stainless steel.

J. Element: Bimetal coil.

K. Pointer: Dark-colored metal.

L. Accuracy: Plus or minus 1 percent of scale range.

2.2 FILLED-SYSTEM THERMOMETERS

A. Remote-Mounted, Metal-Case, Vapor-Actuated Thermometers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Ashcroft Inc.
    b. Marsh Bellofram.
    c. Trerice, H. O. Co.
    d. Weiss Instruments, Inc.
    e. WIKA Instrument Corporation - USA.

2. Standard: ASME B40.200.
3. Case: Sealed type, cast aluminum or drawn steel; 4-1/2-inch nominal diameter with back flange and holes for panel mounting.
4. Element: Bourdon tube or other type of pressure element.
5. Movement: Mechanical, with link to pressure element and connection to pointer.
6. Dial: Nonreflective aluminum with permanently etched scale markings graduated in deg F.
7. Pointer: Dark-colored metal.
8. Window: Glass.
9. Ring: Metal.
10. Connector Type(s): Union joint, bottom; with ASME B1.1 screw threads.
11. Thermal System: Liquid-filled bulb in copper-plated steel, aluminum, or brass stem and of length to suit installation.

    a. Design for Air-Duct Installation: With ventilated shroud.
    b. Design for Thermowell Installation: Bare stem.

12. Accuracy: Plus or minus 1 percent of scale range.

2.3 DUCT-THERMOMETER MOUNTING BRACKETS

A. Description: Flanged bracket with screw holes, for attachment to air duct and made to hold thermometer stem.

2.4 THERMOWELLS

A. Thermowells:

1. Standard: ASME B40.200.
2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
3. Material for Use with Copper Tubing: Brass.
4. Material for Use with Steel Piping: Stainless steel.
5. Type: Stepped shank unless straight or tapered shank is indicated.
6. External Threads: NPS 1/2, NPS 3/4, or NPS 1, ASME B1.20.1 pipe threads.
7. Internal Threads: ASME B1.1 screw threads to match temperature gage.
8. Bore: Diameter required to match thermometer bulb or stem.
9. Insertion Length: Length required to match thermometer bulb or stem.
10. Lagging Extension: Include on thermowells for insulated piping and tubing.
11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

B. Heat-Transfer Medium: Mixture of graphite and glycerin.

2.5 PRESSURE GAGES

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Ashcroft Inc.
    b. Marsh Bellofram.
    c. Trerice, H. O. Co.
    d. Weiss Instruments, Inc.
    e. WIKA Instrument Corporation - USA.

2. Standard: ASME B40.100.
3. Case: Liquid-filled or sealed type(s); cast aluminum or drawn steel; 4-1/2-inch nominal diameter.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.
8. Pointer: Dark-colored metal.
9. Window: Glass.
10. Ring: Metal.
11. Accuracy: Grade B, plus or minus 2 percent of middle half of scale range.

B. Remote-Mounted, Metal-Case, Dial-Type Pressure Gages:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Ashcroft Inc.
    b. Marsh Bellofram.
    c. Trerice, H. O. Co.
    d. Weiss Instruments, Inc.

e. WIKA Instrument Corporation - USA.

2. Standard: ASME B40.100.
3. Case: Sealed type; cast aluminum or drawn steel; 4-1/2-inch nominal diameter with back flange and holes for panel mounting.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.
8. Pointer: Dark-colored metal.
9. Window: Glass.
10. Ring: Metal.
11. Accuracy: Grade B, plus or minus 2 percent of middle half of scale range.

2.6 GAGE ATTACHMENTS

A. Snubbers: ASME B40.100, brass; with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and porous-metal-type surge-dampening device. Include extension for use on insulated piping.

B. Siphons: Loop-shaped section of steel pipe with NPS 1/4 or NPS 1/2 pipe threads.

C. Valves: Brass or stainless-steel needle, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads.

2.7 TEST PLUGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Flow Design, Inc.
2. Peterson Equipment Co., Inc.
3. Trerice, H. O. Co.
4. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
5. Weiss Instruments, Inc.

B. Description: Test-station fitting made for insertion into piping tee fitting.

C. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.

D. Thread Size: NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe thread.

E. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.

F. Core Inserts: EPDM self-sealing rubber.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install thermowells with socket extending to center of pipe and in vertical position in piping tees.

B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.

C. Install thermowells with extension on insulated piping.

D. Fill thermowells with heat-transfer medium.

E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.

F. Install remote-mounted thermometer bulbs in thermowells and install cases on panels; connect cases with tubing and support tubing to prevent kinks. Use minimum tubing length.

G. Install duct-thermometer mounting brackets in walls of ducts. Attach to duct with screws.

H. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.

I. Install remote-mounted pressure gages on panel.

J. Install valve and snubber in piping for each pressure gage for fluids.

K. Install valve and syphon fitting in piping for each pressure gage for steam.

L. Install test plugs in piping tees.

M. Install remote-mounted gages in locations where direct mounting cannot be read from floor level.

N. Install thermometers in the following locations:

1. Inlet and outlet of each hydronic zone.
2. Inlet and outlet of each hydronic boiler.

O. Install pressure gages in the following locations:

1. Inlet and outlet of each pressure-reducing valve.
2. Suction and discharge of each pump.
3. Inlet and outlet of each boiler.

3.2 CONNECTIONS

A. Install gages adjacent to machines and equipment to allow service and maintenance of gages, machines, and equipment.

3.3 ADJUSTING

A. Adjust faces of gages to proper angle for best visibility.

3.4 THERMOMETER SCHEDULE

A. Thermometers at inlet and outlet of each hydronic zone shall be one of the following:

1. Sealed, bimetallic-actuated type.
2. Direct or remote-mounted, vapor-actuated type.
3. Test plug.

B. Thermometers at inlet and outlet of each hydronic boiler shall be one of the following:

1. Liquid-filled, bimetallic-actuated type.
2. Direct or remote-mounted, vapor-actuated type.
3. Test plug.

3.5 THERMOMETER SCALE-RANGE SCHEDULE

A. Scale Range for Heating, Hot-Water Piping: 30 to 240 deg F.

3.6 PRESSURE-GAGE SCHEDULE

A. Pressure gages at discharge of each pressure-reducing valve shall be one of the following:

1. Liquid-filled, direct or remote-mounted.
2. Test plug.

B. Common pressure gages at suction and discharge of each pump shall be one of the following:

1. Liquid-filled, direct-mounted.
2. Test plug.

C. Pressure gages at inlet and outlet of each boiler.

1. Liquid-filled, direct or remote-mounted.

3.7 PRESSURE-GAGE SCALE-RANGE SCHEDULE

A. Scale Range for Heating, Hot-Water Piping: 0 to 100 psi.

END OF SECTION 230519
03/07/11

February 28, 2011

SECTION 230523 - GENERAL-DUTY VALVES FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Brass ball valves.
2. Bronze ball valves.
3. Iron, single-flange butterfly valves.
4. Iron, grooved-end butterfly valves.
5. Bronze swing check valves.
6. Iron swing check valves.
7. Iron, grooved-end swing-check valves.
8. Iron gate valves.
9. Iron globe valves.
10. Chainwheels.

B. Related Sections:

1. Section 230553 "Identification for HVAC Piping and Equipment" for valve tags and schedules.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

B. EPDM: Ethylene propylene copolymer rubber.

C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

D. NRS: Nonrising stem.

E. OS&Y: Outside screw and yoke.

F. PTFE: Tetrafluoroethylene resin.

G. RPTFE: Reinforced tetrafluoroethylene resin.

H. RS: Rising stem.

I. VITON: Fluoroelasteromer FKM.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of valve indicated.

1.5 QUALITY ASSURANCE

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
2. ASME B31.1 for power piping valves.
3. ASME B31.9 for building services piping valves.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set gate and globe valves closed to prevent rattling.
4. Set ball valves open to minimize exposure of functional surfaces.
5. Set butterfly valves closed or slightly open.
6. Block check valves in either closed or open position.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Refer to HVAC valve schedule articles for applications of valves.

B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

C. Valve Sizes: Same as upstream piping unless otherwise indicated.

D. Valve Actuator Types:

1. Handlever: For quarter-turn valves NPS 6 and smaller except plug valves.

E. Valves in Insulated Piping: With 2-inch stem extensions and the following features:

1. Gate Valves: With rising stem.

2. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
3. Butterfly Valves: With extended neck.

F. Valve-End Connections:

1. Flanged: With flanges according to ASME B16.1 for iron valves.
2. Grooved: With grooves according to AWWA C606.
3. Solder Joint: With sockets according to ASME B16.18.
4. Threaded: With threads according to ASME B1.20.1.

G. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRASS BALL VALVES

A. Two-Piece, Full-Port, Brass Ball Valves with Brass Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Conbraco Industries, Inc.; Apollo Valves.
b. DynaQuip Controls.
c. Flow Design.
d. Flow-Tek, Inc.; a subsidiary of Bray International, Inc.
e. Hammond Valve.
f. Kitz Corporation.
g. Marwin Valve; a division of Richards Industries.
h. Milwaukee Valve Company.
i. Nexus.
j. Red-White Valve Corporation.
k. Watts Regulator.

2. Description:

a. Standard: MSS SP-110.
b. CWP Rating: 600 psig.
c. Body Design: Two piece.
d. Body Material: Forged brass.
e. Ends: Threaded or soldered.
f. Seats: PTFE or RPTFE.
g. Stem: Brass.
h. Ball: Chrome-plated brass.
i. Port: Full.
j. Packing gland nut or VITON/FPM double O-ring seals.

2.3 BRONZE BALL VALVES

A. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Valve, Inc.
b. Conbraco Industries, Inc.; Apollo Valves.
c. DynaQuip Controls.
d. Hammond Valve.
e. Kitz Corporation.
f. Legend Valve.
g. Milwaukee Valve Company.
h. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-110.
b. CWP Rating: 600 psig.
c. Body Design: Two piece.
d. Body Material: Bronze.
e. Ends: Threaded or soldered.
f. Seats: PTFE or RPTFE.
g. Stem: Bronze.
h. Ball: Chrome-plated brass.
i. Port: Full.
j. Packing gland nut or VITON/FPM double O-ring seals.

2.4 IRON, SINGLE-FLANGE BUTTERFLY VALVES

A. 200 CWP, Iron, Single-Flange Butterfly Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ABZ Valve and Controls; a division of ABZ Manufacturing, Inc.
b. Cooper Cameron Valves; a division of Cooper Cameron Corp.
c. DeZurik Water Controls.
d. Flow Line Valves and Controls.
e. Hammond Valve.
f. Kitz Corporation.
g. Milwaukee Valve Company.
h. Muller Steam Specialties.
i. Norriseal; a Dover Corporation company.

2. Description:

a. Standard: MSS SP-67, Type I.
b. CWP Rating: 200 psig.
c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.

e. Seat: EPDM or VITON.
f. Stem: Two-piece stainless steel.
g. Disc: Aluminum bronze or nickel-plated.

2.5 IRON, GROOVED-END BUTTERFLY VALVES

A. 300 CWP, Iron, Grooved-End Butterfly Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Victaulic Company.

2. Description:

a. Standard: MSS SP-67, Type I.
b. NPS 8 and Smaller CWP Rating: 300 psig.
c. Body Material: Coated, ductile iron.
d. Stem: Two-piece stainless steel.
e. Disc: Nickel-plated.
f. Seal: EPDM.

2.6 BRONZE SWING CHECK VALVES

A. Class 125, Bronze Swing Check Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Valve, Inc.
b. Cincinnati Valve Company; Licenser of Lukenhimer Valves.
c. Crane Co.; Crane Valve Group; Crane Valves.
d. Crane Co.; Crane Valve Group; Jenkins Valves.
e. Crane Co.; Crane Valve Group; Stockham Division.
f. Hammond Valve.
g. Kitz Corporation.
h. Milwaukee Valve Company.
i. Powell Valves.
j. Red-White Valve Corporation.
k. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
l. Zy-Tech Global Industries, Inc.

2. Description:

a. Standard: MSS SP-80, Type 3.
b. CWP Rating: 200 psig.
c. Body Design: Horizontal flow, Y pattern.
d. Body Material: ASTM B 62, bronze.
e. Ends: Threaded.
f. Disc: Bronze.

2.7 IRON SWING CHECK VALVES

A. Class 125, Iron Swing Check Valves with Metal Seats:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Jenkins Valves.
c. Crane Co.; Crane Valve Group; Stockham Division.
d. Hammond Valve.
e. Kitz Corporation.
f. Legend Valve.
g. Milwaukee Valve Company.
h. Powell Valves.
i. Sure Flow Equipment Inc.
j. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-71, Type I.
b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
c. Body Design: Clear or full waterway.
d. Body Material: ASTM A 126, gray iron with bolted bonnet.
e. Ends: Flanged.
f. Trim: Bronze.
g. Gasket: Asbestos free.

2.8 IRON, GROOVED-END SWING CHECK VALVES

A. 300 CWP, Iron, Grooved-End Swing Check Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Anvil International, Inc.
b. Shurjoint Piping Products.
c. Tyco Fire Products LP; Grinnell Mechanical Products.
d. Victaulic Company.

2. Description:

a. CWP Rating: 300 psig.
b. Body Material: ASTM A 536, ductile iron.
c. Seal: EPDM.
d. Disc: Spring operated, ductile iron or stainless steel.

2.9 IRON GATE VALVES

A. Class 125, NRS, Iron Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Cincinnati Valve Company; Licenser of Lukenhimer Valves.
b. Crane Co.; Crane Valve Group; Crane Valves.
c. Crane Co.; Crane Valve Group; Jenkins Valves.
d. Crane Co.; Crane Valve Group; Stockham Division.
e. Hammond Valve.
f. Kitz Corporation.
g. Legend Valve.
h. Milwaukee Valve Company.
i. Powell Valves.
j. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-70, Type I.
b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
c. Body Material: ASTM A 126, gray iron with bolted bonnet.
d. Ends: Flanged.
e. Trim: Bronze.
f. Disc: Solid wedge.
g. Packing and Gasket: Asbestos free.

B. Class 125, OS&Y, Iron Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Cincinnati Valve Company; Licenser of Lukenhimer Valves.
b. Crane Co.; Crane Valve Group; Crane Valves.
c. Crane Co.; Crane Valve Group; Jenkins Valves.
d. Crane Co.; Crane Valve Group; Stockham Division.
e. Hammond Valve.
f. Kitz Corporation.
g. Legend Valve.
h. Milwaukee Valve Company.
i. Powell Valves.
j. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-70, Type I.
b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
c. Body Material: ASTM A 126, gray iron with bolted bonnet.
d. Ends: Flanged.
e. Trim: Bronze.
f. Disc: Solid wedge.
g. Packing and Gasket: Asbestos free.

2.10 IRON GLOBE VALVES

A. Class 125, Iron Globe Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Cincinnati Valve Company; Licenser of Lukenhimer Valves.
b. Crane Co.; Crane Valve Group; Crane Valves.
c. Crane Co.; Crane Valve Group; Jenkins Valves.
d. Crane Co.; Crane Valve Group; Stockham Division.
e. Hammond Valve.
f. Kitz Corporation.
g. Milwaukee Valve Company.
h. Powell Valves.

2. Description:

a. Standard: MSS SP-85, Type I.
b. CWP Rating: 200 psig.
c. Body Material: ASTM A 126, gray iron with bolted bonnet.
d. Ends: Flanged.
e. Trim: Bronze.
f. Packing and Gasket: Asbestos free.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install check valves for proper direction of flow and as follows:

1. Swing Check Valves: In horizontal position or vertical with vertical flow with hinge pin level.

3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:

1. Shutoff Service: Ball, butterfly, or gate valves.
2. Butterfly Valve Dead-End Service: Single-flange (lug) type.
3. Throttling Service Globe, ball, or butterfly valves.
4. Pump-Discharge Check Valves:

a. NPS 2 and Smaller: Bronze swing check valves with bronze disc.
b. NPS 2-1/2 and Larger: Iron swing check valves, bronze disc.

B. Select valves with the following end connections:

1. For Steel Piping, NPS 2 and Smaller: Threaded ends.
2. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends.
3. For Steel Piping, NPS 5 and Larger: Flanged ends.
4. For Grooved-End Steel Piping.

3.5 HEATING-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:

1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
2. Ball Valves: Two piece, full port, brass or bronze with brass trim.
3. Bronze Swing Check Valves: Class 125, bronze disc.

B. Pipe NPS 2-1/2 and Larger:

1. Iron, Single-Flange, Two-Piece Stem Butterfly Valves, NPS 2-1/2 to NPS 12: 200 CWP, EPDM seat, aluminum-bronze or nickel-plated disc.
2. Iron, Grooved-End Butterfly Valves, NPS 2-1/2 to NPS 12: 300 CWP.
3. Iron Swing Check Valves: Class 125, metal seats.
4. Iron, Grooved-End Check Valves, NPS 3 to NPS 12: 300 CWP.
5. Iron Gate Valves: Class 125, OS&Y.
6. Iron Globe Valves, NPS 2-1/2 to NPS 12: Class 125.

END OF SECTION 230523
03/07/11

February 28, 2011

SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following hangers and supports for HVAC system piping and equipment:

1. Steel pipe hangers and supports.
2. Thermal-hanger shield inserts.
3. Fastener systems.

B. Related Sections include the following:

1. Division 23 Section "Expansion Fittings and Loops for HVAC Piping" for pipe guides and anchors.
2. Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment" for vibration isolation devices.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.

B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 PERFORMANCE REQUIREMENTS

A. Design seismic-restraint hangers and supports for piping and equipment.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Steel pipe hangers and supports.
2. Thermal-hanger shield inserts.
3. Powder-actuated fastener systems.

B. Welding certificates.

1.6 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.2, "Structural Welding Code--Aluminum."
3. AWS D1.3, "Structural Welding Code--Sheet Steel."
4. AWS D1.4, "Structural Welding Code--Reinforcing Steel."
5. ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 STEEL PIPE HANGERS AND SUPPORTS

A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.

B. Manufacturers:

1. AAA Technology & Specialties Co., Inc.
2. Anvil, Inc.
3. Bergen-Power Pipe Supports.
4. B-Line Systems, Inc.; a division of Cooper Industries.
5. Carpenter & Paterson, Inc.
6. Empire Industries, Inc.
7. ERICO/Michigan Hanger Co.
8. Globe Pipe Hanger Products, Inc.
9. GS Metals Corp.
10. National Pipe Hanger Corporation.
11. PHD Manufacturing, Inc.
12. PHS Industries, Inc.
13. Piping Technology & Products, Inc.
14. Tolco Inc.

C. Galvanized, Metallic Coatings: Hot dipped after fabrication (ASTM A 123 and ASTM A 153)..

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

E. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.3 THERMAL-HANGER SHIELD INSERTS

A. Description: 100-psig- minimum, compressive-strength insulation insert encased in sheet metal shield.

B. Manufacturers:

1. ERICO/Michigan Hanger Co.
2. PHS Industries, Inc.
3. Pipe Shields, Inc.
4. Rilco Manufacturing Company, Inc.
5. TOLCO Inc.
6. Value Engineered Products, Inc.

C. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass.

D. For Clamped Systems: Insert and shield shall cover entire circumference of pipe.

E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

F. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.4 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used. Verify suitability for use in lightweight concrete slabs and all slabs less than 4 inches thick.

1. Manufacturers:

a. Hilti, Inc.
b. ITW Ramset/Red Head.
c. Powers Fasteners.

B. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated or stainless steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Manufacturers:

a. Hilti, Inc.
b. ITW Ramset/Red Head.
c. Powers Fasteners.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with hot dipped galvanized, metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use padded hangers for piping that is subject to scratching.

F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30.
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F pipes, NPS 4 to NPS 16, requiring up to 4 inches of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24, requiring clamp flexibility and up to 4 inches of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24, if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated stationary pipes, NPS 3/4 to NPS 8.
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2.
10. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 8.
11. Extension Hinged or 2-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 3.
12. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30.
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.
16. Adjustable, Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes, NPS 2-1/2 to NPS 36, if vertical adjustment is required, with steel pipe base stanchion support and cast-iron floor flange.

17. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30, from 2 rods if longitudinal movement caused by expansion and contraction might occur.
18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes, NPS 2-1/2 to NPS 20, from single rod if horizontal movement caused by expansion and contraction might occur.
19. Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42, if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes, NPS 2 to NPS 24, if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes, NPS 2 to NPS 30, if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

G. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.

H. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.

12. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Pipe-Covering Protection Saddles (MSS Type 39): For supporting insulated pipe without vapor barrier, fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

K. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, provide per Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equpment".

L. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction. Verify suitability for use in lightweight concrete slabs and all slabs less than 4 inches thick.

3.2 HANGER AND SUPPORT INSTALLATION

A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

C. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
3. Verify suitability of fasteners in lightweight concrete slabs and all concrete slabs less than 4 inches thick.

D. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

E. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

F. Install lateral bracing with pipe hangers and supports to prevent swaying.

G. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

H. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

I. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.1 (for power piping) and ASME B31.9 (for building services piping) are not exceeded.

J. Insulated Piping: Comply with the following:

1. Attach clamps and spacers to piping.

    a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    b. Do not exceed pipe stress limits according to ASME B31.1 for power piping and ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, galvanized protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, galvanized protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees or per thermal hanger insert manufacturer's recommendations.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following or per thermal hanger insert manufacturer's recommendations:

    a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
    b. NPS 4: 12 inches long and 0.06 inch thick.

5. Insert Material: Length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.4 PAINTING

A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 230529
03/07/11

February 28, 2011

SECTION 230548 - VIBRATION AND SEISMIC CONTROLS FOR HVAC SYSTEMS

PART 1 - GENERAL

1.1 INTENT

A. It is the intent of this Specification to provide the basis of design for the vibration isolation, accommodation of differential seismic motion across building expansion/seismic joints, and seismic restraints on all HVAC systems. The term "SYSTEMS" applies to all equipment, piping, and ductwork on the project. The following specification provides a requirement for the attachment of all non-structural components to the structure.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.3 SUMMARY

A. This Section includes the following:

1. Isolation pads.
2. Isolation mounts.
3. Restrained elastomeric isolation mounts.
4. Restrained spring isolators.
5. Housed spring mounts.
6. Elastomeric hangers with vertical limit stops.
7. Thrust limits (restraints).
8. Spring hangers with vertical-limit stops.
9. Pipe riser resilient supports.
10. Resilient pipe guides.
11. Seismic snubbers.
12. Restraining braces and cables, and end connection fastening devices.

1.4 DEFINITIONS

A. IBC: International Building Code.

B. ICC-ES: ICC-Evaluation Service.

C. OSHPD: Office of Statewide Health Planning and Development for the State of California.

1.5 PERFORMANCE REQUIREMENTS

A. Comply with seismic restraint requirements in accordance with state and local codes and ordinances and the authority having jurisdiction.

1.6 SUBMITTALS

A. Product Data: For the following:

1. Include detailed type, style, materials, rated load, rated deflection, and overload capacity for each vibration isolation device.
2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.

    a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an evaluation service member of ICC-ES, OSHPD or an independent agency acceptable to authorities having jurisdiction.
    b. Annotate to indicate application of each product submitted and compliance with requirements.

3. Interlocking Snubbers: Include ratings for horizontal, vertical, and combined loads.

B. Delegated-Design Submittal: For vibration isolation and seismic-restraint details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation and registered in the state of the project. Provide submittal in two parts - the first part to address all of the equipment on the project prior to installation, and the second to address seismic bracing of piping and ductwork after final routing has been determined.

1. Seismic Code Summary: Written summary of applicable codes, references and criteria specific to the project.
2. List of all HVAC equipment and systems with annotation of where seismic anchoring and bracing is applicable. If a particular component is exempt due to the conditions of the project, it shall be so stated.
3. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation, seismic forces required to select vibration isolators, seismic restraints.
4. Seismic-Restraint Details:

    a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
    b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
    c. Preapproval and Evaluation Documentation: By an evaluation service member of ICC-ES, OSHPD or an independent agency acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

C. Welding certificates.

D. Qualification Data: For professional engineer and testing agency.

E. Insurance Certificates: Submit for the following and in accordance with "Quality Assurance" article.

1. Professional Engineer: Professional liability.
2. Manufacturer: Product liability.

F. Material Test Reports: From a qualified testing agency indicating and interpreting test results of seismic control devices for compliance with requirements indicated.

G. Field quality-control test reports.

1.7 QUALITY ASSURANCE

A. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

B. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

C. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another independent agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

D. Professional Engineer Qualifications: A professional vibration/seismic engineer who is legally qualified to practice in the jurisdiction where the project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of vibration isolation bases and seismic restraints that are similar to those indicated for this project in material, design, and extent. Engineer shall carry minimum $1,000,000 professional liability insurance.

E. Manufacturers of all vibration isolation and seismic restraint devices shall carry a minimum of $5,000,000 product liability insurance for their products.

1.8 COORDINATION

A. Coordinate size and location of concrete bases with seismic anchoring and vibration isolation requirements. Cast anchor-bolt inserts into base.

B. Coordinate design of seismic restraints and vibration isolation design with expansion compensation systems.

C. Coordinate and design all attachments with building structural system.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

1. Kinetics Noise Control.

2. Mason Industries.
3. Vibration Eliminator Co., Inc.
4. Vibration Mountings & Controls, Inc.

B. Elastomeric Pads: Arranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.

1. Resilient Material: Oil- and water-resistant neoprene. Standard neoprene for indoor applications or where pad is not exposed to the elements. Bridge-bearing neoprene, complying with AASHTO M 251 for exterior applications or where pad is exposed to the elements.

C. Elastomeric Mounts: Double-deflection type, with molded, oil-resistant rubber, hermetically sealed compressed fiberglass, or neoprene isolator elements with factory-drilled, encapsulated top plate for bolting to equipment and with baseplate for bolting to structure. Color-code or otherwise identify to indicate capacity range.

1. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
2. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.

D. Restrained Elastomeric Mounts: All-directional mountings with seismic restraint.

1. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
2. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.
3. Shall have OSHPD or approved anchorage ratings.

E. Spring Isolators: Freestanding, laterally stable, open-spring isolators.

1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
5. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch- thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 500 psig.
6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

F. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic or limit-stop restraint.

1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to weight being removed; factory-drilled baseplate bonded to 1/4-inch- thick, neoprene or rubber isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
2. Restraint: Seismic or limit stop as required for equipment and authorities having jurisdiction.

3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
7. Shall have OSHPD or approved anchorage ratings.

G. Elastomeric Hangers: Single or double-deflection type, fitted with molded, oil-resistant elastomeric isolator elements bonded to steel housings with threaded connections for hanger rods and vertical limit stop. Color-code or otherwise identify to indicate capacity range.

H. Spring Hangers with Vertical-Limit Stop: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression and with a vertical-limit stop.

1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
7. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
8. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

I. Thrust Limits: Combination coil spring and elastomeric insert with spring and insert in compression and with a load stop. Include rod and angle-iron brackets for attaching equipment.

1. Frame: Steel, fabricated for connection to threaded rods and to allow for a maximum of 30 degrees of angular rod misalignment without binding or reducing isolation efficiency.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of the rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
7. Coil Spring: Factory set and field adjustable for a maximum of 1/4-inch movement at start and stop.

J. Pipe Riser Resilient Support: All-directional, acoustical pipe anchor consisting of 2 steel tubes separated by a minimum of 1/2-inch- thick neoprene. Include steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions. Design support for a maximum load on the isolation material of 500 psig and for equal resistance in all directions.

K. Resilient Pipe Guides: Telescopic arrangement of 2 steel tubes or post and sleeve arrangement separated by a minimum of 1/2-inch- thick neoprene. Where clearances are not readily visible, a factory-set guide height with a shear pin to allow vertical motion due to pipe expansion and contraction shall be fitted. Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

2.2 SEISMIC-RESTRAINT DEVICES

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

1. Cooper B-Line, Inc.; a division of Cooper Industries.
2. Hilti, Inc.
3. Kinetics Noise Control.
4. Mason Industries.
5. Unistrut; Tyco International, Ltd.
6. Vibration Mountings & Controls, Inc.

B. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an evaluation service member of ICC-ES, OSHPD or an independent agency acceptable to authorities having jurisdiction.

1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.

C. Snubbers: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.

1. Anchor bolts for attaching to concrete shall be seismic-rated, drill-in, and stud-wedge or female-wedge type.
2. Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.
3. Maximum 1/4-inch air gap, and minimum 1/4-inch- thick resilient cushion.

D. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.

E. Restraint Cables: ASTM A 603 galvanized or ASTM A 492 stainless-steel cables with end connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; and with a minimum of two clamping bolts for cable engagement.

F. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections or reinforcing steel angle clamped to hanger rod.

G. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.

H. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices used.

I. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

J. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488. Minimum length of eight times diameter.

K. Adhesive Anchor Bolts: Drilled-in and capsule anchor system containing polyvinyl or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

2.3 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION DEVICES

A. Elastomeric Expansion Joints, Flexible-Hose Expansion Joints, and Flexible Hoses: Refer to sections detailing pipe expansion fittings and loops for product requirements.

1. Designed and installed in arrangement to accept motion and forces associated with seismic event and thermal expansion.

2.4 FACTORY FINISHES

A. Finish: Manufacturer's standard prime-coat finish ready for field painting.

B. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.

1. Powder coating on springs and housings.
2. All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.
3. Baked enamel or powder coat for metal components on isolators for interior use.
4. Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation, seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Hanger Rod Stiffeners: Install hanger rod stiffeners where required to prevent buckling of hanger rods due to seismic forces.

B. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.3 VIBRATION-CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Equipment Restraints:

1. Install seismic snubbers on HVAC equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
3. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES, OSHPD or an independent agency acceptable to authorities having jurisdiction providing required submittals for component.
4. Provide thrust restraints when the force of total air thrust exceeds ten percent of the isolated weight. Install thrust limits at centerline of thrust, symmetrical on either side of equipment.

B. Piping Restraints:

1. Comply with requirements in MSS SP-127.
2. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
3. Brace a change of direction longer than 12 feet.

C. Install cables so they do not bend across edges of adjacent equipment or building structure.

D. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES, OSHPD or an agency acceptable to authorities having jurisdiction providing required submittals for component. In no case will the LOOPING of cable around piping systems be permitted on the project. Seismic restraints cables and angles shall be mechanically attached to the piping hangers with end fastening devices.

E. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

F. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

G. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

H. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
5. Set anchors to manufacturer's recommended torque, using a torque wrench.

6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

I. Install ducts with hangers and braces designed to support the duct and to restrain against seismic forces required by applicable building codes. Comply with SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems" and ASCE/SEI 7.

1. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
2. Brace a change of direction longer than 12 feet.

J. Select seismic-restraint devices with capacities adequate to carry present and future static and seismic loads.

K. Install cable restraints on ducts that are suspended with vibration isolators.

3.4 EQUIPMENT BASES

A. Concrete Bases: Anchor equipment to concrete base according to support equipment manufacturer's written instructions for seismic codes at project site.

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
2. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base and anchor into structural concrete floor.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and direction furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to supported equipment.
5. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 FIELD QUALITY CONTROL

A. Upon completion of the project, the seismic design professional engineer of record shall visit the project site and supply a stamped letter of compliance. Any systems found to be installed insufficiently, provide additional measures necessary at contractor's expense to put the entire installation in compliance.

B. The owner will engage a special inspector to perform field inspections and verification of proper installation of seismic anchorage and bracing of mechanical equipment, and manufacturer's component certifications of compliance. The contractor is to provide the special inspector safe access to the site throughout the duration of the mechanical work, and to provide timely notification to the special inspector at appropriate points in construction when seismic anchorage and bracing is to be installed.

C. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

D. Tests and Inspections:

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.

3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
5. Test to 90 percent of rated proof load of device.
6. Measure isolator restraint clearance.
7. Measure isolator deflection.
8. Verify snubber minimum clearances.
9. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.

E. Remove and replace malfunctioning units and retest as specified above.

F. Prepare test and inspection reports.

3.6 ADJUSTING

A. Adjust isolators after piping system is at operating weight.

B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

C. Adjust active height of spring isolators.

D. Adjust restraints to permit free movement of equipment within normal mode of operation.

3.7 HVAC VIBRATION-CONTROL AND SEISMIC-RESTRAINT DEVICE SCHEDULE

A. General: Schedule below indicates type of vibration isolator to be used with types of equipment. All rotating equipment shall have vibration isolation whether listed in schedule or not. Where equipment is not listed, provide isolation type of similar equipment or manufacturer recommended. Schedule below only indicates seismic restraint integral with vibration isolators where applicable. Seismically restrain all equipment using materials and products specified in this section. All equipment with vibration isolation shall be resiliently restrained.

B. Components Mounted on Slab-on-Grade:

1. Pumps:

a. Base Mounted Pumps:

1) Base: Concrete housekeeping pad.
2) Isolator Type: None, anchor to structure.

2. Expansion/Compression Tanks:

1) Base: Concrete housekeeping pad.
2) Isolator Type: None, anchor to structure.

3. Boilers:

a. Base: Concrete housekeeping pad.

b. Isolator Type: Restrained elastomeric mounts or elastomeric mounts with seismic snubbers.

C. Components hung from overhead structure.

1. Piping, first three supports from connection to pump or rotating equipment.

2. Piping:

a. Isolator Type: None.

3. Pumps:

a. In-Line:

1) Isolator Type: Spring hangers with vertical limit stop, 1.0 inch deflection.

4. Air Separators:

a. Isolator Type: None.

5. Unit Heaters:

a. Isolator Type: Elastomeric hangers with vertical limit stop, 0.2 inch deflection.

END OF SECTION 230548
03/07/11

February 28, 2011

SECTION 230553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Products specified are for applications referenced in other HVAC specifications.

1.2 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Pipe labels.
3. Valve tags.
4. Valve schedules.
5. Warning tags.
6. Emergency switch labels.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label. Furnish extra copies, in addition to mounted copies, for inclusion in maintenance manuals. Provide one copy on electronic media, type specified by Owner.

D. Valve numbering scheme.

E. Valve Schedules: Provide separate schedule for each piping system. Furnish extra copies, in addition to mounted copies, for inclusion in maintenance manuals. Provide one copy on electronic media, type specified by Owner.

1.4 QUALITY ASSURANCE

A. ASME Compliance: Comply with ASME A13.1, "Scheme for the Identification of Piping Systems," for letter size, length of color field, colors, and viewing angles of identification devices for piping. Comply with recommendations in ASME A13.1 for labeling of equipment and ducts.

1.5 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

D. Coordinate names, abbreviations, and other designations used in mechanical identification with Owner's desired identification scheme, regardless of numbering indicated on the drawing and specifications. Coordinate Owner's desired identification scheme with ASME and OSHA standards.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
2. Letter Color: White.
3. Background Color: Blue.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Equipment Label Content: Include equipment's Drawing designation and Owner specified unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction. Color shall comply with ASME A13.1 unless otherwise indicated.

B. Pretensioned Pipe Markers: Precoiled, semirigid plastic formed to cover circumference of pipe and to attach to pipe without fasteners or adhesive.

1. For Pipes Equal To or Greater Than 6 Inches Outside Diameter with Insulation: Partial cover of circumference with a minimum length and width three times greater than the total lettering size or shaped pipe markers.
2. For Pipes Less Than 6 Inches Outside Diameter with Insulation: Full cover of circumference.

C. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: Manufacturer's standard preprinted captions appropriate for piping systems indicated or 1-1/2 inches high, if requested by Owner.

D. Use metal labels for bare pipes conveying fluids at temperatures of 125 deg F or higher.

2.3 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers, with numbering scheme approved by Owner.

1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass beaded chain.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.
2. Valve Schedule Frames: Glazed display frame for removable mounting on masonry walls for each page of valve schedule. Include mounting screws.
3. Frame: Extruded aluminum.
4. Glazing: ASTM C 1036, Class 1, glazing quality B, 2.5 mm, single thickness glass.

C. Schedule on Electronic Media:

1. In addition to the framed paper schedule, provide valve schedule on electronic media, type specified by Owner, and identified points on as-built drawings.

2.4 WARNING TAGS

A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.

1. Size: Approximately 4 by 7 inches.
2. Fasteners: Brass grommet and wire.
3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Color: Yellow background with black lettering.

2.5 EMERGENCY SWITCH LABEL

A. Emergency Switch Label: Preprinted, emergency operation switch labels of plasticized card stock with matte finish suitable for writing.

1. Size: Approximately 2 by 7 inches.
2. Fasteners: Brass grommet and wire.
3. Nomenclature: Large size primary caption such as: "BOILER EMERGENCY SWITCH."
4. Color: Red background with white lettering.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment. Major equipment includes, but is not limited to, the following:

1. Boilers.
2. Pumps.

B. Locate equipment labels where accessible and visible.

C. Metal Label Content: Provide the following equipment information on metal labels only:

1. Equipment drawing designation and Owner specified unique equipment identification number.
2. Drawing numbers where equipment is located or specified (floor plans and schedules).
3. Specification section equipment is specified.
4. Manufacturer, model name and number, serial number(s).
5. Labels of equipment listings by testing agencies (e.g., UL listings).

D. Plastic Label Content: Provide the following equipment information on plastic labels:

1. Capacity, operating and power characteristics (e.g., entering and leaving conditions, speed, pressure drop).
2. Operating instructions and warnings.
3. Safety warnings.

3.3 PIPE LABEL INSTALLATION

A. Manufactured Pipe Labels: Provided on all piping.

B. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.

C. Pipe Label Color Schedule: According to ASME 13.1, unless otherwise specified.

3.4 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, with the following exceptions: check valves; valves within factory-fabricated equipment units; shutoff valves; faucets. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

1. Valve-Tag Size and Shape: 1-1/2 inches, round.
2. Valve-Tag Color: Natural.
3. Letter Color: Black.

3.5 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

3.6 EMERGENCY SWITCH LABEL INSTALLATION AND REQUIREMENTS

A. Engrave required message on and attach labels to wall at switches and other items where required.

B. Where required:

1. Boiler Emergency Switches: "BOILER EMERGENCY SWITCH."

3.7 VALVE SCHEDULE INSTALLATION

A. Mount valve schedule on wall in accessible location in each major equipment room.

3.8 ADJUSTING

A. Relocate mechanical identification materials and devices that have become visually blocked by other work.

3.9 CLEANING

A. Clean faces of mechanical identification devices and glass frames of valve schedules.

END OF SECTION 230553
03/07/11

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Balancing Hydronic Piping Systems:

a. Constant-flow hydronic systems.
b. Variable-flow hydronic systems.
c. Primary-secondary hydronic systems.

1.3 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. NEBB: National Environmental Balancing Bureau.

C. TAB: Testing, adjusting, and balancing.

D. TABB: Testing, Adjusting, and Balancing Bureau.

E. TAB Specialist: An entity engaged to perform TAB Work.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation that the TAB contractor and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.

B. Contract Documents Examination Report: Within 45 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.

C. Strategies and Procedures Plan: Within 60 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.

D. Certified TAB reports.

E. Sample report forms.

F. Instrument calibration reports, to include the following:

1. Instrument type and make.
2. Serial number.
3. Application.
4. Dates of use.
5. Dates of calibration.

1.5 QUALITY ASSURANCE

A. TAB Contractor Qualifications: Engage a TAB entity certified by AABC or NEBB.

1. TAB Field Supervisor: Employee of the TAB contractor and certified by AABC or NEBB.
2. TAB Technician: Employee of the TAB contractor and who is certified by AABC or NEBB as a TAB technician.

B. TAB Conference: Meet with Owner on approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Require the participation of the TAB field supervisor and technicians. Provide seven days' advance notice of scheduled meeting time and location.

1. Agenda Items:

a. The Contract Documents examination report.
b. The TAB plan.
c. Coordination and cooperation of trades and subcontractors.
d. Coordination of documentation and communication flow.

C. Certify TAB field data reports and perform the following:

1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.

D. TAB Report Forms: Use standard TAB contractor's forms approved by Owner.

E. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

1.6 PROJECT CONDITIONS

A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

1.7 COORDINATION

A. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.

B. Perform TAB after leakage and pressure tests on water distribution systems have been satisfactorily completed.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.

B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings. Verify that locations of these balancing devices are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine equipment performance data including fan and pump curves.

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.

F. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

G. Examine test reports specified in individual system and equipment Sections.

H. Examine HVAC equipment and verify that bearings are greased, and equipment with functioning controls is ready for operation.

I. Examine strainers. Verify that startup screens are replaced by permanent screens with indicated perforations.

J. Examine system pumps to ensure absence of entrained air in the suction piping.

K. Examine operating safety interlocks and controls on HVAC equipment.

L. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

A. Prepare a TAB plan that includes strategies and step-by-step procedures.

B. Complete system-readiness checks and prepare reports. Verify the following:

1. Permanent electrical-power wiring is complete.
2. Hydronic systems are filled, clean, and free of air.

3. Automatic temperature-control systems are operational.
4. Isolating and balancing valves are open and control valves are operational.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance" or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and in this Section.

B. Cut insulation, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.

1. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 230713 "Duct Insulation," Section 230716 "HVAC Equipment Insulation," and Section 230719 "HVAC Piping Insulation."

C. Mark equipment and balancing devices, valve position indicators, similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

A. Prepare test reports with pertinent design data, and number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against the approved pump flow rate. Correct variations that exceed plus or minus 5 percent.

B. Prepare schematic diagrams of systems' "as-built" piping layouts.

C. Prepare hydronic systems for testing and balancing according to the following, in addition to the general preparation procedures specified above:

1. Open all manual valves for maximum flow.
2. Check liquid level in expansion tank.
3. Check makeup water-station pressure gage for adequate pressure for highest vent.
4. Check flow-control valves for specified sequence of operation, and set at indicated flow.
5. Set differential-pressure control valves at the specified differential pressure. Do not set at fully closed position when pump is positive-displacement type unless several terminal valves are kept open.
6. Set system controls so automatic valves are wide open to heat exchangers.
7. Check pump-motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded.
8. Check air vents for a forceful liquid flow exiting from vents when manually operated.

3.5 PROCEDURES FOR CONSTANT-FLOW HYDRONIC SYSTEMS

A. Measure water flow at pumps. Use the following procedures except for positive-displacement pumps:

1. Verify impeller size by operating the pump with the discharge valve closed. Read pressure differential across the pump. Convert pressure to head and correct for differences in gage heights.

Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.

a. If impeller sizes must be adjusted to achieve pump performance, obtain approval from Owner and comply with requirements in Section 232123 "Hydronic Pumps."

2. Check system resistance. With all valves open, read pressure differential across the pump and mark pump manufacturer's head-capacity curve. Adjust pump discharge valve until indicated water flow is achieved.

a. Monitor motor performance during procedures and do not operate motors in overload conditions.

3. Verify pump-motor brake horsepower. Calculate the intended brake horsepower for the system based on pump manufacturer's performance data. Compare calculated brake horsepower with nameplate data on the pump motor. Report conditions where actual amperage exceeds motor nameplate amperage.
4. Report flow rates that are not within plus or minus 10 percent of design.

B. Measure flow at all automatic flow control valves to verify that valves are functioning as designed.

C. Measure flow at all pressure-independent characterized control valves, with valves in fully open position, to verify that valves are functioning as designed.

D. Set calibrated balancing valves, if installed, at calculated presettings.

E. Measure flow at all stations and adjust, where necessary, to obtain first balance.

1. System components that have Cv rating or an accurately cataloged flow-pressure-drop relationship may be used as a flow-indicating device.

F. Measure flow at main balancing station and set main balancing device to achieve flow that is 5 percent greater than indicated flow.

G. Adjust balancing stations to within specified tolerances of indicated flow rate as follows:

1. Determine the balancing station with the highest percentage over indicated flow.
2. Adjust each station in turn, beginning with the station with the highest percentage over indicated flow and proceeding to the station with the lowest percentage over indicated flow.
3. Record settings and mark balancing devices.

H. Measure pump flow rate and make final measurements of pump amperage, voltage, rpm, pump heads, and systems' pressures and temperatures including outdoor-air temperature.

I. Measure the differential-pressure-control-valve settings existing at the conclusion of balancing.

J. Check settings and operation of each safety valve. Record settings.

3.6 PROCEDURES FOR VARIABLE-FLOW HYDRONIC SYSTEMS

A. Balance systems with automatic two- and three-way control valves by setting systems at maximum flow through heat-exchange terminals and proceed as specified above for hydronic systems.

3.7 PROCEDURES FOR PRIMARY-SECONDARY HYDRONIC SYSTEMS

A. Balance the primary circuit flow first and then balance the secondary circuits.

3.8 PROCEDURES FOR MOTORS

A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer's name, model number, and serial number.
2. Motor horsepower rating.
3. Motor rpm.
4. Efficiency rating.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter thermal-protection-element rating.

B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass of the controller to prove proper operation. Record observations including name of controller manufacturer, model number, serial number, and nameplate data.

3.9 PROCEDURES FOR BOILERS

A. Hydronic Boilers: Measure and record entering- and leaving-water temperatures and water flow.

3.10 TOLERANCES

A. Set HVAC system's air flow rates and water flow rates within the following tolerances:

1. Heating-Water Flow Rate: Plus or minus 10 percent.

3.11 REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

3.12 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
2. Include a list of instruments used for procedures, along with proof of calibration.

B. Final Report Contents: In addition to certified field-report data, include the following:

1. Pump curves.
2. Manufacturers' test data.
3. Field test reports prepared by system and equipment installers.
4. Other information relative to equipment performance; do not include Shop Drawings and product data.

C. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.
2. Name and address of the TAB contractor.
3. Project name.
4. Project location.
5. Engineer's name and address.
6. Contractor's name and address.
7. Report date.
8. Signature of TAB supervisor who certifies the report.
9. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
10. Summary of contents including the following:

    a. Indicated versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.

11. Nomenclature sheets for each item of equipment.
12. Data for terminal units, including manufacturer's name, type, size, and fittings.
13. Notes to explain why certain final data in the body of reports vary from indicated values.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:

1. Water rates.
2. Pipe and valve sizes and locations.
3. Balancing stations.
4. Position of balancing devices.

E. Gas-Fired Heat Apparatus Test Reports: In addition to manufacturer's factory startup equipment reports, include the following:

1. Unit Data:

    a. System identification.
    b. Location.
    c. Make and type.
    d. Model number and unit size.
    e. Manufacturer's serial number.
    f. Fuel type in input data.
    g. Output capacity in Btu/h.
    h. Ignition type.
    i. Burner-control types.
    j. Motor horsepower and rpm.

k. Motor volts, phase, and hertz.
l. Motor full-load amperage and service factor.
m. Sheave make, size in inches, and bore.
n. Center-to-center dimensions of sheave, and amount of adjustments in inches.

2. Test Data (Indicated and Actual Values):

a. Low-fire fuel input in Btu/h.
b. High-fire fuel input in Btu/h.
c. Manifold pressure in psig.
d. High-temperature-limit setting in deg F.
e. Operating set point in Btu/h.
f. Motor voltage at each connection.
g. Motor amperage for each phase.
h. Heating value of fuel in Btu/h.

F. Pump Test Reports: Calculate impeller size by plotting the shutoff head on pump curves and include the following:

1. Unit Data:

a. Unit identification.
b. Location.
c. Service.
d. Make and size.
e. Model number and serial number.
f. Water flow rate in gpm.
g. Water pressure differential in feet of head or psig.
h. Required net positive suction head in feet of head or psig.
i. Pump rpm.
j. Impeller diameter in inches.
k. Motor make and frame size.
l. Motor horsepower and rpm.
m. Voltage at each connection.
n. Amperage for each phase.
o. Full-load amperage and service factor.
p. Seal type.

2. Test Data (Indicated and Actual Values):

a. Static head in feet of head or psig.
b. Pump shutoff pressure in feet of head or psig.
c. Actual impeller size in inches.
d. Full-open flow rate in gpm.
e. Full-open pressure in feet of head or psig.
f. Final discharge pressure in feet of head or psig.
g. Final suction pressure in feet of head or psig.
h. Final total pressure in feet of head or psig.
i. Final water flow rate in gpm.
j. Voltage at each connection.
k. Amperage for each phase.

G. Instrument Calibration Reports:

1. Report Data:

a. Instrument type and make.
b. Serial number.
c. Application.
d. Dates of use.
e. Dates of calibration.

3.13 INSPECTIONS

A. Initial Inspection:

1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the final report.

B. Final Inspection:

1. After initial inspection is complete and documentation by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Owner.
2. The TAB contractor's test and balance engineer shall conduct the inspection in the presence of Owner.
3. Owner shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
4. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

C. TAB Work will be considered defective if it does not pass final inspections. If TAB Work fails, proceed as follows:

1. Recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
2. If the second final inspection also fails, Owner may contract the services of another TAB contractor to complete TAB Work according to the Contract Documents and deduct the cost of the services from the original TAB contractor's final payment.

D. Prepare test and inspection reports.

3.14 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 230593
03/07/11

February 28, 2011

SECTION 230716 - HVAC EQUIPMENT INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes insulating the following HVAC equipment that is not factory insulated:

1. Expansion/compression tanks.
2. Air separators.

B. Related Sections:

1. Division 23 Section "HVAC Piping Insulation."

1.3 DEFINITIONS

A. ASJ: All-service jacket.

B. FRK: Foil, reinforced kraft paper.

C. Conditioned Space: An area, room ceiling space/plenum or space within the building structure being heated or cooled (by direct expansion or chilled water) or both, directly or indirectly, by equipment or appliance and is not subject to outdoor ambient conditions.

D. Unconditioned Space: An area, room or space within the building structure not being conditioned and subject to outdoor ambient conditions.

E. Concealed Equipment: Equipment not visible within the room it is located, after the project is completed.

F. Exposed Equipment: Equipment visible within the room it is located, after the project is completed.

G. Ceiling Space/Plenum: An enclosed portion of the building structure, other than an occupiable space being conditioned, that is designed to allow air movement, and thereby serve as part of an air distribution system.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail removable insulation at equipment connections.
3. Detail application of field-applied jackets.
4. Detail field application for each equipment type.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.8 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with equipment Installer for equipment insulation application.

1.9 SCHEDULING

A. Schedule insulation application after pressure testing systems. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Equipment Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied ASJ complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. or more. Thermal conductivity (k-value) at 100 deg F is 0.29 Btu x in./h x sq. ft. x deg F or less. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide one of the following:

a. CertainTeed Corp.; CrimpWrap.
b. Johns Manville; MicroFlex.
c. Knauf Insulation; Pipe and Tank Insulation.
d. Owens Corning; Fiberglas Pipe and Tank Insulation.

2.2 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
b. Eagle Bridges - Marathon Industries; 225.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
d. Mon-Eco Industries, Inc.; 22-25.

C. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
    b. Eagle Bridges - Marathon Industries; 225.
    c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-50.
    d. Mon-Eco Industries, Inc.; 22-25.

D. PVC Jacket Adhesive: Compatible with PVC jacket.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Dow Corning Corporation; 739, Dow Silicone.
    b. Johns Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
    c. P.I.C. Plastics, Inc.; Welding Adhesive.
    d. Speedline Corporation; Polyco VP Adhesive.

2.3 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

B. Breather Mastic: Water based; suitable for indoor use on above ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10.
    b. Eagle Bridges - Marathon Industries; 550.
    c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
    d. Mon-Eco Industries, Inc.; 55-50.
    e. Vimasco Corporation; WC-1/WC-5.

2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: 60 percent by volume and 66 percent by weight.
5. Color: White.

2.4 SEALANTS

A. FSK and Metal Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
    b. Eagle Bridges - Marathon Industries; 405.
    c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.
    d. Mon-Eco Industries, Inc.; 44-05.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.

B. ASJ Flashing Sealants and PVC Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.

2.5 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.6 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; 25/50 flame-spread/smoke developed rating; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Johns Manville; Zeston.
   b. P.I.C. Plastics, Inc.; FG Series.
   c. Proto Corporation; LoSmoke.
   d. Speedline Corporation; SmokeSafe.

2. Adhesive: As recommended by jacket material manufacturer.
3. Color: White.
4. Factory-fabricated tank heads and tank side panels.

C. Metal Jacket:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Metal Jacketing Systems.
b. ITW Insulation Systems; Aluminum and Stainless Steel Jacketing.
c. RPR Products, Inc.; Insul-Mate.

2. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.

a. Factory cut and rolled to required size.
b. Finish and thickness are indicated in field-applied jacket schedules.
c. Moisture Barrier for Indoor Applications: 1-mil- thick, heat-bonded polyethylene and kraft paper.
d. Factory-Fabricated Fitting Covers:

1) Same material, finish, and thickness as jacket.
2) Preformed two-piece or gore, 45- and 90-degree, short- and long-radius elbows.
3) Tee covers.
4) Flange and union covers.
5) End caps.
6) Beveled collars.
7) Valve covers.
8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

3. Stainless-Steel Jacket: ASTM A 167 or ASTM A 240/A 240M.

a. Factory cut and rolled to required size.
b. Material, finish, and thickness are indicated in field-applied jacket schedules.
c. Moisture Barrier for Indoor Applications: 1-mil- thick, heat-bonded polyethylene and kraft paper.
d. Factory-Fabricated Fitting Covers:

1) Same material, finish, and thickness as jacket.
2) Preformed two-piece or gore, 45- and 90-degree, short- and long-radius elbows.
3) Tee covers.
4) Flange and union covers.
5) End caps.
6) Beveled collars.
7) Valve covers.
8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.7 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, provide one of the following:

a. ABI, Ideal Tape Division; 428 AWF ASJ.

b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
c. Compac Corporation; 104 and 105.
d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.

2. Width: 3 inches.
3. Thickness: 11.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, provide one of the following:

a. ABI, Ideal Tape Division; 491 AWF FSK.
b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
c. Compac Corporation; 110 and 111.
d. Venture Tape; 1525 CW NT, 1528 CW, and 1528 CW/SQ.

2. Width: 3 inches.
3. Thickness: 6.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.

1. Products: Subject to compliance with requirements, provide one of the following:

a. ABI, Ideal Tape Division; 370 White PVC tape.
b. Compac Corporation; 130.
c. Venture Tape; 1506 CW NS.

2. Width: 2 inches.
3. Thickness: 6 mils.
4. Adhesion: 64 ounces force/inch in width.
5. Elongation: 500 percent.
6. Tensile Strength: 18 lbf/inch in width.

D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Products: Subject to compliance with requirements, provide one of the following:

a. ABI, Ideal Tape Division; 488 AWF.
b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
c. Compac Corporation; 120.
d. Venture Tape; 3520 CW.

2. Width: 2 inches.
3. Thickness: 3.7 mils.

4. Adhesion: 100 ounces force/inch in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch in width.

2.8 SECUREMENTS

A. Bands:

1. Products: Subject to compliance with requirements, provide one of the following:

   a. ITW Insulation Systems; Gerrard Strapping and Seals.
   b. RPR Products, Inc.; Insul-Mate Strapping, Seals, and Springs.

2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch thick, 3/4 inch wide with wing seal or closed seal.
3. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with wing seal or closed seal.
4. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Insulation Pins and Hangers:

1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.

   a. Products: Subject to compliance with requirements, provide one of the following:

      1) AGM Industries, Inc.; CHP-1.
      2) GEMCO; Cupped Head Weld Pin.
      3) Midwest Fasteners, Inc.; Cupped Head.
      4) Nelson Stud Welding; CHP.

2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick, aluminum sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

   a. Products: Subject to compliance with requirements, provide one of the following:

      1) AGM Industries, Inc.; RC-150.
      2) GEMCO; R-150.
      3) Midwest Fasteners, Inc.; WA-150.
      4) Nelson Stud Welding; Speed Clips.

   b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

2.9 CORNER ANGLES

A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.

B. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems and equipment to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Keep insulation materials dry during application and finishing.

G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

H. Install insulation with least number of joints practical.

I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

K. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints.

L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

O. For above ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.

3.4 INSTALLATION OF EQUIPMENT, TANK, AND VESSEL INSULATION

A. Mineral-Fiber, Pipe and Tank Insulation Installation for Tanks and Vessels: Secure insulation with adhesive and anchor pins and speed washers.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of tank and vessel surfaces.
2. Groove and score insulation materials to fit as closely as possible to equipment, including contours. Bevel insulation edges for cylindrical surfaces for tight joints. Stagger end joints.
3. Protect exposed corners with secured corner angles.
4. Install adhesively attached or self-sticking insulation hangers and speed washers on sides of tanks and vessels as follows:

a. Do not weld anchor pins to ASME-labeled pressure vessels.
b. Select insulation hangers and adhesive that are compatible with service temperature and with substrate.

c. On tanks and vessels, maximum anchor-pin spacing is 3 inches from insulation end joints, and 16 inches o.c. in both directions.
d. Do not overcompress insulation during installation.
e. Cut and miter insulation segments to fit curved sides and domed heads of tanks and vessels.
f. Impale insulation over anchor pins and attach speed washers.
g. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

5. Secure each layer of insulation with stainless-steel or aluminum bands. Select band material compatible with insulation materials.
6. Where insulation hangers on equipment and vessels are not permitted or practical and where insulation support rings are not provided, install a girdle network for securing insulation. Stretch prestressed aircraft cable around the diameter of vessel and make taut with clamps, turnbuckles, or breather springs. Place one circumferential girdle around equipment approximately 6 inches from each end. Install wire or cable between two circumferential girdles 12 inches o.c. Install a wire ring around each end and around outer periphery of center openings, and stretch prestressed aircraft cable radially from the wire ring to nearest circumferential girdle. Install additional circumferential girdles along the body of equipment or tank at a minimum spacing of 48 inches o.c. Use this network for securing insulation with tie wire or bands.
7. Stagger joints between insulation layers at least 3 inches.
8. Install insulation in removable segments on equipment access doors, manholes, handholes, and other elements that require frequent removal for service and inspection.
9. Bevel and seal insulation ends around manholes, handholes, ASME stamps, and nameplates.
10. For equipment with surface temperatures below ambient, apply mastic to open ends, joints, seams, breaks, and punctures in insulation.

3.5 FIELD-APPLIED JACKET INSTALLATION

A. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

B. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

3.7 EQUIPMENT INSULATION SCHEDULE

A. Insulation materials and thicknesses are identified below. If more than one material is listed for a type of equipment, selection from materials listed is Contractor's option.

B. Insulate indoor equipment that is not factory insulated.

C. Heating-hot-water expansion tank insulation shall be the following:

1. Mineral-Fiber Pipe and Tank: 1-1/2 inches thick.

D. Heating-hot-water air-separator insulation shall be the following:

1. Mineral-Fiber Pipe and Tank: 1-1/2 inches thick.

3.8 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Equipment, Concealed:

1. None.

D. Equipment, Exposed, up to 48 Inches in Diameter or with Flat Surfaces up to 72 Inches:

1. PVC: 30 mils thick.

E. Equipment, Exposed, Larger Than 48 Inches in Diameter or with Flat Surfaces Larger Than 72 Inches:

1. Aluminum, Stucco Embossed: 0.032 inch thick.

END OF SECTION 230716
03/07/11

SECTION 230719 - HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 DEFINITIONS

A. Conditioned Space: An area, room, ceiling space/plenum or space within the building structure being heated or cooled (by direct expansion or chilled water) or both, by equipment or appliance and is not subject to outdoor ambient conditions.

B. Unconditioned Space: An area, room or space within the building structure not being conditioned and subject to outdoor ambient conditions. Select examples: above ceiling spaces in ducted return systems, mechanical and electrical rooms, crawl spaces, tunnels, plenums or rooms connecting to the outside.

C. Concealed Ducts/Pipes: Ducts/Pipes not visible within the room they are located, after the project is completed.

D. Exposed Ducts/Pipes: Ducts/Pipes visible within the room they are located, after the project is completed.

E. Ceiling Space/Plenum: An enclosed portion of the building structure, other than an occupiable space being conditioned, that is designed to allow air movement, and thereby serve as part of an air distribution system.

1.3 SUMMARY

A. Section includes insulating the following HVAC piping systems:

1. Heating hot-water piping, indoors.

B. Related Sections:

1. Division 23 Section "HVAC Equipment Insulation."

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail insulation application at pipe expansion joints for each type of insulation.
3. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
4. Detail removable insulation at piping specialties.
5. Detail application of field-applied jackets.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.8 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.9 SCHEDULING

A. Schedule insulation application after pressure testing systems. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General" and "Indoor Piping Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Mineral-Fiber, Preformed Pipe Insulation:

1. Products: Subject to compliance with requirements, provide one of the following:

   a. CertainTeed Corp.
   b. Johns Manville; Micro-Lok.
   c. Knauf Insulation; 1000-Degree Pipe Insulation.
   d. Owens Corning; Fiberglas Pipe Insulation or SSL II.

2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

G. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied ASJ complying with ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. or more. Thermal conductivity (k-value) at 100 deg F is 0.29 Btu x in./h x sq. ft. x deg F or less. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. CertainTeed Corp.; CrimpWrap.
   b. Johns Manville; MicroFlex.
   c. Knauf Insulation; Pipe and Tank Insulation.
   d. Owens Corning; Fiberglas Pipe and Tank Insulation.

2.2 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
    b. Eagle Bridges - Marathon Industries; 225.
    c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
    d. Mon-Eco Industries, Inc.; 22-25.

C. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
    b. Eagle Bridges - Marathon Industries; 225.
    c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-50.
    d. Mon-Eco Industries, Inc.; 22-25.

D. PVC Jacket Adhesive: Compatible with PVC jacket.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Dow Corning Corporation; 739, Dow Silicone.
    b. Johns Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
    c. P.I.C. Plastics, Inc.; Welding Adhesive.
    d. Speedline Corporation; Polyco VP Adhesive.

2.3 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

B. Breather Mastic: Water based; suitable for indoor use on above-ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10.
    b. Eagle Bridges - Marathon Industries; 550.
    c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
    d. Mon-Eco Industries, Inc.; 55-50.
    e. Vimasco Corporation; WC-1/WC-5.

2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: 60 percent by volume and 66 percent by weight.
5. Color: White.

2.4 SEALANTS

A. FSK and Metal Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
   b. Eagle Bridges - Marathon Industries; 405.
   c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.
   d. Mon-Eco Industries, Inc.; 44-05.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.

B. ASJ Flashing Sealants and PVC Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.

2.5 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.

2.6 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; 25/50 flame-spread/smoke developed rating; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Johns Manville; Zeston.
   b. P.I.C. Plastics, Inc.; FG Series.

c. Proto Corporation; LoSmoke.
d. Speedline Corporation; SmokeSafe.

2. Adhesive: As recommended by jacket material manufacturer.
3. Color: White.
4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

C. Metal Jacket:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Metal Jacketing Systems.
b. ITW Insulation Systems; Aluminum and Stainless Steel Jacketing.
c. RPR Products, Inc.; Insul-Mate.

2. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.

a. Factory cut and rolled to required size.
b. Finish and thickness are indicated in field-applied jacket schedules.
c. Moisture Barrier for Indoor Applications: 1-mil- thick, heat-bonded polyethylene and kraft paper.
d. Factory-Fabricated Fitting Covers:

1) Same material, finish, and thickness as jacket.
2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
3) Tee covers.
4) Flange and union covers.
5) End caps.
6) Beveled collars.
7) Valve covers.
8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

3. Stainless-Steel Jacket: ASTM A 167 or ASTM A 240/A 240M.

a. Factory cut and rolled to required size.
b. Material, finish, and thickness are indicated in field-applied jacket schedules.
c. Moisture Barrier for Indoor Applications: 1-mil- thick, heat-bonded polyethylene and kraft paper.
d. Factory-Fabricated Fitting Covers:

1) Same material, finish, and thickness as jacket.
2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
3) Tee covers.
4) Flange and union covers.
5) End caps.
6) Beveled collars.
7) Valve covers.

8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.7 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, provide one of the following:

a. ABI, Ideal Tape Division; 428 AWF ASJ.
b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
c. Compac Corporation; 104 and 105.
d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.

2. Width: 3 inches.
3. Thickness: 11.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, provide one of the following:

a. ABI, Ideal Tape Division; 491 AWF FSK.
b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
c. Compac Corporation; 110 and 111.
d. Venture Tape; 1525 CW NT, 1528 CW, and 1528 CW/SQ.

2. Width: 3 inches.
3. Thickness: 6.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.

1. Products: Subject to compliance with requirements, provide one of the following:

a. ABI, Ideal Tape Division; 370 White PVC tape.
b. Compac Corporation; 130.
c. Venture Tape; 1506 CW NS.

2. Width: 2 inches.
3. Thickness: 6 mils.
4. Adhesion: 64 ounces force/inch in width.
5. Elongation: 500 percent.
6. Tensile Strength: 18 lbf/inch in width.

D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Products: Subject to compliance with requirements, provide one of the following:

a. ABI, Ideal Tape Division; 488 AWF.
b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
c. Compac Corporation; 120.
d. Venture Tape; 3520 CW.

2. Width: 2 inches.
3. Thickness: 3.7 mils.
4. Adhesion: 100 ounces force/inch in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch in width.

2.8 SECUREMENTS

A. Bands:

1. Products: Subject to compliance with requirements, provide one of the following:

a. ITW Insulation Systems; Gerrard Strapping and Seals.
b. RPR Products, Inc.; Insul-Mate Strapping, Seals, and Springs.

2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch thick, 3/4 inch wide with wing seal or closed seal.
3. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with wing seal or closed seal.
4. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches o.c.
4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.

5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.

3.4 PENETRATIONS

A. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.

6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.6 INSTALLATION OF MINERAL-FIBER INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches o.c.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.

2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.7 FIELD-APPLIED JACKET INSTALLATION

A. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

B. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.8 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

3.9 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Service Drains and Vents: Insulation and jacketing to be the same as for the piping system served.

3.10 INDOOR, CONDITIONED SPACE PIPING INSULATION SCHEDULE

A. Mineral-Fiber, Preformed Pipe, Type I:

Service	Temp. Deg. F	1" and Less	1" to 1.25"	1.5" to 3"	4" to 6"
Hot Water	105-200	1.5	1.5	2	2

3.11 INDOOR, UNCONDITIONED SPACE PIPING INSULATION SCHEDULE

A. Mineral-Fiber, Preformed Pipe Insulation, Type I:

Service	Temp. Deg. F	1" and Less	1" to 1.25"	1.5" to 3"	4" to 6"
Hot Water	105-200	2.5	2.5	2.5	3.5

3.12 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed:

1. None.

D. Piping, Exposed:

1. None.

END OF SECTION 230719
03/07/11

February 28, 2011

SECTION 230900 - HVAC INSTRUMENTATION AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes control equipment for HVAC systems and components.

B. This Section includes the following items for wiring systems used as signal pathways for high-speed data transmission:

1. Mounting elements.
2. Unshielded twisted-pair cabling.
3. Fiber-optic cabling.

C. Identification products, related sections include the following:

1. Division 23 Section "Sequence of Operation" for requirements that relate to this Section.

D. Work in this Section includes:

1. A complete system including power and control wiring of all control system components and devices.
2. Wiring circuits which are activated/de-activated by a control system component, such as but not limited to, high and low limit protective devices, relays, etc.
3. Control panel wiring to control panels (unless noted otherwise) and to terminal strips, and field wiring from terminal strips to field-mounted devices.
4. Wiring to the "auto" side of hand-off-auto switches on units being controlled by the controls contractor.
5. Wiring of all electro-mechanical devices required to be located on or in temperature control panels.
6. Power and control wiring to all control system equipment including, but not limited to, control panels, control transformers, relays, transformers, and all other control devices. Provide power wiring from electrical panel circuit breakers. Circuit breakers provided under Division 26 Section "Panelboards." Coordinate requirements with the Division 26 Contractor.
7. Control equipment and devices that are provided with a voltage rating readily available at the location of installation. Coordinate with Contract Documents and Division 26 Contractor.
8. All line voltage wiring and conduit. Comply with the requirements of Division 26 Section "Wires and Cables." A licensed electrician shall perform all work in strict accordance with the NEC and other local codes.
9. All control wiring and cable. A licensed electrician shall perform all work in strict accordance with the NEC and other local codes.
10. Integration with balancing work to provide support and calibration.
11. Ethernet devices, hardware and coordination as required to access LAN and Internet.

E. Work By Others: The following work shall be performed by the associated division contractor under the supervision and coordination of this subcontractor.

1. Division 26 contract shall be responsible for:

a. Furnishing, installing and terminating all feeder and/or branch circuit wiring to major equipment including:

1) Wiring to and between all disconnects, starters, drives and equipment motors.

b. Furnishing and installing of circuit breakers (20 A-1 phase) in power panels for use by the ATCS Contractor to power the ATCS.

1.3 DEFINITIONS

A. Backbone: A facility (e.g., pathway, cable, or conductors) between automation system cabinets or between buildings.

B. BICSI: Building Industry Consulting Service International.

C. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.

D. DDC: Direct digital control.

E. EMI: Electromagnetic interference.

F. Horizontal Cabling: Cabling between, and including, the building automation system outlet or the first mechanical terminations on the horizontal connection point and the horizontal cross-connect.

G. IDC: Insulation displacement connector.

H. I/O: Input/output.

I. LAN: Local area network.

J. LonWorks: A control network technology platform for designing and implementing interoperable control devices and networks.

K. MS/TP: Master slave/token passing.

L. PC: Personal computer.

M. PID: Proportional plus integral plus derivative.

N. RCDD: Registered Communications Distribution Designer.

O. RMC: Rigid metallic conduit.

P. RTD: Resistance temperature detector.

Q. UTP: Unshielded twisted pair.

1.4 SYSTEM PERFORMANCE

A. Comply with the following performance requirements:

1. Graphic Display: Display graphic with minimum 20 dynamic points with current data within 10 seconds.
2. Graphic Refresh: Update graphic with minimum 20 dynamic points with current data within 8 seconds.
3. Object Command: Reaction time of less than two seconds between operator command of a binary object and device reaction.
4. Object Scan: Transmit change of state and change of analog values to control units or workstation within six seconds.
5. Alarm Response Time: Annunciate alarm at workstation within 45 seconds. Multiple workstations must receive alarms within five seconds of each other.
6. Program Execution Frequency: Run capability of applications as often as five seconds, but selected consistent with mechanical process under control.
7. Performance: Programmable controllers shall execute DDC PID control loops, and scan and update process values and outputs at least once per second.
8. Reporting Accuracy: The system shall report all values with an end to end minimum accuracy as follows:

    a. Water Temperature: Plus or minus 1 deg F.
    b. Water Flow: Plus or minus 5 percent of full scale.
    c. Water Pressure: Plus or minus 2 percent of full scale.
    d. Space Temperature: Plus or minus 1 deg F.
    e. Outside Air Temperature: Plus or minus 2 deg F.
    f. Dew Point Temperature: Plus or minus 3 deg F.
    g. Temperature Differential: Plus or minus 0.25 deg F.
    h. Relative Humidity: Plus or minus 5 percent.

9. The system shall be capable of supporting both standard and vendor specific protocols to integrate a wide variety of third-party devices and legacy systems.
10. Installed system software must be DICAP/AOP compliant prior to system being installed on the Military Network.

1.5 COMMON REQUIREMENTS FOR SEQUENCES OF OPERATION

A. The following items are common requirements that apply unless noted otherwise:

1. All setpoints shall be program adjustable at the operator workstation.
2. All high and low limits shall be alarmed.

1.6 TECHNICAL PROPOSAL

A. Technical proposals shall be prepared in accordance with these specifications. Four copies of the proposal shall be submitted at the time of Bid. Proposals that are unbound, loose, in a file folder, or stapled in a file folder will not be acceptable. The technical proposal shall include the following data/information as a minimum.

1. Information on organizational capabilities to handle this project (project management, personnel and staffing, single source responsibility, etc.).
2. Information and description of training program.
3. Description of system architecture including schematic block diagram showing DDC panels, interface with existing BAS network.
4. Describe system operation, functions and control techniques.
5. A full description of system modularity.
6. Provisions against obsolescence due to technological advancements.
7. Provide hardware and software technical data sheets on system interfaces and integration requirements.
8. Provide a detailed narrative description of how the new BAS will interface with existing systems. Include a description of all hardware and software upgrades (including web-based enhancements) required for the existing systems for seamless integration.
9. Detailed description of all operating, command, application and energy management software provided for this project.
10. Provide a written guarantee of how long the system proposed will be a standard product backed by ongoing parts availability and factory/field technical support.
11. A signed certificate stating that the BAS Contractor has read the performance and functional requirements, understands them, and that the technical proposal shall conform with all parts of the Specification. Provide a line by line concordance summary stating compliance with every specification section herein.
12. Provide a recommended spare parts list, which the Owner shall maintain at the site with the associated cost of each part. The BAS Contractor shall provide a separate spare parts list for both the warranty period and beyond for the post-warranty period. All spare parts recommended shall be made available 10 years beyond the warranty period.
13. Provide detailed information on the web server browser package proposed for this project.

1.7 SUBMITTALS

A. Product Data: Include manufacturer's technical literature for each control device. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials, and installation and startup instructions for each type of product indicated.

1. DDC System Hardware: Bill of materials of equipment indicating quantity, manufacturer, and model number. Include technical data for interface equipment, control units, transducers/transmitters, relays/switches, control panels, and interface equipment.
2. Control System Software: Include technical data for operating system software, operator interface, color graphics, and other third-party applications.
3. Controlled Systems: Instrumentation list with element name, type of device, manufacturer, model number, and product data. Include written description of sequence of operation including schematic diagram.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Bill of materials of equipment indicating quantity, manufacturer, and model number.
2. Schematic flow diagrams showing pumps and control devices.
3. Wiring Diagrams: Power, signal, and control wiring.
4. Details of control panel faces, including controls, instruments, and labeling.
5. Written description of sequence of operation.
6. DDC System Hardware:

    a. Wiring diagrams for control units with termination numbers.

b. Schematic diagrams for control, communication, and power wiring, showing trunk data conductors and wiring between operator workstation and control unit locations.

7. Control System Software: List of color graphics indicating monitored systems, data (connected and calculated) point addresses, output schedule, operator notations, and a graphics tree showing how graphics are organized and linked.
8. Controlled Systems:

   a. Schematic diagrams of each controlled system with control points labeled and control elements graphically shown, with wiring.
   b. Scaled drawings showing mounting, routing, and wiring of elements including bases and special construction.
   c. Written description of sequence of operation including schematic diagram.
   d. Points list.

C. Data Communications Protocol Certificates: Certify that each proposed DDC system component complies with ASHRAE 135.

D. Software and Firmware Operational Documentation: Include the following:

1. Software operating and upgrade manuals.
2. Program Software Backup: On a magnetic media or compact disc, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.
5. Software license required by and installed for DDC workstations and control systems.

E. Software Upgrade Kit: For Owner to use in modifying software to suit future systems revisions or monitoring and control revisions.

F. Qualification Data: For Installer and manufacturer.

G. Field quality-control test reports.

H. Operation and Maintenance Data: For HVAC instrumentation and control system to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Interconnection wiring diagrams with identified and numbered system components and devices.
2. Keyboard illustrations and step-by-step procedures indexed for each operator function.
3. Inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.
4. Calibration records and list of set points.
5. An electronic copy of all graphics, programming and settings in final as-built form on a CD-ROM.

I. Project Record Drawings: These shall be as-built versions of the submittal shop drawings. One set of magnetic media including CAD, .DWG, or .DXF drawing files also shall be provided.

J. Testing and Checklists: Completed versions of all reports and checklists, along with all trend logs, used to meet the requirements of Part 3 "Demonstration and Acceptance."

1.8 QUALITY ASSURANCE

A. The BAS system shall be designed and installed, commissioned and serviced by factory trained personnel. BAS contractor shall have an in-place support facility within 100 miles of the site with technical staff, spare parts inventory and necessary test and diagnostic equipment. The BAS contractor shall provide full time, on site, experienced project manager for this work, responsible for direct supervision of the design, installation, start up and commissioning of the BAS. The Bidder shall be regularly engaged in the installation and maintenance of BAS systems and shall have a minimum of ten (10) years of demonstrated technical expertise and experience in the installation and maintenance of BAS systems similar in size and complexity to this project

B. Installer Qualifications: Automatic control system manufacturer's authorized representative who is trained and approved for installation of system components required for this Project.

C. Installer Qualifications: Cabling installer must have on staff personnel certified by BICSI.

1. Installation Supervision: Installation shall be under the direct supervision of a Registered Technician, who shall be present at all times when Work of this Section is performed at the project site.

D. Electrical Installer: Line voltage wiring for the automatic control system shall be done by a Licensed Electrician.

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

F. Comply with ASHRAE 135 for DDC system components.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Factory-Mounted Components: Where control devices specified in this Section are indicated to be factory mounted on equipment, arrange for shipping of control devices to equipment manufacturer.

B. System Software: Update to latest version of software at Project completion.

1.10 LICENSING

A. Software: Owner has full license of use of all software programming, including the right to change and edit programming to suit needs.

B. Protocols: Owner has full license to all system and networking protocols.

C. Points: Owner has full license to all system points to change, modify or otherwise alter to suit needs.

1.11 TRAINING

A. Provide five days of training on site.

B. The BAS Contractor shall provide instructors to give full instructions to designated personnel in the adjustment, operation, and maintenance of the system installed. Instructors shall be thoroughly familiar with all aspects of the subject matter they are to teach. All training shall be held during normal work hours of 8:00 am to 4:30 pm weekdays.

C. Training shall include, but not be limited to, the following:

1. Explanation of drawings and operations and maintenance manuals.
2. Walk-through of the job to locate control components.
3. DDC controller and TEC operation.
4. Explanation of adjustment, calibration, and replacement procedures.

D. Training of the Owner's operation and maintenance personnel is required in cooperation with the Owner's representative. Provide competent, factory authorized personnel to provide instruction to operation and maintenance personnel concerning the location, operation, and troubleshooting of the installed systems. The instruction shall be scheduled in coordination with the Construction Manager after submission and approval of formal training plans.

1.12 WARRANTY

A. Warrant labor and materials for specified control system free from defects for a period of 12 months after final acceptance. Failures on control systems that include all computer equipment, transmission equipment and all sensors and control devices during warranty period shall be adjusted, repaired, or replaced at no additional cost or reduction in service to Owner. Respond during normal business hours within 24 hours of Owner's warranty service request.

1. Warranty also applies to any system components and wiring that are reused

B. Work shall have a single warranty date, even if Owner receives beneficial use due to early system start-up. If specified work is split into multiple contracts or a multi-phase contract, each contract or phase shall have a separate warranty start date and period.

C. If Project Manager (Owner) determines that equipment and systems operate satisfactorily at the end of final start-up, testing, and commissioning phase, Project Manager will certify in writing that control system operation has been tested and accepted in accordance with the terms of this specification. Date of acceptance shall begin warranty period.

D. Provide updates to operator workstation software, project-specific software, graphic software, database software, and firmware that resolve Contractor identified software deficiencies at no charge during warranty period. If available, Owner can purchase in-warranty service agreement to receive upgrades for functional enhancements associated with the above-mentioned items. Do not install updates or upgrades without Owner's written authorization.

E. Exception:

1. Contractor shall not be required to warrant systems, equipment and devices or software if the damages and/or failures were caused by lack of training, unauthorized use, negligence or deliberate action of other parties, or job site conditions.

1.13 OWNERSHIP OF PROPRIETARY MATERIAL

A. Project specific software and documentation shall become Owner's property. This includes, but not limited to:

1. All Software
2. Graphics
3. Record drawings
4. Database
5. Application programming code

B. Documentation

1. General

a. Provide completely Web-based electronic project documentation in addition to the hard copy owner's manual by utilizing Internet Web access. The electronic project documentation shall be accessible for authorized personnel any time from anywhere requiring only a simple Internet access.
b. Submit two (2) draft copies of owner's manuals for review. After review by authorized representative, the contractor shall incorporate review comments and submit four (4) interim final copies.
c. Submit four (4) copies of owner's manuals upon completion of project.
d. Submit two (2) electronic copies of complete as-built documentation on CD ROM or equivalent. All drawings shall be in standard AutoCAD format, other documentation shall be in standard MS Office format.
e. Update manuals with modifications made to system during guarantee period. Provide replacement pages or supplements in quantity stated above for "as built" manuals.
f. Assemble owner's manuals into multi-volume sets as necessary and required by the owner.
g. Protect each volume with a heavy duty binder. Volumes to have plastic printed dividers between major sections and have oversized binders to accommodate up to ½ inch thick set of additional information.
h. Each binder to be printed with project name and volume title on front cover and binder.
i. On the first page of each manual identify with project name, manual title, owner's name, engineer's name, contractor's name, address and service phone number, and person who prepared manual.

C. Operating manual to serve as training and reference manual for all aspects of day-to-day operation of the system. As a minimum include the following:

1. Sequence of operation for automatic and manual operating modes for all building systems. The sequences shall cross reference the system point/object names.
2. Description of manual override operation of all control point/objects in system.
3. EMS system manufacturers complete operating manuals.

D. Provide maintenance manual to serve as training and reference manual for all aspects of day-to-day maintenance and major system repairs. As a minimum include the following:

1. Complete as-built installation drawings for each building system.
2. Overall system electrical power supply schematic indicating source of electrical power for each system component. Indicate all battery backup provisions.
3. Photographs and/or drawings showing installation details and locations of equipment.
4. Routine preventive maintenance procedures, corrective diagnostics troubleshooting procedures, and calibration procedures.

5. Parts lists with manufacturer's catalog numbers and ordering information.
6. Lists of ordinary and special tools, operating materials supplies and test equipment recommended for operation and servicing.
7. Manufacturer's operation, set-up, maintenance and catalog literature for each piece of equipment.
8. Maintenance and repair instructions.
9. Recommended spare parts.

E. Provide Programming Manual to serve as training and reference manual for all aspects of system programming. As a minimum include the following:

1. Complete programming manuals, and reference guides.
2. Details of any custom software packages and compilers supplied with system.
3. Information and access required for independent programming of system.

PART 2 - PRODUCTS

2.1 COMMUNICATION AND ARCHITECTURE

A. All control products provided for this project shall comprise a BACnet internetwork. Communication involving control components (i.e., all types of controllers and operator interfaces) shall conform to ANSI/ASHRAE Standard 135-1995, BACnet.

B. Each BACnet device shall operate on the BACnet Data Link/Physical layer protocol specified for that device as defined in this Section.

C. The Contractor shall provide all communication media, connectors, repeaters, hubs, and routers necessary for the internetwork.

D. All controllers shall have a communication port for connections with the operator interfaces using the BACnet Data Link/Physical layer protocol.

E. Remote operator interface shall be via web-based server software for remote operator interface using the BACnet PTP Data Link/Physical layer protocol. Remote operator interface via this software shall allow for communication with any and all controllers on this network as described below.

F. Operator Workstation Communication:

1. System shall be web-based and viewable from any Workstation on the Owners network.
2. The server will act as the central database for system graphics and databases to provide consistency throughout all system workstations.
3. The network shall allow concurrent use of multiple EMS software site licenses.

G. Primary Network

1. Server shall be capable of simultaneous direct connection and communication with BACnet/IP, OPC and TCP/IP corporate level networks without the use of interposing devices.
2. The Primary Network shall not impose a maximum constraint on the number of concurrent users.
3. Any controller esiding on the primary building level networks shall connect to Ethernet network without the use of a PC or a gateway with a hard drive.
4. Any PC on the Primary Network shall have transparent communication with controllers on the building level networks connected via Ethernet.

5. Any break in Ethernet communication from the Server to the controllers on the building level networks shall result in a notification at the Server.
6. The standard client and server workstations on the Primary Network shall reside on industry standard Ethernet utilizing standard TCP/IP, IEEE 802.3.
7. System software applications will run as a service to allow communication with Primary Network Controllers without the need for user log in. Closing the application or logging off shall not prevent the processing of alarms, network status, panel failures, and trend information.
8. Access to the system database shall be available from any standard client computer (security permitting) on the Owner's network.

H. Primary Network - Panel to Panel Communication:

1. All Building Controllers shall directly reside on the primary BACnet/IP Ethernet network such that communications may be executed directly between Building Controllers, directly between server and Building Controllers on a peer-to-peer basis.
2. Systems that operate via polled response or other types of protocols that rely on a central processor, file server, or similar device to manage panel-to-panel or device-to-device communications shall not be acceptable.
3. All operator interfaces shall have the ability to access all point/object status and application report data or execute control functions for any and all other devices. Access to data shall be based upon logical identification of building equipment. No hardware or software limits shall be imposed on the number of devices with global access to the network data.
4. The primary network shall use BACnet/IP over Ethernet. All devices must:

    a. Auto-sense 10/100 Mbps networks.
    b. Receive and IP Address from a Dynamic Host Configuration Protocol (DHCP) Server or be configured with a Fixed IP Address.
    c. Resolve Name to IP Addresses for devices using a Domain Name Service (DNS) Server on the Ethernet network.
    d. Allow local access to an individual Primary Controller using industry standard Telnet software to view and edit entire Primary Network.

5. The primary network shall provide the following minimum performance:

    a. Provide high-speed data transfer rates for alarm reporting, report generation from multiple controllers and upload/download efficiency between network devices. System performance shall insure that an alarm occurring at any Primary Controller is displayed at any PC workstations, all Primary controllers, and other alarm printers within 15 seconds.
    b. Message and alarm buffering to prevent information from being lost.
    c. Error detection, correction, and re-transmission to guarantee data integrity.
    d. Synchronization of real-time clocks between Primary Controllers, including automatic daylight savings time corrections.
    e. The primary network shall allow the Primary Controllers to access any data from, or send control commands and alarm reports directly to, any other Primary Controller or combination of controllers on the network without dependence upon a central or intermediate processing device. Primary Controllers shall send alarm reports to multiple operator workstations without dependence upon a central or intermediate processing device. The network shall also allow any Primary controller to access, edit, modify, add, delete, back up, restore all system point/object database and all programs.
    f. The primary network shall allow the Primary Controllers to assign password access and control priorities to each point/object individually. The logon password (at any PC workstation or portable operator terminal) shall enable the operator to monitor, adjust and control only the point/objects that the operator is authorized for. All other point/objects shall not be displayed at the PC workstation or portable terminal. (e.g. all base building and

all tenant point/objects shall be accessible to any base building operators, but only certain base building and tenant point/objects shall be accessible to tenant building operators). Passwords and priorities for every point/object shall be fully programmable and adjustable.

g. Devices containing custom programming must reside on the Primary Network

I. Secondary Network – Application Specific Controller Communication:

1. Communication over the secondary network shall be BACnet MS/TP protocol.
2. This level communication shall support a family of application specific controllers for terminal equipment.
3. The Application Specific Controllers shall communicate bi-directionally with the primary network through Primary Controllers for transmission of global data.

J. Communication services over the internetwork shall result in operator interface and value passing that is transparent to the internetwork architecture as follows:

1. Connection of an operator interface device to any one controller on the internetwork will allow the operator to interface with all other controllers as if that interface were directly connected to the other controllers. Data, status information, reports, system software, custom programs, etc., for all controllers shall be available for viewing and editing from any one controller on the internetwork.
2. All database values (e.g., objects, software variables, custom program variables) of any one controller shall be readable by any other controller on the internetwork. This value passing shall be automatically performed by a controller when a reference to an object name not located in that controller is entered into the controller's database. An operator/installer shall not be required to set up any communication services to perform internetwork value passing.
3. Remote client access via Windows Terminal Services shall provide multiple, independent sessions of the workstations software – Terminal Services clients shall have workstation software access, without the need to install the workstation software on the local hard drive.

K. The time clocks in all controllers shall be automatically synchronized daily via the internetwork. An operator change to the time clock in any controller shall be automatically broadcast to all controllers on the internetwork.

L. The internetwork shall have the following minimum capacity for future expansion:

1. Each building controller shall have routing capacity for 50 controllers.
2. The building controller network shall have capacity for 50 building controllers.
3. The system shall have an overall capacity for 12,500 building controllers, custom application controller, and application specific controller input/output objects.

M. Building Controllers: Provide an adequate number of building controllers to achieve the performance specified in Part 1 article on "System Performance." Each of these panels shall meet the following requirements:

1. The Building Automation System (BAS) shall be composed of one or more independent, standalone, microprocessor-based building controllers to manage the global strategies of the system.
2. The building controller shall have sufficient memory to support its operating system, database, trending, and programming requirements.
3. Data shall be shared between networked building controllers.
4. The operating system of the building controller shall manage the input and output communication signals to allow distributed controllers to share real and virtual object information and allow for central monitoring and alarms.

5. Each building controller shall reside on a BACnet network using the ISO 8802-3 (Ethernet) Data Link/Physical layer protocol. Each building controller also shall perform BACnet routing to a network of custom application and application specific controllers.
6. The controller shall provide a service communication port using BACnet Data Link/Physical layer protocol for connection to a portable operator's terminal.

N. Manufacturers:

1. Johnson Controls, Inc.; Controls Group.

O. Control system shall consist of indicators, final control elements, interface equipment, other apparatus, power and control wiring, and accessories to control mechanical systems.

2.2 DDC EQUIPMENT

A. Control Units: Modular, comprising processor board with programmable, nonvolatile, random-access memory; local operator access and display panel; integral interface equipment; and backup power source.

1. Units monitor or control each I/O point; process information; execute commands from other control units, devices, and operator stations; and download from or upload to operator workstation or diagnostic terminal unit.
2. Stand-alone mode control functions operate regardless of network status. Functions include the following:

a. Global communications.
b. Discrete/digital, analog, and pulse I/O.
c. Monitoring, controlling, or addressing data points.
d. Software applications, scheduling, and alarm processing.
e. Testing and developing control algorithms without disrupting field hardware and controlled environment.

3. Standard Application Programs:

a. Electric Control Programs: Demand limiting, duty cycling, automatic time scheduling, start/stop time optimization, night setback/setup, on-off control with differential sequencing, staggered start, antishort cycling, PID control, DDC with fine tuning, and trend logging.
b. HVAC Control Programs: Optimal run time, supply-air reset, and enthalpy switchover.
c. Programming Application Features: Include trend point; alarm processing and messaging; weekly, monthly, and annual scheduling; energy calculations; run-time totalization; and security access.
d. Remote communications.
e. Maintenance management.
f. Units of Measure: Inch-pound.

4. Local operator interface provides for download from or upload to operator workstation or diagnostic terminal unit.
5. ASHRAE 135 Compliance: Control units shall use ASHRAE 135 protocol and communicate using ISO 8802-3 (Ethernet) datalink/physical layer protocol.

B. Local Control Units: Modular, comprising processor board with electronically programmable, nonvolatile, read-only memory; and backup power source.

1. Units monitor or control each I/O point, process information, and download from or upload to operator workstation or diagnostic terminal unit.
2. Stand-alone mode control functions operate regardless of network status. Functions include the following:

    a. Global communications.
    b. Discrete/digital, analog, and pulse I/O.
    c. Monitoring, controlling, or addressing data points.

3. Local operator interface provides for download from or upload to operator workstation or diagnostic terminal unit.
4. ASHRAE 135 Compliance: Control units shall use ASHRAE 135 protocol and communicate using ISO 8802-3 (Ethernet) datalink/physical layer protocol.

C. I/O Interface: Hardwired inputs and outputs may tie into system through controllers. Protect points so that shorting will cause no damage to controllers.

1. Binary Inputs: Allow monitoring of on-off signals without external power.
2. Pulse Accumulation Inputs: Accept up to 10 pulses per second.
3. Analog Inputs: Allow monitoring of low-voltage (0- to 10-V dc), current (4 to 20 mA), or resistance signals.
4. Binary Outputs: Provide on-off or pulsed low-voltage signal, selectable for normally open or normally closed operation.
5. Analog Outputs: Provide modulating signal, either low voltage (0- to 10-V dc) or current (4 to 20 mA).
6. Tri-State Outputs: Provide two coordinated binary outputs for control of three-point, floating-type electronic actuators.
7. Universal I/Os: Provide software selectable binary or analog outputs.

D. Power Supplies: Transformers with Class 2 current-limiting type or overcurrent protection; limit connected loads to 80 percent of rated capacity. DC power supply shall match output current and voltage requirements and be full-wave rectifier type with the following:

1. Output ripple of 5.0 mV maximum peak to peak.
2. Combined 1 percent line and load regulation with 100-mic.sec. response time for 50 percent load changes.
3. Built-in overvoltage and overcurrent protection and be able to withstand 150 percent overload for at least 3 seconds without failure.

E. Power Line Filtering: Internal or external transient voltage and surge suppression for workstations or controllers with the following:

1. Minimum dielectric strength of 1000 V.
2. Maximum response time of 10 nanoseconds.
3. Minimum transverse-mode noise attenuation of 65 dB.
4. Minimum common-mode noise attenuation of 150 dB at 40 to 100 Hz.

2.3 UNITARY CONTROLLERS

A. Unitized, capable of stand-alone operation with sufficient memory to support its operating system, database, and programming requirements, and with sufficient I/O capacity for the application.

1. Configuration: Local keypad and display; diagnostic LEDs for power, communication, and processor; wiring termination to terminal strip or card connected with ribbon cable; memory with bios; and 72-hour battery backup.
2. Operating System: Manage I/O communication to allow distributed controllers to share real and virtual object information and allow central monitoring and alarms. Perform scheduling with real-time clock. Perform automatic system diagnostics; monitor system and report failures.
3. ASHRAE 135 Compliance: Communicate using read (execute and initiate) and write (execute and initiate) property services defined in ASHRAE 135. Reside on network using MS/TP datalink/physical layer protocol and have service communication port for connection to diagnostic terminal unit.
4. Enclosure: Dustproof rated for operation at 32 to 120 deg F.
5. Enclosure: Waterproof rated for operation at 40 to 150 deg F.

2.4 MISCELLANEOUS DEVICES

A. Local Control Panels:

1. All control panels shall be factory constructed, incorporating the BAS manufacturer's standard designs and layouts. All control panels shall be UL inspected and listed as an assembly and carry a UL 508 label listing compliance. Control panels shall be fully enclosed, with perforated sub-panel, hinged door and slotted flush latch.
2. In general, the control panels shall consist of the DDC controller(s), display module as specified and indicated on the plans, and I/O devices such as relays, transducers, and so forth that are not required to be located external to the control panel due to function. Where specified the display module shall be flush-mounted in the panel face unless otherwise noted.
3. All I/O connections on the DDC controller shall be provided via removable or fixed screw terminals.
4. Low and line voltage wiring shall be segregated. All provided terminal strips and wiring shall be UL listed, 300 volt service and provide adequate clearance for field wiring.
5. All wiring shall be neatly installed in plastic trays or tie-wrapped.
6. A convenience 120 Vac duplex receptacle shall be provided in each enclosure, fused on/off power switch, and required transformers.

B. Power Supplies:

1. DC power supplies shall be sized for the connected device load. Total rated load shall not exceed 75% of the rated capacity of the power supply.
2. Input: 120 Vac +10%, 60 Hz.
3. Output: 24 Vdc.
4. Line Regulation: +0.05% for 10% line change.
5. Load Regulation: +0.05% for 50% load change.
6. Ripple and Noise: 1 mV rms, 5 mV peak to peak.
7. An appropriately sized fuse and fuse block shall be provided and located next to the power supply.
8. A power disconnect switch shall be provided next to the power supply.

2.5 UNSHIELDED TWISTED-PAIR CABLING

A. Cable Manufacturers:

1. Avaya Inc.
2. Belden Inc.; Electronics Division.
3. CommScope Properties, LLC.

4. General Cable Technologies Corporation.
5. Helix/HiTemp Cables, Inc.
6. KRONE Incorporated.
7. Mohawk/CDT; a division of Cable Design Technologies.
8. Nordex/CDT; a Subsidiary of Cable Design Technologies.
9. Remee Products Corp.
10. Superior Essex; Superior Telecommunications Inc.
11. West Penn Wire/CDT; a division of Cable Design Technologies.

B. Terminal and Connector Component Manufacturers:

1. AMP; a Tyco International Ltd. Company.
2. Amphenol Corporation.
3. Avaya Inc.
4. Connect-Tech Products.
5. Cooper Wiring Devices; a division of Cooper Industries, Inc.
6. Homaco.
7. Hubbell Premise Wiring.
8. KRONE Incorporated.
9. Leviton Voice & Data Division.
10. Lucent Technologies; Global Service Provider.
11. Mohawk/CDT; a division of Cable Design Technologies.
12. Molex Premise Networks; a division of Molex, Incorporated.
13. Nordex/CDT; a Subsidiary of Cable Design Technologies.
14. Panduit Corp.
15. Thomas & Betts Corporation.

C. 100-Ohm UTP: Comply with UL 444.

D. Backbone Copper Cable:

1. No. 24 AWG.
2. Comply with ICEA S-80-576 and TIA/EIA-568 B.2, Categories 5e and 6.
3. NFPA 70, Type CMR complying with UL 1666.
4. Cable Jacket Color: Per Owner standards.

E. Horizontal Copper Cable:

1. No. 24 AWG, 100 ohm, four pair.
2. Comply with TIA/EIA-568-B.2, Categories 5e and 6.
3. NFPA 70, Types CMG and CMP.
4. Cable Jacket Color: Per Owner standards.

F. Cable Connecting Hardware: Comply with TIA/EIA-568-B.2, IDC type, using modules designed for punch-down caps or tools.

1. IDC Terminal Block Modules: Integral with connector bodies, including plugs and jackets where indicated.
2. IDC Connecting Hardware: Consistent throughout Project.

G. Patch Panel: Comply with TIA/EIA-568-B.2, meeting or exceeding cable performance. Modular panels housing multiple-numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables.

1. Number of Jacks per Field: One for each four-pair conductor group of indicated cables, plus spares and blank positions adequate to satisfy specified expansion criteria.

H. Jack and Jack Assemblies: Modular, color-coded, RJ-45 receptacle units with integral IDC-type terminals. Use keyed jacks for data service.

I. Patch Cords: Factory-made, four-pair cables in 48-inch lengths; terminated with RJ-45 plug at each end. Use keyed plugs for data service.

PART 3 - EXECUTION

3.1 INSTALLATION STANDARDS

A. Comply with BICSI TCI, TIA/EIA-568-B.1, TIA/EIA-568-B.2, TIA/EIA-568-B.3, and TIA/EIA-569-A.

3.2 EXAMINATION

A. Verify that power supply is available for control units.

B. Examine pathway elements intended for cables.

1. Verify proposed routes of pathways. Check raceways, cable trays, and other elements for compliance with space allocations, clearances, installation tolerances, hazards to cable installation, and other conditions affecting installation. Verify that cabling can be installed complying with EMI clearance requirements.
2. Prepare wall penetrations and verify that penetrations of rated fire walls are made using products labeled for type of wall penetrated.
3. Identify plan to support cables and raceways in suspended ceilings. Verify weight of individual types and sizes of cables. Verify that load capacity of cable support structures is adequate for each pathway.
4. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

A. Install software in control units and operator workstation(s). Implement all features of programs to specified requirements and as appropriate to sequence of operation.

B. Connect and configure equipment and software to achieve sequence of operation specified.

C. Install line voltage power wiring to DDC system according to Division 26 Sections. Provide local UPS Power supply for all BAS system panels and equipment that will supply a minimum fifteen (15) minutes backup.

3.4 EXISTING EQUIPMENT

A. Wiring: The contractor may reuse any abandoned wires. The integrity of the wire and its proper application to the installation are the responsibility of the contractor. The wire shall be properly identified and tested in accordance with this specification. Unused or redundant wiring must be properly identified

as such. Interconnecting control wiring shall be removed and become the property of the contractor, unless specifically noted or shown to be reused.

B. Local Control Panels: The contractor may reuse any existing local control panels (Stratford only) or control panel cabinets, to locate new equipment. All redundant equipment within these panels must be removed. Panel face cover must be patched to fill all holes caused by removal of unused equipment or replaced with new.

C. Unless otherwise directed, the contractor is not responsible for the repairs or replacement of existing energy equipment and systems, valves not used for control, or dampers. Should the contractor find existing equipment that requires maintenance or repair, the Owner is to be notified immediately.

3.5 APPLICATION OF MEDIA

A. Backbone Cable for Data Service: Use UTP Category 6 for runs between cabinets.

B. Horizontal Cable for Data Service: Use UTP Category 5e cable for runs between cabinets and peripheral equipment.

3.6 ELECTRICAL WIRING AND CONNECTION INSTALLATION

A. Comply with NECA 1.

B. Wiring Method: Install wiring and optical fiber in raceway except consoles, cabinets, desks, and counters, and except in accessible ceiling spaces where unenclosed wiring method may be used for systems that are not part of life safety systems, including but not limited to, smoke exhaust systems, stair pressurization systems, smoke control systems, or hazardous exhaust systems, or systems on emergency/standby power, or main communications systems cable. Use UL listed plenum cable in environmental air spaces, including plenum ceilings. Conceal raceway and cables except in mechanical rooms and areas where other raceway and piping are exposed.

C. Cable Installation:

1. Install exposed cables parallel and perpendicular to surfaces or exposed structural members and follow surface contours where possible.
2. Make splices, taps, and terminations only at indicated outlets, terminals, and cross-connect and patch panels.
3. Pulling Cable: Do not exceed manufacturer’s written recommended pulling tensions. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
4. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
5. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
6. Install UTP cables using techniques, practices, and methods that are consistent with Category 5e or 6 rating of components and that ensure Category 5e or 6 performance of completed and linked signal paths, end to end.

    a. Do not untwist more than 1/2 inch of Categories 5e and 6 cables at connector terminations.

D. Separation from EMI Sources: Comply with BICSI TDM and TIA/EIA-569-A recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment. Comply with the following minimum separation distances from possible sources of EMI:

1. Separation between unshielded power lines or electrical equipment in proximity to open cables or cables in nonmetallic raceways is as follows:

   a. Electrical Equipment Rating Less Than 2 kVA: 5 inches.
   b. Electrical Equipment Rating Between 2 and 5 kVA: 12 inches.
   c. Electrical Equipment Rating More Than 5 kVA: 24 inches.

2. Separation between unshielded power lines or electrical equipment in proximity to cables in grounded metallic raceways is as follows:

   a. Electrical Equipment Rating Less Than 2 kVA: 2-1/2 inches.
   b. Electrical Equipment Rating Between 2 and 5 kVA: 6 inches.
   c. Electrical Equipment Rating More Than 5 kVA: 12 inches.

3. Separation between power lines and electrical equipment located in grounded metallic conduits or enclosures in proximity to cables in grounded metallic raceways is as follows:

   a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
   b. Electrical Equipment Rating Between 2 and 5 kVA: 3 inches.
   c. Electrical Equipment Rating More Than 5 kVA: 6 inches.

4. Electrical Motors and Transformers, 5 kVA or HP and Larger: 48 inches.
5. Fluorescent Fixtures: 5 inches.

E. Conduit:

1. Comply with TIA/EIA-569-A for maximum length of conduit and bends between pull points, and for pull-box sizing.
2. Use manufactured conduit sweeps and long-radius ells whenever possible.
3. In mechanical rooms, position conduit ends adjacent to a corner on backboard (in case of a single piece of plywood) or in the corner of room (where multiple sheets of plywood are installed around perimeter walls of room). Use cable trays to route cables if conduits cannot be located in these positions. Secure conduits to backboard when entering room from overhead. Extend conduits 1 to 3 inches in finished floor.
4. Conceal cable, except in mechanical rooms and areas where other conduit and piping are exposed.
5. Install exposed cable in raceway.
6. Install concealed cable in raceway.
7. Bundle and harness multiconductor instrument cable in place of single cables where several cables follow a common path.
8. Fasten flexible conductors, bridging cabinets and doors, along hinge side; protect against abrasion. Tie and support conductors.
9. Number-code or color-code conductors for future identification and service of control system, except local individual room control cables.
10. Install wire and cable with sufficient slack and flexible connections to allow for vibration of piping and equipment.

F. Install raceways, boxes, and cabinets according to Division 26 Section "Raceway and Boxes."

G. Connect manual-reset limit controls independent of manual-control switch positions.

H. Connect hand-off-auto selector switches to override automatic interlock controls when switch is in hand position.

I. Ground electrical systems per NEC.

3.7 WARNING LABELS AND IDENTIFICATION TAGS

A. Permanent warning labels shall be affixed to all equipment that can be automatically started by the DDC system.

1. Labels shall use white lettering (12-point type or larger) on a red background.
2. Warning labels shall read as follows: "C A U T I O N This equipment is operating under automatic control and may start or stop at any time without warning. Switch disconnect to "Off" position before servicing."

B. Permanent warning labels shall be affixed to all motor starters and all control panels that are connected to multiple power sources utilizing separate disconnects.

1. Labels shall use white lettering (12-point type or larger) on a red background.
2. Warning labels shall read as follows: "C A U T I O N This equipment is fed from more than one power source with separate disconnects. Disconnect all power sources before servicing."

C. Equipment and Device labeling:

1. Labels and tags shall be keyed to the unique identifiers shown on the As-Built drawings.
2. All Enclosures and DDC Hardware shall be labeled.
3. Tags shall be plastic or metal and shall be mechanically attached directly to each device or attached by a metal chain or wire.
4. Labels exterior to protective enclosures shall be engraved plastic and mechanically attached to the enclosure or DDC Hardware.
5. Labels inside protective enclosures may be attached using adhesive, but shall not be hand written.
6. Identify all other control components with permanent labels. All plug-in components shall be labeled such that removal of the component does not remove the label.
7. Manufacturers' nameplates and UL or CSA labels are to be visible and legible after equipment is installed.

D. Identification of Wiring

1. All wiring and cabling including that within factory-fabricated panels shall be labeled at each end within 2 in. of termination with the DDC address or termination number.
2. Permanently label or code each point of field terminal strips to show the instrument or item served.

3.8 IDENTIFICATION OF HARDWARE AND WIRING:

A. All wiring and cabling, including that within factory-fabricated panels shall be labeled at each end within 2 in. of termination with the DDC address or termination number.

B. Permanently label or code each point of field terminal strips to show the instrument or item served.

C. Identify control panels with minimum ½ in. letters on laminated plastic nameplates.

D. Identify all other control components with permanent labels. All plug-in components shall be labeled such that removal of the component does not remove the label.

E. Manufacturers' nameplates and UL or CSA labels are to be visible and legible after equipment is installed.

F. Identifiers shall match record documents.

3.9 BUILDING AUTOMATION SYSTEM SIMULATION TESTING

A. The Controls Contractor shall fully simulate the BAS for all phases of operation prior to site delivery of control system. The simulation shall be performed in order to fully test the system prior to installation. The simulation shall be performed off-site at the Control Contractor's facility. The simulation shall be formally scheduled as part of the Control Contractor's project execution schedule. The simulation shall be attended by the Engineer and client's representative.

B. The testing shall include each BAS panel's control program and system graphic.

C. The testing shall include the entire system as a whole, each panel shall be networked together along with a workstation during the simulation.

3.10 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including connections. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove and replace malfunctioning units and retest.
2. Test and adjust controls and safeties.
3. Test calibration of electronic controllers by disconnecting input sensors and stimulating operation with compatible signal generator.
4. Test each point through its full operating range to verify that safety and operating control set points are as required.
5. Test each control loop to verify stable mode of operation and compliance with sequence of operation. Adjust PID actions.
6. Test each system for compliance with sequence of operation.
7. Test software and hardware interlocks.

C. DDC Verification:

1. Check DDC system as follows:

   a. Verify that wires at control panels are tagged with their service designation and approved tagging system.
   b. Verify that spare I/O capacity has been provided.
   c. Verify that DDC controllers are protected from power supply surges.

D. Replace damaged or malfunctioning controls and equipment and repeat testing procedures.

E. In addition to requirements in this Article, comply with TIA/EIA-606-A.

1. Administration class for this Project shall be Class 2 or 3.
2. Color-code cross-connect fields. Apply colors to service backboards, connections, covers, and labels.

F. Using cable and asset management software specified in Part 2, develop Cabling Administration Drawings for system identification, testing, and management. Use unique, alphanumeric designation for each cable, and label cable, jacks, connectors, and terminals to which it connects with same designation. Use logical and systematic designations for facility's architectural arrangement. At completion, cable and asset management software shall reflect as-built conditions.

G. Use logical and systematic designations for facility's architectural arrangement and nomenclature, and a consistent color-coded identification of individual conductors.

H. Cable and Wire Identification:

1. Label each cable within 4 inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
2. Label each terminal strip and screw terminal in each cabinet.

a. All wiring conductors connected to terminal strips shall be individually numbered, and each cable or wiring group being extended from a panel or cabinet to a building-mounted device shall be identified with name and number of particular device as shown.
b. Label each unit and field within distribution racks and frames.

I. Cable Schedule: Post in prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.

3.11 GRAPHICS ORGANIZATION

A. General:

1. Graphics shall be full color with motion utilizing floor plans wherever possible to indicate location of applicable information and fully accessible through the web-based software.
2. A general color scheme shall be utilized to indicate status of equipment and information.

a. BLUE: Equipment/system normal, off; point normal.
b. GREEN: Equipment/system normal, on.
c. YELLOW: Equipment/system alarm, operating; point minor alarm.
d. RED: Equipment failure; point major alarm.
e. PURPLE: Operator override.

3. Provide the following links in a block in the same general location on every graphic:

a. Primary graphic.
b. All screens associated with the current graphic.
c. As-Built Sequence of Operation
d. Back to previous.
e. Forward to next.

4. Organize graphics in easily understandable levels to minimize search time for desired information.

   a. There shall be at least 2 levels and no more than 4 levels.
   b. Smaller systems can have one primary graphic with links to all other graphics.
   c. Larger systems can be organized with one primary graphic, a secondary set of categorized graphics to organize like specific graphics (i.e., zones, air systems, chilled water systems, hot water systems, etc.), then a third layer to take the user to specific graphics.

B. Primary Graphic:

1. The primary graphic will show well organized links to all other graphic levels with short descriptive labels.
2. Import the Owner's logo and clearly show the project name.

C. System Graphics:

1. Each discreet system shall have a single graphic organized in schematic form accurately representing the installation configuration.
2. Each system or piece of equipment that has been provided with 2-way communications such as through an RS 485 connection shall be provided with a dedicated graphic regardless of which contract it was provided under or if it was Owner/tenant provided.
3. Provide links to all associated graphics.
4. Locate pertinent information next to its associated graphic representation.
5. Provide a link to a separate page that displays the system as-built sequence of operation.

D. Monitoring Graphics:

1. Where equipment is monitored for specific information and no 2-way communication is available, it may be grouped on a floor plan or multiple plans.

E. Show the block in its general location with an equipment label and normal and alarm color changing.

F. Custom Graphics: Custom graphic files shall be created with the use of a graphics generation package furnished with the system. The graphics generation package shall be a graphically based system that uses the mouse to create and modify graphics that are saved in industry standard formats such as PCX, TIFF, and GEM. The graphics generation package also shall provide the capability of capturing or converting graphics from other programs such as Designer or AutoCAD.

G. Graphics Library: Furnish a complete library of standard HVAC equipment graphics such as boilers. This library also shall include standard symbols for other equipment including pumps and piping. The library shall be furnished in a file format compatible with the graphics generation package program.

3.12 PROGRAMMING

A. Provide sufficient internal memory for the specified sequences of operation and trend logging. There shall be a minimum of 50% of available memory free for future use.

B. Point Naming: System point names shall be modular in design, allowing easy operator interface without the use of a written point index. Use the following naming convention: AA.BBB.CCDDE where AA is used to designate the location of the point within the building, such as mechanical room, wing, or level, or the building itself in a multi-building environment, BBB is used to designate the mechanical system with which the point is associated (e.g., A01, HTG, CLG, LTG), CC represents the equipment or material

referenced (e.g., SF for supply fan, RW for return water, EA for exhaust air, ZN for zone), D or DD may be used for clarification or for identification if more than one CC exists (e.g., SF10, ZNB), E represents the action or state of the equipment or medium (e.g., T for temperature, H for humidity, C for control, S for status, D for damper control, I for current).

C. Software Programming:

1. Provide programming for the system and adhere to the sequences of operation provided. All other system programming necessary for the operation of the system, but not specified in this document, also shall be provided by the Contractor. Imbed into the control program sufficient comment statements to clearly describe each section of the program. The comment statements shall reflect the language used in the sequences of operation. Use the appropriate technique based on the following programming types:

   a. Text-based:

      1) Organized in single purpose blocks of programming.
      2) Must provide actions for all possible situations.
      3) Must be modular and structured.
      4) Must be commented with a description and purpose.

   b. Graphic-based:

      1) Organized in single purpose functional blocks.
      2) Must provide actions for all possible situations.
      3) Organize blocks in a neat flowing structure.
      4) Blocks must be annotated with a description and purpose in a text block.
      5) Must be documented.

D. Operator Interface:

1. Standard Graphics: Provide graphics for all mechanical systems and floor plans of the building. This includes each boiler. Point information on the graphic displays shall dynamically update. Show on each graphic all input and output points for the system. Also show relevant calculated points such as set points.
2. Show terminal equipment information on a "graphic" summary table. Provide dynamic information for each point shown.
3. The Contractor shall provide all the labor necessary to install, initialize, start up, and troubleshoot all operator interface software and its functions as described in this Section. This includes any operating system software, the operator interface database, and any third party software installation and integration required for successful operation of the operator interface.

3.13 ADJUSTING

A. Calibrating and Adjusting:

1. Calibrate instruments.
2. Make single-point calibration test for accuracy, plus testing of full span for each analog instrument.
3. Calibrate equipment and procedures using manufacturer's written recommendations and instruction manuals. Use test equipment with accuracy at least double that of instrument being calibrated.

4. Control System Inputs and Outputs:

   a. Check analog inputs at 0, 50, and 100 percent of span.
   b. Check analog outputs using milliampere meter at 0, 50, and 100 percent output.
   c. Check digital inputs using jumper wire.
   d. Check digital outputs using ohmmeter to test for contact making or breaking.
   e. Check resistance temperature inputs at 0, 50, and 100 percent of span using a precision-resistant source.

5. Temperature:

   a. Calibrate resistance temperature transmitters at approximately mid-point of span using a precision-resistance source, and check full span with an artificial signal generator.
   b. Calibrate temperature switches to make or break contacts.

6. Provide diagnostic and test instruments for calibration and adjustment of system.
7. Provide written description of procedures and equipment for calibrating each type of instrument. Submit procedures review and approval before initiating startup procedures.

B. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to three visits to Project during other than normal occupancy hours for this purpose.

3.14 FIELD QUALITY TESTING

A. Perform the following field tests and inspections and prepare test reports:

1. Category 5e UTP Cabling Tests:

   a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.2. Perform tests with a tester that complies with performance requirements in Annex I, complying with measurement accuracy specified in Annex H. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
   b. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
   c. Wire-map test that reports open circuits, short circuits, crossed pairs, reversed pairs, split pairs, and improper terminations.
   d. Channel and permanent link tests for cable length, insertion loss, near-end crosstalk loss, power sum near-end crosstalk loss, equal-level far-end crosstalk loss, power sum equal-level far-end crosstalk, return loss, propagation delay, and delay skew. Performance shall comply with minimum criteria in TIA/EIA-568-B.2.

2. Category 6 UTP Cabling Tests:

   a. Tests shall include all tests of Category 5e, conducted from 1 to 250 MHz.
   b. Channel and permanent link tests shall be performed with at ester that complies with performance requirements in TIA/EIA-568-B.2, Level III. Include tests for longitudinal or transverse conversion loss.
   c. Performance shall comply with minimum criteria in TIA/EIA-568-B.2.

B. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.

C. Remove and replace cabling where test results indicate that they do not comply with specified requirements.

D. Retest and inspect cabling to determine compliance of replaced or additional work with specified requirements.

3.15 STABILITY TRENDING SET-UP

A. Set up trending of points for confirmation of stability and control.

B. Trend three weeks of data as follows:

1. Trend all analog input values on a 30 minute basis.
2. Trend all digital input points on a change of value basis.
3. Trend all analog virtual points on a 60 minute basis.

C. Test network capacity according to standards indicated during trending tests.

D. When trending indicates system instability for certain points, set-up additional trending for one week as follows to facilitate tuning and trouble-shooting:

1. Trend all associated analog input points on a 10 minute basis.
2. Trend all associated digital input points on a change of value basis.
3. Trend all associated analog outputs on a 10 minute basis.
4. Trend all associated digital outputs on a change of value basis.
5. Trend all associated virtual analog points on a 10 minute basis.
6. Trend all associated virtual digital points on a change of value basis.

E. Reporting system shall automatically email trend reports to the Owner on a daily basis.

F. Continue trending as long as required to enable system stability and trouble shooting. Owner's representative must sign off.

G. Leave trending of point as directed by Owner's representative for long term information gathering.

3.16 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain HVAC instrumentation and controls. Refer to Division 01 for additional requirements.

B. Train Owner's maintenance personnel in cable-plant management operations, including changing signal pathways for different workstations, rerouting signals in failed cables, and keeping records of cabling assignments and revisions when extending wiring to establish new outlets. Refer to Division 01 for additional requirements.

END OF SECTION 230900
03/07/11

February 28, 2011

SECTION 230993 - SEQUENCE OF OPERATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes control sequences for HVAC systems, subsystems, and equipment.

B. Related Sections include the following:

1. Division 23 Section "HVAC Instrumentation and Controls” for control equipment and devices and submittal requirements.

1.3 DEFINITIONS

A. DDC: Direct-digital controls.

B. Industry Standard: Most commonly used sub routines as utilized by the industry to control temperature, air flows, sub routine switching or other related HVAC control process.

1.4 COMMON REQUIREMENTS

A. The following items are common requirements that apply unless noted otherwise:

1. All set points shall be program adjustable at the operator workstation.
2. All high and low limits shall be alarmed.

1.5 B-1 AND B-2 - HOT WATER BOILERS

A. Provide the following sequences utilizing industry standard control parameters.

1. Boilers to run based on boiler manufacturer control panel. See Division 23 Section "Condensing Boilers" for sequence of operation.
2. Monitor Hot water boiler system for general alarms and water temperature readings.
3. Graphic representation of viewable points

1.6 P-1A, P-1B, P-2A, P-2B - SINGLE CONSTANT VOLUME PUMPS (PRIMARY PUMPS)

A. Provide the following sequences utilizing industry standard control parameters.

1. Pumps to run based on boiler manufacturer control panel. See Division 23 Section "Condensing Boilers" for sequence of operation.
2. Monitor pump status and alarm if not equal to command.
3. Graphic representation of viewable points.

1.7 EXISTING INLINE PUMPS - RUN/STANDBY SET OF CONSTANT VOLUME PUMPS (SECONDARY PUMPS)

A. Provide the following sequences utilizing industry standard control parameters.

1. Pump Enable / Disable

a. Establish Lead / Lag and fail recovery routines.
b. Summer mode (above 60 degrees F (adj) outside air temperature) – Disable pump.
c. Winter mode (60 degrees F (adj) and below outside air temperature) – Cycle pump based on room temperature setpoint.

2. Monitor pump status and alarm if not equal to command.
3. Graphic representation of viewable points.

1.8 P-3 AND P-4 - RUN/STANDBY SET OF VARIABLE SPEED PUMPS (SECONDARY PUMPS)

A. Provide the following sequences utilizing industry standard control parameters.

1. Pump Enable / Disable

a. Establish Lead / Lag and fail recovery routines.
b. Vary speed based on room temperature setpoint.
c. Summer mode (above 60 degrees F (adj) outside air temperature) – Disable pump.
d. Winter mode (60 degrees F (adj) and below outside air temperature) – Enable pump.

2. Monitor pump status and alarm if not equal to command
3. Graphic representation of viewable points

1.9 HWRP - DOMESTIC HOT WATER RECIRCULATION PUMP (ENFIELD)

A. Provide the following sequences utilizing industry standard control parameters. Reconnect point from old recirculation pump being removed to new recirculation pump.

1. Enable / Disable pump based on programmable occupancy schedule.
2. Graphic representation of points.

1.10 HWRP - DOMESTIC HOT WATER RECIRCULATION PUMP (NORWALK)

A. Provide the following sequences utilizing industry standard control parameters. Connect point from water heater being removed to new recirculation pump.

1. Enable / Disable pump based on programmable occupancy schedule.
2. Graphic representation of points.

1.11 UH-1 - HOT WATER UNIT HEATER

A. Unit-mounted thermostat cycles fan. (Note: Standalone control. Do not tie into BMS.)

1. Unit-mounted thermostat stops fan when return heating water space temperature falls below setpoint, subject to aquastat, verifying hot water flow.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 230993
03/07/11

SECTION 232113 - HYDRONIC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes pipe and fitting materials, joining methods, special-duty valves, and specialties for the following:

1. Hot-water heating piping.
2. Makeup-water piping.
3. Blowdown-drain piping.
4. Air-vent piping.
5. Safety-valve-inlet and -outlet piping.

B. Related Sections include the following:

1. Division 23 Section "Hydronic Pumps" for pumps, motors, and accessories for hydronic piping.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of the following:

1. Valves. Include flow and pressure drop curves based on manufacturer's testing for calibrated-orifice balancing valves.
2. Air control devices.
3. Chemical treatment.
4. Hydronic specialties.

B. Shop Drawings: Detail, CAD-generated and drawn at 1/4-inch scale, the piping layout, fabrication of piping systems, pipe anchors, hangers, valves, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to the building structure and seismic restraints. Detail location of anchors, alignment guides, and expansion joints and loops.

1. Fabrication, assembly and installation including plans, elevations, sections, components, and attachments to other work.
2. Equipment installation based on equipment being used on project.
3. Piping accessories, including access panels.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Welding certificates.

C. Field quality-control test reports.

D. Water Analysis: Submit a copy of the water analysis to illustrate water quality available at Project site.

E. Chemical Removal Certificates: Written and signed certificates from a licensed hazardous chemical removal company.

1. Written, signed approval from the appropriate agencies, water/sewer authorities, and Owner may be substituted for chemical removal where noted herein.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air control devices, hydronic specialties, and special-duty valves to include in emergency, operation, and maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Water-Treatment Chemicals: Furnish enough chemicals for initial system startup and for preventive maintenance for one year from date of Substantial Completion.

1.7 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX.

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for hydronic systems 350 psig and/or 250 deg F and below, for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 01.

1.8 MAINTENANCE SERVICE

A. Scope of Maintenance Service: Provide chemicals and service program to maintain water conditions required above to inhibit corrosion, scale formation, and biological growth for piping and equipment. Services and chemicals shall be provided for a period of one year from date of Substantial Completion, and shall include the following:

1. Initial water analysis and HVAC water-treatment recommendations.
2. Start-up assistance for Contractor to flush the systems, clean with detergents, and initially fill systems with required chemical treatment prior to operation.
3. Quarterly customer report charts and log sheets.

4. Quarterly certified laboratory technical analysis.
5. Annual certified laboratory legionella analysis.
6. Analyses and reports of all chemical items concerning safety and compliance with government regulations.
7. Monthly service to test all system levels along with written reports and coupon replacement.
8. Monthly maintenance on all equipment.
9. Handling of all chemicals (Owner will not handle chemicals).

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Drawn-Temper Copper Tubing: ASTM B 88, Type L.

B. Annealed-Temper Copper Tubing: ASTM B 88, Type K.

C. Wrought-Copper Fittings: ASME B16.22.

D. Wrought-Copper Unions: ASME B16.22.

2.2 STEEL PIPE AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel with plain ends; type, grade, and wall thickness as indicated in Part 3 "Piping Applications" Article.

B. Cast-Iron Threaded Fittings: ASME B16.4; Classes 125 and 250 as indicated in Part 3 "Piping Applications" Article.

C. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 and 300 as indicated in Part 3 "Piping Applications" Article.

D. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300 as indicated in Part 3 "Piping Applications" Article.

E. Wrought-Steel Fittings: ASTM A 234/A 234M, wall thickness to match adjoining pipe.

F. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:

1. Material Group: 1.1.
2. End Connections: Butt welding.
3. Facings: Raised face.

G. Grooved Mechanical-Joint Fittings and Couplings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Anvil International, Inc.
b. Central Sprinkler Company; a division of Tyco Fire & Building Products.
c. National Fittings, Inc.

d. S. P. Fittings; a division of Star Pipe Products.
e. Victaulic Company.

2. Joint Fittings: ASTM A 536, Grade 65-45-12 ductile iron; ASTM A 47/A 47M, Grade 32510 malleable iron; ASTM A 53/A 53M, Type F, E, or S, Grade B fabricated steel; or ASTM A 106, Grade B steel fittings with grooves or shoulders constructed to accept grooved-end couplings; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.
3. Couplings: Ductile- or malleable-iron housing and synthetic rubber gasket of central cavity pressure-responsive design; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.

2.3 JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness unless thickness or specific material is indicated.

a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

D. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for joining copper with copper; or BAg-1, silver alloy for joining copper with bronze or steel.

E. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.4 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Capitol Manufacturing Company.
b. Central Plastics Company.
c. Hart Industries International, Inc.
d. Jomar International Ltd.
e. Matco-Norca, Inc.
f. McDonald, A. Y. Mfg. Co.
g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
h. Wilkins; a Zurn company.

2. Description:

a. Standard: ASSE 1079.
b. Pressure Rating: 125 psig minimum at 180 deg F.
c. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Capitol Manufacturing Company.
b. Central Plastics Company.
c. Matco-Norca, Inc.
d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
e. Wilkins; a Zurn company.

2. Description:

a. Standard: ASSE 1079.
b. Factory-fabricated, bolted, companion-flange assembly.
c. Pressure Rating: 125 psig minimum at 180 deg F.
d. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Insulating Kits:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Central Plastics Company.
d. Pipeline Seal and Insulator, Inc.

2. Description:

a. Nonconducting materials for field assembly of companion flanges.
b. Pressure Rating: 150 psig.
c. Gasket: Neoprene or phenolic.
d. Bolt Sleeves: Phenolic or polyethylene.
e. Washers: Phenolic with steel backing washers.

E. Dielectric Nipples:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Elster Perfection.
b. Grinnell Mechanical Products.
c. Matco-Norca, Inc.
d. Precision Plumbing Products, Inc.
e. Victaulic Company.

2. Description:

a. Standard: IAPMO PS 66
b. Electroplated steel nipple. complying with ASTM F 1545.
c. Pressure Rating: 300 psig at 225 deg F.
d. End Connections: Male threaded or grooved.
e. Lining: Inert and noncorrosive, propylene.

2.5 VALVES

A. Gate, Globe, Check, Ball, and Butterfly Valves: Comply with requirements specified in Division 23 Section "General-Duty Valves for HVAC Piping."

B. Automatic Temperature-Control Valves, Actuators, and Sensors: Comply with requirements specified in Division 23 Section "Instrumentation and Control for HVAC."

C. Bronze, Calibrated-Orifice, Balancing Valves, NPS 2 and Smaller:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

a. Bell & Gossett Domestic Pump; a division of ITT Industries.
b. Flow Design Inc.
c. Griswold Controls.
d. Nexus Valve.
e. Taco.

2. Body: Bronze, ball or plug type with calibrated orifice or venturi.
3. Ball: Brass or stainless steel.
4. Plug: Resin.
5. Seat: PTFE.
6. End Connections: Threaded or socket.
7. Pressure Gage Connections: Integral seals for portable differential pressure meter.
8. Handle Style: Lever, with memory stop to retain set position.
9. CWP Rating: Minimum 125 psig.
10. Maximum Operating Temperature: 250 deg F.
11. Factory molded insulation kit.
12. Provide "low flow type" valves and sizes for all terminal units (radiation, reheat coils, fan coil units, unit heaters, radiant panels, etc.) where flow rate is 1.5 gpm or less.

D. Multi-Turn, Globe-Style, Balancing Valves, NPS 2 and Smaller:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Armstrong Pumps, Inc.
b. Macon Balancing MMA.
c. Tour & Andersson.
d. Wheatley HVAC.

2. Body: Y-pattern, brass or copper alloy.
3. Balancing Device: Globe valve.
4. Wheel: High-strength resin.

5. Seals: EPDM.
6. End Connections: Threaded or socket.
7. Pressure Gage Connections: Threaded brass ports with check valves and gasketed caps.
8. Handle Style: Handwheel with lockable stop.
9. CWP Rating: Minimum 125 psig.
10. Maximum Operating Temperature: 250 deg F.
11. Factory molded insulation kit.
12. Provide "low flow type" valves and sizes for all terminal units (radiation, reheat coils, fan coil units, unit heaters, radiant panels, etc.) where flow rate is 1.5 gpm or less.

E. Cast-Iron or Steel, Calibrated-Orifice, Balancing Valves, NPS 1-1/2 to 4:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

    a. Bell & Gossett Domestic Pump; a division of ITT Industries.
    b. Flow Design Inc.
    c. Griswold Controls.
    d. Nexus Valve.
    e. Taco.

2. Body: Cast-iron or steel body, ball, plug, or butterfly pattern with calibrated orifice or venturi.
3. Ball: Brass or stainless steel.
4. Stem Seals: EPDM O-rings.
5. Disc: Glass and carbon-filled PTFE.
6. Seat: PTFE.
7. End Connections: Flanged or grooved.
8. Pressure Gage Connections: Integral seals for portable differential pressure meter.
9. Handle Style: Lever, with memory stop to retain set position.
10. CWP Rating: Minimum 125 psig.
11. Maximum Operating Temperature: 250 deg F.
12. Factory molded insulation kit.

F. Diaphragm-Operated Safety Valves:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

    a. Amtrol, Inc.
    b. Armstrong Pumps, Inc.
    c. Bell & Gossett Domestic Pump; a division of ITT Industries.
    d. Conbraco Industries, Inc.
    e. Spence Engineering Company, Inc.
    f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Body: Bronze or brass.
3. Disc: Glass and carbon-filled PTFE.
4. Seat: Brass.
5. Stem Seals: EPDM O-rings.
6. Diaphragm: EPT.
7. Wetted, Internal Work Parts: Brass and rubber.
8. Inlet Strainer: Removable without system shutdown.
9. Valve Seat and Stem: Noncorrosive.

10. Valve Size, Capacity, and Operating Pressure: Comply with ASME Boiler and Pressure Vessel Code: Section IV, and selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.

2.6 AIR CONTROL DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Amtrol, Inc.
2. Armstrong Pumps, Inc.
3. Bell & Gossett Domestic Pump; a division of ITT Industries.
4. Taco.

B. Manual Air Vents:

1. Body: Bronze.
2. Internal Parts: Nonferrous.
3. Operator: Screwdriver or thumbscrew.
4. Inlet Connection: NPS 1/2.
5. Discharge Connection: NPS 1/8.
6. CWP Rating: 150 psig.
7. Maximum Operating Temperature: 225 deg F.

C. High Capacity Automatic Air Vents:

1. Body: Cast iron.
2. Internal Parts: Stainless steel.
3. Operator: Noncorrosive metal float.
4. Inlet Connection: NPS 1/2to NPS 3/4.
5. Discharge Connection: NPS 1/4.
6. CWP Rating: 150 psig.
7. Maximum Operating Temperature: 240 deg F.

D. Automatic Air Vents:

1. Body: Bronze.
2. Internal Parts: Nonferrous.
3. Operator: Noncorrosive metal float.
4. Inlet Connection: NPS 1/8 to NPS 1/2.
5. Discharge Connection: NPS 1/4.
6. CWP Rating: 150 psig.
7. Maximum Operating Temperature: 240 deg F.

E. Bladder-Type Expansion Tanks:

1. Tank: Welded steel, rated for 125-psig working pressure and 240 deg F maximum operating temperature. Factory test with taps fabricated and supports installed and labeled according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
2. Bladder: Securely sealed into tank to separate air charge from system water to maintain required expansion capacity.
3. Air-Charge Fittings: Schrader valve, stainless steel with EPDM seats.

F. Tangential-Type Air Separators:

1. Tank: Welded steel; ASME constructed and labeled for 125-psig minimum working pressure and 350 deg F maximum operating temperature.
2. Air Collector Tube: Perforated stainless steel, constructed to direct released air into expansion tank.
3. Tangential Inlet and Outlet Connections: Threaded for NPS 2 and smaller; flanged connections for NPS 2-1/2 and larger.
4. Blowdown Connection: Threaded.
5. Size: Match system flow capacity.

2.7 CHEMICAL TREATMENT

A. Filtered Bypass Chemical Feeder: Welded steel construction; 125-psig working pressure; 5-gal. capacity; with fill funnel and inlet, outlet, and drain valves.

1. Filters: Bag type, replaceable through top of feeder. Provide sets of 20 micron, 10 micron and 5 micron for cleaning and passivation and final.

2.8 HYDRONIC PIPING SPECIALTIES

A. Y-Pattern Strainers:

1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig.

B. Basket Strainers:

1. Body: ASTM A 126, Class B, high-tensile cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig.

C. Stainless-Steel Bellow, Flexible Connectors:

1. Body: Stainless-steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket.
2. End Connections: Threaded or flanged to match equipment connected.
3. Performance: Capable of 3/4-inch misalignment.
4. CWP Rating: 150 psig.
5. Maximum Operating Temperature: 250 deg F.

D. Expansion fittings are specified in Division 23 Section "Expansion Fittings and Loops for HVAC Piping."

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Hot-water heating piping, aboveground, NPS 2 and smaller, shall be any of the following:

1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.
2. Schedule 40 steel pipe; Class 150, malleable-iron flanges and flange fittings; and threaded joints with cast-iron or steel fittings.

B. Hot-water heating piping, aboveground, NPS 2-1/2 and larger, shall be any of the following:

1. Schedule 40 steel pipe, wrought-steel fittings and Class 150 forged-steel flanges and flange fittings, and welded and flanged joints.
2. Schedule 40 steel pipe; grooved, mechanical joint coupling and fittings; and grooved, mechanical joints.

C. Makeup-water piping installed aboveground shall be the following:

1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered or brazed joints.

D. Blowdown-Drain Piping: Same materials and joining methods as for piping specified for the service in which blowdown drain is installed.

E. Air-Vent Piping:

1. Inlet: Same as service where installed with metal-to-plastic transition fittings for plastic piping systems according to the piping manufacturer's written instructions.
2. Outlet: Type K, annealed-temper copper tubing with soldered or flared joints.

F. Safety-Valve-Inlet and -Outlet Piping for Hot-Water Piping: Same materials and joining methods as for piping specified for the service in which safety valve is installed with metal-to-plastic transition fittings for plastic piping systems according to the piping manufacturer's written instructions.

3.2 VALVE APPLICATIONS

A. Install shutoff-duty valves at each branch connection to supply mains, and at supply connection to each piece of equipment.

B. Install calibrated, balancing valves at each branch connection to return main.

C. Install calibrated-orifice, balancing valves in the return pipe of each heating terminal.

D. Install check valves at each pump discharge and elsewhere as required to control flow direction.

E. Install safety valves at hot-water generators and elsewhere as required by ASME Boiler and Pressure Vessel Code. Install drip-pan elbow on safety-valve outlet and pipe without valves to the outdoors; and pipe drain to nearest floor drain or as indicated on Drawings. Comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, for installation requirements.

F. Install pressure-reducing valves at makeup-water connection to regulate system fill pressure.

G. Install drain valves at low points in mains, risers, branch lines, and elsewhere as required for system drainage.

3.3 PIPING INSTALLATIONS

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicate piping locations and arrangements if such were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.

B. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. Select system components with pressure rating equal to or greater than system operating pressure.

K. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

L. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.

M. Install piping at a uniform grade of 0.2 percent upward in direction of flow.

N. Reduce pipe sizes using eccentric reducer fitting installed with level side up.

O. Install branch connections to mains using tee fittings in main pipe, with the branch connected to the bottom of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.

P. Install valves according to Division 23 Section "General-Duty Valves for HVAC Piping."

Q. Install unions in piping**,** NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.

R. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated.

S. Install strainers on inlet side of each control valve, pressure-reducing valve, solenoid valve, in-line pump, and elsewhere as indicated. Install NPS 3/4 nipple and ball valve in blowdown connection of strainers NPS 2 and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2.

T. Install unions in pipes 2 inches NPS and smaller, adjacent to each valve, at final connections of each piece of equipment and elsewhere as indicated. Unions are not required at flanged connections.

U. Install flanges on valves, apparatus and equipment having 2 inches NPS and larger connections.

V. Install flexible connectors at inlet and discharge connections to pumps (except inline pumps) and other vibration producing equipment.

W. Anchor piping for proper direction of expansion and contraction.

X. Install expansion loops, expansion joints, anchors, and pipe alignment guides as specified in Division 23 Section "Expansion Fittings and Loops for HVAC Piping."

Y. Identify piping as specified in Division 23 Section "Identification for HVAC Piping and Equipment."

Z. Install sleeves for piping penetrations of walls. Comply with requirements for sleeves specified in Division 23 Section "Sleeves and Sleeve Seals for HVAC Piping."

AA. Install escutcheons for piping penetrations of walls. Comply with requirements for escutcheons specified in Division 23 Section "Escutcheons for HVAC Piping."

3.4 HANGERS AND SUPPORTS

A. Hanger, support, and anchor devices are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment." Comply with the following requirements for maximum spacing of supports. Piping supports must account and contraction, vibration, seismic restraint, and dead load of piping and its contents.

B. Seismic restraints are specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

C. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.
3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
4. Spring hangers to support vertical runs to support horizontal runs for first three support points from all equipment and support points up to 50 linear feet from all rotating type equipment.
5. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

D. Install hangers for steel piping with the following maximum spacing and minimum rod sizes and in accordance with MSS-SP-69:

1. NPS 3/4: Maximum span, 7 feet; minimum rod size, 3/8 inch.
2. NPS 1: Maximum span, 7 feet; minimum rod size, 3/8 inch.
3. NPS 1-1/4: Maximum span, 7 feet; minimum rod size, 3/8 inch.
4. NPS 1-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
5. NPS 2: Maximum span, 10 feet; minimum rod size, 3/8 inch.
6. NPS 2-1/2: Maximum span, 11 feet; minimum rod size, 3/8 inch.
7. NPS 3: Maximum span, 12 feet; minimum rod size, 3/8 inch.
8. NPS 4: Maximum span, 14 feet; minimum rod size, 1/2 inch.

E. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes and in accordance with MSS-SP-69:

1. NPS 3/4: Maximum span, 5 feet; minimum rod size, 3/8 inch.
2. NPS 1: Maximum span, 6 feet; minimum rod size, 3/8 inch.
3. NPS 1-1/4: Maximum span, 7 feet; minimum rod size, 3/8 inch.
4. NPS 1-1/2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
5. NPS 2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
6. NPS 2-1/2: Maximum span, 9 feet; minimum rod size, 1/2 inch.
7. NPS 3: Maximum span, 10 feet; minimum rod size, 1/2 inch.

3.5 PIPE JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Welded Joints: Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

I. Grooved Joints: Assemble joints with coupling and gasket, lubricant, and bolts. Cut or roll grooves in ends of pipe based on pipe and coupling manufacturer's written instructions for pipe wall thickness. Use grooved-end fittings and rigid, grooved-end-pipe couplings.

3.6 HYDRONIC SPECIALTIES INSTALLATION

A. Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.

B. Install automatic air vents at high points of system piping in mechanical equipment rooms only. Manual vents at heat-transfer coils and elsewhere as required for air venting.

C. Install tangential air separator in pump suction. Install blowdown piping with gate or full-port ball valve; extend full size to nearest floor drain. Install piping to expansion tank from side of main.

D. Install bypass chemical feeders in each hydronic system, in upright position with top of funnel not more than 48 inches above the floor. Install NPS 3/4 pipe from chemical feeder drain, to nearest equipment drain and include a full-size, full-port, ball valve.

E. Install expansion tanks on the floor. Vent and purge air from hydronic system, and ensure tank is properly charged with air to suit system Project requirements.

3.7 TERMINAL EQUIPMENT CONNECTIONS

A. Sizes for supply and return piping connections shall be the same as or larger than equipment connections.

B. Install control valves in accessible locations close to connected equipment.

C. Install ports for pressure gages and thermometers at coil inlet and outlet connections and at locations requiring gages and thermometers according to Division 23 Section "Meters and Gages for HVAC Piping."

3.8 CHEMICAL TREATMENT

A. Perform an analysis of makeup water to determine type and quantities of chemical treatment needed to keep system free of scale, corrosion, and fouling.

B. Perform a certified laboratory analysis of the following:

1. Supply water to determine quality of water available at project site.
2. Water systems after cleaning and flushing to determine complete removal of cleaning chemicals prior to treatment.
3. Water systems after treatment to determine compliance with required water quality.
4. Water systems after treatment to determine compliance with required legionella levels.
5. Retests if any tests are failed.

C. Cleaning and Passivation Procedures for Hydronic Pipe Systems:

1. Drain the entire system completely from as many points as possible. Install a water meter on the system makeup and refill the system. Record the volume of the system. Provide chemical manufacturer with that volume for use in calculating the appropriate concentration of cleaner and inhibitor.
2. Introduce into the system via the filter/feeder or transfer pump alkaline new pipe cleaner.
3. The alkaline new pipe cleaner should be thoroughly circulated for 8 to 24 hours with all temporary circulator pumps running and all valves open. The minimum circulation velocity shall be 2 ft./sec. in all pipes. Provide temporary pumping capacity as required to meet velocity requirements. There should be no isolated areas or "dead legs." Provide cross connects in the system to eliminate dead legs. It is essential to have good thorough circulation for the cleaning process. A sample of the system water with cleaner should be retained for the chemical manufacturer. That sample will be tested by the chemical manufacturer to determine if the proper concentration of cleaner is present.

4. After the cleaning process is complete, the system should be thoroughly drained and flushed. The system should be refilled and a sample of the system water retained for the chemical manufacturer to test.
5. If the test indicates that the cleaner is still present, the system will require another complete drain and fill. A sample will be provided to the chemical manufacturer for testing again. This process will continue until the chemical manufacturer has determined that the cleaner is completely flushed from the system.
6. Time, materials, testing and retesting shall be included.
7. Once the chemical manufacturer has determined that the system is thoroughly flushed, a corrosion inhibitor shall be introduced into the system via the filter/feeder or pump. The chemical manufacturer will specify the necessary amount to be used.
8. Circulate with all circulator pumps on and all valves open. A sample of the treated system water should be provided to the chemical manufacturer to determine the correct concentration of inhibitor. Once a proper concentration of inhibitor is present, circulation is to continue for three weeks for proper filming and passivation to occur.
9. Begin using the filter "bags" in the filter/feeder to remove any remaining suspended solids. The filters are to be changed weekly for three weeks. Filter sizes will also change from larger to smaller (20 micron, 10 micron and 5 micron) each week depending on the solids level.
10. A final sample of system water should be provided to the chemical manufacturer. The chemical manufacturer shall complete a laboratory analysis of the cleaned and treated water.

D. Closed hydronic systems, including hot water heating, shall have the following water qualities:

1. pH: Maintain a value within 9.0 to 10.3.
2. "P" Alkalinity: Maintain a value within 100 to 500 ppm.
3. "M" Alkalinity: Maintain a value within 100 to 500 ppm.
4. Boron: Maintain a value within 100 to 200 ppm.
5. Chemical Oxygen Demand: Maintain a maximum value of 100 ppm.
6. Soluble Copper: Maintain a maximum value of 0.20 ppm.
7. TDS: Maintain a maximum value of 10 ppm.
8. Ammonia: Maintain a maximum value of 20 ppm.
9. Free Caustic Alkalinity: Maintain a maximum value of 20 ppm.
10. Specific Conductance: Maintain a maximum value of 2,500.
11. Silica: Maintain a maximum value of 120 ppm.
12. Molybdenum: Maintain a value within 12 to 100 ppm.
13. Nitrite: Maintain a value within 600 to 1,000 ppm.
14. Microbiological Limits:

    a. Total Aerobic Plate Count: Maintain a maximum value of 1,000 organisms/ml.
    b. Total Anaeroabic Plate Count: Maintain a maximum value of 100 organisms/ml.
    c. Nitrate Reducers: Maintain a maximum value of 100 organisms/ml.
    d. Sulfate Reducers: Maintain a maximum value of 0 organisms/ml.
    e. Iron Bacteria: Maintain a maximum value of 0 organisms/ml.

E. Add initial chemical treatment and maintain water quality in ranges noted above for the first year of operation.

3.9 CHEMICAL DISPOSAL

A. Removal of Chemicals from Site: Chemicals will be disposed of off-site by a licensed hazardous chemical waste company.

1. Provide written and signed certification of proper disposal.

B. Alternative Disposal: If all approvals and acceptances are obtained, chemicals may be disposed of through the building sanitary system.

1. Written and Signed Approvals/Acceptances:

a. Owner.
b. Water/Sewer Authority.
c. Other Authorities Having Jurisdiction.

2. Monitoring: Effluent shall be continually monitored during all disposal events for all restrictive allowable variables (e.g., pH level) outline in the specific approvals and acceptances gained.

3.10 FIELD QUALITY CONTROL

A. Prepare hydronic piping according to ASME B31.9 and as follows:

1. Leave joints, including welds, uninsulated and exposed for examination during test.
2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
3. Chemically clean and Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens. After cleaning and flushing hydronic piping systems, but before balancing, remove disposable fine-mesh strainers in pump suction diffusers.
4. Isolate equipment from piping. Install valves, caps or blinds in flanged joints at final equipment connection points to isolate equipment. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve.
5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.

B. Perform the following tests on hydronic piping:

1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
3. Isolate expansion tanks and determine that hydronic system is full of water.
4. Subject piping system up to equipment final connection points to hydrostatic test pressure of 1.5 times the system's working pressure, minimum 100 psig but shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times "SE" value in Appendix A in ASME B31.9, "Building Services Piping." Expansion joints which cannot sustain the reactions due to test pressure shall be provided with temporary restraint or shall be isolated from testing.
5. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
6. Prepare written report of testing.

C. Test and inspect field welds are follows:

1. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field inspections and tests, and to prepare test reports.

2. Provide the testing agency and the Engineer safe access to the site throughout the duration of the piping installation. Notify the testing agency and the Engineer a minimum of 48 hours prior to start of welding.
3. Field welds will be tested and inspected according to ASME B31.9 for hydronic distribution systems 350 psig and/or 250 deg F and below, and the inspection procedures listed below:

    a. Visual Inspection: Visual inspection on 100 percent of all field pipe welds. The percentage of welds inspected may be modified by the Engineer of Record, depending on initial results. Witness of the actual welding by the testing agency to occur on a minimum of 15 percent of all field welds.

4. Correct deficiencies in or remove and replace welds that test reports and inspections indicate do not comply with the Contract Documents at no additional cost to the Owner.
5. Additional testing and inspection, at the Contractor's expense, will be performed by the Owner's testing agency to determine compliance of corrected work with specified requirements.

D. Sample boiler water at one week intervals after boiler startup for a period of five weeks, and prepare test report advising Owner of changes necessary to adhere to Part 1 "Performance Requirements" article for each required characteristic. Sample boiler water at six-week intervals following the testing noted above to show the automatic chemical feed systems are maintaining water quality within performance requirements specified in this Section.

E. At six-week intervals following Substantial Completion, perform separate water analyses on hydronic systems to show the automatic chemical feed systems are maintain water quality within performance requirements specified in this Section. Submit written reports of water analysis advising Owner of changes necessary to adhere to Part 1 "Performance Requirements" article.

F. Comply with ASTM D 3370 and with the following standards:

1. Silica: ASTM D 859.
2. Steam System: ASTM D 1066.
3. Acidity and Alkalinity: ASTM D 1067.
4. Iron: ASTM D 1068.
5. Water Hardness: ASTM D 1126.

G. Perform the following before operating the system:

1. Open manual valves fully.
2. Inspect pumps for proper rotation.
3. Set makeup pressure-reducing valves for required system pressure.
4. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
5. Set temperature controls so all coils are calling for full flow.
6. Inspect and set operating temperatures of hydronic equipment, such as boilers, to specified values.
7. Verify lubrication of motors and bearings.

END OF SECTION 232113
03/07/11

February 28, 2011

SECTION 231123 - FACILITY NATURAL-GAS PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Pipes, tubes, and fittings.
2. Piping and tubing joining materials.
3. Valves.
4. Pressure regulators.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

1.4 PERFORMANCE REQUIREMENTS

A. Minimum Operating-Pressure Ratings:

1. Piping and Valves: 100 psig minimum unless otherwise indicated.

B. Natural-Gas System Pressure within Buildings: 0.5 psig or less.

1.5 SUBMITTALS

A. Product Data: For each type of the following:

1. Piping specialties.
2. Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.
3. Pressure regulators. Indicate pressure ratings and capacities.

4. Dielectric fittings.

B. Welding certificates.

C. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Handling Flammable Liquids: Remove and dispose of liquids from existing natural-gas piping according to requirements of authorities having jurisdiction.

1.8 PROJECT CONDITIONS

A. Interruption of Existing Natural-Gas Service: Do not interrupt natural-gas service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide purging and startup of natural-gas supply according to requirements indicated:

1. Notify Owner no fewer than two days in advance of proposed interruption of natural-gas service.
2. Do not proceed with interruption of natural-gas service without Owner's written permission.

PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.

1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.

2.2 JOINING MATERIALS

A. Joint Compound and Tape: Suitable for natural gas.

B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.3 MANUAL GAS SHUTOFF VALVES

A. See “Aboveground Manual Gas Shutoff Valve Schedule" Articles for where each valve type is applied in various services.

B. General Requirements for Metallic Valves, NPS 2 and Smaller: Comply with ASME B16.33.

1. CWP Rating: 125 psig.
2. Threaded Ends: Comply with ASME B1.20.1.
3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
4. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
5. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch and smaller.
6. Service Mark: Valves 1-1/4 inches to NPS 2 shall have initials "WOG" permanently marked on valve body.

C. General Requirements for Metallic Valves, NPS 2-1/2 and Larger: Comply with ASME B16.38.

1. CWP Rating: 125 psig.
2. Flanged Ends: Comply with ASME B16.5 for steel flanges.
3. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
4. Service Mark: Initials "WOG" shall be permanently marked on valve body.

D. One-Piece, Bronze Ball Valve with Bronze Trim: MSS SP-110.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. BrassCraft Manufacturing Company; a Masco company.
    b. Conbraco Industries, Inc.; Apollo Div.
    c. Lyall, R. W. & Company, Inc.
    d. McDonald, A. Y. Mfg. Co.
    e. Perfection Corporation; a subsidiary of American Meter Company.

2. Body: Bronze, complying with ASTM B 584.
3. Ball: Chrome-plated brass.
4. Stem: Bronze; blowout proof.
5. Seats: Reinforced TFE; blowout proof.
6. Packing: Separate packnut with adjustable-stem packing threaded ends.
7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
8. CWP Rating: 600 psig.
9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

E. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. BrassCraft Manufacturing Company; a Masco company.
    b. Conbraco Industries, Inc.; Apollo Div.
    c. Lyall, R. W. & Company, Inc.
    d. McDonald, A. Y. Mfg. Co.
    e. Perfection Corporation; a subsidiary of American Meter Company.

2. Body: Bronze, complying with ASTM B 584.
3. Ball: Chrome-plated bronze.
4. Stem: Bronze; blowout proof.
5. Seats: Reinforced TFE; blowout proof.
6. Packing: Threaded-body packnut design with adjustable-stem packing.
7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
8. CWP Rating: 600 psig.
9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

F. Two-Piece, Regular-Port Bronze Ball Valves with Bronze Trim: MSS SP-110.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. BrassCraft Manufacturing Company; a Masco company.
    b. Conbraco Industries, Inc.; Apollo Div.
    c. Lyall, R. W. & Company, Inc.
    d. McDonald, A. Y. Mfg. Co.
    e. Perfection Corporation; a subsidiary of American Meter Company.

2. Body: Bronze, complying with ASTM B 584.
3. Ball: Chrome-plated bronze.
4. Stem: Bronze; blowout proof.
5. Seats: Reinforced TFE.
6. Packing: Threaded-body packnut design with adjustable-stem packing.
7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
8. CWP Rating: 600 psig.
9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

G. Bronze Plug Valves: MSS SP-78.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Lee Brass Company.
    b. McDonald, A. Y. Mfg. Co.

2. Body: Bronze, complying with ASTM B 584.
3. Plug: Bronze.

4. Ends: Threaded, socket, or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
5. Operator: Square head or lug type with tamperproof feature where indicated.
6. Pressure Class: 125 psig.
7. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
8. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

H. Cast-Iron, Lubricated Plug Valves: MSS SP-78.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Flowserve.
   b. Homestead Valve; a division of Olson Technologies, Inc.
   c. McDonald, A. Y. Mfg. Co.
   d. Milliken Valve Company.
   e. Mueller Co.; Gas Products Div.
   f. R&M Energy Systems, A Unit of Robbins & Myers, Inc.

2. Body: Cast iron, complying with ASTM A 126, Class B.
3. Plug: Bronze or nickel-plated cast iron.
4. Seat: Coated with thermoplastic.
5. Stem Seal: Compatible with natural gas.
6. Ends: Threaded or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
7. Operator: Square head or lug type with tamperproof feature where indicated.
8. Pressure Class: 125 psig.
9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

2.4 PRESSURE REGULATORS

A. General Requirements:

1. Single stage and suitable for natural gas.
2. Steel jacket and corrosion-resistant components.
3. Elevation compensator.
4. End Connections: Threaded for regulators NPS 2 and smaller; flanged for regulators NPS 2-1/2 and larger.

B. Line Pressure Regulators: Comply with ANSI Z21.80.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Actaris.
   b. American Meter Company.
   c. Eclipse Combustion, Inc.
   d. Fisher Control Valves and Regulators; Division of Emerson Process Management.

2. Body and Diaphragm Case: Cast iron or die-cast aluminum.

3. Springs: Zinc-plated steel; interchangeable.
4. Diaphragm Plate: Zinc-plated steel.
5. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
6. Orifice: Aluminum; interchangeable.
7. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
8. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
9. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
10. Overpressure Protection Device: Factory mounted on pressure regulator.
11. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
12. Maximum Inlet Pressure: 2 psig.

2.5 LABELING AND IDENTIFYING

A. Detectable Warning Tape: Acid- and alkali-resistant, PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored yellow.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for natural-gas piping system to verify actual locations of piping connections before equipment installation.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Close equipment shutoff valves before turning off natural gas to premises or piping section.

B. Inspect natural-gas piping according to NFPA 54 to determine that natural-gas utilization devices are turned off in piping section affected.

C. Comply with NFPA 54 requirements for prevention of accidental ignition.

3.3 INDOOR PIPING INSTALLATION

A. Comply with NFPA 54 for installation and purging of natural-gas piping.

B. Basic piping installation requirements are specified in Division 22 Section "Common Work Requirements for Plumbing."

C. Locate valves for easy access.

D. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.

E. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.

F. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.

1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.

G. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.

H. Concealed Location Installations: Except as specified below, install concealed natural-gas piping and piping installed under the building in containment conduit constructed of steel pipe with welded joints as described in Part 2. Install a vent pipe from containment conduit to outdoors and terminate with weatherproof vent cap.

1. Above Accessible Ceilings: Natural-gas piping, fittings, valves, and regulators may be installed in accessible spaces without containment conduit.
2. In Walls or Partitions: Protect tubing installed inside partitions or hollow walls from physical damage using steel striker barriers at rigid supports.

a. Exception: Tubing passing through partitions or walls does not require striker barriers.

3. Prohibited Locations:

a. Do not install natural-gas piping in or through circulating air ducts, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts, or dumbwaiter or elevator shafts.
b. Do not install natural-gas piping in solid walls or partitions.

I. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.

J. Connect branch piping from top or side of horizontal piping.

K. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment. Unions are not required at flanged connections.

L. Do not use natural-gas piping as grounding electrode.

M. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.

3.4 VALVE INSTALLATION

A. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.

3.5 PIPING JOINT CONSTRUCTION

A. Basic pipe joint construction is specified in Division 22 Section "Common Work Results for Plumbing."

B. Use materials suitable for natural gas.

C. Flanged Joints: Install gasket material, size, type, and thickness appropriate for natural-gas service. Install gasket concentrically positioned.

3.6 HANGER AND SUPPORT INSTALLATION

A. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Comply with requirements for pipe hangers and supports specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

C. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:

1. NPS 1 and Smaller: Maximum span, 96 inches; minimum rod size, 3/8 inch.
2. NPS 1-1/4: Maximum span, 108 inches; minimum rod size, 3/8 inch.
3. NPS 1-1/2 and NPS 2: Maximum span, 108 inches; minimum rod size, 3/8 inch.
4. NPS 2-1/2 to NPS 3-1/2: Maximum span, 10 feet; minimum rod size, 1/2 inch.
5. NPS 4 and Larger: Maximum span, 10 feet; minimum rod size, 5/8 inch.

3.7 CONNECTIONS

A. Connect to utility's gas main according to utility's procedures and requirements.

B. Install natural-gas piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.

C. Install piping adjacent to appliances to allow service and maintenance of appliances.

D. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.

E. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

3.8 LABELING AND IDENTIFYING

A. Comply with requirements in Division 22 Section "Identification for Plumbing Piping and Equipment" for piping and valve identification.

3.9 PAINTING

A. Comply with requirements in Division 09 painting Sections for painting interior and exterior natural-gas piping.

B. Paint exposed, interior metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, except components, with factory-applied paint or protective coating.

C. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.

3.10 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Test, inspect, and purge natural gas according to NFPA 54 and authorities having jurisdiction.

C. Natural-gas piping will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.11 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain earthquake valves.

B. Aboveground natural-gas piping shall be one of the following:

1. Steel pipe with malleable-iron fittings and threaded joints, for piping 2 inches and smaller.
2. Steel pipe with wrought-steel fittings and welded joints, for piping 2-1/2 inches and larger.

3.12 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES LESS THAN 0.5 PSIG

A. Aboveground, branch piping NPS 2 and smaller shall be the following:

1. Steel pipe with malleable-iron fittings and threaded joints.

B. Aboveground, distribution piping shall be one of the following:

1. Steel pipe with malleable-iron fittings and threaded joints, for piping 2 inches and smaller.
2. Steel pipe with wrought-steel fittings and welded joints, for piping 2-1/2 inches and larger.

3.13 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

A. Valves for pipe sizes NPS 2 and smaller at service meter shall be one of the following:

1. Bronze plug valve.

B. Valves for pipe sizes NPS 2-1/2 and larger at service meter shall be one of the following:

1. Cast-iron, nonlubricated plug valve.

C. Distribution piping valves for pipe sizes NPS 2 and smaller shall be one of the following:

1. Bronze plug valve.

D. Distribution piping valves for pipe sizes NPS 2-1/2 and larger shall be one of the following:

1. Cast-iron, lubricated plug valve.

END OF SECTION 231123
03/07/11

February 28, 2011

SECTION 231126 - FACILITY LIQUEFIED-PETROLEUM GAS PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Pipes, tubes, and fittings.
2. Piping specialties.
3. Piping and tubing joining materials.
4. Valves.
5. Pressure regulators.
6. Storage containers.
7. Transport truck unloading facility specialties.
8. Pumps.
9. Concrete bases.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. LPG: Liquefied-petroleum gas.

1.4 PERFORMANCE REQUIREMENTS

A. Minimum Operating-Pressure Ratings:

1. For Piping Containing Only Vapor:

a. Piping and Valves: 250 psig unless otherwise indicated.

2. For Piping Containing Liquid:

   a. Piping between Shutoff Valves: 350 psig unless otherwise indicated.
   b. Piping Other Than Above: 250 psig unless otherwise indicated.
   c. Valves and Fittings: 250 psig unless otherwise indicated.

3. Minimum Operating Pressure of Service Meter: As determined by the vendor.

B. LPG System Pressure within Buildings: One pressure range. 0.5 psig or less.

C. LPG System Pressures within Buildings: Two pressure ranges. Primary pressure is more than 0.5 psig but not more than 2 psig and is reduced to secondary pressure of 0.5 psig or less.

D. LPG System Pressures within Buildings: Two pressure ranges. Primary pressure is more than 2 psig but not more than 5 psig and is reduced to secondary pressure of more than 0.5 psig but not more than 2 psig.

E. LPG System Pressures within Buildings: Three pressure ranges. Primary pressure is more than 2 psig but not more than 5 psig and is reduced to secondary pressures of more than 0.5 psig but not more than 2 psig and is reduced again to pressures of 0.5 psig or less.

F. Delegated Design: Design restraints and anchors for LPG piping and equipment, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

G. Seismic Performance: Vaporizers and storage container supports shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

1.5 ACTION SUBMITTALS

A. Product Data: For each type of the following:

1. Piping specialties.
2. Corrugated stainless-steel tubing with associated components.
3. Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.
4. Pressure regulators. Indicate pressure ratings and capacities.
5. Service meters. Indicate pressure ratings and capacities. Include bypass fittings and meter bars and supports.
6. Dielectric fittings.
7. Storage containers.
8. Transport truck unloading specialties.
9. Pumps.
10. Air mixers.

B. Shop Drawings: For facility LPG piping layout. Include plans, piping layout and elevations, sections, and details for fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to building structure. Detail location of anchors, alignment guides, and expansion joints and loops.

1. Shop Drawing Scale: 1/4 inch per foot.

2. Detail mounting, supports, and valve arrangements for service meter assembly and pressure regulator assembly.

C. Delegated-Design Submittal: For LPG piping and equipment indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of seismic restraints.
2. Design Calculations: Calculate requirements for selecting seismic restraints.

1.6 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans and details, drawn to scale, on which LPG piping is shown and coordinated with other installations, using input from installers of the items involved.

B. Site Survey: Plans, drawn to scale, on which LPG piping is shown and coordinated with other services and utilities.

C. Qualification Data: For qualified professional engineer.

D. Seismic Qualification Certificates: Submit certification that vaporizer, air mixer, storage container supports, accessories, and components will withstand seismic forces defined in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment." Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
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.

E. Welding certificates.

F. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For LPG equipment and accessories to include in emergency, operation, and maintenance manuals.

1.8 QUALITY ASSURANCE

A. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Handling Flammable Liquids: Remove and dispose of liquids from existing LPG piping according to requirements of authorities having jurisdiction.

B. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

C. Store pipes and tubes with protective PE coating to avoid damaging coating and protect from direct sunlight.

D. Protect stored PE pipes and valves from direct sunlight.

1.10 PROJECT CONDITIONS

A. Perform site survey, research public utility records, and verify existing utility locations. Contact utility-locating service for area where Project is located.

B. Interruption of Existing LPG Service: Do not interrupt LPG service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide purging and startup of LPG supply according to requirements indicated:

1. Notify Owner no fewer than two days in advance of proposed interruption of LPG service.
2. Do not proceed with interruption of LPG service without Owner's written permission.

1.11 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

B. Coordinate requirements for access panels and doors for valves installed concealed behind finished surfaces. Comply with requirements in Division 08 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Comply with requirements in Part 3 articles for where materials shall be applied.

2.2 PIPES, TUBES, AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedules 40 and 80, Type S, Grade B.

1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.

4. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:

    a. Material Group: 1.1.
    b. End Connections: Threaded or butt welding to match pipe.
    c. Lapped Face: Not permitted underground.
    d. Gasket Materials: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.
    e. Bolts and Nuts: ASME B18.2.1, carbon steel aboveground, and stainless steel underground.

5. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.

    a. Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.

6. Mechanical Couplings:

    a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

        1) Dresser Piping Specialties; Division of Dresser, Inc.
        2) Smith-Blair, Inc.

    b. Steel flanges and tube with epoxy finish.
    c. Buna-nitrile seals.
    d. Steel bolts, washers, and nuts.
    e. Coupling shall be capable of joining PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.
    f. Steel body couplings installed underground on plastic pipe shall be factory equipped with anode.

B. Corrugated, Stainless-Steel Tubing: Comply with ANSI/IAS LC 1.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. OmegaFlex, Inc.
    b. Parker Hannifin Corporation; Parflex Division.
    c. Titeflex.
    d. Tru-Flex Metal Hose Corp.

2. Tubing: ASTM A 240/A 240M, corrugated, Series 300 stainless steel.
3. Coating: PE with flame retardant.

    a. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

        1) Flame-Spread Index: 25 or less.
        2) Smoke-Developed Index: 50 or less.

4. Fittings: Copper-alloy mechanical fittings with ends made to fit and listed for use with corrugated stainless-steel tubing and capable of metal-to-metal seal without gaskets. Include brazing socket or threaded ends complying with ASME B1.20.1.
5. Striker Plates: Steel, designed to protect tubing from penetrations.
6. Manifolds: Malleable iron or steel with factory-applied protective coating. Threaded connections shall comply with ASME B1.20.1 for pipe inlet and corrugated tubing outlets.
7. Operating-Pressure Rating: 5 psig.

C. Aluminum Tubing: Comply with ASTM B 210 and ASTM B 241/B 241M.

1. Aluminum Alloy: Alloy 5456 is prohibited.
2. Protective Coating: Factory-applied coating capable of resisting corrosion on tubing in contact with masonry, plaster, insulation, water, detergents, and sewerage.
3. Flare Fittings: Comply with ASME B16.26 and SAE J513.

    a. Copper-alloy fittings.
    b. Metal-to-metal compression seal without gasket.
    c. Dryseal threads shall comply with ASME B1.20.3.

D. Drawn-Temper Copper Tube: Comply with ASTM B 88, Type K.

1. Copper Fittings: ASME B16.22, wrought copper, and streamlined pattern.
2. Bronze Flanges and Flanged Fittings: ASME B16.24, Class 150.

    a. Gasket Material: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.
    b. Bolts and Nuts: ASME B18.2.1, carbon steel or stainless steel.

3. Protective Coating for Underground Tubing: Factory-applied, extruded PE a minimum of 0.022 inch thick.

E. Annealed-Temper Copper Tube: Comply with ASTM B 88, Type K.

1. Copper Fittings: ASME B16.22, wrought copper, and streamlined pattern.
2. Flare Fittings: Comply with ASME B16.26 and SAE J513.

    a. Copper fittings with long nuts.
    b. Metal-to-metal compression seal without gasket.
    c. Dryseal threads complying with ASME B1.20.3.

3. Protective Coating for Underground Tubing: Factory-applied, extruded PE a minimum of 0.022 inch thick.

F. PE Pipe: ASTM D 2513, SDR 11.

1. PE Fittings: ASTM D 2683, socket-fusion type or ASTM D 3261, butt-fusion type with dimensions matching PE pipe.
2. PE Transition Fittings: Factory-fabricated fittings with PE pipe complying with ASTM D 2513, SDR 11; and steel pipe complying with ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
3. Anodeless Service-Line Risers: Factory fabricated and leak tested.

    a. Underground Portion: PE pipe complying with ASTM D 2513, SDR 11 inlet.

b. Casing: Steel pipe complying with ASTM A 53/A 53M, Schedule 40, black steel, Type E or S, Grade B with corrosion-protective coating covering. Vent casing aboveground.
c. Aboveground Portion: PE transition fitting.
d. Outlet shall be threaded or flanged or suitable for welded connection.
e. Tracer wire connection.
f. Ultraviolet shield.
g. Stake supports with factory finish to match steel pipe casing or carrier pipe.

4. Transition Service-Line Risers: Factory fabricated and leak tested.

a. Underground Portion: PE pipe complying with ASTM D 2513, SDR 11 inlet connected to steel pipe complying with ASTM A 53/A 53M, Schedule 40, Type E or S, Grade B, with corrosion-protective coating for aboveground outlet.
b. Outlet shall be threaded or flanged or suitable for welded connection.
c. Bridging sleeve over mechanical coupling.
d. Factory-connected anode.
e. Tracer wire connection.
f. Ultraviolet shield.
g. Stake supports with factory finish to match steel pipe casing or carrier pipe.

5. Plastic Mechanical Couplings,NPS 1-1/2 and Smaller: Capable of joining PE pipe to PE pipe.

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Lyall, R. W. & Company, Inc.
2) Mueller Co.; Gas Products Div.
3) Perfection Corporation; a subsidiary of American Meter Company.

b. PE body with molded-in, stainless-steel support ring.
c. Buna-nitrile seals.
d. Acetal collets.
e. Electro-zinc-plated steel stiffener.

6. Plastic Mechanical Couplings, NPS 2 and Larger: Capable of joining PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Lyall, R. W. & Company, Inc.
2) Mueller Co.; Gas Products Div.
3) Perfection Corporation; a subsidiary of American Meter Company.

b. Fiber-reinforced plastic body.
c. PE body tube.
d. Buna-nitrile seals.
e. Acetal collets.
f. Stainless-steel bolts, nuts, and washers.

7. Steel Mechanical Couplings: Capable of joining plain-end PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Dresser Piping Specialties; Division of Dresser, Inc.
2) Smith-Blair, Inc.

b. Stainless-steel flanges and tube with epoxy finish.
c. Buna-nitrile seals.
d. Stainless-steel bolts, washers, and nuts.
e. Factory-installed anode for steel-body couplings installed underground.

2.3 PIPING SPECIALTIES

A. Flexible Piping Joints:

1. Approved for LPG service.
2. Stainless-steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket.
3. Minimum working pressure of 250 psig and 250 deg F operating temperature.
4. Flanged- or threaded-end connections to match equipment connected and shall be capable of minimum 3/4-inch misalignment.
5. Maximum 36-inch length for liquid LPG lines.

B. Appliance Flexible Connectors:

1. Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.
2. Indoor, Movable-Appliance Flexible Connectors: Comply with ANSI Z21.69.
3. Outdoor, Appliance Flexible Connectors: Comply with ANSI Z21.75.
4. Corrugated stainless-steel tubing with polymer coating.
5. Operating-Pressure Rating: 0.5 psig.
6. End Fittings: Zinc-coated steel.
7. Threaded Ends: Comply with ASME B1.20.1.
8. Maximum Length: 72 inches.

C. Quick-Disconnect Devices: Comply with ANSI Z21.41.

1. Copper-alloy convenience outlet and matching plug connector.
2. Nitrile seals.
3. Hand operated with automatic shutoff when disconnected.
4. For indoor or outdoor applications.
5. Adjustable, retractable restraining cable.

D. Y-Pattern Strainers:

1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: [**40**] [**60**]-mesh startup strainer and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig.

E. Basket Strainers:

1. Body: ASTM A 126, Class B, high-tensile cast iron with bolted cover and bottom drain connection.

2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: 60-mesh startup strainer and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig.

F. T-Pattern Strainers:

1. Body: Ductile or malleable iron with removable access coupling and end cap for strainer maintenance.
2. End Connections: Grooved ends.
3. Strainer Screen: 60-mesh startup strainer and perforated stainless-steel basket with 57 percent free area.
4. CWP Rating: 750 psig.

G. Weatherproof Vent Cap: Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.

2.4 JOINING MATERIALS

A. Joint Compound and Tape: Suitable for LPG.

B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

C. Brazing Filler Metals: Alloy with melting point greater than 1000 deg F complying with AWS A5.8/A5.8M.

2.5 MANUAL GAS SHUTOFF VALVES

A. See "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles for where each valve type is applied in various services.

B. Metallic Valves, NPS 2 and Smaller for Liquid Service: Comply with ASME B16.33 and UL 842.

1. CWP Rating: 250 psig.
2. Threaded Ends: Comply with ASME B1.20.1.
3. Socket ends for brazed joints.
4. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
5. Listing by CSA or agency acceptable to authorities having jurisdiction for valves 1 inch and smaller.
6. Valves 1-1/4 inch and larger shall be suitable for LPG service, with "WOG" indicated on valve body.

C. General Requirements for Metallic Valves, NPS 2 and Smaller for Vapor Service: Comply with ASME B16.33.

1. CWP Rating: 125 psig.
2. Threaded Ends: Comply with ASME B1.20.1.
3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
4. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.

5. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch and smaller.
6. Service Mark: Valves 1-1/4 inch to NPS 2 shall have initials "WOG" permanently marked on valve body.

D. General Requirements for Metallic Valves, NPS 2-1/2 and Larger: Comply with ASME B16.38.

1. CWP Rating: 125 psig.
2. Flanged Ends: Comply with ASME B16.5 for steel flanges.
3. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
4. Service Mark: Initials "WOG" shall be permanently marked on valve body.

E. One-Piece, Bronze Ball Valve with Bronze Trim: MSS SP-110.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. BrassCraft Manufacturing Company; a Masco company.
    b. Conbraco Industries, Inc.; Apollo Div.
    c. Lyall, R. W. & Company, Inc.
    d. McDonald, A. Y. Mfg. Co.
    e. Perfection Corporation; a subsidiary of American Meter Company.

2. Body: Bronze, complying with ASTM B 584.
3. Ball: Chrome-plated brass.
4. Stem: Bronze; blowout proof.
5. Seats: Reinforced TFE; blowout proof.
6. Packing: Separate packnut with adjustable-stem packing threaded ends.
7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
8. CWP Rating: 600 psig.
9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for LPG service with "WOG" indicated on valve body.

F. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. BrassCraft Manufacturing Company; a Masco company.
    b. Conbraco Industries, Inc.; Apollo Div.
    c. Lyall, R. W. & Company, Inc.
    d. McDonald, A. Y. Mfg. Co.
    e. Perfection Corporation; a subsidiary of American Meter Company.

2. Body: Bronze, complying with ASTM B 584.
3. Ball: Chrome-plated bronze.
4. Stem: Bronze; blowout proof.
5. Seats: Reinforced TFE; blowout proof.
6. Packing: Threaded-body packnut design with adjustable-stem packing.
7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.

8. CWP Rating: 600 psig.
9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for LPG service with "WOG" indicated on valve body.

G. Two-Piece, Regular-Port Bronze Ball Valves with Bronze Trim: MSS SP-110.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. BrassCraft Manufacturing Company; a Masco company.
    b. Conbraco Industries, Inc.; Apollo Div.
    c. Lyall, R. W. & Company, Inc.
    d. McDonald, A. Y. Mfg. Co.
    e. Perfection Corporation; a subsidiary of American Meter Company.

2. Body: Bronze, complying with ASTM B 584.
3. Ball: Chrome-plated bronze
4. Stem: Bronze; blowout proof.
5. Seats: Reinforced TFE.
6. Packing: Threaded-body packnut design with adjustable-stem packing.
7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
8. CWP Rating: 600 psig.
9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for LPG service with "WOG" indicated on valve body.

H. Bronze Plug Valves: MSS SP-78.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Lee Brass Company.
    b. McDonald, A. Y. Mfg. Co.

2. Body: Bronze, complying with ASTM B 584.
3. Plug: Bronze.
4. Ends: Threaded, socket, or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
5. Operator: Square head or lug type with tamperproof feature where indicated.
6. Pressure Class: 125 psig.
7. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
8. Service: Suitable for LPG service with "WOG" indicated on valve body.

I. PE Ball Valves: Comply with ASME B16.40.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Kerotest Manufacturing Corp.
    b. Lyall, R. W. & Company, Inc.
    c. Perfection Corporation; a subsidiary of American Meter Company.

2. Body: PE.
3. Ball: PE.
4. Stem: Acetal.
5. Seats and Seals: Nitrile.
6. Ends: Plain or fusible to match piping.
7. CWP Rating: 80 psig.
8. Operating Temperature: Minus 20 to plus 140 deg F.
9. Operator: Nut or flat head for key operation.
10. Include plastic valve extension.
11. Include tamperproof locking feature for valves where indicated on Drawings.

J. Valve Boxes:

1. Cast-iron, two-section box.
2. Top section with cover with "GAS" lettering.
3. Bottom section with base to fit over valve and barrel a minimum of 5 inches in diameter.
4. Adjustable cast-iron extensions of length required for depth of bury.
5. Include tee-handle, steel operating wrench with socket end fitting valve nut or flat head and with stem of length required to operate valve.

2.6 MOTORIZED GAS VALVES

A. Automatic Gas Valves: Comply with ANSI Z21.21.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. ASCO.
b. ASCO Power Technologies, LP; Division of Emerson.
c. ASCO Valve Canada; Division of Emerson Electric Canada Limited.
d. Dungs, Karl, Inc.
e. Eaton Corporation; Controls Div.
f. Eclipse Combustion, Inc.
g. Honeywell International Inc.
h. Johnson Controls.

2. Body: Brass or aluminum.
3. Seats and Disc: Nitrile rubber.
4. Springs and Valve Trim: Stainless steel.
5. Normally closed.
6. Visual position indicator.
7. Electrical operator for actuation by appliance automatic shutoff device.

B. Electrically Operated Valves: Comply with UL 429.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. ASCO.
b. ASCO Power Technologies, LP; Division of Emerson.
c. Dungs, Karl, Inc.
d. Eclipse Combustion, Inc.
e. Goyen Valve Corp.; Tyco Environmental Systems.

f. Magnatrol Valve Corporation.
g. Parker Hannifin Corporation; Climate & Industrial Controls Group; Skinner Valve Div.
h. Watts Regulator Co.; Division of Watts Water Technologies, Inc.

2. Pilot operated.
3. Body: Brass or aluminum.
4. Seats and Disc: Nitrile rubber.
5. Springs and Valve Trim: Stainless steel.
6. 120-V ac, 60 Hz, Class B, continuous-duty molded coil, replaceable.
7. NEMA ICS 6, Type 4, coil enclosure.
8. Normally closed.
9. Visual position indicator.

2.7 EARTHQUAKE VALVES

A. Earthquake Valves: Comply with ASCE 25.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. Vanguard Valves, Inc.

2. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction.
3. Maximum Operating Pressure: 5 psig.
4. Cast-aluminum body with nickel-plated chrome steel internal parts.
5. Nitrile-rubber valve washer.
6. Sight windows for visual indication of valve position.
7. Threaded-end connections complying with ASME B1.20.1.

B. Earthquake Valves: Comply with ASCE 25.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. Pacific Seismic Products, Inc.

2. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction.
3. Maximum Operating Pressure: Coordinate with gas supplier.
4. Cast-aluminum body with stainless-steel internal parts.
5. Nitrile-rubber, reset-stem o-ring seal.
6. Valve position, open or closed, indicator.
7. Composition valve seat with clapper held by spring or magnet locking mechanism.
8. Level indicator.
9. End Connections: Threaded for valves NPS 2 and smaller; flanged for valves NPS 2-1/2 and larger.

2.8 PRESSURE REGULATORS

A. General Requirements:

1. Single stage and suitable for LPG.
2. Steel jacket and corrosion-resistant components.

3. Elevation compensator.
4. End Connections: Threaded for regulators NPS 2 and smaller; flanged for regulators NPS 2-1/2 and larger.

B. Service Pressure Regulators: Comply with ANSI Z21.80.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

    a. Actaris.
    b. American Meter Company.
    c. Fisher Control Valves and Regulators; Division of Emerson Process Management.
    d. Invensys.
    e. Richards Industries; Jordan Valve Div.

2. Body and Diaphragm Case: Cast iron or die-cast aluminum.
3. Springs: Zinc-plated steel; interchangeable.
4. Diaphragm Plate: Zinc-plated steel.
5. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
6. Orifice: Aluminum; interchangeable.
7. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
8. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet and no pressure sensing piping external to the regulator.
9. Pressure regulator shall maintain discharge pressure setting downstream and not exceed 150 percent of design discharge pressure at shutoff.
10. Overpressure Protection Device: Factory mounted on pressure regulator.
11. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
12. Maximum Inlet Pressure: 100 psig.

C. Line Pressure Regulators: Comply with ANSI Z21.80.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

    a. Actaris.
    b. American Meter Company.
    c. Eclipse Combustion, Inc.
    d. Fisher Control Valves and Regulators; Division of Emerson Process Management.
    e. Invensys.
    f. Maxitrol Company.
    g. Richards Industries; Jordan Valve Div.

2. Body and Diaphragm Case: Cast iron or die-cast aluminum.
3. Springs: Zinc-plated steel; interchangeable.
4. Diaphragm Plate: Zinc-plated steel.
5. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
6. Orifice: Aluminum; interchangeable.
7. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
8. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet and no pressure sensing piping external to the regulator.
9. Pressure regulator shall maintain discharge pressure setting downstream and not exceed 150 percent of design discharge pressure at shutoff.
10. Overpressure Protection Device: Factory mounted on pressure regulator.

11. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
12. Maximum Inlet Pressure: Coordinate with supplier.

D. Appliance Pressure Regulators: Comply with ANSI Z21.18.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

    a. Canadian Meter Company Inc.
    b. Eaton Corporation; Controls Div.
    c. Harper Wyman Co.
    d. Maxitrol Company.
    e. SCP, Inc.

2. Body and Diaphragm Case: Die-cast aluminum.
3. Springs: Zinc-plated steel; interchangeable.
4. Diaphragm Plate: Zinc-plated steel.
5. Seat Disc: Nitrile rubber.
6. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
7. Factory-Applied Finish: Minimum three-layer polyester and polyurethane paint finish.
8. Regulator may include vent limiting device, instead of vent connection, if approved by authorities having jurisdiction.
9. Maximum Inlet Pressure: 1 psig.

2.9 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Capitol Manufacturing Company.
    b. Central Plastics Company.
    c. Hart Industries International, Inc.
    d. Jomar International Ltd.
    e. Matco-Norca, Inc.
    f. McDonald, A. Y. Mfg. Co.
    g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
    h. Wilkins; a Zurn company.

2. Description:

    a. Standard: ASSE 1079.
    b. Pressure Rating: 250 psig.
    c. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Capitol Manufacturing Company.
b. Central Plastics Company.
c. Matco-Norca, Inc.
d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
e. Wilkins; a Zurn company.

2. Description:

a. Standard: ASSE 1079.
b. Factory-fabricated, bolted, companion-flange assembly.
c. Pressure Rating: 300 psig.
d. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Insulating Kits:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Central Plastics Company.
d. Pipeline Seal and Insulator, Inc.

2. Description:

a. Nonconducting materials for field assembly of companion flanges.
b. Pressure Rating: 150 psig.
c. Gasket: Neoprene or phenolic.
d. Bolt Sleeves: Phenolic or polyethylene.
e. Washers: Phenolic with steel backing washers.

2.10 STORAGE CONTAINERS

A. Description: Factory fabricated, complying with requirements in NFPA 58 and ASME Boiler and Pressure Vessel Code and bearing the ASME label. Tanks shall be rated for 250-psig minimum working pressure.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. American Welding & Tank.
b. Hanson, Roy E. Jr. Mfg.
c. Trinity Industries, Inc.
d. United Industries Group, Inc.

2. Liquid outlet and vapor inlet and outlet connections shall have shutoff valves with excess-flow safety shutoff valves and bypass and back-pressure check valves with smaller than 0.039-inch drill-size hole to equalize pressure. Liquid-fill connection shall have backflow check valve.

    a. Connections: Color-code and tag valves to indicate type.

        1) Liquid fill and outlet, red.
        2) Vapor inlet and outlet, yellow.

3. Level gage shall indicate current level of liquid in the container. Gages shall also indicate storage container contents; e.g., "Propane."
4. Pressure relief valves, type and number as required by NFPA 58, connected to vapor space and having discharge piping same size as relief-valve outlet and long enough to extend at least 84 inches directly overhead. Identify relief valves as follows:

    a. Discharge pressure in psig.
    b. Rate of discharge for standard air in cfm.
    c. Manufacturer's name.
    d. Catalog or model number.

5. Container pressure gage.
6. For outdoor installation, exposed metal surfaces mechanically cleaned, primed, and painted for resistance to corrosion.
7. Ladders for access to valves more than 72 inches aboveground.
8. Stainless-Steel Nameplate: Attach to aboveground storage container or to adjacent structure for underground storage container.

    a. Name and address of supplier or trade name of container.
    b. Water capacity in gallons and liters.
    c. Design pressure in psig (kPa).
    d. Statement, "This container shall not contain a product having a vapor pressure in excess of 130 psig at 70 deg F."
    e. Outside surface area in sq. ft. (sq. m).
    f. Year of manufacture.
    g. Shell thickness in inches (mm).
    h. Overall length in feet (m).
    i. OD in feet (m).
    j. Manufacturer's serial number.
    k. ASME Code label.

9. Felt support pads and two concrete or painted-steel saddles per storage container. Corrosion protection required at container-to-felt contact.
10. Tie straps for each saddle.
11. Straps and anchors for tie-down slab.
12. Asphalt-based coating for corrosion protection.
13. Container connections and valves protected in manway at top of storage container.
14. Manway equipped with ventilation louvers.

2.11 TRANSPORT TRUCK UNLOADING FACILITY

A. Description: Comply with requirements in NFPA 58.

1. Support structure consisting of a minimum 6-inch steel channel or 6-by-4-inch rectangular steel tubing, a minimum of 36 inches above and below grade.
2. Liquid-fill and vapor-return, quick-disconnect fittings.
3. Liquid and vapor shutoff valves with hydrostatic relief valves mounted between the quick-disconnect fittings and shutoff valves.
4. Excess-flow safety shutoff valve in vapor-return line.
5. Backflow check valve in liquid-fill line.
6. Remote emergency shutoff valve station with underground cable to the vapor emergency shutoff valve.

2.12 LABELING AND IDENTIFYING

A. Detectable Warning Tape: Acid- and alkali-resistant PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored yellow.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for LPG piping system to verify actual locations of piping connections before equipment installation.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 EARTHWORK

A. Comply with requirements in Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

3.3 PREPARATION

A. Close equipment shutoff valves before turning off LPG to premises or piping section.

B. Inspect LPG piping according to NFPA 58 and NFPA 54 and the International Fuel Gas Code to determine that LPG utilization devices are turned off in piping section affected.

C. Comply with NFPA 58 and NFPA 54 and the International Fuel Gas Code requirements for prevention of accidental ignition.

3.4 OUTDOOR PIPING INSTALLATION

A. Comply with NFPA 58 and NFPA 54 and the International Fuel Gas Code requirements for installation and purging of LPG piping.

B. Install underground, LPG piping buried at least 36 inches below finished grade. Comply with requirements in Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

1. If LPG piping is installed less than 36 inches below finished grade, install it in containment conduit.

C. Install underground, PE, LPG piping according to ASTM D 2774.

D. Steel Piping with Protective Coating:

1. Apply joint cover kits to pipe after joining to cover, seal, and protect joints.
2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.
3. Replace pipe having damaged PE coating with new pipe.

E. Copper Tubing with Protective Coating:

1. Apply joint cover kits over tubing to cover, seal, and protect joints.
2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.

F. Install fittings for changes in direction and branch connections.

G. Joints for connection to inlets and outlets on vaporizers, air mixers, regulators, and valves may be flanged or threaded to match the equipment.

H. Install pressure gage upstream and downstream from each service regulator. Pressure gages are specified in Division 23 Section "Meters and Gages for HVAC Piping."

3.5 INDOOR PIPING INSTALLATION

A. Comply with NFPA 54 and the International Fuel Gas Code for installation and purging of LPG piping.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.

D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

G. Locate valves for easy access.

H. Install LPG piping at uniform grade of 2 percent down toward drip and sediment traps.

I. Install piping free of sags and bends.

J. Install fittings for changes in direction and branch connections.

K. Verify final equipment locations for roughing-in.

L. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.

M. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where readily accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.

1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.

N. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap. The term "outdoors" shall imply to mean "above roof." Vent terminations at roofs shall be a minimum of 24 inches above roof to vent openings. If the extension of the relief vent piping to above roof is not physically possible, an outdoor location that is acceptable to the authority having jurisdiction may be used with prior written approval. Relief vent piping terminations shall not occur within or near any exhaust or intake areaways. Relief vent piping from other regulators or other venting devices shall not be combined. Size of relief vent piping shall be the same as the relief opening. Increase relief vent piping by one pipe size for every 25 ft. of developed length.

O. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.

P. Concealed Location Installations: Except as specified below, install concealed LPG piping and piping installed under the building in containment conduit constructed of steel pipe with welded joints as described in Part 2. Install a vent pipe from containment conduit to outdoors and terminate with weatherproof vent cap.

1. Above Accessible Ceilings: LPG piping, fittings, valves, and regulators may be installed in accessible spaces without containment conduit.
2. In Floors: Install LPG piping with welded or brazed joints and protective coating in cast-in-place concrete floors. Cover piping to be cast in concrete slabs with minimum of 1-1/2 inches of concrete. Piping may not be in physical contact with other metallic structures such as reinforcing rods or electrically neutral conductors. Do not embed piping in concrete slabs containing quick-set additives or cinder aggregate.
3. In Floor Channels: Install LPG piping in floor channels. Channels must have cover and be open to space above cover for ventilation.
4. In Walls or Partitions: Protect tubing installed inside partitions or hollow walls from physical damage using steel striker barriers at rigid supports.

    a. Exception: Tubing passing through partitions or walls does not require striker barriers.

5. Prohibited Locations:

    a. Do not install LPG piping in or through circulating air ducts, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts, or dumbwaiter or elevator shafts.
    b. Do not install LPG piping in solid walls or partitions.

Q. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.

R. Connect branch piping from top or side of horizontal piping.

S. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment. Unions are not required at flanged connections.

T. Do not use LPG piping as grounding electrode.

U. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.

V. Install pressure gage upstream and downstream from each line regulator. Pressure gages are specified in Division 23 Section "Meters and Gages for HVAC Piping."

W. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 23 Section "Sleeves and Sleeve Seals for HVAC Piping."

X. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 23 Section "Sleeves and Sleeve Seals for HVAC Piping."

Y. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 23 Section "Escutcheons for HVAC Piping."

3.6 VALVE INSTALLATION

A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing, aluminum, or copper connector.

B. Install underground valves with valve boxes.

C. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.

D. Install earthquake valves aboveground outside buildings according to listing.

E. Install anode for metallic valves in underground PE piping.

3.7 PIPING JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Threaded Joints:

1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
2. Cut threads full and clean using sharp dies.
3. Ream threaded pipe ends to remove burrs and restore full ID of pipe.
4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

D. Welded Joints:

1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
2. Bevel plain ends of steel pipe.
3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Ch. 22, "Pipe and Tube."

F. Flanged Joints: Install gasket material, size, type, and thickness appropriate for LPG service. Install gasket concentrically positioned.

G. Flared Joints: Cut tubing with roll cutting tool. Flare tube end with tool to result in flare dimensions complying with SAE J513. Tighten finger tight, then use wrench. Do not overtighten.

H. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.

1. Plain-End Pipe and Fittings: Use butt fusion.
2. Plain-End Pipe and Socket Fittings: Use socket fusion.

3.8 HANGER AND SUPPORT INSTALLATION

A. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

B. Comply with requirements for pipe hangers and supports specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

C. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:

1. NPS 1 and Smaller: Maximum span, 96 inches; minimum rod size, 3/8 inch.
2. NPS 1-1/4: Maximum span, 108 inches; minimum rod size, 3/8 inch.
3. NPS 1-1/2 and NPS 2: Maximum span, 108 inches; minimum rod size, 3/8 inch.
4. NPS 2-1/2 to NPS 3-1/2: Maximum span, 10 feet; minimum rod size, 1/2 inch.
5. NPS 4 and Larger: Maximum span, 10 feet; minimum rod size, 5/8 inch.

D. Install hangers for horizontal, drawn-temper copper tubing with the following maximum spacing and minimum rod sizes:

1. NPS 3/8: Maximum span, 48 inches; minimum rod size, 3/8 inch.
2. NPS 1/2 and NPS 5/8: Maximum span, 72 inches; minimum rod size, 3/8 inch.
3. NPS 3/4 and NPS 7/8: Maximum span, 84 inches; minimum rod size, 3/8 inch.
4. NPS 1: Maximum span, 96 inches; minimum rod size, 3/8 inch.

E. Install hangers for horizontal, corrugated stainless-steel tubing with the following maximum spacing and minimum rod sizes:

1. NPS 3/8: Maximum span, 48 inches; minimum rod size, 3/8 inch.
2. NPS 1/2: Maximum span, 72 inches; minimum rod size, 3/8 inch.
3. NPS 3/4 and Larger: Maximum span, 96 inches; minimum rod, 3/8 inch.

3.9 CONNECTIONS

A. Connect to utility's gas main according to utility's procedures and requirements.

B. Install LPG piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.

C. Corrugated Stainless Steel Tubing (CSST) gas piping shall be bonded in accordance with manufacturer’s installation instructions.

D. Install piping adjacent to appliances to allow service and maintenance of appliances.

E. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches of each gas-fired appliances and equipment. Install union between valve and appliances or equipment.

F. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

3.10 TRANSPORT TRUCK UNLOADING FACILITY

A. Install transport truck unloading in a cast-in-place concrete base, 48 inches square by 36 inches deep. Set top of concrete base at least 6 inches above finished grade.

B. Install remote emergency shutoff station with cable release in an accessible location, a minimum of 25 feet and a maximum of 100 feet away from transport truck unloading.

C. Install at least two 6-inch- diameter metal bollards set in and filled with concrete on both sides of transport truck unloading. Bollard length shall be at least 48 inches above and below grade, with concrete encasement a minimum of 12 inches in diameter.

3.11 STORAGE CONTAINER INSTALLATION

A. Fill storage container to at least 80 percent capacity with propane.

B. Install piping connections with swing joints or flexible connectors to allow for storage container settlement and for thermal expansion and contraction.

C. Ground containers according to NFPA 780. Grounding is specified in Division 26 Section "Lightning Protection for Structures."

D. Set storage containers in felt pads on concrete or steel saddles. Install corrosion protection at container-to-felt contact.

E. Install tie-downs over storage containers on saddles with proper tension.

F. Set concrete saddles on dowels set in concrete base. Anchor steel saddles to concrete base.

G. Set storage container on concrete ballast base large enough to offset buoyancy of empty storage container immersed in water.

H. Install tie-down straps over container anchored in ballast base and repair damaged coating.

I. Backfill with a minimum coverage for underground or mounded storage containers according to NFPA 58.

J. Backfill with pea gravel as required in Division 31 Section "Earth Moving."

K. Install cathodic protection for storage container. Cathodic protection is specified in Division 26 Section "Cathodic Protection."

3.12 PUMP INSTALLATION

A. Install pumps with access space for periodic maintenance including removal of motors, impellers, and accessories.

B. Set pumps on and anchored to concrete base.

C. Install suction piping with minimum fittings and change of direction.

D. Connect liquid suction to container, supply to vaporizer, and return line to container.

3.13 LABELING AND IDENTIFYING

A. Comply with requirements in Division 23 Section "Identification for HVAC Piping and Equipment" for piping and valve identification.

B. Install detectable warning tape directly above gas piping, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.14 PAINTING

A. Comply with requirements in Division 09 painting Sections for painting interior and exterior LPG piping.

B. Paint exposed, exterior metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, except components with factory-applied paint or protective coating.

1. Alkyd System: MPI EXT 5.1D.

a. Prime Coat: Alkyd anticorrosive metal primer.
b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
c. Topcoat: Exterior alkyd enamel (gloss).
d. Color: Gray.

C. Paint exposed, interior metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, except components with factory-applied paint or protective coating.

1. Latex Over Alkyd Primer System: MPI INT 5.1Q.

a. Prime Coat: Alkyd anticorrosive metal primer.
b. Intermediate Coat: Interior latex matching topcoat.
c. Topcoat: Interior latex (semigloss).
d. Color: Gray.

2. Alkyd System: MPI INT 5.1E.

    a. Prime Coat: Alkyd anticorrosive metal primer.
    b. Intermediate Coat: Interior alkyd matching topcoat.
    c. Topcoat: Interior alkyd (semigloss).
    d. Color: Gray.

D. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.

3.15 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to seismic codes at Project.

1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Use 3000-psig, 28-day, compressive-strength concrete and reinforcement as specified in Division 03 Section.

3.16 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Test, inspect, and purge LPG according to NFPA 58 and NFPA 54 and the International Fuel Gas Code and requirements of authorities having jurisdiction.

C. LPG piping will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.17 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain LPG equipment.

3.18 OUTDOOR PIPING SCHEDULE

A. Underground LPG piping shall be one of the following:

1. Schedule 40 steel pipe with wrought-steel fittings and welded joints, or mechanical couplings. Coat pipe and fittings with protective coating for steel piping.

B. Aboveground LPG liquid pipingshall be one of the following:

1. NPS 2 and Smaller: Schedule 40 steel pipe, malleable-iron threaded fittings and threaded and seal welded joints. Coat pipe and fittings with protective coating for steel piping.
2. NPS 2-1/2 and Larger: Schedule 40, steel pipe with wrought-steel fittings and welded joints, or mechanical couplings. Coat pipe and fittings with protective coating for steel piping.
3. Annealed-temper copper tube, Type K, with wrought-copper fittings and brazed joints. Coat pipe and fittings with protective coating for copper tubing.

C. Underground LPG vapor pipingshall be one of the following:

1. PE pipe and fittings joined by heat-fusion, or mechanical couplings; service-line risers with tracer wire terminated in an accessible location.
2. Annealed-temper copper tube, Type K with wrought-copper fittings and brazed joints. Coat pipe and fittings with protective coating for copper tubing.

D. Aboveground LPG vapor pipingshall be one of the following:

1. Schedule 40, steel pipe with malleable-iron fittings and threaded joints.
2. Schedule 40, steel pipe with wrought-steel fittings and welded joints, or mechanical couplings.
3. Apply protective coating.

E. Containment Conduit: Schedule 40, steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

3.19 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES LESS THAN 0.5 PSIG

A. Aboveground, branch piping NPS 1 and smaller shall be one of the following:

1. Corrugated stainless-steel tubing with mechanical fittings having socket or threaded ends to match adjacent piping.
2. Schedule 40, steel pipe with malleable-iron fittings and threaded joints.

B. Aboveground, distribution piping shall be one of the following:

1. Schedule 40, steel pipe with malleable-iron fittings and threaded joints.
2. Schedule 40, steel pipe with wrought-steel fittings and welded joints.

3.20 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES MORE THAN 0.5 PSIG AND LESS THAN5 PSIG

A. Aboveground, branch piping NPS 1 and smaller shall be one of the following:

1. Corrugated stainless-steel tubing with mechanical fittings having socket or threaded ends to match adjacent piping.
2. Schedule 40, steel pipe with malleable-iron fittings and threaded joints.

B. Aboveground, distribution piping shall be one of the following:

1. Schedule 40, steel pipe with malleable-iron fittings and threaded joints.
2. Schedule 40, steel pipe with steel welding fittings and welded joints.

C. No underground piping inside building is allowed.

D. Relief Vent Piping: Steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints.

3.21 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

A. Aboveground Liquid Piping:

1. Two-piece, full-port, bronze ball valves with bronze trim.

B. Valves for pipe NPS 2 and smaller at service meter shall be one of the following:

1. One-piece, bronze ball valve with bronze trim.
2. Two-piece, full-port, bronze ball valves with bronze trim.
3. Bronze plug valve.

END OF SECTION 231126
03/07/11

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SECTION 232123 - HYDRONIC PUMPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Close-coupled, in-line centrifugal pumps.
2. Separately coupled, base-mounted, end-suction centrifugal pumps.

1.3 DEFINITIONS

A. Buna-N: Nitrile rubber.

B. EPT: Ethylene propylene terpolymer.

1.4 SUBMITTALS

A. Product Data: Include certified performance curves and rated capacities, operating characteristics, furnished specialties, final impeller dimensions, and accessories for each type of product indicated. Indicate pump's operating point on curves.

B. Shop Drawings: Show pump layout and connections. Include setting drawings with templates for installing foundation and anchor bolts and other anchorages.

1. Wiring Diagrams: Power, signal, and control wiring.

C. Operation and Maintenance Data: For pumps to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain hydronic pumps through one source from a single manufacturer.

B. Product Options: Drawings indicate size, profiles, and dimensional requirements of hydronic pumps and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. UL Compliance: Comply with UL 778 for motor-operated water pumps.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Manufacturer's Preparation for Shipping: Clean flanges and exposed machined metal surfaces and treat with anticorrosion compound after assembly and testing. Protect flanges, pipe openings, and nozzles with wooden flange covers or with screwed-in plugs.

B. Store pumps in dry location.

C. Retain protective covers for flanges and protective coatings during storage.

D. Protect bearings and couplings against damage from sand, grit, and other foreign matter.

E. Comply with pump manufacturer's written rigging instructions.

1.7 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Mechanical Seals: One mechanical seal for each pump.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 CLOSE-COUPLED, IN-LINE CENTRIFUGAL PUMPS

A. Manufacturers:

1. Armstrong Pumps Inc.
2. Bell & Gossett; Div. of ITT Industries.
3. PACO Pumps.
4. Patterson Pump Co.; a Subsidiary of The Gorman-Rupp Co.
5. Peerless Pump; a Member of the Sterling Fluid Systems Group.
6. Taco, Inc.

7. Weinman; Div. of Crane Pumps & Systems.

B. Description: Factory-assembled and -tested, centrifugal, overhung-impeller, close-coupled, in-line pump as defined in HI 1.1-1.2 and HI 1.3; designed for installation with pump and motor shafts mounted horizontally or vertically. Rate pump for 125-psig minimum working pressure and a continuous water temperature of 225 deg F.

C. Pump Construction:

1. Casing: Radially split, cast iron, with replaceable bronze wear rings, threaded gage tappings at inlet and outlet, and threaded companion-flange or union end connections.
2. Impeller: ASTM B 584, cast bronze; statically and dynamically balanced, keyed to shaft, and secured with a locking cap screw. Trim impeller to match specified performance.
3. Pump Shaft: Steel, with copper-alloy shaft sleeve.
4. Mechanical Seal: Carbon rotating ring against a ceramic seat held by a stainless-steel spring, and Buna-N bellows and gasket. Include water slinger on shaft between motor and seal.
5. Pump Bearings: Permanently lubricated ball bearings.

D. Motor: Single speed, with permanently lubricated ball bearings for motors less than 5 HP, grease lubricated ball bearings for 5 HP and above, unless otherwise indicated; and rigidly mounted to pump casing. Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."

2.3 SEPARATELY COUPLED, BASE-MOUNTED, END-SUCTION CENTRIFUGAL PUMPS

A. Manufacturers:

1. Armstrong Pumps Inc.
2. Bell & Gossett; Div. of ITT Industries.
3. G&L Pump (Goulds); Division of ITT Industries.
4. PACO Pumps.
5. Patterson Pump Co.; a Subsidiary of The Gorman-Rupp Co.
6. Taco, Inc.
7. Weinman; Div. of Crane Pumps & Systems.

B. Description: Factory-assembled and -tested, centrifugal, overhung-impeller, separately coupled, end-suction pump as defined in HI 1.1-1.2 and HI 1.3; designed for base mounting, with pump and motor shafts horizontal. Rate pump for 175-psig minimum working pressure and a continuous water temperature of 225 deg F.

C. Pump Construction:

1. Casing: Radially split, cast iron, with threaded gage tappings at inlet and outlet, drain plug at bottom and air vent at top of volute, and flanged connections. Provide integral mount on volute to support the casing, and attached piping to allow removal and replacement of impeller without disconnecting piping or requiring the realignment of pump and motor shaft.
2. Impeller: ASTM B 584, cast bronze; statically and dynamically balanced, keyed to shaft, and secured with a locking cap screw. Trim impeller to match specified performance.
3. Pump Shaft: Stainless steel.
4. Mechanical Seal: Carbon rotating ring against a ceramic seat held by a stainless-steel spring, and Buna-N bellows and gasket.
5. Pump Bearings: Grease-lubricated ball bearings contained in cast-iron housing with grease fittings.

D. Shaft Coupling: Molded rubber insert and interlocking spider capable of absorbing vibration. Couplings shall be drop-out type to allow disassembly and removal without removing pump shaft or motor. Couplings shall be suitable for variable speed applications.

E. Coupling Guard: Dual rated; ANSI B15.1, Section 8; OSHA 1910.219 approved; steel; removable; attached to mounting frame.

F. Mounting Frame: Welded-steel frame and cross members, factory fabricated from ASTM A 36/A 36M channels and angles. Fabricate to mount pump casing, coupling guard, and motor.

G. Motor: Single speed, with permanently lubricated ball bearings for motors less than 5 HP, grease lubricated for 5 HP and above, unless otherwise indicated; secured to mounting frame, with adjustable alignment. Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."

2.4 PUMP SPECIALTY FITTINGS

A. Suction Diffuser: Angle pattern, 175-psig pressure rating, cast-iron body and end cap, pump-inlet fitting; with bronze startup and bronze or stainless-steel permanent strainers; bronze or stainless-steel straightening vanes; drain plug; and factory-fabricated support.

B. Triple-Duty Valve: Angle or straight pattern, 175-psig pressure rating, cast-iron body, pump-discharge fitting; with drain plug and bronze-fitted shutoff, calibrated, and non-slam check valve features. Brass gage ports with integral check valve, and orifice for flow measurement. Valve design shall permit re-packing under full system pressure. Size valve for minimum 1 psi drop across valve at 100 percent open per manufacturer’s recommendations and to achieve balance point in mid-range of valve. Cv rating shall be provided at every 10 percent increment opening for the valve. Manufacturer shall supply the Cv rating for read-out of flow determination and system pressure drop.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine equipment foundations and anchor-bolt locations for compliance with requirements for installation tolerances and other conditions affecting performance of work.

B. Examine roughing-in for piping systems to verify actual locations of piping connections before pump installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 CONCRETE BASES

A. Install concrete bases for pumps.

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around full perimeter of base.
2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.

3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to supported equipment.

3.3 PUMP INSTALLATION

A. Comply with HI 1.4.

B. Install pumps with access for periodic maintenance including removal of motors, impellers, couplings, and accessories.

C. Independently support pumps and piping so weight of piping is not supported by pumps and weight of pumps is not supported by piping.

D. Suspend in-line centrifugal pumps independent of piping. Install pumps with motor and pump shafts vertical. Use continuous-thread hanger rods and spring hangers with vertical-limit stop of sufficient size to support pump weight. Vibration isolation devices are specified in Division 23"Vibration and Seismic Controls for HVAC Piping and Equipment." Hanger and support materials are specified in Division 23"Hangers and Supports for HVAC Piping and Equipment."

E. Set base-mounted pumps on concrete foundation. Disconnect coupling before setting. Do not reconnect couplings until alignment procedure is complete.

3.4 ALIGNMENT

A. Align pump and motor shafts and piping connections after setting on foundation, grout has been set and foundation bolts have been tightened, and piping connections have been made.

B. Comply with pump and coupling manufacturers' written instructions.

C. Adjust pump and motor shafts for angular and offset alignment by methods specified in HI 1.1-1.5, "Centrifugal Pumps for Nomenclature, Definitions, Application and Operation."

D. After alignment is correct, tighten foundation bolts evenly but not too firmly. Completely fill baseplate with nonshrink, nonmetallic grout while metal blocks and shims or wedges are in place. After grout has cured, fully tighten foundation bolts.

3.5 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to machine to allow service and maintenance.

C. Connect piping to pumps. Install valves that are same size as piping connected to pumps.

D. Install suction and discharge pipe sizes equal to or greater than diameter of pump nozzles.

E. Install triple-duty valve on discharge side of pumps.

F. Install suction diffuser and shutoff valve on suction side of pumps.

G. Install flexible connectors on suction and discharge sides of base-mounted pumps between pump casing and valves. Flexible connectors shall not be used to correct misalignment.

H. Install single gage with multiple input selector valve and tubing to pump suction and discharge points.

I. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

J. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.6 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Check piping connections for tightness.
3. Clean strainers on suction piping.
4. Perform the following startup checks for each pump before starting:

    a. Verify bearing lubrication.
    b. Verify that pump is free to rotate by hand and that pump for handling hot liquid is free to rotate with pump hot and cold. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.
    c. Verify that pump is rotating in the correct direction.

5. Prime pump by opening suction valves and closing drains, and prepare pump for operation.
6. Start motor.
7. Open discharge valve slowly.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain hydronic pumps. Refer to Division 01 for additional requirements.

END OF SECTION 232123
03/07/11

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SECTION 235216 - CONDENSING BOILERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes packaged, factory-fabricated and -assembled, gas-fired, condensing boilers, trim, and accessories for generating hot water.

1.3 ACTION SUBMITTALS

A. Product Data: Include performance data, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings: For boilers, boiler trim, and accessories. Include plans, elevations, sections, details, and attachments to other work.

1. Design calculations and vibration isolation signed and sealed by a qualified professional engineer.

a. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints.

2. Wiring Diagrams: Power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Manufacturer Seismic Qualification Certification: Submit certification that boiler, accessories, and components will withstand seismic forces defined in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment." Include the following:

1. Basis for 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 device when subjected to the seismic forces specified 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.

B. Source quality-control test reports.

C. Field quality-control test reports.

D. Warranty: Special warranty specified in this Section.

E. Other Informational Submittals:

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For boilers to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. ASME Compliance: Fabricate and label boilers to comply with ASME Boiler and Pressure Vessel Code.

C. ANSI/ASHRAE/IESNA Standard 90.1 Compliance: Boilers shall have minimum efficiency required by standard. Each boiler shall bear a permanent label installed by the manufacturer stating that the equipment complies with the requirements of ASHRAE Standard 90.1.

D. DOE Compliance: Minimum efficiency shall comply with 10 CFR 430, Subpart B, Appendix N, "Uniform Test Method for Measuring the Energy Consumption of Furnaces and Boilers."

E. UL Compliance: Test boilers for compliance with UL 795, "Commercial-Industrial Gas Heating Equipment." Boilers shall be listed and labeled by a testing agency acceptable to authorities having jurisdiction.

1.7 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of boilers that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Boilers:

a. Heat Exchanger: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

1. Lochinvar Corporation.
2. Viessmann Manufacturing Co. (US) Inc.
3. Buderus.

2.2 CONDENSING BOILERS

A. Description: Factory-fabricated, -assembled, and -tested, condensing boiler with heat exchanger, built on a steel base; including steel jacket; flue-gas vent; combustion-air intake connections; water supply, return, and condensate drain connections; and controls.

B. Heat Exchanger: Type 316L, stainless-steel.

C. Burner: Natural gas.

D. Blower: Variable speed.

1. Motors: Comply with requirements specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."

a. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

E. Casing:

1. Jacket: Steel.
2. Finish: Primed and pre-painted.
3. Mounting base to secure boiler to concrete base.

a. Seismic Fabrication Requirements: Fabricate mounting base and attachment to boiler pressure vessel, accessories, and components with reinforcement strong enough to withstand seismic forces defined in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment" when mounting base is anchored to building structure.

2.3 TRIM

A. Include devices sized to comply with ANSI B31.9, "Building Services Piping."

B. Temperature/pressure gauge.

C. Outlet water temperature sensor.

D. High limit temperature control with manual reset.

E. ASME pressure relief valve.

F. Return water temperature sensor.

G. Outdoor air sensor.

H. Flue temperature sensor.

I. High and low gas pressure switches.

J. Low water cut-off with manual reset.

K. Condensate trap.

2.4 CONTROLS

A. Boiler operating controls shall include the following devices and features:

1. Touch screen and display.
2. Password security.
3. Outdoor air reset.
4. Pump delay with freeze protection.
5. Pump exercise.
6. PC port connection.
7. Sequence of Operation: Electric, factory-fabricated and field-installed panel to control burner firing rate to reset supply-water temperature inversely with outside-air temperature. At 10 deg F outside-air temperature, set supply-water temperature at 180 deg F; at 60 deg F outside-air temperature, set supply-water temperature at 100 deg F. Primary pumps to run in conjunction with respective boilers.

B. Building Automation System Interface: 0-10 V DC input connection.

C. Boiler and Domestic Water Heater Burner Emergency Shutdown:

1. Interrupt each burner safety circuit to turn off the boiler and domestic water heater burner units by a manually operated remote shutdown switch(es) located at each boiler room door, minimum 60” AFF. Switch(es) shall be located just outside the boiler/water heater room door, except where the door is located on an exterior wall, the switch(es) shall be located just inside the door. Where the switch(es) would be accessible to the public and subject to possible tampering, review with the Authority Having Jurisdiction and upon obtaining AHJ approval, locate the switch(es) just inside of the door. Provide individual switches for each boiler/water heater/burner unit or single switch for multiple units per AHJ requirements. Switches shall have red face plate with white lettering indicated “Burner Emergency Shutoff” and be properly rated for voltage. Switches shall be hardwired to boiler and burner controls.

2.5 ELECTRICAL POWER

A. Controllers, Electrical Devices, and Wiring: Electrical devices and connections are specified in Division 26 Sections.

2.6 SOURCE QUALITY CONTROL

A. Burner and Hydrostatic Test: Factory adjust burner to eliminate excess oxygen, carbon dioxide, oxides of nitrogen emissions, and carbon monoxide in flue gas and to achieve combustion efficiency; perform hydrostatic test.

B. Test and inspect factory-assembled boilers, before shipping, according to ASME Boiler and Pressure Vessel Code.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Before boiler installation, examine roughing-in for concrete equipment bases, anchor-bolt sizes and locations, and piping and electrical connections to verify actual locations, sizes, and other conditions affecting boiler performance, maintenance, and operations.

1. Final boiler locations indicated on Drawings are approximate. Determine exact locations before roughing-in for piping and electrical connections.

B. Examine mechanical spaces for suitable conditions where boilers will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 BOILER INSTALLATION

A. Equipment Mounting: Install boilers on cast-in-place concrete equipment base(s) using elastomeric mounts. Comply with requirements for vibration isolation devices specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

1. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
3. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install on 6-inch- high concrete base designed to withstand, without damage to equipment, seismic force required by code.
7. Minimum Compression Strength: 3,000 psi at 28 days.

B. Install gas-fired boilers according to NFPA 54.

C. Assemble and install boiler trim.

D. Install electrical devices furnished with boiler but not specified to be factory mounted.

E. Install control wiring to field-mounted electrical devices.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to boiler to allow service and maintenance.

C. Install piping from equipment drain connection through neutralization kit to nearest floor drain. Piping shall be at least full size of connection. Provide an isolation valve if required.

D. Connect piping to boilers, except safety relief valve connections, with flexible connectors of materials suitable for service. Flexible connectors and their installation are specified in Division 23 Section "Hydronic Piping."

E. Connect gas piping to boiler gas-train inlet with union. Piping shall be at least full size of gas train connection. Provide a reducer if required.

F. Connect hot-water piping to supply- and return-boiler tappings with shutoff valve and union or flange at each connection.

G. Install piping from safety relief valves to nearest floor drain.

H. Boiler Venting:

1. Install flue venting and combustion-air intake through sidewall vent terminal plate and vent termination cap.

I. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

J. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. Perform installation and startup checks according to manufacturer's written instructions.
2. Leak Test: Hydrostatic test. Repair leaks and retest until no leaks exist.
3. Operational Test: Start units to confirm proper motor rotation and unit operation. Adjust air-fuel ratio and combustion.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

a. Check and adjust initial operating set points and high- and low-limit safety set points of fuel supply, water level and water temperature.
b. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

C. Remove and replace malfunctioning units and retest as specified above.

D. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other than normal occupancy hours for this purpose.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain boilers. Refer to Division 01 for additional requirements.

END OF SECTION 235216
03/07/11

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SECTION 238239 - UNIT HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Propeller unit heaters with hot-water coils.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

B. PTFE: Polytetrafluoroethylene plastic.

C. TFE: Tetrafluoroethylene plastic.

1.4 SUBMITTALS

A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories for each product indicated.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Plans, elevations, sections, and details.
2. Location and size of each field connection.
3. Details of anchorages and attachments to structure and to supported equipment.
4. Equipment schedules to include rated capacities, operating characteristics, furnished specialties, and accessories.
5. Location and arrangement of piping valves and specialties.
6. Location and arrangement of integral controls.
7. Wiring Diagrams: Power, signal, and control wiring.

C. Manufacturer Seismic Qualification Certification: Submit certification that cabinet unit heaters, accessories, and components will withstand seismic forces defined in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment." Include the following:

1. Basis for 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 device when subjected to the seismic forces specified."

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.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For cabinet unit heaters to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

PART 2 - PRODUCTS

2.1 PROPELLER UNIT HEATERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Airtherm; a Mestek Company.
2. McQuay International.
3. Rittling.
4. Rosemex Products.
5. Sterling Radiator; a Mestek Company.
6. Trane.
7. Vulcan.

B. Description: An assembly including casing, coil, fan, and motor in horizontal discharge configuration with adjustable discharge louvers.

C. Cabinet: Removable panels for maintenance access to controls.

D. Cabinet Finish: Manufacturer's standard baked enamel applied to factory-assembled and -tested propeller unit heater before shipping.

E. Discharge Louver: Adjustable fin diffuser.

F. General Coil Requirements: Test and rate hot-water propeller unit heater coils according to ASHRAE 33.

G. Hot-Water Coil: Copper tube, minimum 0.025-inch wall thickness, with mechanically bonded aluminum fins spaced no closer than 0.1 inch and rated for a minimum working pressure of 150 psig and a maximum entering-water temperature of 325 deg F, with manual air vent. Test for leaks to 200 psig underwater.

H. Fan: Propeller type with aluminum wheel directly mounted on motor shaft in the fan venturi.

I. Fan Motors: Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."

1. Motor Type: Permanently lubricated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive unit heaters for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in for piping and electrical connections to verify actual locations before unit heater installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install propeller unit heaters level and plumb.

B. Suspend propeller unit heaters from structure with all-thread hanger rods and spring hangers with vertical-limit stop. Hanger rods and attachments to structure are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment." Vibration hangers are specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to machine to allow service and maintenance.

C. Comply with safety requirements in UL 1995.

D. Unless otherwise indicated, install union and shutoff valve on supply-water connection and union, calibrated balancing valve, and shutoff valve on return-water connection of unit heater. Hydronic specialties are specified in Division 23 Section "Hydronic Piping."

E. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

F. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
2. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace malfunctioning units and retest as specified above.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain cabinet unit heaters. Refer to Division 01 for additional requirements.

END OF SECTION 238239
03/07/11

February 28, 2011

SECTION 260010 - GENERAL CONDITIONS FOR ELECTRICAL TRADES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. This section is intended to supplement the requirements of Division 01 requirements. For any conflicting requirements for minimum quantities or quality levels between this Section and Division 01, comply with the most stringent requirement.

1.2 SUMMARY

A. This Section includes the following when associated with Divisions 26, 27, and 28 work:

1. Permits and fees, code requirements, work under other contracts.
2. Work restrictions.
3. Specification formats and conventions.
4. Request for information.
5. Coordination.
6. Conflicting requirements.
7. Quality assurance and control.
8. Coordination drawings.
9. Product delivery, storage, and handling.
10. Product warranties.
11. Submittals.
12. Product selection procedures.
13. Product interoperability requirements.
14. General execution of project scope of work.
15. Record drawings.
16. Demonstration and training.
17. Minimum commissioning responsibilities.

B. Related Sections include the following:

1. Division 01 Sections.

1.3 PERMITS AND FEES

A. Give all necessary notices, obtain all permits; pay all government and state sales taxes and fees where applicable, and other costs, including utility connections or extensions in connection with the Project scope of work. File all necessary drawings, prepare all documents and obtain all necessary approvals of all governmental and state departments having jurisdiction, obtain all required certificates of inspections for Project scope of work and deliver a copy to the Owner/Engineer before request for acceptance and final payment for the Project scope of work.

1.4 CODE REQUIREMENTS

A. Project Code: Confirm the codes in effect at the time of permitting.

B. Project Legislative Requirements: Confirm the State and Local Legislations in effect at the time of permitting or those that affect construction.

C. Compliance: Comply with all codes and legislations applicable to the project, including energy related:

1. Means and Methods
2. Equipment and Devices.
3. Materials and Work Product.

1.5 WORK UNDER OTHER CONTRACTS

A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract. Coordinate the Work of this Contract with work performed under separate contracts.

1.6 WORK RESTRICTIONS

A. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services:

1. Notify Construction Manager or Owner not less than 10 days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Construction Manager's or Owner's written permission.

1.7 REQUESTS FOR INFORMATION (RFIs)

A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.

1. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:

1. Project name.
2. Project number.
3. Date.
4. Name of Contractor.
5. Name of Engineer and Construction Manager.
6. RFI number, numbered sequentially.
7. RFI subject.
8. Specification Section number and title and related paragraphs, as appropriate.
9. Drawing number and detail references, as appropriate.

10. Field dimensions and conditions, as appropriate.
11. Contractor's suggested resolution.
12. Contractor's signature.
13. Attachments: Include sketches, descriptions, measurements, photos, product data, shop drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.

    a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

C. The following RFIs will be returned without action:

1. Requests for approval of submittals.
2. Requests for approval of substitutions.
3. Requests for coordination information already indicated in the Contract Documents.
4. Requests for adjustments in the Contract Time or the Contract Sum.
5. Requests for interpretation of Architect's actions on submittals.
6. Incomplete RFIs or inaccurately prepared RFIs.

D. Action may include a request for additional information, in which case time for response will date from time of receipt of additional information.

1.8 COORDINATION

A. Coordination: Each Contractor shall coordinate its construction operations with those of other Contractors and entities to ensure efficient and orderly installation of each part of the Work. Each Contractor shall coordinate its operations with operations, included in different Sections that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components with other Contractors to ensure maximum performance and accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

B. Contractor shall coordinate all final specific utility requirements.

1.9 CONFLICTING REQUIREMENTS

A. General: If compliance with two or more standards or directives is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Architect/Engineer for a decision before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Engineer for a decision before proceeding.

1.10 MINOR CHANGES IN THE WORK

A. Engineer/Owner will issue through the Construction Manager, supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time.

B. Drawings are diagrammatic, the Contractor shall relocate devices a reasonable distance for coordination.

1. A reasonable distance is considered to be 15 feet at no additional cost.

1.11 QUALITY ASSURANCE AND CONTROL

A. General: Qualifications paragraphs in this Article establish some of the minimum qualification levels required; Division 01 and individual Specification Sections specify additional requirements.

B. Code Compliance: Work and equipment shall comply with all latest applicable codes and legislations.

C. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those required for this Project.

D. Instructor Qualifications: A factory-authorized service representative, complying with requirements in "Quality Requirements," experienced in operation and maintenance procedures and training.

E. Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.

1. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.

a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.

2. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
3. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

F. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections.

G. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

H. Associated Services: Cooperate with agencies performing required commissioning, tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.

3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.
5. Delivery of samples to testing agencies.
6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
7. Security and protection for samples and for testing and inspecting equipment at Project site.

I. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

J. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, product selected shall be compatible with products previously selected, even if previously selected products were also options.

1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
2. If a dispute arises between contractors over concurrently selectable but incompatible products, Engineer will determine which products shall be used at no additional cost to the project.

K. Acceptance of Work: Failure on the part of the Engineer to reject shop drawings or to reject Work in progress shall not be interpreted as acceptance of Work not in conformance with Code, Legislation, the Drawings and/or Specifications. Correct Work not in conformance whenever non-conformance is discovered.

1.12 COORDINATION DRAWINGS

A. Coordination Drawings, General: Prepare coordination drawings in accordance with requirements in this Section and individual equipment and distribution sections, to facilitate integration of products and materials fabricated or installed by more than one entity. Maintain maximum headroom, where space conditions appear inadequate to maintain proposed ceiling heights or code clearances, notify Engineer with proposed solutions.

1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts, but no less than 1/4" equals 1'-0". Do not base coordination drawings on standard printed data. Include the following information, as applicable:

a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
b. Coordinate the addition of trade-specific information to the coordination drawings by multiple contractors in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
e. Show location and size of access doors required for access to concealed equipment, devices, junction boxes.
f. Indicate required installation sequences.

g. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

B. Coordination Drawing Process:

1. Particular emphasis is placed on timely installation of major apparatus and furnishing other Contractors, especially the General Contractor or Construction Manager, with information as to openings, chases, sleeves, bases, inserts, equipment locations, panels, access doors, etc., required by other trades.
2. In general, ductwork, heating piping, sprinkler piping and drainage lines take precedence over water, gas and electrical conduits. The Engineer regarding the arrangement of Work, which cannot be agreed upon by the Contractors, will make final decisions.
3. Where the Work of the Contractor will be installed in close proximity to or will interfere with Work of other trades, assist in working out space conditions to make a satisfactory adjustment.
4. If Work is installed before coordinating with other Divisions or so as to cause interference with Work of other Sections, the Contractor causing the interference will make necessary changes to correct the condition without extra charge to the Owner.
5. The Construction Manager/General Contractor shall coordinate the coordination process between the trades. Each trade shall incorporate their systems electronically using a different color code. Establish a meeting schedule where the Architect and Engineer can be present, including initiation of a kickoff meeting to establish the process with all parties, Contractor Coordination Meetings, and Engineer/Contractor Coordination Review Meetings. Regular Contractor Coordination Meetings of all Contractors involved shall be held to resolve all conflicts, assure accessibility, coordinate sequences and make adjustment to the layout to achieve the Architectural/Engineering intent of spaces, ceiling heights, accessibility, and to maximize headroom clearances in preparation for the Engineer/Contractor Coordination Review Meetings. Forward one (1) preliminary copy to the Architect and Engineer each, one (1) week prior to the Engineer Review Meeting identifying all unresolved conflicts. Upon resolving any outstanding conflicts (which may take a couple of rounds), drawings shall be completed and all trades shall sign acceptance of the drawings and submit a minimum of six (6) prints of each drawing to the Engineer for review.

C. Coordination drawing creation is an interactive process. Submit multiple options and configurations at no additional cost until the Engineer's and Architect's acceptance is given.

D. Coordination Drawing Organization: Organize coordination drawings as follows:

1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire protection, fire alarm, and electrical work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Project scope of work.
2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within ceiling plenum to accommodate layout of luminaires indicated on Drawings. Indicate areas of conflict between luminaires and other components.
3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire protection, fire alarm, and electrical equipment.
4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.

6. Mechanical and Plumbing Work: Show the following:

    a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
    b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
    c. Fire-rated enclosures around ductwork.

7. Electrical Work: Show the following:

    a. Runs of vertical and horizontal conduit 1-1/4 inch diameter and larger.
    b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire alarm locations.
    c. Panelboard, switchboard, switchgear, transformer, busway, generator, and motor control center locations.
    d. Location of pull boxes and junction boxes, dimensioned from column center lines.

8. Fire Protection System: Show the following:

    a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.

9. Review: Engineer will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are the Contractor's responsibility. If the Architect determines that the coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, the Architect will so inform the Contractor, who shall make changes as directed and resubmit.
10. Coordination Drawing Prints: Prepare coordination drawing prints in accordance with requirements of this Section "Submittal Procedures."

E. Coordination Digital Data Files: Prepare coordination digital data files in accordance with the following requirements:

1. File Preparation Format: DWG or Revit operating in Microsoft Windows operating system.
2. File Submittal Format: Submit or post coordination drawing files using Portable Data File (PDF) format.
3. Engineer/Architect will furnish Contractor one set of digital data files of the Drawings for use in preparing coordination digital data files.

    a. Engineer/Architect makes no representations as to the accuracy or completeness of digital data files as they relate to the Drawings.
    b. Contractor shall execute a data licensing agreement in the form of AIA Document C106.

1.13 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions and generally accepted construction practice.

B. Storage:

1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.

3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Store cementitious products and materials on elevated platforms.
5. Store foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
7. Protect stored products from damage and liquids from freezing.
8. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.14 PRODUCT WARRANTIES

A. Refer to Division 01 and individual sections for requirements.

B. The following requirements are supplemental and in addition to those stated in other specific sections and Division 01.

1. Warranty all materials and workmanship under these Specifications and the Contract for a period of one year from the date of final acceptance by the Owner.
2. During this warranty period, correct or replace all defects developing through materials or workmanship immediately as directed by the Engineer without expense to the Owner; make all such repairs or replacements to the Owner’s satisfaction.

C. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

D. Warranty Start Date: Date of substantial completion.

1.15 SUBMITTAL PROCEDURES

A. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Product List: Submit a list, in tabular from, showing specified products. Include generic names of products required. Include manufacturer's name and proprietary product names for each product.

1. Initial Submittal: Within 30 days after date of commencement of the Work, submit 3 copies of initial product list. Include a written explanation for omissions of data and for variations from Contract requirements.

C. Substitution Requests: Submit four copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Substitution: A submittal shall be considered a substitution when the Engineer/Architect does not accept the product or material as an “equivalent” or where one of the listed manufacturers is not submitted.
2. Substitution Requirements: Substitutions shall meet the requirements of "Comparable Products."

3. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

    a. Statement indicating why specified material or product cannot be provided.
    b. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
    c. Detailed comparison of significant qualities of proposed substitution with those of the Project scope of work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
    d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
    e. Samples, where applicable or requested.
    f. Cost information, including a proposal of change, if any, in the Contract Sum.
    g. Contractor's certification that proposed substitution complies with requirements in the Contract Documents and is appropriate for applications indicated.
    h. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
    i. Statement indicating why the requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations.

1.16 RECORD DRAWINGS

A. Record Drawings: Comply with the following:

1. Number of Copies: Submit copies of Record Drawings as follows:

    a. Initial Submittal: Submit one set of plots from corrected Record CAD Drawings and one set of marked-up Record Prints. Engineer will initial and date each plot and mark whether general scope of changes, additional information recorded, and quality of drafting are acceptable. Engineer will return plot for organizing into sets, printing, binding, and final submittal.
    b. Final Submittal: Submit one set(s) of marked-up Record Prints, one set(s) of Record Transparencies, and three copies printed from Record Transparencies. Print each Drawing, whether or not changes and additional information were recorded.
    c. Final Submittal: Submit three sets of Record CAD Drawing files and one set of Record CAD Drawing plots. Plot and print each Drawing, whether or not changes and additional information were recorded.

        1) Electronic Media: CD-R.

B. Qualification Data: For training instructor.

1.17 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, that are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.

2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Engineer will make selection.
5. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.
6. Or Equal: Where products are specified by name and accompanied by the term "or equal" or "or approved equal" or "or approved," comply with provisions in "Comparable Products" Article to obtain approval for use of an unnamed product.

B. Product Selection Procedures:

1. Design Basis: The design has been based on the single manufacturer indicated in the contract documents. The Contractor is responsible for verifying prior to submission, that any other manufacturer even though listed complies with dimensional and performance characteristics of the base specified product. Modifications shall be made by the Contractor as part of this contract to accommodate changes to the design basis.
2. Product: Where Specifications name a single product and manufacturer, provide the named product that complies with requirements.
3. Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements.
4. Equivalent Product: Equipment, material or devices submitted for review as an "accepted equivalent" shall meet all of the following requirements:

    a. A product of a listed manufacturer.
    b. The equivalent shall have the same construction features such as, but not limited to:

        1) Material thickness, gauge, weight, density, etc.
        2) Welded, riveted, bolted, etc., construction
        3) Finish, undercoating, corrosion protection

    c. The equivalent shall perform with the same or better operating efficiency.
    d. The equivalent shall have equal or greater reserve capacity.
    e. The equivalent shall be locally represented by the manufacturer for service, parts and technical information.
    f. The equivalent shall bear the same labels of performance certification as is applicable to the specified item, such as UL, AMCA or ARI labels.

1.18 PRODUCT INTEROPERABILITY REQUIREMENTS

A. Interoperability Coordination Meeting: Attend a minimum of 3 weekly coordination meetings to coordinate interoperability between all systems and equipment. Meetings shall be scheduled by the construction manager.

B. General Networking and Protocol Interoperability Requirements: Provide products that are fully BACNet interoperable.

1. All systems and equipment shall interface with the primary building management network provided under "Instrumentation and Controls for HVAC" using Ethernet standards and BACNet protocol.

2. Equipment that is native BACNet may connect directly to a BACNet MS/TP subnet that is provided by "Instrumentation and Controls for HVAC" when coordinated with that Section Contractor.
3. Communication involving control components (i.e., all types of controllers and operator interfaces) shall conform to the most current ANSI/ASHRAE Standard 135, BACnet.
4. The MS/TP trunks support all of the ASHRAE 135 approved baud rates.
5. All MS/TP devices support all baud rates of the ASHRAE 135.
6. All MS/TP devices shall be BTL approved (BACnet Testing Lab).
7. All BACnet routers must support B-BC (BIBB) and support BBMD routing.
8. Lonworks and Modbus subnets may be utilized where no BACNet protocol is available provided full 2-way compatibility is provided through a gateway.

    a. Exception: Fire alarm systems shall be 1-way, read only communication.

9. Each individual system and/or equipment manufacturer/installer shall provide all necessary gateways/translators Provide Gateway with all products as required facilitating full BACNet interoperability with BACNet Protocol.
10. It must be possible to read and display the value of any property, including all required properties, supported optional properties, and proprietary extensions of very object of every networked device.
11. Operating setpoints and parameters must be available for modification via BACnet services via a graphical user interface (GUI).
12. An operator shall be able to display at any time the operational status of any device on the BACnet internetwork. An operator shall be able to display at any time any property of any BACnet object. An operator shall also be able to display property values of objects grouped by object type, object location, building system, and by user defined parameters.
13. An operator shall have the ability to issue re-initialization commands to any device that supports remote re-initialization.
14. An operator shall have the ability to backup and restore all BACnet devices on the network.
15. It shall be each contractor's responsibility to configure each router using the network numbering scheme for the project. Each router shall be configured such that all network layer error messages shall be directed to a specific workstation using the BACnet Confirmed Text Message service. It shall be the contractor's responsibility to initially configure each router with routing tables containing all network numbers that are part of the project's internet. The router shall be able to receive messages at each port of any length that is valid for the LAN technology connected to that port, and to forward the message to any directly-connected network that can convey a message of that size.
16. Legacy Systems: Bi-directional gateways shall be provided for systems and equipment operating on a legacy/proprietary system. The operator workstation shall display information from both the BACnet and non-BACnet devices. Any information specified or required for system functionality shall be made readable and modifiable. Gateways shall have 10% expansion capacity. Gateways shall support archiving, uploading, trending, scheduling, and alarm/event detection, notification and acknowledgement.
17. Systems and equipment shall have full 2- way communications and interoperability.

    a. Exception: Fire safety systems and equipment shall have only read access to outside systems:

        1) Fire alarm.

18. Coordinate with "Instrumentation and Controls for HVAC" and other building operational systems for specific interoperability requirements.

C. Communications Standard: Coordinate communications standards requirements with other Sections and Divisions.

1. MS/TP LAN: RS 485

2. Systems with dedicated network(s) shall connect on the BACNet Ethernet LAN: utilizing a switch and shall meet standard Ethernet requirements.

a. Utilize RJ-45 terminations.
b. Utilize CAT 6 cabling.
c. Meet IEEE Standard 802.3 standards and requirements.
d. Speed: 100 Mbps.

3. Equipment without dedicated networks shall connect to the BACNet MS/TP LAN.

a. RS 485 communications standard.
b. Speed: 1 Mbps.

D. Information Availability: Make all product information, points, variables, setpoints, etc., available for access of building operational systems upon request.

1. Provide bi-directional point mapping/addressing instructions.
2. Provide on-site technicians as required to ensure proper information exchange.

E. Factory Provided Equipment Controllers: Provide all information, points, variables, setpoints, etc., indicated and referenced in all documentation, including "Instrumentation and Controls for HVAC." Products shall have full interoperability as indicated in this Section, in BACNet standards and elsewhere.

1.19 MINIMUM CONTRACTOR'S COMMISSIONING RESPONSIBILITIES

A. Each Contractor shall assign representatives with expertise and authority to act on its behalf and shall schedule them to participate in and perform commissioning process activities including, but not limited to, the following:

1. Evaluate performance deficiencies identified in test reports and, in collaboration with entity responsible for system and equipment installation, recommend corrective action.
2. Cooperate with the CxA for resolution of issues recorded in the Issues Log.
3. Attend commissioning team meetings held on a weekly basis.
4. Integrate and coordinate commissioning process activities with construction schedule.
5. Review and accept construction checklists provided by the CxA.
6. Complete paper or electronic construction checklists as Work is completed and provide to the Commissioning Authority on a weekly basis.
7. Review and accept commissioning process test procedures provided by the Commissioning Authority.
8. Complete commissioning process test procedures.

B. Refer to related information in other sections for additional requirements.

PART 2 - PRODUCTS

2.1 COORDINATION DRAWINGS

A. Coordination Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Coordination Drawings on reproductions of the Contract Documents or standard printed data.

1. Preparation: Fully illustrate requirements in the Contract Documents and actual special restrictions.
2. Sheet Size: Submit Coordination Drawings on sheets at least 30 by 42 inches.
3. Submit Shop Drawings in the following format:

a. PDF electronic file.
b. AutoCAD/Revit file in the latest version.
c. Six opaque (bond) copies of each submittal. Engineer will return five copies.

2.2 SHOP DRAWINGS

A. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed or electronic data.

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:

a. Identification of products.
b. Schedules.
c. Compliance with specified standards.
d. Notation of coordination requirements.
e. Notation of dimensions established by field measurement.
f. Relationship and attachment to adjoining construction clearly indicated.
g. Seal and signature of professional engineer if specified.

2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 30 by 42 inches.

2.3 RECORD DRAWINGS

A. Record Prints: Maintain one set of black-line white prints of the Contract Drawings and Shop Drawings.

1. Preparation: Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.

a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
b. Accurately record information in an understandable drawing technique.
c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.

2. Content: Types of items requiring marking include, but are not limited to, the following:

    a. Revisions to details shown on Drawings.
    b. Locations and depths of underground system entities.
    c. Revisions to routing of piping.
    d. Actual equipment locations.
    e. Duct size and routing.
    f. Locations of concealed internal utilities.
    g. Changes made by Change Order or Change Directive.
    h. Changes made following Engineer's written orders.
    i. Details not on the original Contract Drawings.
    j. Field records for variable and concealed conditions.
    k. Record information on the Project scope of work that is shown only schematically.

3. Mark the Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-reference on the Contract Drawings.
4. Mark record sets with erasable, colored pencil. Use multiple colors to distinguish between changes for different categories of the Work at same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Record CAD Drawings: Immediately before observation for Certificate of Substantial Completion, review marked-up Record Prints with Engineer and Construction Manager. When authorized, prepare a full set of corrected CAD Drawings of the Contract Drawings, as follows:

1. Format: DWG or Revit format of the same version, and operating system as the original Contract Drawings.
2. Incorporate changes and additional information previously marked on Record Prints. Delete, redraw, and add details and notations where applicable.
3. Refer instances of uncertainty to Engineer for resolution.
4. Contractor may request one set of CAD Drawings of the Contract Drawings for use in recording information.

    a. Engineer makes no representations as to the accuracy or completeness of CAD Drawings as they relate to the Contract Drawings.

C. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

1. Record Prints: Organize Record Prints and newly prepared Record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Record CAD/Revit Drawings: Organize information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each file.
3. Identification: As follows:

    a. Project name.
    b. Date.
    c. Designation "PROJECT RECORD DRAWINGS."
    d. Name of Engineer, Architect and Construction Manager.

e. Name of Contractor.

2.4 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and modifications to Project Record Documents as they occur; do not wait until the end of Project.

B. Maintenance of Record Documents and Samples: Store Record Documents and Samples in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Engineer's reference during normal working hours.

2.5 TRAINING AND INSTRUCTION PROGRAM

A. Program Structure: In addition to Division 01 and individual section requirements, develop an instruction program that includes individual training modules for each system and equipment not part of a system.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. Provide instruction for the following modules.

1. Basis of System Design and Operational Requirements
2. Documentation
3. Emergencies
4. Adjustments
5. Troubleshooting
6. Maintenance
7. Repairs

C. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

D. Video Record: Training shall be recorded as video.

1. Format: Standard DVD format.
2. Quantity: Three discs of each individual DVD.
3. Labeling: Label each DVD with it's library of training sections based on equipment type and system type.

2.6 COMPARABLE PRODUCTS

A. Conditions for Consideration: Engineer/Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Engineer/Architect may return requests without action, except to record noncompliance with these requirements:

1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning work, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utility and system connections.
2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
3. Existing Utility Information: Furnish information to local utility and Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Acceptance of Conditions: Examine substrates, areas, and conditions, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Written Report: Where a written report listing conditions detrimental to performance of the Project scope of work is required by other Sections, include the following:

a. Description of the Work.
b. List of detrimental conditions, including substrates.
c. List of unacceptable installation tolerances.
d. Recommended corrections.

2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

3. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
4. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
5. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Existing Utility Information: Furnish information to local utility and Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Engineer. Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents.

3.3 DEMOLITION

A. Work indicated to be removed includes removal of all auxiliary materials, accessories, anchorage, fasteners, and etc., down to bare substrate. No residual materials shall remain from work to be removed. Contractor will use whatever means necessary; including removal of all materials attached or related to those items designated to be removed, as acceptable to Owner and Engineer, to provided complete and thorough removal of existing work.

B. Protect existing equipment and installations indicated to remain. If damaged or disturbed in the course of the Work, remove damaged portions and install new products of equal capacity, quality, and functionality.

C. Accessible Work: Remove exposed equipment and installations, indicated to be demolished, in their entirety.

D. Abandoned Work: Cut and remove buried MEP system materials, equipment, raceways, piping and distribution, indicated to be abandoned in place, 2 inches below the surface of adjacent construction. Cap and patch surface to match existing finish.

E. Remove demolished materials from Project site.

F. Remove, store, clean, reinstall, reconnect, and make operational components indicated for relocation.

G. Field verify all existing MEP system materials, equipment, raceways, piping and distribution to be removed for exact quantities.

H. Remove all existing MEP system materials, equipment, raceways, piping and distribution located above ceilings and in walls that are not being reused.

I. Remove all MEP systems and appurtances, which are to be removed, in their entireties back to the source or source panels.

J. Remove all existing MEP system materials, equipment, raceways, piping and distribution located in walls or ceilings being demolished. Abandon no devices that have been disconnected unless specifically noted.

K. Maintain continuity of all existing MEP devices, and utilization equipment not removed.

L. Remove, store, protect, and reinstall existing work as required to accommodate alteration indicated.

M. The existing work to be removed, in general, is as indicated on the Drawings and in this Section, but also includes any materials or work necessary to permit installation of new materials, as approved by Owner and Engineer.

N. Disconnect, demolish, and remove systems, equipment, and components indicated to be removed, abandoned or as made obsolete by this project.

1. To Be Removed: Remove portion of systems, equipment, and components indicated to be removed and cap or plug remaining with same or compatible material.
2. To Be Abandoned in Place: Drain piping and cap or plug systems, equipment, and components with same or compatible material.
3. Equipment to Be Removed: Disconnect, make safe and cap services and remove equipment.
4. Equipment to Be Removed and Reinstalled: Disconnect, make safe and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
5. Equipment to Be Removed and Salvaged: Disconnect, make safe and cap services and remove equipment and deliver at direction of Owner.

O. If systems, equipment, and components to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

P. In finished areas, all systems, equipment, and components shall be cut back to a concealed location, i.e., within walls, above ceilings, etc., before capping.

3.4 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.
4. Maintain minimum headroom clearance as indicated by Architect and/or Construction Manager in spaces without a suspended ceiling.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Tools and Equipment: Do not use tools or equipment that produces harmful noise levels.

F. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

G. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Engineer and/or to allow for proper access.
2. Allow for building movement, including thermal expansion and contraction.
3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

H. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.5 CUTTING AND PATCHING

A. See Division 01 for additional requirements. The Contractor shall furnish sketches showing the location and sizes of all openings, chases, etc., required for the installation of Work.

B. Work under this Division shall include furnishing, locating and setting inserts and/or sleeves required before the floors and walls are built or be responsible for cutting, drilling or chopping where sleeves and inserts were not installed, where wall or floors are existing or not correctly located. The Contractor shall do all drilling required for the installation of hangers.

C. Exercise extreme caution when core drilling or punching openings in concrete floor slabs in order to avoid cutting or damaging structural members. No structural members or structural slabs/floors shall be cut without the written acceptance of the Structural Engineer and all such cutting shall be done in a manner directed by him.

D. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.6 SCAFFOLDING, RIGGING, HOISTING

A. The Contractor shall furnish all scaffolding, rigging, hoisting and services necessary for erection and delivery into the premises any equipment and apparatus furnished under this Division. Remove same from premises when no longer required.

3.7 EXCAVATION AND BACKFILLING

A. It is the responsibility of the Contractor to coordinate sizes, depths, fill and bedding requirements and any other excavation work required under this Division.

3.8 ACCESSIBILITY AND ACCESS PANELS

A. The Contractor shall be responsible for the sufficiency of the size of shafts and chases, the adequate thickness of partitions, and the adequate clearance in double partitions and hung ceilings for the proper installation of the Work.

B. Locate all equipment which must be serviced, operated or maintained in fully accessible positions. Access doors shall be furnished for accessibility. Minor deviations from the Drawings may be made to allow better accessibility, but changes of magnitude or which involve extra cost shall not be made without the acceptance of the Engineer.

C. Locate all equipment which must be serviced, operated or maintained in fully accessible positions. Equipment shall include, but not be limited to: motors, controllers, coil, valves, switchgear, drain points, etc. Access doors shall be furnished if required for better accessibility. Minor deviations from the Drawings may be made to allow better accessibility, but changes of magnitude or which involve extra cost shall not be made without the acceptance of the Engineer.

D. Access doors in walls, ceilings, floors, etc., shall be field coordinated. It is the responsibility of the Contractor to coordinate and provide information regarding the sizes and quantities of access doors required for his work. The Contractor shall arrange his work in such a manner as to minimize the quantity of access doors required, such as grouping shutoff valves in the same area. Where possible, locate valves in already accessible areas, such as lay-in ceilings, etc.

E. On a clean set of prints, the Contractor shall mark in red pencil the location of each required access door, including its size and fire rating (if any), and shall submit the print to the Architect for review before access doors are purchased or installed.

F. Upon completion of the Project, the Contractor shall physically demonstrate that all equipment and devices installed have been located and/or provided with adequate access panels for repair, maintenance and/or operation. Any equipment not so furnished shall be relocated or provided with additional access panels by the installing Contractor at no additional cost to the Owner.

3.9 STARTING AND ADJUSTING

A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

B. Adjust operating components for proper operation without binding. Adjust equipment for proper operation.

C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Manufacturer's Field Service: Provide a factory-authorized service representative to inspect field-assembled components and equipment installation, comply with qualification requirements in "Quality Requirements."

3.10 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

C. Remove debris from concealed spaces before enclosing the space.

D. Remove liquid spills promptly.

E. Where dust would impair proper execution of the Project scope of work, broom-clean or vacuum the entire work area, as appropriate.

F. Installed Work: Keep installed work clean.

G. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

J. Limiting Exposures: Supervise construction operations to assure that no part of the construction completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.11 CORRECTION OF THE WORK

A. The cost of corrective work shall be included under the contract.

B. Repair or remove and replace defective construction.

1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

C. Restore permanent facilities used during construction to their specified or original condition.

D. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

E. Repair components that do not operate properly. Remove and replace operating components to new condition.

F. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 260010
03/07/11

February 28, 2011

SECTION 260500 - COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Electrical equipment coordination and installation.
2. Sleeves for raceways and cables.
3. Sleeve seals.
4. Grout.
5. Common electrical installation requirements.
6. Coordination drawing requirements.

1.3 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

B. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. Product Data: For sleeve seals.

1.5 COORDINATION

A. Coordinate arrangement, mounting, and support of electrical equipment:

1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
3. To allow right of way for piping and conduit installed at required slope.
4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

C. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08 Section "Access Doors and Frames."

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

E. Coordination drawings for electrical installation.

F. Prepare coordination drawings according to Division 01 Section "Submittals" to a 1/4" = 1'-0" scale for floor plans. Detail major elements, components, and systems of electrical equipment and materials in relation to each other and to other systems, installations, and building components. Indicate locations and space requirements for installation, access, and working clearance. Show where sequence and coordination of installations are important to the efficient flow of the work. Coordinate drawing preparation with effort specified in other specification sections. Include the following:

1. Provisions for scheduling, sequencing, moving and positioning large equipment in the building during construction.
2. Floor plans, elevations and details, including the following:

a. Clearances to meet safety requirements and for servicing and maintaining equipment, including space for equipment disassembly required for periodic maintenance.
b. Equipment support details.
c. Exterior wall, roof and foundation penetrations of cable and raceway; and their relation to offer penetrations and installations.
d. Fire-rated interior wall and floor penetrations by electrical installations.
e. Sizes and locations of required concrete pads and bases.

PART 2 - PRODUCTS

2.1 SLEEVES FOR RACEWAYS AND CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel.

1. Minimum Metal Thickness:

a. For sleeve cross-section rectangle perimeter less than 50 inches and no side more than 16 inches, thickness shall be 0.052 inch.
b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches and 1 or more sides equal to, or more than, 16 inches, thickness shall be 0.138 inch.

2.2 SLEEVE SEALS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following:

    a. Advance Products & Systems, Inc.
    b. Calpico, Inc.
    c. Metraflex Co.
    d. Pipeline Seal and Insulator, Inc.

2. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
3. Pressure Plates: Plastic. Include two for each sealing element.
4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.3 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

A. Comply with NECA 1.

B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

E. Right of Way: Give to piping systems installed at a required slope.

3.2 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

E. Cut sleeves to length for mounting flush with both surfaces of walls.

F. Extend sleeves installed in floors 2 inches above finished floor level.

G. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable, unless indicated otherwise.

H. Seal space outside of sleeves with grout for penetrations of concrete and masonry

1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.

I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants.".

J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."

K. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

L. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel or cast-iron pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

M. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

N. Install seal fittings on conduits and cables, as required by NEC, which are in or pass through hazardous areas.

O. Use sealing bushings on conduit and cable ends to effectively prevent the intrusion of water, a damp or corrosive atmosphere, hot or cold air, or dust.

3.3 SLEEVE-SEAL INSTALLATION

A. Install to seal exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.4 FIRESTOPPING

A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

END OF SECTION 260500
03/07/11

February 28, 2011

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.

B. Related Sections include the following:

1.3 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

B. NBR: Acrylonitrile-butadiene rubber.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Field quality-control test reports.

1.6 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Comply with requirements in Part 3 articles for where materials shall be applied.

2.2 CONDUCTORS AND CABLES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Alcan Products Corporation; Alcan Cable Division.
2. American Insulated Wire Corp.; a Leviton Company.
3. General Cable Corporation.
4. Rome Cable Corporation.
5. Southwire Company.

B. Copper Conductors: Comply with NEMA WC 70.

C. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN.

D. Multiconductor Cable: Comply with NEMA WC 70 for metal-clad cable, Type MC with insulated equipment ground conductor.

2.3 CONNECTORS AND SPLICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AFC Cable Systems, Inc.
2. Hubbell Power Systems, Inc.
3. O-Z/Gedney; EGS Electrical Group LLC.
4. 3M; Electrical Products Division.
5. Tyco Electronics Corp.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper. Solid for No. 12 AWG and smaller; stranded for No. 10 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 12 AWG and smaller; stranded for No. 10 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTI-CONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Exposed Feeders: Type THHN-THWN, single conductors in raceway.

B. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN-THWN, single conductors in raceway.

C. Exposed Branch Circuits, Including in Crawlspaces: Type THHN-THWN, single conductors in raceway.

D. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.

E. Branch Circuits Concealed in Ceilings, Walls and Partitions: Type THHN-THWN, single conductors in raceway to outlet box located within 10 ft. of first wiring device, luminaire, or utilization equipment indicated on documents served by branch circuit. Metal-clad cable, Type MC may be used on load side of this outlet box.

F. Class 1 Control Circuits: Type THHN-THWN, in raceway.

G. Class 2 Control Circuits: Type THHN-THWN, in raceway.

H. Minimum Branch Circuit Conductor Size: No. 12 AWG. For all 120-volt circuits in excess of 100 ft. from power source to last device, provide No. 10 AWG entire length of circuit. For all 120-volt circuits in excess of 200 ft. from power source to last device, provide No. 8 AWG entire length of circuit. For all 208-volt circuits in excess of 200 ft. from power source to last device, provide No. 10 AWG entire length of circuit. Wherever common neutrals are utilized, increase size of neutral one wire size over phase conductor size.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.

B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

E. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems" and Section 260548 "Vibration and Seismic Controls for Electrical Systems."

F. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."

3.4 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.6 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 078413 "Penetration Firestopping."

3.7 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test feeder conductors, and conductors for compliance with requirements.
2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
3. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in cables and conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner.

    a. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
    b. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

C. Test Reports: Prepare a written report to record the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

D. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 260519
03/07/11

February 28, 2011

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes methods and materials for grounding systems and equipment.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Qualification Data: For testing agency and testing agency's field supervisor.

C. Field quality-control test reports.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
4. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
5. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

C. Grounding Bus: Rectangular bars of annealed copper, 1/4 by 2 inches in cross section, unless otherwise indicated; with insulators.

2.2 CONNECTORS

A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.

1. Pipe Connectors: Clamp type, sized for pipe.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Bond Together the Following Electrodes if Present on Site: Metal underground water pipe, metal frame of the building, concrete encased electrode, ground ring, rod electrode, plate electrode, and all other local metal underground systems. If none of the first seven electrodes listed are present, then provide and bond together two of the last four electrodes listed.

B. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger, unless otherwise indicated.

C. Grounding Bus: Install in electrical and telecommunication rooms and closets, in rooms housing service equipment, and elsewhere as indicated.

1. Install bus on insulated spacers 1 inch, minimum, from wall 6 inches above finished floor, 24 inches in length, unless otherwise indicated.
2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, down to specified height above floor, and connect to horizontal bus.

D. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors, except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

3.2 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Water Heater, Heat-Tracing, and Anti-frost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

3.3 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.

C. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes, using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections and prepare test reports:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.

B. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity 500 kVA and Less: 10 ohms.

C. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 260526
03/07/11

February 28, 2011

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Hangers and supports for electrical equipment and systems.
2. Construction requirements for concrete bases.

B. Related Sections include the following:

1. Section 260548 "Vibration and Seismic Controls for Electrical Systems" for products and installation requirements necessary for compliance with seismic criteria.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. RMC: Rigid metal conduit.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.5 ACTION SUBMITTALS

A. Product Data: For the following:

1. Steel slotted support systems.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following:

1. Trapeze hangers. Include Product Data for components.
2. Steel slotted channel systems. Include Product Data for components.
3. Equipment supports.

1.6 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.7 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Comply with NFPA 70.

1.8 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified together with concrete Specifications.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Section 077200 "Roof Accessories."

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Allied Tube & Conduit.
b. Cooper B-Line, Inc.; a division of Cooper Industries.
c. ERICO International Corporation.
d. GS Metals Corp.
e. Thomas & Betts Corporation.
f. Unistrut; Tyco International, Ltd.
g. Wesanco, Inc.

2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
3. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
4. Channel Dimensions: Selected for applicable load criteria.

B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

C. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

    a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

        1) Hilti Inc.
        2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
        3) MKT Fastening, LLC.
        4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.

2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated or stainless steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.

    a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

        1) Cooper B-Line, Inc.; a division of Cooper Industries.
        2) Empire Tool and Manufacturing Co., Inc.
        3) Hilti Inc.
        4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
        5) MKT Fastening, LLC.

3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Section 055000 "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with two-bolt conduit clamps, single-bolt conduit clamps, or single-bolt conduit clamps using spring friction action for retention in support channel.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT and RMC may be supported by openings through structure members, as permitted in NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
6. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts, beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69, or spring-tension clamps.

7. To Light Steel: Sheet metal screws.
8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Section 055000 "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Touchup: Comply with requirements in Division 09 painting sections for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 260529
03/07/11

February 28, 2011

SECTION 260533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Metal conduits, tubing, and fittings.
2. Nonmetal conduits, tubing, and fittings.
3. Metal wireways and auxiliary gutters.
4. Nonmetal wireways and auxiliary gutters.
5. Surface raceways.
6. Boxes, enclosures, and cabinets.

1.3 DEFINITIONS

A. ARC: Aluminum rigid conduit.

B. GRC: Galvanized rigid steel conduit.

1.4 ACTION SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:

1. Structural members in paths of conduit groups with common supports.
2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.

B. Qualification Data: For professional engineer.

C. Seismic Qualification Certificates: For enclosures, cabinets, and conduit racks and their mounting provisions, including those for internal components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
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.
4. Detailed description of conduit support devices and interconnections on which the certification is based and their installation requirements.

D. Source quality-control reports.

1.6 COORDINATION

A. Coordinate layout and installation of raceways, boxes, enclosures, cabinets, and suspension system with other construction that penetrates ceilings or is supported by them, including luminaires, HVAC equipment, fire suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AFC Cable Systems, Inc.
2. Allied Tube & Conduit; a Tyco International Ltd. Co.
3. Electri-Flex Company.
4. O-Z/Gedney; a brand of EGS Electrical Group.
5. Picoma Industries, a subsidiary of Mueller Water Products, Inc.
6. Republic Conduit.
7. Robroy Industries.
8. Southwire Company.
9. Thomas & Betts Corporation.
10. Western Tube and Conduit Corporation.
11. Wheatland Tube Company; a division of John Maneely Company.

B. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. GRC: Comply with ANSI C80.1 and UL 6.

D. ARC: Comply with ANSI C80.5 and UL 6A.

E. EMT: Comply with ANSI C80.3 and UL 797.

F. FMC: Comply with UL 1; zinc-coated steel.

G. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

H. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.

1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
2. Fittings for EMT:

   a. Material: Steel.
   b. Type: Setscrew or compression.

3. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.

I. Joint Compound for GRC or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AFC Cable Systems, Inc.
2. CANTEX Inc.
3. Electri-Flex Company.
4. Kraloy.
5. Lamson & Sessions; Carlon Electrical Products.
6. Niedax-Kleinhuis USA, Inc.
7. RACO; a Hubbell company.
8. Thomas & Betts Corporation.

B. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. ENT: Comply with NEMA TC 13 and UL 1653.

D. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.

E. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

F. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

G. Solvent cements and adhesive primers shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper B-Line, Inc.
2. Hoffman; a Pentair company.
3. Mono-Systems, Inc.

4. Square D; a brand of Schneider Electric.

B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1, Type 3R, Type 4 or Type 12 unless otherwise indicated, and sized according to NFPA 70.

1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Wireway Covers: Hinged type unless otherwise indicated.

E. Finish: Manufacturer's standard enamel finish.

2.4 NONMETALLIC WIREWAYS AND AUXILIARY GUTTERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Allied Moulded Products, Inc.
2. Hoffman; a Pentair company.
3. Lamson & Sessions; Carlon Electrical Products.
4. Niedax-Kleinhuis USA, Inc.

B. Listing and Labeling: Nonmetallic wireways and auxiliary gutters shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Description: PVC, extruded and fabricated to required size and shape, and having snap-on cover, mechanically coupled connections, and plastic fasteners.

D. Fittings and Accessories: Couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings shall match and mate with wireways as required for complete system.

E. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

F. Solvent cements and adhesive primers shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.5 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Technologies Company; Cooper Crouse-Hinds.
2. EGS/Appleton Electric.
3. FSR Inc.
4. Hoffman; a Pentair company.
5. Hubbell Incorporated; Killark Division.
6. Milbank Manufacturing Co.

7. Mono-Systems, Inc.
8. O-Z/Gedney; a brand of EGS Electrical Group.
9. RACO; a Hubbell Company.
10. Spring City Electrical Manufacturing Company.
11. Thomas & Betts Corporation.
12. Wiremold / Legrand.

B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy or aluminum, Type FD, with gasketed cover.

E. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.

F. Metal Floor Boxes:

1. Material: Cast metal or sheet metal.
2. Type: Fully adjustable.
3. Shape: Rectangular.
4. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

G. Nonmetallic Floor Boxes: Nonadjustable, round.

1. Listing and Labeling: Nonmetallic floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

H. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. Outlet boxes designed for attachment of luminaires weighing more than 50 lb shall be listed and marked for the maximum allowable weight.

I. Paddle Fan Outlet Boxes: Nonadjustable, designed for attachment of paddle fan weighing 70 lb.

1. Listing and Labeling: Paddle fan outlet boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

J. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

K. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum or galvanized, cast iron with gasketed cover.

L. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

M. Gangable boxes are prohibited.

N. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1, Type 3R, Type 4 or Type 12 with continuous-hinge cover with flush latch unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

O. Cabinets:

1. NEMA 250, Type 1, Type 3R or Type 12 galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.
6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Indoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed, Not Subject to Severe Physical Damage: EMT.
3. Exposed and Subject to Severe Physical Damage: GRC. Raceway locations include the following:

    a. Loading dock.
    b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
    c. Mechanical rooms.
    d. Gymnasiums.
    e. Raceways penetrating roof to within 3 ft. of enclosed switch.

4. Concealed in Ceilings and Interior Walls and Partitions: EMT. Include raceways in the following locations:

    a. Open parking garages.

5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
6. Damp or Wet Locations: GRC.

B. Minimum Raceway Size: 3/4-inch trade size.

C. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. EMT: Comply with NEMA FB 2.10.

    a. Utilize steel compression fittings in the following locations:

        1) Damp locations.
        2) Boiler rooms.
        3) Mechanical rooms.
        4) Within block walls.

b. Utilize steel set-screw fittings in the following locations:

1) Dry locations.
2) Above suspended ceilings.
3) Within stud walls.

3. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

D. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.

E. Install surface raceways only where indicated on Drawings.

F. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.

3.2 INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.

1. Whenever any raceway crosses an expansion or seismic joint, provide a pull box on each side of the joint with sufficient length of flexible raceway to accommodate movement in all directions. See section regarding seismic control for electrical work for additional requirements. Coordinate movement requirements at expansion and seismic joints with Structural Engineer of Record.

E. Arrange stub-ups so curved portions of bends are not visible above finished slab.

F. Conceal raceway and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

G. Support raceway within 12 inchesof enclosures to which attached.

H. Stub-ups to Above Recessed Ceilings:

1. Use RMC for raceways.
2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

I. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

J. Join raceways with fittings designed and approved for that purpose and make joints tight.

1. Use insulating bushings to protect conductors. Within return air plenums utilize plenum rated bushings.

K. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

L. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

M. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

N. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

O. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.

P. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Within return air plenums utilize a #10 AWG conductor in place of a plastic line. Cap underground raceways designated as spare above grade alongside raceways in use.

Q. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.

R. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where an underground service raceway enters a building or structure.
3. Where otherwise required by NFPA 70.

S. Comply with manufacturer's written instructions for solvent welding RNC and fittings.

T. Expansion-Joint Fittings:

1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F and that has straight-run length that exceeds 25 feet. Install in each run of aboveground RMC and EMT conduit that is located where environmental temperature change may exceed 100 deg F and that has straight-run length that exceeds 100 feet.
2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:

a. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.

b. Attics: 135 deg F temperature change.

3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.
4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

U. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches of flexible conduit for recessed and semirecessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations subject to severe physical damage.
2. Use LFMC in damp or wet locations not subject to severe physical damage.
3. Healthcare facilities cable may be utilized in place of FMC as permitted in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

V. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to [**center**] [**top**] [**bottom**] of box unless otherwise indicated.

W. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.

X. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

Y. Locate boxes so that cover or plate will not span different building finishes.

Z. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

AA. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

BB. Set metal floor boxes level and flush with finished floor surface.

CC. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.4 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 260533
03/07/11

February 28, 2011

SECTION 260544 - SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
2. Sleeve-seal systems.
3. Sleeve-seal fittings.
4. Grout.
5. Silicone sealants.

B. Related Requirements:

1. Section 078413 "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Wall Sleeves:

1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

C. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

D. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

E. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

F. Sleeves for Rectangular Openings:

1. Material: Galvanized sheet steel.
2. Minimum Metal Thickness:

a. For sleeve cross-section rectangle perimeter less than 50 inches and with no side larger than 16 inches, thickness shall be 0.052 inch.
b. For sleeve cross-section rectangle perimeter equal to, or more than 50 inches or more and one or more sides equal to, or more than 16 inches, thickness shall be 0.138 inch.

2.2 SLEEVE-SEAL SYSTEMS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings product by one of the following:

a. Advance Products & Systems, Inc.
b. CALPICO, Inc.
c. Metraflex Company (The).
d. Pipeline Seal and Insulator, Inc.
e. Proco Products, Inc.

2. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
3. Pressure Plates: Plastic.
4. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following:

a. Presealed Systems.

2.4 GROUT

A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.

B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.5 SILICONE SEALANTS

A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.

B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

A. Comply with NECA 1.

B. Comply with NEMA VE 2 for cable tray and cable penetrations.

C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:

1. Interior Penetrations of Non-Fire-Rated Walls and Floors:

a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 079200 "Joint Sealants."
b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.

2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
3. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed or unless seismic criteria require different clearance.
4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches above finished floor level. Install sleeves during erection of floors.

D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:

1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.

E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel or cast-iron pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.

B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.3 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

3.4 SLEEVE INSTALLATION FOR FIRE-RATED ELECTRICAL PENETRATIONS

A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Section 078413 "Penetration Firestopping."

B. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

C. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials.

END OF SECTION 260544
03/07/11

February 28, 2011

SECTION 260548 - VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 INTENT

A. It is the intent of this Specification to provide the basis of design for the vibration isolation, accommodation of differential seismic motion across building expansion/seismic joints, and seismic restraints on all systems specified under Divisions 26, 27 and 28. The term "SYSTEMS" applies to all equipment and raceways on the project. The following Specification provides a requirement for the attachment of all non-structural components to the structure.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.3 SUMMARY

A. This Section includes the following:

1. Channel support systems.
2. Anchorage bushings and washers.
3. Building expansion/seismic joint accommodation equipment.

B. Related Sections include the following:

1. Section 260529 "Hangers and Supports for Electrical Systems" for commonly used electrical supports and installation requirements.

1.4 DEFINITIONS

A. The IBC: International Building Code.

B. ICC-ES: ICC-Evaluation Service.

1.5 PERFORMANCE REQUIREMENTS

A. Comply with seismic restraint requirements in accordance with state and local codes and ordinances and the authority having jurisdiction.

B. Determine the following, but not limited to, design criteria conditions for the project location required in accordance with all state and local codes and ordinances. Include criteria with code references in shop drawing submittal.

C. Seismic-Restraint Loading:

1. Site Class as Defined in the IBC: [**A**] [**B**] [**C**] [**D**] [**E**] [**F**].
2. Assigned Building Classification Category as Defined in the IBC: [**I**] [**II**] [**III**] **[IV**].

   a. Component Importance Factor: 1.5 for life safety systems, components with hazardous content and components required for continued operation in Seismic Use Group III structures; 1.0 for all other components.
   b. Component Response Modification Factor: As determined by the Seismic Engineer.
   c. Component Amplification Factor: As determined by the Seismic Engineer.

3. Design Spectral Response Acceleration at Short Periods (0.2 Second): <**Insert percent**>.
4. Design Spectral Response Acceleration at 1.0-Second Period: <**Insert percent**>.
5. Seismic Design Category: A; Electrical systems are exempt from requirements for seismic bracing. B; Electrical systems are exempt from requirements for seismic bracing.

D. Determine and design system accommodation of differential seismic motion across building expansion/seismic joints. Motion to be accommodated shall be determined by the Architect and the Structural Engineer of Record. Accommodation can be designed by either of the following suitable for project conditions and layout:

1. Design systems to have inherent flexibility required to accept the differential motion using pipe loops and/or offsets.
2. Design system arrangement to localize area at which differential motion will occur by anchoring to each building and provide a set of expansion joints arranged to accept the motion and forces determined.

1.6 ACTION SUBMITTALS

A. Product Data: For the following:

1. Include detailed type, style, materials, rated load, rated deflection, and overload capacity for each vibration isolation device.

B. Delegated-Design Submittal: For vibration isolation details indicated to comply with performance requirements and design criteria, including analysis data.

1. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation, forces required to select vibration isolators and expansion/seismic joint accommodation.

   a. Coordinate design calculations with wind-load calculations required for equipment mounted outdoors. Comply with requirements in other electrical Sections for equipment mounted outdoors.

2. Indicate materials and dimensions and identify hardware, including attachment and anchorage devices.
3. Field-fabricated supports.

4. Building Expansion/Seismic Joint Accommodation Details: Detail fabrication and attachment of seismic restraints and expansion compensators. Show piping configuration including expansion compensators and piping lengths. Show anchorage details and indicate strength, quantity,

diameter, and depth of penetration of anchors. Indicate direction and value of forces transmitted to piping and structure during seismic event and thermal expansion.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Welding certificates.

C. Qualification Data: For firms and persons specified in "Quality Assurance" article.

D. Field quality-control test reports.

1.8 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Comply with NFPA 70.

1.9 COORDINATION

A. Coordinate size and location of concrete bases with vibration isolation requirements. Cast anchor-bolt inserts into base. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. Coordinate design of vibration isolation design with expansion compensation systems.

C. Coordinate and design all attachments with building structural system.

D. Coordinate and design all duct and pipe accommodations for building expansion/seismic joint crossovers.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following:

1. Kinetics Noise Control.
2. Mason Industries.
3. Vibration Eliminator Co., Inc.
4. Vibration Mountings & Controls, Inc.

B. Elastomeric Pads: Arrange in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.

1. Resilient Material: Oil- and water-resistant neoprene. Standard neoprene for indoor applications or where pad is not exposed to elements. Bridge-bearing neoprene, complying with AASHTO M 251 for exterior applications or where pad is exposed to elements.

C. BVH Note: BVH standard is to exclude all mounts that are not seismic. The incremental cost of seismic mounts is small compared to the total project, and this minimizes the risk of specifying a non-seismic product where it should have been seismic. Spring Isolators: Freestanding, laterally stable, open-spring isolators.

1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
5. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch- thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 500 psig.
6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

D. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic or limit-stop restraint.

1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to weight being removed; factory-drilled baseplate bonded to 1/4-inch- thick, neoprene or rubber isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
2. Restraint: Seismic or limit-stop as required for equipment and authorities having jurisdiction.
3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
7. Shall have OSHPD or approved anchorage ratings.

E. Elastomeric Hangers: Single or double-deflection type, fitted with molded, oil-resistant elastomeric isolator elements bonded to steel housings with threaded connections for hanger rods and vertical limit stop. Color-code or otherwise identify to indicate capacity range.

F. Spring Hangers with Vertical-Limit Stop: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression and with a vertical-limit stop.

1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
7. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
8. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

2.2 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION DEVICES

A. Flexible-Raceways and Loops: Refer to Section 260533 "Raceways and Boxes for Electrical Systems" for product requirements.

1. Designed and installed in arrangement to accept motion and forces associated with seismic event and thermal expansion.

2.3 FACTORY FINISHES

A. Finish: Manufacturer's standard prime-coat finish ready for field painting.

B. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.

1. Powder coating on springs and housings.
2. All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.
3. Baked enamel or powder coat for metal components on isolators for interior use.
4. Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation control devices and building expansion/seismic joint accommodation for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Multiple Raceways or Cables: Secure raceways and cables to trapeze member with clamps approved for application by an evaluation service member of ICC-ES or an independent agency acceptable to authorities having jurisdiction.

3.3 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in runs of raceways, cables, wireways, cable trays, and busways where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where they terminate with connection to equipment that is anchored to a different structural element from the one supporting them as they approach equipment.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
5. Test to 90 percent of rated proof load of device.
6. Measure isolator restraint clearance.
7. Measure isolator deflection.
8. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.

C. Remove and replace malfunctioning units and retest as specified above.

D. Prepare test and inspection reports.

3.5 ADJUSTING

A. Adjust isolators after isolated equipment is at operating weight.

B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

C. Adjust active height of spring isolators.

D. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION 260548
03/07/11

February 28, 2011

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Identification for raceways.
2. Identification of power and control cables.
3. Identification for conductors.
4. Underground-line warning tape.
5. Warning labels and signs.
6. Instruction signs.
7. Equipment identification labels.
8. Miscellaneous identification products.

1.3 ACTION SUBMITTALS

A. Product Data: For each electrical identification product indicated.

B. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

1.4 QUALITY ASSURANCE

A. Comply with ANSI A13.1.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.5 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams,

and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with location of access panels and doors.

D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 POWER RACEWAY IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.

B. Colors for Raceways Carrying Circuits at 600 V or Less:

1. Black letters on an orange field.
2. Legend: Indicate voltage and system or service type.

C. Snap-Around Labels for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.

2.2 ARMORED AND METAL-CLAD CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Colors for Raceways Carrying Circuits at 600 V and Less:

1. Black letters on an orange field.
2. Legend: Indicate voltage and system or service type.

C. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

2.3 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

2.4 CONDUCTOR IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.

B. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

C. Write-On Tags: Polyester tag, 0.010 inch thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.

2.5 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

C. Warning label and sign shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

2.6 INSTRUCTION SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. inches and 1/8 inch thick for larger sizes.

1. Engraved legend with black letters on white face.
2. Punched or drilled for mechanical fasteners.
3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.7 EQUIPMENT IDENTIFICATION LABELS

A. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch.

B. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 2 inches.

2.8 CABLE TIES

A. General-Purpose Cable Ties: Fungus inert, self extinguishing, one piece, self locking, Type 6/6 nylon.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F, According to ASTM D 638: 12,000 psi.
3. Temperature Range: Minus 40 to plus 185 deg F.

4. Color: Black except where used for color-coding.

B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self extinguishing, one piece, self locking, Type 6/6 nylon.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F, According to ASTM D 638: 12,000 psi.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black.

C. Plenum-Rated Cable Ties: Self extinguishing, UV stabilized, one piece, self locking.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F, According to ASTM D 638: 7000 psi.
3. UL 94 Flame Rating: 94V-0.
4. Temperature Range: Minus 50 to plus 284 deg F.
5. Color: Black.

2.9 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Verify identity of each item before installing identification products.

B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

E. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

F. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

G. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.

H. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:

1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.

I. Painted Identification: Comply with requirements in painting Sections for surface preparation and paint application.

3.2 IDENTIFICATION SCHEDULE

A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A, and 120 V to ground: Identify with self-adhesive vinyl label. Install labels at 10-foot maximum intervals.

B. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage.

C. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.

1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder and branch-circuit conductors.

a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.
b. Colors for 208/120-V Circuits:

1) Phase A: Black.
2) Phase B: Red.
3) Phase C: Blue.

c. Colors for 480/277-V Circuits:

1) Phase A: Brown.
2) Phase B: Orange.
3) Phase C: Yellow.

d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

D. Power-Circuit Conductor Identification, More than 600 V: For conductors in vaults, pull and junction boxes, manholes, and handholes, use [**write-on tags**] [**nonmetallic plastic tag holder with adhesive-backed phase tags, and a separate tag with the circuit designation**].

E. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.

F. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source.

G. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.

H. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.
1. Install underground-line warning tape for both direct-buried cables and cables in raceway.

I. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

J. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels.

1. Comply with 29 CFR 1910.145.
2. Identify system voltage with black letters on an orange background.
3. Apply to exterior of door, cover, or other access.
4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:

    a. Power transfer switches.
    b. Controls with external control power connections.

5. Color code all junction boxes and associated cover plates serving emergency equipment with red paint.

K. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

L. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch- high letters for emergency instructions at equipment used for power transfer and load shedding.

M. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:

    a. Indoor Equipment: Self-adhesive, engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch-high label; where two lines of text are required, use labels 2 inches high.
    b. Outdoor Equipment: Stenciled legend 4 inches high.
    c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
    d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

2. Equipment to Be Labeled:

   a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be [**self-adhesive, engraved**] [**engraved**], laminated acrylic or melamine label.
   b. Enclosures and electrical cabinets.
   c. Access doors and panels for concealed electrical items.
   d. Enclosed switches.
   e. Enclosed circuit breakers.
   f. Enclosed controllers.
   g. Variable-speed controllers.
   h. Push-button stations.
   i. Contactors.
   j. Remote-controlled switches, dimmer modules, and control devices.
   k. Monitoring and control equipment.

END OF SECTION 260553
03/07/11

February 28, 2011

SECTION 262416 - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Submittals will not be reviewed or accepted without a protective device coordination study report.

1.2 SUMMARY

A. Section Includes:

1. Lighting and appliance branch-circuit panelboards.

1.3 DEFINITIONS

A. SVR: Suppressed voltage rating.

B. TVSS: Transient voltage surge suppressor.

1.4 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Panelboards shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

1.5 ACTION SUBMITTALS

A. Product Data: For each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
2. Detail enclosure types and details for types other than NEMA 250, Type 1.
3. Detail bus configuration, current, and voltage ratings.
4. Short-circuit current rating of panelboards and overcurrent protective devices.
5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

6. Include wiring diagrams for power, signal, and control wiring.
7. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Seismic Qualification Certificates: Submit certification that panelboards, overcurrent protective devices, accessories, and components will withstand seismic forces defined in Section 260548 "Vibration and Seismic Controls for Electrical Systems." Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
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.

C. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.8 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Keys: Two spares for each type of panelboard cabinet lock.
2. Circuit Breakers Including GFCI and Ground Fault Equipment Protection (GFEP) Types: Two spares for each panelboard.
3. Circuit Breakers: Equal to 5 percent of all 20 A, 1-phase active circuit breakers over and above all spares listed in Panelboard Schedule.

1.9 QUALITY ASSURANCE

A. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Comply with NEMA PB 1.

E. Comply with NFPA 70.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.

B. Handle and prepare panelboards for installation according to NEMA PB 1.

1.11 PROJECT CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:

    a. Altitude: Not exceeding 6600 feet.

B. Service Conditions: NEMA PB 1, usual service conditions, as follows:

1. Ambient temperatures within limits specified.
2. Altitude not exceeding 6600 feet.

C. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Architect, Construction Manager and Owner no fewer than five days in advance of proposed interruption of electric service.
2. Do not proceed with interruption of electric service without Architect's, Construction Manager's and Owner's written permission.
3. Comply with NFPA 70E.

1.12 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping,

encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

1.13 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Section 260548 "Vibration and Seismic Controls for Electrical Systems."

B. Enclosures: Flush- and surface-mounted cabinets.

1. Rated for environmental conditions at installed location.

a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
b. Outdoor Locations: NEMA 250, Type 3R.
c. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.

2. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
3. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.
4. Finishes:

a. Panels and Trim: Steel and galvanized steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
b. Back Boxes: Galvanized steel.

5. Directory Card: Inside panelboard door, mounted in [**transparent card holder**] [**metal frame with transparent protective cover**].

C. Incoming Mains Location: Top or bottom as directed by Contractor.

D. Phase, Neutral, and Ground Buses:

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
3. Isolated Ground Bus: Adequate for branch-circuit isolated ground conductors; insulated from box.

4. Extra-Capacity Neutral Bus: Neutral bus rated 200 percent of phase bus and UL listed as suitable for nonlinear loads.

E. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Main and Neutral Lugs: Mechanical type.
3. Ground Lugs and Bus-Configured Terminators: Mechanical type.
4. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
5. Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
6. Gutter-Tap Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
7. Extra-Capacity Neutral Lugs: Rated 200 percent of phase lugs mounted on extra-capacity neutral bus.

F. Service Equipment Label: NRTL labeled for use as service equipment for panelboards or load centers with one or more main service disconnecting and overcurrent protective devices.

G. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

H. Panelboard Short-Circuit Current Rating:

1. Fully rated to interrupt symmetrical short-circuit current available at terminals.
2. Panelboards containing main breakers with instantaneous off function or main lugs only must be rated to withstand a short-circuit for a minimum of 30 cycles.

2.2 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

C. Mains: Circuit breaker or lugs only.

D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

E. Contactors in Main Bus: NEMA ICS 2, Class A, [**electrically**] [**mechanically**] held, general-purpose controller, with same short-circuit interrupting rating as panelboard.

1. Internal Control-Power Source: Control-power transformer, with fused primary and secondary terminals, connected to main bus ahead of contactor connection.
2. External Control-Power Source: [**120-V branch circuit**] [**24-V control circuit**].

F. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.3 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:

    a. Instantaneous trip.
    b. Long- and short-time pickup levels.
    c. Long- and short-time time adjustments.

3. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
4. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
5. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
6. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:

    a. Standard frame sizes, trip ratings, and number of poles.
    b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
    c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
    d. Ground-Fault Protection: [**Integrally mounted**] [**Remote-mounted**] relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
    e. Communication Capability: [**Circuit-breaker-mounted**] [**Universal-mounted**] [**Integral**] [**Din-rail-mounted**] communication module with functions and features compatible with power monitoring and control system specified in Section 260913 "Electrical Power Monitoring and Control."
    f. Shunt Trip: [**120**] [**24**]-V trip coil energized from separate circuit, set to trip at [**55**] [**75**] percent of rated voltage.
    g. Auxiliary Contacts: [**One SPDT switch**] [**Two SPDT switches**] with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts and "b" contacts operate in reverse of circuit-breaker contacts.
    h. Multipole units enclosed in a single housing or factory assembled to operate as a single unit.

i. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.
j. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

C. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.

1. Fuses, and Spare-Fuse Cabinet: Comply with requirements specified in Section 262813 "Fuses."
2. Fused Switch Features and Accessories: Standard ampere ratings and number of poles.
3. Auxiliary Contacts: One normally open and normally closed contact(s) that operate with switch handle operation.

2.4 ACCESSORY COMPONENTS AND FEATURES

A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

B. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

PART 3 - EXECUTION

3.1 CIRCUIT BREAKER APPLICATION

A. Install types of circuit breakers within panelboards as follows:

1. Thermal-Magnetic: OCPDs under 225 A.
2. Electronic Trip Unit: OCPDs 225 A and larger and for all elevators.
3. Type SWD (Switching Duty): OCPDs serving lighting branch circuits without local switches.
4. Type HACR (Heating, Air Conditioning and Refrigeration): OCPDs serving motor feeder and branch circuits requiring HACR devices.
5. Type HID (High Intensity Discharge): OCPDs serving HID luminaire branch circuits.
6. Type HM (High Magnetic): OCPDs serving corridor receptacle branch circuits. Provide a minimum of three in each 208Y/120V panel.
7. Type AF (Arc-Fault): OCPDs serving dwelling unit bedroom lighting and power branch circuits.
8. Type GF 5 mA (Ground-Fault): OCPDs serving receptacles, except as listed below, or where GF receptacles are utilized.
9. Type GFEP 30 mA (Ground-Fault): OCPDs serving electric heating cable systems, sump pumps, and laboratory bench power branch circuits.
10. Shunt-Trip: OCPDs serving electric devices under kitchen hood and elevator shutdown control.
11. GF breakers for all circuits serving devices within 6 ft. of sinks, except where GF receptacles are utilized.

3.2 EXAMINATION

A. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.

B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.

C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

A. Install panelboards and accessories according to NEMA PB 1.1.

B. Comply with mounting and anchoring requirements specified in Section 260548 "Vibration and Seismic Controls for Electrical Systems."

C. Mount panelboard so that centerline of top device is no higher than 79 inches above finished floor.

D. Mount top of trim 90 inches above finished floor unless otherwise indicated.

E. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

F. Install overcurrent protective devices and controllers not already factory installed.

1. Set field-adjustable, circuit-breaker trip ranges.

G. Install filler plates in unused spaces.

H. Stub four 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch empty conduits into raised floor space or below slab not on grade.

I. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.

J. Comply with NECA 1.

3.4 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Section 260553 "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable. Identify circuit breakers for future use as "SPARE." Turn all spare circuit breakers to the "OFF" position.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

C. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Perform the following infrared scan tests and inspections and prepare reports:

a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each panelboard. Remove front panels so joints and connections are accessible to portable scanner.
b. Instruments and Equipment:

1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

D. Panelboards will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.6 ADJUSTING

A. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as specified in Section 260573 "Overcurrent Protective Device Coordination Study."

C. Insert Class CC fuses into fused panelboard fuse holders only after panelboard has been tested for insulation integrity.

D. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.

1. Measure as directed during period of normal system loading.

2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

3.7 PROTECTION

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION 262416
03/07/11

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SECTION 262813 - FUSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Cartridge fuses rated 600-V ac and less for use in control circuits, enclosed switches and enclosed controllers.
2. Spare-fuse cabinets.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material, dimensions, descriptions of individual components, and finishes for spare-fuse cabinets. Include the following for each fuse type indicated:

1. Ambient Temperature Adjustment Information: If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses with adjusted ratings.

a. For each fuse having adjusted ratings, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.
b. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.

2. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
3. Current-limitation curves for fuses with current-limiting characteristics.
4. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse.
5. Coordination charts and tables and related data.
6. Fuse sizes for elevator feeders and elevator disconnect switches.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. Ambient temperature adjustment information.
2. Current-limitation curves for fuses with current-limiting characteristics.

3. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse.
4. Coordination charts and tables and related data.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: Equal to 20 percent of quantity installed for each size and type, but no fewer than six of each size and type.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain fuses, for use within a specific product or circuit, from single source from single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NEMA FU 1 for cartridge fuses.

D. Comply with NFPA 70.

1.7 PROJECT CONDITIONS

A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F or more than 100 deg F, apply manufacturer's ambient temperature adjustment factors to fuse ratings.

1.8 COORDINATION

A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following:

1. Cooper Bussmann, Inc.
2. Edison Fuse, Inc.
3. Ferraz Shawmut, Inc.
4. Littelfuse, Inc.

2.2 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

2.3 SPARE-FUSE CABINET

A. Characteristics: Wall-mounted steel unit with full-length, recessed piano-hinged door and key-coded cam lock and pull.

1. Size: Adequate for storage of spare fuses specified with 15 percent spare capacity minimum.
2. Finish: Gray, baked enamel.
3. Identification: "SPARE FUSES" in 1-1/2-inch- high letters on exterior of door.
4. Fuse Pullers: For each size of fuse, where applicable and available, from fuse manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.

B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.

C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FUSE APPLICATIONS

A. Cartridge Fuses:

1. Feeders: [**Class L, time delay**] [**Class RK5, time delay**].
2. Motor Branch Circuits: Class RK1, time delay.
3. Other Branch Circuits: Class RK5, time delay.
4. Control Circuits: Class CC, time delay.

3.3 INSTALLATION

A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

B. Install spare-fuse cabinet in main electrical room.

3.4 IDENTIFICATION

A. Install labels complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems" and indicating fuse replacement information on inside door of each fused switch and adjacent to each fuse block, socket, and holder.

END OF SECTION 262813
03/07/11

February 28, 2011

SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Fusible switches.
2. Nonfusible switches.
3. Receptacle switches.
4. Enclosures.

1.3 DEFINITIONS

A. NC: Normally closed.

B. NO: Normally open.

C. SPDT: Single pole, double throw.

1.4 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Enclosed switches and circuit breakers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

1.5 ACTION SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

1. Enclosure types and details for types other than NEMA 250, Type 1.
2. Current and voltage ratings.
3. Short-circuit current ratings (interrupting and withstand, as appropriate).
4. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.

5. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.

1. Wiring Diagrams: For power, signal, and control wiring.

1.6 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For enclosed switches and circuit breakers, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
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.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
2. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

1.8 QUALITY ASSURANCE

A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.

B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Comply with NFPA 70.

1.9 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
2. Altitude: Not exceeding 6600 feet.

B. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Engineer, Construction Manager and Owner no fewer than seven days in advance of proposed interruption of electric service.
2. Indicate method of providing temporary electric service.
3. Do not proceed with interruption of electric service without Engineer’s, Construction Manager's, Owner's written permission.
4. Comply with NFPA 70E.

1.10 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 FUSIBLE SWITCHES

A. Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Type GD, General Duty, Single Throw, 240-V ac, 800 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with cartridge fuse interiors to accommodate indicated fuses, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

C. Type HD, Heavy Duty, Single Throw, 240 or 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

D. Type HD, Heavy Duty, Double Throw, 240 or 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

E. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
4. Auxiliary Contact Kit: One NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
5. Lugs: Mechanical type, suitable for number, size, and conductor material.
6. Service-Rated Switches: Labeled for use as service equipment.
7. Accessory Control Power Voltage: Remote mounted and powered.

2.2 NONFUSIBLE SWITCHES

A. Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Type GD, General Duty, Single Throw, 600 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

C. Type HD, Heavy Duty, Single Throw, 240 or 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

D. Type HD, Heavy Duty, Six Pole, Single Throw, 240 or 600-V ac, 200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

E. Type HD, Heavy Duty, Double Throw, 240 or 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

F. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Isolated Ground Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
4. Auxiliary Contact Kit: Two NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
5. Hookstick Handle: Allows use of a hookstick to operate the handle.
6. Lugs: Mechanical type, suitable for number, size, and conductor material.
7. Accessory Control Power Voltage: Remote mounted and powered.

2.3 RECEPTACLE SWITCHES

A. Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Type HD, Heavy-Duty, Single-Throw Fusible Switch: 240 or 600-V ac, [**30**] [**60**] [**100**] A; UL 98 and NEMA KS 1; horsepower rated, with clips or bolt pads to accommodate [**specified**] [**indicated**] fuses; lockable handle with capability to accept three padlocks; interlocked with cover in closed position.

C. Type HD, Heavy-Duty, Single-Throw Nonfusible Switch: 240 or 600-V ac, [**30**] [**60**] [**100**] A; UL 98 and NEMA KS 1; horsepower rated, lockable handle with capability to accept three padlocks; interlocked with cover in closed position.

D. Interlocking Linkage: Provided between the receptacle and switch mechanism to prevent inserting or removing plug while switch is in the on position, inserting any plug other than specified, and turning switch on if an incorrect plug is inserted or correct plug has not been fully inserted into the receptacle.

E. Receptacle: Polarized, three-phase, four-wire receptacle (fourth wire connected to enclosure ground lug).

1. Receptacle Manufacturer and Catalog Number: <**Insert manufacturer and catalog number**>.

2.4 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
2. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.
3. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

B. Comply with mounting and anchoring requirements specified in Section 260548 "Vibration and Seismic Controls for Electrical Systems."

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

D. Install fuses in fusible devices.

E. Comply with NECA 1.

3.3 IDENTIFICATION

A. Comply with requirements in Section 260553 "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Acceptance Testing Preparation:

1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

C. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Perform the following infrared scan tests and inspections and prepare reports:

    a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Remove front panels so joints and connections are accessible to portable scanner.
    b. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

D. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

END OF SECTION 262816
03/07/11

February 28, 2011

SECTION 262923 - VARIABLE-FREQUENCY MOTOR CONTROLLERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes separately enclosed, pre-assembled, combination VFCs, rated 600 V and less, for speed control of three-phase, squirrel-cage induction motors. All VFDs for indoor mounted applications (air handling units, pumps, exhaust fans, cooling towers) shall be products of the same manufacturer and provided by the mechanical contractor.

B. Related Sections:

1. Section 262419 "Motor-Control Centers" for VFCs installed in motor-control centers.

1.3 DEFINITIONS

A. BAS: Building automation system.

B. CE: Conformite Europeene (European Compliance).

C. CPT: Control power transformer.

D. EMI: Electromagnetic interference.

E. IGBT: Insulated-gate bipolar transistor.

F. LAN: Local area network.

G. LED: Light-emitting diode.

H. MCP: Motor-circuit protector.

I. NC: Normally closed.

J. NO: Normally open.

K. OCPD: Overcurrent protective device.

L. PCC: Point of common coupling.

M. PID: Control action, proportional plus integral plus derivative.

N. PWM: Pulse-width modulated.

O. RFI: Radio-frequency interference.

P. TDD: Total demand (harmonic current) distortion.

Q. THD(V): Total harmonic voltage demand.

R. VFC: Variable-frequency motor controller.

1.4 PERFORMANCE REQUIREMENTS

A. Seismic Performance: VFCs shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

1.5 ACTION SUBMITTALS

A. Product Data: For each type and rating of VFC indicated. Include features, performance, electrical ratings, operating characteristics, shipping and operating weights, and furnished specialties and accessories.

1.6 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Floor plans, drawn to scale, showing dimensioned layout, required working clearances, and required area above and around VFCs. Show VFC layout and relationships between electrical components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate field measurements.

B. Qualification Data: For qualified testing agency.

C. Seismic Qualification Certificates: For VFCs, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
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.

D. Product Certificates: For each VFC, from manufacturer.

E. Harmonic Analysis Study and Report: Comply with IEEE 399 and NETA Acceptance Testing Specification; identify the effects of nonlinear loads and their associated harmonic contributions on the voltages and currents throughout the electrical system. Analyze possible operating scenarios, including recommendations for VFC input filtering to limit TDD and THD(V) at the defined PCC to specified levels.

F. Source quality-control reports.

G. Field quality-control reports.

H. Load-Current and Overload-Relay Heater List: Compile after motors have been installed, and arrange to demonstrate that selection of heaters suits actual motor nameplate, full-load currents.

I. Load-Current and List of Settings of Adjustable Overload Relays: Compile after motors have been installed and arrange to demonstrate that switch settings for motor-running overload protection suit actual motors to be protected.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For VFCs to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting thermal-magnetic circuit breaker and MCP trip settings.
2. Manufacturer's written instructions for setting field-adjustable overload relays.
3. Manufacturer's written instructions for testing, adjusting, and reprogramming microprocessor control modules.
4. Manufacturer's written instructions for setting field-adjustable timers, controls, and status and alarm points.

1.8 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Power Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
2. Control Power Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.
3. Indicating Lights: Two of each type and color installed.
4. Auxiliary Contacts: Furnish one spare(s) for each size and type of magnetic controller installed.
5. Power Contacts: Furnish three spares for each size and type of magnetic contactor installed.

1.9 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NFPA 70.

D. IEEE Compliance: Fabricate and test VFC according to IEEE 344 to withstand seismic forces defined in Section 260548 "Vibration and Seismic Controls for Electrical Systems."

1.10 DELIVERY, STORAGE, AND HANDLING

A. If stored in space that is not permanently enclosed and air conditioned, remove loose packing and flammable materials from inside controllers and [**install temporary electric heating, with at least 250 W per controller**] [**connect factory-installed space heaters to temporary electrical service**].

1.11 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation, capable of driving full load without derating, under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than 14 deg F and not exceeding 104 deg F.
2. Ambient Storage Temperature: Not less than minus 4 deg F and not exceeding 140 deg F
3. Humidity: Less than 95 percent (noncondensing).
4. Altitude: Not exceeding 3300 feet.

B. Interruption of Existing Electrical Systems: Do not interrupt electrical systems in facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:

1. Notify Engineer, Construction Manager and Owner no fewer than two days in advance of proposed interruption of electrical systems.
2. Indicate method of providing temporary electrical service.
3. Do not proceed with interruption of electrical systems without Engineer's, Construction Manager's and Owner's written permission.
4. Comply with NFPA 70E.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for VFCs, including clearances between VFCs, and adjacent surfaces and other items.

1.12 COORDINATION

A. Coordinate features of motors, load characteristics, installed units, and accessory devices to be compatible with the following:

1. Torque, speed, and horsepower requirements of the load.
2. Ratings and characteristics of supply circuit and required control sequence.
3. Ambient and environmental conditions of installation location.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases.

C. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

1.13 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace VFCs that fail in materials or workmanship within specified warranty period. Warranty to include parts, labor and travel time.

1. Warranty Period: Two years from date of start-up, not-to-exceed 30 months from date of shipment.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following:

1. ABB.
2. Danfoss Inc.; Danfoss Drives Div.
3. Yaskawa Electric America, Inc; Drives Division.

B. General Requirements for VFCs: Comply with NEMA ICS 7, NEMA ICS 61800-2, and UL 508C.

C. Application: Constant torque or variable torque depending on application.

D. VFC Description: Variable-frequency power converter (rectifier, dc bus, and IGBT, PWM inverter) factory packaged in an enclosure, with integral disconnecting means and overcurrent and overload protection; listed and labeled by an NRTL as a complete unit; arranged to provide self-protection, protection, and variable-speed control of one or more three-phase induction motors by adjusting output voltage and frequency.

1. Units suitable for operation of NEMA MG 1, Design A and Design B motors as defined by NEMA MG 1, Section IV, Part 30, "Application Considerations for Constant Speed Motors Used on a Sinusoidal Bus with Harmonic Content and General Purpose Motors Used with Adjustable-Voltage or Adjustable-Frequency Controls or Both."
2. Units suitable for operation of inverter-duty motors as defined by NEMA MG 1, Section IV, Part 31, "Definite-Purpose Inverter-Fed Polyphase Motors."
3. Listed and labeled for integrated short-circuit current (withstand) rating by an NRTL acceptable to authorities having jurisdiction.

E. Design and Rating: Match load type, such as fans, blowers, and pumps; and type of connection used between motor and load such as direct or through a power-transmission connection.

F. Output Rating: Three-phase; 10 to 60 Hz, with voltage proportional to frequency throughout voltage range; maximum voltage equals input voltage.

G. Unit Operating Requirements:

1. Input AC Voltage Tolerance: Plus 10 and minus 15 percent of VFC input voltage rating.
2. Input AC Voltage Unbalance: Not exceeding 5 percent.
3. Input Frequency Tolerance: Plus or minus 3 percent of VFC frequency rating.
4. Minimum Efficiency: 97 percent at 60 Hz, full load.
5. Minimum Displacement Primary-Side Power Factor: 98 percent under any load or speed condition.
6. Minimum Short-Circuit Current (Withstand) Rating: 100 kAIC.
7. Ambient Temperature Rating: Not less than 32 deg F and not exceeding 104 deg F.
8. Ambient Storage Temperature Rating: Not less than minus 4 deg F and not exceeding 140 deg F
9. Humidity Rating: Less than 95 percent (noncondensing).
10. Altitude Rating: Not exceeding 3300 feet.

11. Vibration Withstand: Comply with IEC 60068-2-6.
12. Overload Capability: 1.1 times the base load current for (1 min./10 min.); minimum of 1.35 times the base load current (2 sec./1 min.).
13. Starting Torque: Minimum 100 percent of rated torque from 3 to 60 Hz.
14. Speed Regulation: Plus or minus 5 percent.
15. Output Carrier Frequency: Selectable; 0.5 to 8 kHz to minimize harmonically induced noise or vibration.
16. Stop Modes: Programmable; includes fast, free-wheel, and dc injection braking.

H. Inverter Logic: Microprocessor based, [**16**] [**32**] bit, isolated from all power circuits.

I. Isolated Control Interface: Allows VFCs to follow remote-control signal over a minimum 40:1 speed range.

1. Signal: Electrical.
2. Signal: Pneumatic.

J. Internal Adjustability Capabilities:

1. Minimum Speed: 5 to 25 percent of maximum rpm.
2. Maximum Speed: 80 to 100 percent of maximum rpm.
3. Acceleration: 0.1 to 1800 seconds.
4. Deceleration: 0.1 to 1800 seconds.
5. Current Limit: 30 to minimum of 150 percent of maximum rating.

K. Self-Protection and Reliability Features:

1. Input transient protection by means of surge suppressors to provide three-phase protection against damage from supply voltage surges 10 percent or more above nominal line voltage.
2. Loss of Input Signal Protection: Selectable response strategy, including speed default to a percent of the most recent speed, a preset speed, or stop; with alarm.
3. Under- and overvoltage trips.
4. Inverter overcurrent trips.
5. VFC and Motor Overload/Overtemperature Protection: Microprocessor-based thermal protection system for monitoring VFCs and motor thermal characteristics, and for providing VFC overtemperature and motor overload alarm and trip; settings selectable via the keypad; NRTL approved.
6. Critical frequency rejection, with three selectable, adjustable deadbands.
7. Instantaneous line-to-line and line-to-ground overcurrent trips.
8. Loss-of-phase protection.
9. Reverse-phase protection.
10. Short-circuit protection.
11. Motor overtemperature fault.

L. Automatic Reset/Restart: Attempt three restarts after drive fault or on return of power after an interruption and before shutting down for manual reset or fault correction; adjustable delay time between restart attempts.

M. Power-Interruption Protection: To prevent motor from re-energizing after a power interruption until motor has stopped, unless "Bidirectional Autospeed Search" feature is available and engaged.

N. Bidirectional Autospeed Search: Capable of starting VFC into rotating loads spinning in either direction and returning motor to set speed in proper direction, without causing damage to drive, motor, or load.

O. Torque Boost: Automatically varies starting and continuous torque to at least 1.5 times the minimum torque to ensure high-starting torque and increased torque at slow speeds.

P. Motor Temperature Compensation at Slow Speeds: Adjustable current fall-back based on output frequency for temperature protection of self-cooled, fan-ventilated motors at slow speeds.

Q. Integral Input Disconnecting Means and OCPD: NEMA AB 1, instantaneous-trip circuit breaker with pad-lockable, door-mounted handle mechanism.

1. Disconnect Rating for VFCs without Bypass Controller: Not less than 115 percent of VFC input current rating.
2. Disconnect Rating for VFCs with Bypass Controller: Not less than 115 percent of NFPA 70 motor full-load current rating or VFC input current rating, whichever is larger.

2.2 CONTROLS AND INDICATION

A. Status Lights: Door-mounted LED indicators displaying the following conditions:

1. Power on.
2. Run.
3. Overvoltage.
4. Line fault.
5. Overcurrent.
6. External fault.

B. Panel-Mounted Operator Station: Manufacturer's standard front-accessible, sealed keypad and plain-English language digital display; allows complete programming, program copying, operating, monitoring, and diagnostic capability.

1. Keypad: In addition to required programming and control keys, include keys for HAND, OFF, and AUTO modes.
2. Security Access: Provide electronic security access to controls through identification and password with at least three levels of access: View only; view and operate; and view, operate, and service.

a. Control Authority: Supports at least four conditions: Off, local manual control at VFC, local automatic control at VFC, and automatic control through a remote source.

C. Historical Logging Information and Displays:

1. Real-time clock with current time and date.
2. Running log of total power versus time.
3. Total run time.
4. Fault log, maintaining last three faults with time and date stamp for each.

D. Indicating Devices: Digital displayand additional readout devices as required, mounted flush in VFC door and connected to display VFC parameters including, but not limited to:

1. Output frequency (Hz).
2. Motor speed (rpm).
3. Motor status (running, stop, fault).
4. Motor current (amperes).
5. Motor torque (percent).

6. Fault or alarming status (code).
7. PID feedback signal (percent).
8. DC-link voltage (V dc).
9. Set point frequency (Hz).
10. Motor output voltage (V ac).
11. kW.
12. kWH.
13. Operating hours.

E. Control Signal Interfaces:

1. Electric Input Signal Interface:

   a. A minimum of two programmable analog inputs: 0- to 10-V dc or 4- to 20-mA.
   b. A minimum of six multifunction programmable digital inputs.

2. Remote Signal Inputs: Capability to accept any of the following speed-setting input signals from the BAS or other control systems:

   a. 0- to 10-V dc.
   b. 4- to 20-mA dc.
   c. Potentiometer using up/down digital inputs.
   d. Fixed frequencies using digital inputs.

3. Output Signal Interface: A minimum of two programmable analog output signal(s) (0- to 10-V dc or 4- to 20-mA), which can be configured for any of the following:

   a. Output frequency (Hz).
   b. Output current (load).
   c. DC-link voltage (V dc).
   d. Motor torque (percent).
   e. Motor speed (rpm).
   f. Set point frequency (Hz).
   g. kW.

4. Remote Indication Interface: A minimum of three programmable dry-circuit relay outputs (120-V ac, 1 A) for remote indication of the following:

   a. Motor running.
   b. Set point speed reached.
   c. Fault and warning indication (overtemperature or overcurrent).
   d. PID high- or low-speed limits reached.
   e. Motor current supervision.

F. PID Control Interface: Provides closed-loop set point, differential feedback control in response to dual feedback signals. Allows for closed-loop control of fans and pumps for pressure, flow, or temperature regulation.

1. Number of Loops: Two.

G. BAS Interface: Factory-installed hardware and software to enable the BAS to monitor, control, and display VFC status and alarms and energy usage. Allows VFC to be used with an external system within a multidrop LAN configuration; settings retained within VFC's nonvolatile memory.

1. Network Communications Ports: Ethernet and RS-422/485.
2. Serial Communications:

    a. The VFD shall have a RS-485 port as standard. The standard protocols shall be Modbus, BACnet, Johnson Controls N2 bus, and Siemens Building Technologies FLN. Each individual drive shall have the protocol in the base VFD. The use of third party gateways and multiplexers is not acceptable. All protocols shall be "certified" by the governing authority (i.e., BTL listing for BACnet). Use of non-certified protocols is not allowed.

3. The BACnet connection shall be a RS-485, MS/TP interface operating at 9.6, 19.2, 38.4 or 76.8 Kbps. The connection shall be tested by the BACnet Testing Labs (BTL) and be BTL listed. The BACnet interface shall conform to the BACnet standard device type of an Applications Specific Controller (B-ASC). The interface shall support all BIBBs defined by the BACnet standard profile for a B-ASC, including but not limited to:

    a. Data Sharing – Read Property – B.
    b. Data Sharing – Write Property – B.
    c. Device Management – Dynamic Device Binding (Who-Is; I-Am).
    d. Device Management – Dynamic Object Binding (Who-Has; I-Have).
    e. Device Management – Communication Control – B.

4. Serial communication capabilities shall include, but not be limited to, run-stop control, speed set adjustment, proportional/integral/derivative PID control adjustments, current limit, accel/decel time adjustments, and lock and unlock the keypad. The drive shall have the capability of allowing the DDC to monitor feedback such as process variable feedback, output speed/frequency, current (in amps), percent torque, power (kW), kilowatt hours (resettable), operating hours (resettable), and drive temperature. The DDC shall also be capable of monitoring the VFD relay output status, digital input status, and all analog input and analog output values. All diagnostic warning and fault information shall be transmitted over the serial communications bus. Remote VFD fault reset shall be possible.

2.3 LINE CONDITIONING AND FILTERING

A. Input Line Conditioning: The VFD shall have 5 percent equivalent impedance internal reactors for all ratings to reduce the harmonics to the power line and to add protection from AC line transients. The 5 percent equivalent impedance may be from dual (positive or negative DC bus) reactors, or 5 percent AC line reactors. VFDs with only one DC reactor shall add an AC line reactor. Based on the harmonic analysis study and report, provide additional input filtering, as required, to limit TDD at input terminals of all VFCs to less than 5 percent and THD(V) to 3 percent. For each VFC serving a motor 100 HP or greater, provide an 18 pulse unit allowing less than 8 percent current load distortion at input terminals of VFC.

B. Input Line Conditioning: Based on the harmonic analysis study and report, provide input filtering, as required, to limit TDD and THD(V) at the defined PCC per IEEE 519.

C. EMI/RFI Filtering: CE marked; certify compliance with IEC 61800-3 for Category C2.

2.4 BYPASS SYSTEMS

A. Bypass Operation: Safely transfers motor between power converter output and bypass circuit, manually, automatically, or both. Selector switches set modes and indicator lights indicate mode selected. Unit is

capable of stable operation (starting, stopping, and running) with motor completely disconnected from power converter.

B. Bypass Mode: Manual operation only; requires local operator selection at VFC. Transfer between power converter and bypass contactor and retransfer shall only be allowed with the motor at zero speed.

C. Bypass Mode: Field-selectable automatic or manual, allows local and remote transfer between power converter and bypass contactor and retransfer, either via manual operator interface or automatic control system feedback.

D. Bypass Controller: Three-contactor-style bypass allows motor operation via the power converter or the bypass controller; with input isolating switch and barrier arranged to isolate the power converter input and output and permit safe testing and troubleshooting of the power converter, both energized and de-energized, while motor is operating in bypass mode.

1. Bypass Contactor: Load-break, IEC-rated contactor.
2. Input and Output Isolating Contactors: Non-load-break, IEC-rated contactors.
3. Isolating Switch: Non-load-break switch arranged to isolate power converter and permit safe troubleshooting and testing of the power converter, both energized and de-energized, while motor is operating in bypass mode; pad-lockable, door-mounted handle mechanism.
4. Motor Protection from Single-Phase Power Conditions: The bypass system must be able to detect a single-phase input power condition while running in bypass, disengage the motor in a controlled fashion, and give a single-phase input power indication. Bypass systems not incorporating single-phase protection in bypass mode are not acceptable.
5. The system (VFD and bypass) tolerated voltage window shall allow the system to operate from a line of plus 30 percent, minus 35 percent nominal voltage as a minimum. The system shall incorporate circuitry that will allow the drive or bypass contactor to remain "sealed in" over this voltage tolerance at a minimum.
6. The bypass system shall not depend on the VFD for bypass operation. The bypass shall be completely functional in both hand and automatic modes even if the VFD has been removed from the enclosure for repair/replacement.
7. Serial Communications: The bypass and VFD shall be capable of being monitored and/or controlled via serial communications. Provide communications protocols for Modbus, Johnson Controls N2, Siemens Building Technologies FLN (P1), and BACnet in the bypass controller.

E. Bypass Contactor Configuration: Full-voltage (across-the-line) type.

1. NORMAL/BYPASS selector switch.
2. HAND/OFF/AUTO selector switch.
3. NORMAL/TEST Selector Switch: Allows testing and adjusting of VFC while the motor is running in the bypass mode.
4. Contactor Coils: Pressure-encapsulated type with coil transient suppressors.

    a. Operating Voltage: Depending on contactor NEMA size and line-voltage rating, manufacturer's standard matching control power or line voltage.
    b. Power Contacts: Totally enclosed, double break, and silver-cadmium oxide; assembled to allow inspection and replacement without disturbing line or load wiring.

5. Control Circuits: 120-V ac; obtained from integral CPT, with primary and secondary fuses, with CPT control power source of sufficient capacity to operate all integral devices and remotely located pilot, indicating, and control devices.

    a. CPT Spare Capacity: [**50**] [**100**] [**200**] VA.

6. Overload Relays: NEMA ICS 2.

   a. Solid-State Overload Relays:

      1) Switch or dial selectable for motor-running overload protection.
      2) Sensors in each phase.
      3) Class 10/20 selectable tripping characteristic selected to protect motor against voltage and current unbalance and single phasing.
      4) Class II ground-fault protection, with start and run delays to prevent nuisance trip on starting.
      5) Analog communication module.

   b. [**NC**] [**NO**] isolated overload alarm contact.
   c. External overload reset push button.

2.5 ADDITIONAL FEATURES

A. Damper control circuit with end of travel feedback capability.

B. Sleep Function: Senses a minimal deviation of a feedback signal and stops the motor. On an increase in speed-command signal deviation, VFC resumes normal operation.

C. Motor Preheat Function: Preheats motor when idle to prevent moisture accumulation in the motor.

D. Remote Indicating Circuit Terminals: Mode selection, controller status, and controller fault.

E. Remote digital operator kit.

F. Communication Port: RS-232 port, USB 2.0 port, or equivalent connection capable of connecting a printer and a notebook computer.

2.6 ENCLOSURES

A. VFC Enclosures: NEMA 250, to comply with environmental conditions at installed location.

1. Dry and Clean Indoor Locations: Type 1.
2. Outdoor Locations: [**Type 3R**] [**Type 4X**].
3. Other Wet or Damp Indoor Locations: Type 4.
4. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: Type 12.

B. Plenum Rating: UL 1995; NRTL certification label on enclosure, clearly identifying VFC as "Plenum Rated."

2.7 ACCESSORIES

A. General Requirements for Control-Circuit and Pilot Devices: NEMA ICS 5; factory installed in VFC enclosure cover unless otherwise indicated.

1. Push Buttons, Pilot Lights, and Selector Switches: Standard-duty, type.

   a. Push Buttons: Covered shielded types; maintained.

b. Pilot Lights: LED types;; push to test.
c. Selector Switches: Rotary type.

B. [**NC**] [**NO**] [**Reversible NC/NO**] bypass contactor auxiliary contact(s).

C. Control Relays: Auxiliary and adjustable solid-state time-delay relays.

D. Sun shields installed on fronts, sides, and tops of enclosures installed outdoors and subject to direct and extended sun exposure.

E. Spare control-wiring terminal blocks[**; unwired**] [**; wired**].

2.8 SOURCE QUALITY CONTROL

A. Testing: Test and inspect VFCs according to requirements in NEMA ICS 61800-2.

1. Test each VFC while connected to its specified motor.
2. Verification of Performance: Rate VFCs according to operation of functions and features specified.

B. VFCs will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, surfaces, and substrates to receive VFCs, with Installer present, for compliance with requirements for installation tolerances, and other conditions affecting performance.

B. Examine VFC before installation. Reject VFCs that are wet, moisture damaged, or mold damaged.

C. Examine roughing-in for conduit systems to verify actual locations of conduit connections before VFC installation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 HARMONIC ANALYSIS STUDY

A. Prepare a harmonic analysis study and report per requirements listed in submittals.

3.3 INSTALLATION

A. Coordinate layout and installation of VFCs with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Whenever the VFC is not within sight of the motor controlled, then provide a safety switch with auxiliary contact adjacent to the motor.

C. Wall-Mounting Controllers: Install VFCs on walls with tops at uniform height and with disconnect operating handles not higher than 79 inches above finished floor unless otherwise indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For controllers not on walls, provide freestanding racks complying with Section 260529 "Hangers and Supports for Electrical Systems."

D. Seismic Bracing: Comply with requirements specified in Section 260548 "Vibration and Seismic Controls for Electrical Systems."

E. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

F. Comply with NECA 1.

G. Locate adjacent VFCs no closer than 6 inches vertically and 24 inches horizontally.

3.4 IDENTIFICATION

A. Identify VFCs, components, and control wiring. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each VFC with engraved nameplate.
3. Label each enclosure-mounted control and pilot device.

B. Operating Instructions: Frame printed operating instructions for VFCs, including control sequences and emergency procedures. Fabricate frame of finished metal, and cover instructions with clear acrylic plastic. Mount on front of VFC units.

3.5 CONTROL WIRING INSTALLATION

A. Install wiring between VFCs and remote devices. Comply with requirements in Section 260523 "Control-Voltage Electrical Power Cables."

B. Install wiring between VFCs and auxiliary contacts located within enclosed switch adjacent to motor.

C. Install control wiring per Section 230900 "Instrumentation and Control for HVAC."

D. Bundle, train, and support wiring in enclosures.

E. Connect selector switches and other automatic control devices where applicable.

1. Connect selector switches to bypass only those manual- and automatic control devices that have no safety functions when switches are in manual-control position.
2. Connect selector switches with control circuit in both manual and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor overload protectors.

3.6 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Acceptance Testing Preparation:

1. Test insulation resistance for each VFC element, bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

C. Tests and Inspections:

1. Inspect VFC, wiring, components, connections, and equipment installation. Test and adjust controllers, components, and equipment.
2. Test insulation resistance for each VFC element, component, connecting motor supply, feeder, and control circuits.
3. Test continuity of each circuit.
4. Verify that voltages at VFC locations are within 5 percent of motor nameplate rated voltages. If outside this range for any motor, notify Engineer before starting the motor(s).
5. Test each motor for proper phase rotation.
6. Perform each electrical test and visual and mechanical inspection stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
7. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

8. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

D. VFCs will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports, including a certified report that identifies the VFC and describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations made after remedial action.

3.7 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

3.8 ADJUSTING

A. Program microprocessors for required operational sequences, status indications, alarms, event recording, and display features. Clear events memory after final acceptance testing and prior to Substantial Completion.

B. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and overload-relay pickup and trip ranges.

C. Adjust the trip settings of MCPs and thermal-magnetic circuit breakers with adjustable, instantaneous trip elements. Initially adjust to six times the motor nameplate full-load amperes and attempt to start motors

several times, allowing for motor cool-down between starts. If tripping occurs on motor inrush, adjust settings in increments until motors start without tripping. Do not exceed eight times the motor full-load amperes (or 11 times for NEMA Premium Efficient motors if required). Where these maximum settings do not allow starting of a motor, notify Engineer, Construction Manager, Owner before increasing settings.

D. Set the taps on reduced-voltage autotransformer controllers.

E. Set field-adjustable circuit-breaker trip ranges

F. Set field-adjustable pressure switches.

3.9 PROTECTION

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions until controllers are ready to be energized and placed into service.

B. Replace VFCs whose interiors have been exposed to water or other liquids prior to Substantial Completion.

3.10 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, reprogram, and maintain VFCs.

END OF SECTION 262923
03/07/11

February 28, 2011

SECTION 311000 - SITE CLEARING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. State of Connecticut Department of Transportation, Standard Specifications for Roads, Bridges and Incidental Construction, latest edition.

1.2 SUMMARY

A. Section Includes:

1. Protecting existing vegetation to remain.
2. Removing existing vegetation.
3. Clearing and grubbing.
4. Stripping and stockpiling topsoil.
5. Removing above- and below-grade site improvements.
6. Disconnecting, capping or sealing, and removing site utilities and abandoning site utilities in place.

1.3 DEFINITIONS

A. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

B. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.

C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil and is the zone where plant roots grow.

D. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil and is the zone where plant roots grow. Its appearance is generally friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches in diameter; and free of subsoil and weeds, roots, toxic materials, or other nonsoil materials.

E. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction, and indicated on Drawings.

F. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, defined by a circle concentric with each tree with a radius 1.5 times the diameter of the drip line unless otherwise indicated.

G. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 MATERIAL OWNERSHIP

A. Except for stripped topsoil and other materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.5 INFORMATIONAL SUBMITTALS

A. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.

1. Use sufficiently detailed photographs or videotape.
2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.

B. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.6 QUALITY ASSURANCE

A. Preinstallation Conference: Conduct conference at Project site.

1.7 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

B. Improvements on Adjoining Property: Authority for performing site clearing indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.

1. Do not proceed with work on adjoining property until directed by Engineer and coordinated with property Owner.

C. Salvable Improvements: Carefully remove items indicated to be salvaged and turn over to the Owner.

D. Utility Locator Service: Notify Call Before You Dig for area where Project is located before site clearing.

E. Do not commence site clearing operations until temporary erosion- and sedimentation-control and plant-protection measures are in place.

F. The following practices are prohibited within protection zones:

1. Storage of construction materials, debris, or excavated material.
2. Parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

G. Do not direct vehicle or equipment exhaust towards protection zones.

H. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

I. Soil Stripping, Handling, and Stockpiling: Perform only when the topsoil is dry or slightly moist.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Division 31 Section "Earth Moving."

1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

B. Antirust Coating: Fast-curing, lead- and chromate-free, self-curing, universal modified-alkyd primer complying with MPI #79, Alkyd Anticorrosive Metal Primer or SSPC-Paint 20 or SSPC-Paint 29 zinc-rich coating.

1. Use coating with a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Locate and clearly identify trees, shrubs, and other vegetation to be removed or relocated. Wrap a 1-inch red vinyl tie tape flag around each tree trunk at 54 inches above the ground.

C. Protect existing site improvements to remain from damage during construction.

1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion- and sedimentation-control drawings and specifications.

B. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

C. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.

D. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.3 TREE AND PLANT PROTECTION

A. General: Protect trees and plants remaining on-site according to requirements in Division 01 Section "Temporary Tree and Plant Protection." If Division 01 Section is not included, trees to be saved that are buried in fills over 12 inches deep shall be protected by a dry-stone wall placed at least 36 inches from the tree trunk. All wells are to be properly drained. Before fills of over 12 inches are made upon the tree root areas, at least a 6-inch layer of broken stones or coarse gravel covered by inverted sods shall be spread to facilitate proper drainage and aeration. The area to be treated in this manner shall be extended to the drip line.

B. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Architect.

3.4 EXISTING UTILITIES

A. Owner will arrange for disconnecting and sealing indicated utilities that serve existing structures before site clearing, when requested by Contractor.

1. Verify that utilities have been disconnected and capped before proceeding with site clearing.

B. Locate, identify, disconnect, and seal or cap utilities indicated to be removed or abandoned in place.

1. Arrange with utility companies to shut off indicated utilities.
2. Owner will arrange to shut off indicated utilities when requested by Contractor.

C. Locate, identify, and disconnect utilities indicated to be abandoned in place.

D. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
1. Do not proceed with utility interruptions without Owner’s written permission.

E. Excavate for and remove underground utilities indicated to be removed.

F. Removal of underground utilities is included in Division 21, Division 22, Division 23, Division 26, Division 27, Division 28, and Division 33 Sections.

3.5 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.

1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
2. Grind down stumps and remove roots, obstructions, and debris to a depth of 18 inches below exposed subgrade.
3. Use only hand methods for grubbing within protection zones.
4. Chip removed tree branches and dispose of off-site.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.

1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches, and compact each layer to a density equal to adjacent original ground.

3.6 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to required depth to prevent intermingling with underlying subsoil or other waste materials.

1. Remove subsoil and nonsoil materials from topsoil, including clay lumps, gravel, and other objects more than 2 inches in diameter; trash, debris, weeds, roots, and other waste materials.

C. Stockpile topsoil away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.

1. Limit height of topsoil stockpiles to 72 inches.
2. Do not stockpile topsoil within protection zones.
3. Dispose of surplus topsoil. Surplus topsoil is that which exceeds quantity indicated to be stockpiled or reused.
4. Stockpile surplus topsoil to allow for respreading deeper topsoil.

3.7 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.

B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.

1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.
2. Paint cut ends of steel reinforcement in concrete to remain with two coats of antirust coating, following coating manufacturer's written instructions. Keep paint off surfaces that will remain exposed.

3.8 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

B. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities. Do not interfere with other Project work.

END OF SECTION 311000
03/07/11

February 28, 2011

SECTION 312000 - EARTH MOVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. State of Connecticut Department of Transportation, Standard Specifications for Roads, Bridges and Incidental Construction, latest edition.

C. American Society for Testing and Materials (ASTM) Standards:

1. ASTM C 136: Method for sieve analysis of fine and coarse aggregates.
2. ASTM C 117: Standard test method for materials finer than No. 200 sieve in mineral aggregate washing.
3. ASTM D 422: Standard test method for particle size analysis of soils.
4. ASTM D 1140: Test for amount of material in soils finer than No. 200 sieve.
5. ASTM D 1556: Test method for density of soil in place by the sand cone method.
6. ASTM D 1557: Test methods for moisture-density relations of soils and soil aggregate mixtures using 10 lb. hammer and 18-inch drop. AASHTO Standard T-180 may be substitute for ASTM D 1557.
7. ASTM D 2922: Test methods for density of soil and soil-aggregate in place by nuclear methods (shallow depth).
8. ASTM D 4318: Test method for liquid limit, plastic limit and plasticity index of soils.

1.2 SUMMARY

A. Section Includes:

1. Preparing subgrades for equipment pads, slabs on grade walks, pavements, turf and grasses and plants.
2. Subbase course and base course for asphalt paving.
3. Excavating and backfilling trenches for buried piping and conduits.
4. Excavation and off-site disposal of all unsuitable and excess materials, and stockpiling of all suitable on-site materials required for reuse.
5. Provision, transportation and placement of all required fill and backfill materials.
6. Drainage and dewatering required to perform the work in the dry.

1.3 UNIT PRICES

A. Work of this Section is affected by unit prices for earth moving specified in Division 01 Section "Unit Prices."

B. Quantity allowances for earth moving are included in Division 01 Section "Allowances."

C. Rock Measurement: Volume of rock actually removed, measured in original position. See Part 3 for rock paylimits. Unit prices for rock excavation include replacement with approved materials. Unit prices for rock are included in Division 01 Section "Unit Prices."

1.4 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.

B. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.

C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Geotechnical Engineer and/or the Owner's Testing Agency. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
2. Bulk Excavation: Excavation more than 10 feet.
3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Geotechnical Engineer and/or the Owner's Testing Agency. Unauthorized excavation, as well as remedial work directed by Geotechnical Engineer and/or the Owner's Testing Agency, shall be without additional compensation.

F. Fill: Soil materials used to raise existing grades.

G. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 1 cu. yd. for bulk excavation or 3/4 cu. yd. for footing, trench, and pit excavation that cannot be removed by rock excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting, when permitted:

1. Excavation of Footings, Trenches, and Pits: Late-model, track-mounted hydraulic excavator; equipped with a 42-inch- wide, maximum, short-tip-radius rock bucket; rated at not less than 138-hp flywheel power with bucket-curling force of not less than 28,700 lbf and stick-crowd force of not less than 18,400 lbf with extra-long reach boom; measured according to SAE J-1179.
2. Bulk Excavation: Late-model, track-mounted loader; rated at not less than 230-hp flywheel power and developing a minimum of 47,992-lbf breakout force with a general-purpose bare bucket; measured according to SAE J-732.

H. Structures: Retaining walls, equipment pads, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

I. Subbase Course: Aggregate layer placed between the subgrade and base course.

J. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase.

K. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within building limits.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of the following manufactured products required:

1. Warning tapes.

B. Earth Material Samples: Contractor shall be responsible for obtaining samples (50 pounds minimum) of earthwork materials proposed to be used and transporting them to the site 7 calendar days in advance of the time planned for incorporating them into the work. Use of proposed materials by the Contractor prior to testing and approval or rejection shall be at the Contractor's risk. The following information shall be submitted:

1. Location of borrow source site.
2. Present and past usage of the source site and material.
3. Any previously existing report(s) associated with an assessment of the source site, as relates to the presence of oil or hazardous material.
4. Location within the source site from which the material will be obtained.

C. Up to three test series (gradation and laboratory compaction) will be completed by the Geotechnical Engineer or Owner's Testing Agency for off-site borrow sources for each category of earth materials defined in Part 2 of this Section at the Owner's cost. Testing of additional samples or sources shall be at the Contractor's cost.

1. Sieve analysis to be based on washed sieve analysis in accordance with appropriate ASTM standard.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Material Test Reports: For each on-site and borrow soil material proposed for fill and backfill as follows:

1. Classification according to ASTM D 2487.
2. Laboratory compaction curve according to ASTM D 1557.

C. Preexcavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by earth moving operations. Submit before earth moving begins.

D. Flowable Fill Mix Design: Submit mix design with admixture information for review and approval a minimum of 15 days prior to start of work.

1.7 QUALITY ASSURANCE

A. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E 329 and ASTM D 3740 for testing indicated.

B. Earthwork Observation and Testing:

1. The Owner will retain a qualified Geotechnical Engineer and/or Testing Agency to perform on-site observation and testing during work under this and related sections and as indicated in the

"Schedule of Special Inspections." The services of the Geotechnical Engineer and/or Owner's Testing Agency may include, but not be limited to the following:

a. Observation during excavation, subgrade preparation and backfill for footings, pavements, walks, utility trenches, equipment pads and subsurface drainage construction, etc.
b. Determination of requirements for additional excavation to remove unsuitable materials.
c. Observation and testing during placement and compaction of fill and backfill.
d. Laboratory testing and analysis of fill material specified.
e. Review of submittals.

2. During the course of construction, the Geotechnical Engineer and/or Owner's Testing Agency shall advise the Owner's Agent, in writing, with a copy to the Architect and Contractor, if at any time, in his opinion, the work is not in substantial conformity with the plans and specifications. The Geotechnical Engineer's and/or the Owner's Testing Agency's presence does not include supervision of direction of the actual work by the Contractor, his employees, subcontractors or agents. Neither the presence of the Geotechnical Engineer and/or Owner's Testing Agency, nor any observations and testing performed by him shall excuse the Contractor from defects discovered in his work.
3. Testing equipment will be provided by and testing performed by the Geotechnical Engineer and/or Owner's Testing Agency, except as otherwise provided by contract. Upon request by Owner's Agent, the Contractor shall provide such auxiliary personnel and services as needed to accomplish testing work and to repair damage caused thereby to permanent work.
4. References herein to observations, testing, and determinations by the "Engineer" include services to be provided by the Geotechnical Engineer and/or Owner's Testing Agency when appropriate and when so authorized by the Engineer or Owner.
5. The Contractor shall not proceed without the Testing Agency in place. Contractor to coordinate with Testing Agency.

C. Preexcavation Conference: Conduct conference at Project site.

1. Before commencing tree clearing and grubbing, have tree clearing limits staked and meet with representatives of the governing authorities, Owner, Engineer and other concerned entities to review the area in question. Notify the participants at least three working days prior to convening conference. Record discussions and agreements and furnish a copy to each participant.
2. Before commencing earthwork, meet with representatives of the governing authorities, Owner, Engineer, consultants, independent testing agency, and other concerned entities. Review earthwork procedures and responsibilities including testing and inspection procedures and requirements. Record discussions and agreements and furnish a copy to each participant.

1.8 PROJECT CONDITIONS

A. Existing Utilities:

1. Notify utility locator service for area where project is located before site clearing or excavating. Hire private utility mark-out service for areas not marked by utility companies. See General Conditions of the construction contract.
2. Before starting excavation, establish location and extent of any underground utilities occurring in work area. Make arrangements with appropriate utility company for removal and relocation of lines which are in the way of excavation. If utilities are to remain in-place, provide adequate means of support and protection during earthwork operations.
3. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, consult utility owner immediately for directions. Cooperate with Owner, Owner's Agent, and

utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner.

4. Inactive or abandoned utilities encountered during construction operations shall be removed, plugged or capped. The location of such utilities shall be noted on record drawings and reported in writing to Owner's Agent. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies for shutoff of services if lines are inactive.
5. Do not interrupt existing utilities serving facilities occupied and used by Owner or others, during occupied hours, except when permitted in writing by Owner's Agent and then only after arranging to provide acceptable temporary utility services. Provide minimum of 48 hours notice to Owner's Agent and receive written notice to proceed before interrupting any utility. Do not proceed with utility interruptions without Owner' written permission.
6. When in the course of the work it is necessary to connect a utility to a main in a public way, all the requirements of both the authorities governing the utility and those governing the public way shall be met. Pavement shall be temporarily and permanently replaced as directed by these authorities at no additional cost to the Owner.

B. Site Information:

1. Information in the Contract Plans and in the Specifications relating to subsurface conditions, existing utilities and structures is from the best sources presently available. Such information is furnished only for the information and convenience of the Contractor, and the accuracy and completeness of this information is not guaranteed.

C. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth moving operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

D. Improvements on Adjoining Property: Authority for performing earth moving indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.

1. Do not proceed with work on adjoining property until directed by Architect.

E. Do not commence earth moving operations until temporary erosion- and sedimentation-control measures, are in place.

F. Do not commence earth moving operations until plant-protection measures are in place.

G. The following practices are prohibited within protection zones:

1. Storage of construction materials, debris, or excavated material.
2. Parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

H. Do not direct vehicle or equipment exhaust towards protection zones.

I. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations. All rock and soil materials furnished for use as fill or backfill shall be free of grease, oil, solvents, pesticides, herbicides or other hazardous or deleterious materials and/or contaminants. All rock and soil materials specified in this Section shall also be free from ice, snow, trash, debris, stumps, roots and organic material.

B. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D 2487, or a combination of these groups; free of rock or gravel larger than 2 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487, contaminated soils or a combination of these groups. Symbols shall not be used as fill or backfill except where impervious fill is specified or detailed. Satisfactory soils which have been rendered wet, such that the Contractor cannot establish a stable soil mass compacted as specified in this Section, also shall not be used as fill or backfill.

1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

D. Backfill and Fill: Satisfactory soil materials.

E. 3/4-Inch Crushed Stone: Crushed stone shall be a quarry product or washed gravel stone obtained from offsite sources for use as detailed on the drawings. Crushed stone shall consist of durable crushed rock or gravel stone essentially free of silt, clay, loam or other deleterious materials and shall conform to the following graduation requirements for the nominal size indicated.

SQUARE MESH SIEVES	PERCENT FINER BY WEIGHT
Pass 1 Inch	100
Pass 3/4 Inch	90 - 100
Pass 1/2 Inch	20 - 55
Pass 3/8 Inch	0 - 15
Pass No. 4	0 - 5

F. Base: Naturally or artificially graded non-plastic mixture of durable, sound coarse and fine aggregate and obtained from suitable excavated onsite soils or offsite sources. Mixture to be free of debris, waste, frozen materials, and organics, and shall be well graded within the following limits (processed stone, no gravel):

SQUARE MESH SIEVES	PERCENT FINER BY WEIGHT
Pass 2-1/2 Inch	100
Pass 2 Inch	95 - 100
Pass 3/4 Inch	50 - 75
Pass 1/4 Inch	25 - 45
Pass No. 40	5 - 20
Pass No. 100	2 - 12

G. Subbase: Subbase material for use as pavement subbase course and other uses as detailed shall be obtained from suitable excavated onsite soils or offsite sources. Base shall consist of a non-plastic mixture of durable, sound coarse and fine aggregate with no more than 15 percent by weight of recycled bituminous concrete and shall be well graded within the following limits:

SQUARE MESH SIEVES	PERCENT FINER BY WEIGHT
Pass 3-1/2 Inch	100
Pass 1-1/2 Inch	55 - 100
Pass 1/4 Inch	25 - 60
Pass No. 10	15 - 45
Pass No. 40	5 - 25
Pass No. 100	0 - 10
Pass No. 200	0 - 5

H. Bedding Material: Sand or sandy soil free of debris, waste, frozen materials, and organics with 100 percent passing a 3/8-inch sieve and not more than ten percent passing a No. 200 sieve.

I. Granular Fill (Also Termed Structural Fill): Granular fill shall be obtained from suitable excavated onsite soil or offsite borrow sources for use as fill and backfill below and interior to building areas except where other materials are specified or detailed, and as details on the drawings. Granular fill shall consist of non-plastic naturally or artificially graded mixture of sound coarse and fine aggregates free of debris, waste, frozen materials and organics and conforming to the following gradation:

SQUARE MESH SIEVES	PERCENT FINER BY WEIGHT
Pass 3-1/2 Inch	100
Pass 1-1/2 Inch	55 - 100
Pass 1/4 Inch	25 - 60
Pass No. 10	15 - 45
Pass No. 40	5 - 25
Pass No. 100	0 - 10
Pass No. 200	0 - 5

J. General Fill: Clean, sound mixture of material free of debris, waste, frozen materials and organics with 5-inch maximum size aggregate and not more than 12 percent passing the No. 200 sieve.

K. Sand: ASTM C 33; fine aggregate.

L. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

M. Flowable / Excavatable Fill: Mixture of cement, GranCem, sand, water, and admixtures to produce a flowable/excavatable fill with a compressive strength at 28 days of 100 psi to 200 psi.

2.2 ACCESSORIES

A. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:

1. Red: Electric.
2. Yellow: Gas, oil, steam, and dangerous materials.

3. Orange: Telephone and other communications.
4. Blue: Water systems.
5. Green: Sewer systems.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations.

B. Protect and maintain erosion and sedimentation controls during earth moving operations.

C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

D. Provide protective construction fence around all landscaping in work area to remain.

3.2 DEWATERING

A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. The Contractor shall grade and ditch the site as necessary to direct surface runoff away from open excavations. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding project site and surrounding areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
2. The Contractor shall provide, at his own expense, adequate pumping and drainage facilities to keep all excavations and work sufficiently dry from groundwater and/or surface runoff so as not to adversely affect construction product or procedures nor cause excessive disturbance of underlying natural ground or footing and slab subgrades. Contractor shall similarly control water entering the excavation as a result of construction operations, such as washing of concrete equipment and tools and the like.
3. Protect subgrades and foundation soils from softening, undermining, washout, and damage by water accumulation.
4. Install dewatering as required to keep subgrades dry and convey groundwater away from excavations. Maintain until dewatering is no longer required.
5. Water from trenches and excavations shall be disposed of in such a manner as will not cause injury to public health, nor damage to public or private property, existing work, or work in progress, nor to the surface of roads, walks and streets, nor cause any undue interference with the use of the same by the public. The Contractor shall comply with all applicable environmental protection and/or sediment/erosion control regulations.
6. Under no circumstances place concrete or fill, or lay piping or install appurtenances in excavations containing free water. Keep utility trenches free from water until pipe joint material has hardened.

3.3 EXPLOSIVES

A. Explosives: Do not use explosives.

3.4 EXCAVATION, GENERAL

A. Classified Excavation: Excavate to subgrade elevations. Material to be excavated will be classified as earth and rock. Do not disintegrate or excavate rock until it has been classified by the Geotechnical Engineer and/or Owner's Agent and cross-sectioned by the Owner's registered land surveyor. The Contract Sum will be adjusted for rock excavation according to contract provisions for changes in the work. Changes in the Contract Time may be authorized for rock excavation.

1. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; together with soil, boulders, and other materials not classified as rock or unauthorized excavation.

a. Intermittent drilling; ram hammering; or ripping of material not classified as rock excavation is earth excavation.

2. Rock excavation includes removal and disposal of rock and includes replacement with approved materials.

a. Uncover and expose all rock surfaces to be removed.
b. Notify Owner in writing before rock removal proceeds.
c. The Owner will engage a registered land surveyor to cross section the top of rock and determine the quantity of rock for payment. Measurements for payment will be based on in place cubic yards of rock removed to paylines, as defined:

1) For Walls with Footings: The measurements will be taken horizontally parallel to and 12 inches outside of the edges of the concrete footings and vertically 12 inches below bottom of footing elevation.
2) For Walls without Footings: The measurements will be taken horizontally parallel to and 12 inches outside of the edges of the concrete limits and vertically 12 inches below bottom of concrete elevation as indicated in the Contract Documents.
3) For Walks, Pavements and Equipment Pads: The measurement will be taken vertically 12 inches below slab subgrade elevation as indicated in the Contract Documents.
4) For Utility Trenches: The measurement will be taken vertically 6 inches below bottom of pipe and horizontally 24 inches wider than the nominal diameter of pipe/conduit as indicated in the Contract Documents.
5) For Structures: The measurement will be taken horizontally 24 inches greater in both length and width or diameter than the actual exterior dimensions of the structures and vertically 12 inches below bottom elevation of structure as indicated in the Contract Documents.

d. No payment will be made for overblasted rock and/or shattered layers below paylimits, associated removal and replacement with suitable fill material.

B. Dimensions:

1. Excavate to elevations and dimensions indicated on the drawings or as otherwise required for the work. Do all necessary excavation, including, but not limited to, excavation for structures, footings, foundations, grade beams, walls and slabs below grade, paving, utility lines, mechanical

work, mechanical and drainage structures, drains, and other below grade work. Excavate sufficient material so as to allow ample space for construction operations including placing and removal of forms, installation of waterproofing, dampproofing or utilities and inspection of excavated areas.

2. Side forms will be required for all concrete work unless omission of forms is requested by the Contractor, in writing, to the Engineer. Where omission of forms is requested by the Contractor, and accepted by the Engineer, the Contractor shall bear the cost of any additional concrete volume required beyond the minimum profiles and dimensions of the footing, wall, or utility trench as detailed.

C. Disposition of Excavated Material:

1. Sort and stockpile excavated material according to its suitability for re-use and job requirements. Onsite stockpile room will be limited and the Contractor shall plan his operations to facilitate prompt reuse of excavated material or provide offsite stockpile locations as required.
2. Stockpile soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
3. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.
4. Offsite Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris and legally dispose of it off Owner's property.

D. Unauthorized Excavation: Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimension without specific direction of the Engineer or Owner's agent. Unauthorized excavation, as well as remedial work specified by the Engineer, shall be at the Contractor's expense.

1. In areas below structures, pavements and walks, backfill unauthorized excavation with granular fill placed and compacted in accordance with this Section, unless otherwise directed by the Engineer.
2. Elsewhere, backfill and compact unauthorized excavations with general fill, compacted to the requirements of this Section.
3. Where the excavation of otherwise suitable materials is required due to these materials being rendered unsuitable due to disturbance, construction activity, freezing, or lack of protection from the elements, the Contractor shall excavate these materials and provide remedial work as specified above at no additional cost to the Owner.

E. Authorized Additional Excavation: In the case that unsuitable materials, as determined by the Engineer, are encountered at the specified subgrade elevation, the Engineer may direct the removal of the unsuitable material and refill will granular fill placed and compacted in accordance with the requirements of this Section. Authorized addition excavation with granular fill backfill will be paid according to contract provisions for changes in the work.

F. Backfilling Prior to Acceptance of Work Installed:

1. Do not allow or cause the work performed or installed to be covered up or enclosed by work of this Section prior to all required inspections, tests, and acceptances.
2. Should any of the work be so enclosed or covered up before it has been accepted, uncover all such work at no additional cost to the Owner.
3. After the work has been completed, tested, inspected, and accepted, make all repairs and replacements necessary to restore the work to the condition in which it was found at the time of uncovering, all at no additional cost to the Owner.

G. Sheeting, Shoring, and Bracing:

1. Provide sheeting, shoring and/or bracing at excavations as required to assure safety against collapse of earth or rock at sides of excavations; as required for support of adjacent structures, streets, or utilities; or as required to comply with federal, state or local regulations, codes or ordinances.
2. Provide materials for sheeting, shoring and bracing, such as sheet piling, uprights, stringers and cross braces, in good serviceable condition. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Carry down sheeting, shoring and bracing as excavation progresses.
3. All sheeting and bracing not ordered left in place shall be carefully removed in such a manner as not to endanger the construction of other structures, utilities or property whether public or private. All voids left after withdrawal of sheeting shall be immediately refilled with sand and rammed with tools especially adapted to that purpose or otherwise compacted as directed to achieve the required density.
4. Wood sheeting shall not be completely withdrawn if driven below mid-diameter of any pipe, and under no circumstances shall any wood sheeting be cut off at a level lower than one foot above the top of pipe.

H. Dust and Erosion Control:

1. The Contractor shall take all necessary measures and provide equipment and/or materials to minimize dust from rising and blowing across the site and also to control surface water throughout the operation so that it does not run onto paved ways without being filtered. In addition, the Contractor shall control all dust created by construction operations and movement of construction vehicles, both on site and on paved ways.
2. Thoroughly moisten all surfaces as required to prevent dust being a nuisance to the public, neighbors and performance of other work on the site.
3. Repair any broken or damaged sections of hay bales or other erosion and siltation control measures damaged during excavation and grading operations and install any additional sections necessary for proper control.

I. Frost Protection and Snow Removal:

1. The Contractor shall, at his own expense, keep the operations under this contract clear and free of accumulations of snow or as required to carry out the work.
2. Do not excavate to full indicated depth when freezing temperatures may be expected. Protect the excavation from frost if placing of concrete is delayed. Do not cast concrete or initial utilities on frozen ground.

J. Protection of Persons and Property:

1. The work shall be executed in such manner as to prevent any damage to adjacent property and any other property and existing improvements, such as but not limited to, streets, curbs, paving, service utility lines, structures, monuments, bench marks and other public or private property. Protect existing improvements from damage caused by settlement, lateral movements, undermining, washout, vibration and other hazards created by earthwork operations.
2. In the case of any damage or injury caused in the performance of the work, the Contractor shall, at his own expense, make good such damage or injury to the satisfaction of and without cost to, the Owner. Existing roads, sidewalks, and curbs damaged during the project work shall be repaired or replaced to their original condition at the commencement of operations. The Contractor shall replace, at his own expense, existing bench marks, monuments and other reference points which are disturbed or destroyed.

3. Barricade open excavations occurring as part of this work and post with warning lights. Operate warning lights during hours from dusk to dawn each day and otherwise as required.
4. Buried structures, utility lines, etc., including those which project less than 18 inches above grade, which are subject to damage from construction equipment shall be clearly marked to indicate the hazard.
5. Provide protective construction fence around all landscaping in work area to remain.

3.5 EXCAVATION - GENERAL

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

1. General: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.

B. Excavation for Structures and Piping, Etc.:

1. Excavate to elevations and dimensions indicated within a tolerance of plus or minus one inch. Do not disturb bottom of excavations intended for bearing surface.
2. Allow the Geotechnical Engineer to view the excavated subgrade. The Geotechnical Engineer shall determine whether authorized additional excavation is required to remove unsuitable material. Remove and replace such unsuitable material as directed by the Engineer.

C. Excavations at Edges of Tree- and Plant-Protection Zones:

1. Excavate by hand to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
2. Cut and protect roots according to requirements in Division 01 Section "Temporary Tree and Plant Protection."

3.6 EXCAVATION FOR WALKS, PAVEMENTS AND EQUIPMENT PADS

A. Excavate surfaces under walks, pavements and equipment pads to indicated lines, cross sections, elevations, and subgrades.

1. Walks, pavements and equipment pads shall be supported on subbase/base course(s) as indicated on the drawings.
2. Remove and replace excessively wet, disturbed or unstable material and proof compact the subgrade for the subbase/base course with at least six passes of a vibratory plate or vibratory roller compactor immediately prior to placement of slab base course material unless otherwise directed.
3. The final surface of the subgrade for the walks, pavements and equipment pads shall be proof rolled with at least four passes of an approved vibratory plate or vibratory drum compactor immediately prior to placing the reinforcing and/or concrete (as may be applicable).

3.7 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe, conduit or ductbank. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe, conduit or ductbank unless otherwise indicated.

1. Clearance: As indicated on Contract Documents.

C. Trench Bottoms: Excavate trenches to depth indicated on Contract Documents, to allow for bedding course. Hand-excavate deeper for bells of pipe.

D. Trenches in Tree- and Plant-Protection Zones:

1. Hand-excavate to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
2. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities.
3. Cut and protect roots according to requirements in Division 01 Section "Temporary Tree and Plant Protection."

3.8 SUBGRADE INSPECTION

A. Notify Geotechnical Engineer and/or Owner’s Testing Agency when excavations have reached required subgrade.

B. If Geotechnical Engineer and/or Owner’s Testing Agency determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed and in accordance with excavation requirements of this Section.

C. Unforeseen additional excavation and replacement material will be paid for according to contract provisions for changes in the work.

D. Proof-roll subgrade as directed by the Geotechnical Engineer and/or Owner’s Testing Agency.

E. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices and changes in the Work.

F. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Geotechnical Engineer and/or Owner’ s Testing Agency, without additional compensation.

3.9 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.10 PLACEMENT AND COMPACTION OF FILL AND BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
2. Surveying locations of underground utilities for Record Documents.
3. Testing and inspecting underground utilities.
4. Removing concrete formwork.
5. Removing trash and debris.
6. Removing temporary shoring and bracing, and sheeting.
7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

C. Unless otherwise specified or indicated on the drawings, the products specified in Part 2 of this Section shall be employed in the various fill and backfill applications indicated in the part. Place and compact fill material in layers to required elevations as follows:

1. Under grass, use common fill material.
2. Under walks, use base material.
3. Under pavements, use subbase and base material.
4. Under steps, ramps, and site walls, use granular fill material.
5. Under footings, use granular fill.
6. Under utilities, use either bedding material or granular fill (see drawings).
7. Under equipment pads and structures, use crushed stone.

D. All vegetation, peat, organic topsoil or subsoil, trash, debris, roots, stumps, and any compressible or otherwise deleterious materials shall be stripped from the existing ground surface and removed from excavations prior to placement of fill or backfill.

E. All fill and backfill materials shall be placed in horizontal layers. Each layer shall be spread evenly and thoroughly mixed during spreading to ensure uniformity of material in each layer. Layer thickness shall not exceed that specified in Paragraph L of this Section.

F. Where horizontal fill layers meet a natural or excavated slope, the layer shall be keyed into the slope by cutting a bench. The surface of benches shall be compacted to the same requirements as apply to the area being filled.

G. In no instance place fill over materials that were permitted to freeze prior to compaction or over ice or snow. Removal of such materials will be required as directed by the Engineer. In no case will frozen material be allowed for use in fill or backfill.

H. No fill shall be placed or compacted during unfavorable weather conditions. When work is interrupted by heavy rains or snow, fill operations shall not be resumed until the moisture content and density of previously placed fill are as specified hereinafter.

I. Allow the Geotechnical Engineer and/or Owner's Testing Agency sufficient time to make necessary observations and tests. The degree of compaction shall be based on a maximum dry density as determined by ASTM D 1557 or AASHTO Standard T180. All fill and backfill placed in various areas shall be compacted in individual layers to minimum dry densities as follows:

1. Under Site Walls, Within Building Foundations Backfill Limits, Equipment Pads, Structures, Steps and Pavements (Other Than Stone Base): 95 percent.

2. Under and Around Utilities (Other Than Stone): 95 percent.
3. Under Walkways: 95 percent.
4. Under Lawn or Unpaved Areas: 92 percent.
5. Uniformly graded crushed stone materials which are not suited to field density testing shall be compacted in accordance with the minimum compactive effort indicated in Paragraph 3.11 L of this Section.

J. The term "under," as applied to buildings, structures and paved areas, shall be construed to include all materials immediately below the plan area of the building, as well as those materials within a line sloping at one vertical and one horizontal drawn downward and outward from the exterior of building foundation, structure foundation or paved area.

K. Compaction shall be by mechanical means designed specifically for compaction and approved by the Engineer. The Engineer reserves the right to disapprove any device of inadequate capacity or of type unsuited to the character of the material being compacted. In areas which are too restricted to permit the use of mechanical compactors, fill may be placed in 3-inch layers and compacted by hand rammer or pneumatic tools.

L. In addition to the stated degree of compaction, all fill and backfill shall receive at least the compactive effort given in the following table. Lift thickness shall not exceed that shown for the compaction method selected, except that the first lift of fill or backfill placed over natural ground in wet conditions may be as much as 12 inches thick. Application of the minimum compactive effort does not relieve the Contractor from his requirement to achieve the specified degree of compaction.

Compaction Method	Maximum Stone Size	Maximum Loose Lift Thickness		Minimum Number of Passes	
		Below Structures and Pavement	Less Critical Areas	Below Structures and Pavement	Less Critical Areas
Hand-operated vibratory plate or light roller in confined areas	4"	6"	8"	6	4
Hand-operated vibratory drum rollers weighing at least 1,000 lbs.	6"	8"	10"	6	4
Light vibratory drum roller, minimum dynamic force 3,000 lbs. per ft. of drum width	6"	10"	14"	6	4
Medium vibratory drum roller, minimum dynamic force 5,000 lbs. per ft. of drum width	8"	12"	18"	6	4
Large vibratory drum roller, minimum dynamic force 8,000 lbs. per ft. of drum width	10"	16"	24"	6	4

M. Moisture Control:

1. Water shall be added to fill material which does not contain sufficient moisture to be compacted to the specified densities. Fill and backfill material containing excess moisture shall be required to dry prior to or during compaction to a moisture content not greater than two percentage points (2%) above optimum except that material which displays pronounced elasticity or deformation underfoot or under load shall be required to dry to optimum moisture content before it is placed and compacted, if that is required to achieve specified compaction. At the Contractor's option,

material which is too wet may be removed and replaced with satisfactory material at no additional cost to the Owner.

2. The Contractor is alerted to the potential silty nature of the on-site soil which renders them sensitive to moisture. On-site silty soils are difficult to handle and compact and are easily disturbed when wet. The Contractor shall plan and conduct his excavation and filling operations considering the nature of the onsite materials.

N. Where the Engineer, Geotechnical Engineer and/or Owner's Testing Agency determines that fill or backfill does not conform to the compacted density specified, or did not receive the minimum compactive effort specified, such fill shall be removed and replaced with conforming materials at the Contractor's own cost.

O. Backfilling of Walls:

1. In placing backfill, take special care to prevent any wedge action, eccentric loading or overloading by equipment used in backfilling and compaction. See Contract Documents for additional requirements.
2. Do not use equipment weighing more than 5,000 lbs. within 10 feet of all walls. Equipment weighing more than 5,000 lbs. shall not be used adjacent to walls, except as expressly approved by the Engineer.
3. Prevent damage to wall waterproofing or dampproofing when backfilling.

3.11 DISTURBANCE OF EXCAVATED AND FILLED AREAS DURING CONSTRUCTION

A. The Contractor shall take the necessary steps to avoid disturbance of subgrade during excavation and filling operations. Methods of excavation and filling shall be revised as necessary to avoid disturbance of the subgrade, including restricting the use of certain types of construction equipment and their movement over sensitive or unstable materials, dewatering and other acceptable control measures. The Contractor shall cooperate with the Engineer to modify his operations as necessary to mitigate disturbance and protect bearing soils, based on the Engineer's observations.

B. All excavated or filled areas disturbed during construction; damaged by freezing temperatures, frost, rain, accumulated water, or construction activities; all loose or saturated soil, and other areas that do not meet compaction requirements as specified herein shall be removed and replaced with compacted fill materials specified. Costs of removal of disturbed material and refill with compacted fill shall be borne by the Contractor.

3.12 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits and ductbanks.

C. Do not excavate trenches under new or existing footings unless approved by the Engineer. If approved, backfill trenches excavated under footings and within 18 inches of bottom of footings; fill with concrete to an elevation of 4 inches above bottom of footings.

D. Trenches under Roadways: Provide 4-inch- thick, concrete-base slab support for piping or conduit less than 30 inches below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches of concrete before backfilling or placing roadway subbase course.

E. Backfill voids with satisfactory soil while removing shoring and bracing.

F. Place and compact initial backfill of material as shown on the drawings, free of particles larger than 1 inch in any dimension, to a height over the pipe or conduit as indicated in the Contract Documents.

1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

G. Place and compact final backfill of satisfactory soil to final subgrade elevation.

H. Coordinate backfilling with utilities testing.

3.13 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:

1. Turf or Unpaved Areas: Plus 1 inch.
2. Walks: Plus 1/2 inch.
3. Pavements: Plus 1/2 inch.

3.14 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

A. On prepared subgrade, place subbase course and base course under pavements and walks as follows:

1. Place base course material over subbase course under hot-mix asphalt pavement.
2. Shape subbase course and base course to required crown elevations and cross-slope grades.
3. Place subbase course and base course 6 inches or less in compacted thickness in a single layer.
4. Place subbase course and base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
5. Compact subbase course and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry density according to ASTM D 1557.

B. Pavement Shoulders: Place shoulders along edges of subbase course and base course to prevent lateral movement. Construct shoulders, at least 12 inches wide, of satisfactory soil materials and compact simultaneously with each subbase and base layer to not less than 95 percent of maximum dry density according to ASTM D 1557.

3.15 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform tests and inspections.

B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.

C. Footing Subgrade: At footing subgrades, each soil stratum will be verified by Geotechnical Engineer and/or Owner's Testing Agency based on the required design bearing capacities.

D. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable.

1. Field in-place density tests may also be performed by the nuclear method according to ASTM D 2922, provided that calibration curves are periodically checked and adjusted to correlate to tests performed using ASTM D 1556. With each density calibration check, check the calibration curves furnished with the moisture gages according to ASTM D 3017.
2. When field in-place density tests are performed using nuclear methods, make calibration checks for both density and moisture gages at beginning of work, on each different type of material encountered, and at intervals as directed by the Engineer.

E. Tests will be performed at the following locations and frequencies, subject to the discretion of the Geotechnical Engineer and/or Owner's Testing Agency:

1. Paved Areas and Walks: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. or less of paved area or building slab, but in no case fewer than three tests.
2. Site Wall Backfill and Base, Structure Base: At each compacted backfill layer, at least one test for every 100 feet or less of wall length, but no fewer than two tests along a wall face.
3. Trench Backfill and Base: At each compacted initial and final backfill layer, at least one test for every 150 feet or less of trench length, but no fewer than two tests.

F. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.16 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by Geotechnical Engineer and/or Owner's Testing Agency; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.17 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

B. Transport surplus satisfactory soil to designated storage areas on Owner's property. Stockpile or spread soil as directed by Architect.

1. Remove waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 312000
03/07/11

February 28, 2011

SECTION 312005 - SEDIMENTATION AND EROSION CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. The work under this Section includes, but is not limited to, the following:

1. Provide all labor, equipment and materials for the installation of required site related erosion control measures if not otherwise directed on the plans. Erosion control shall be in strict conformance with the latest revision of the local and state guidelines for soil erosion and sediment control.

B. All sedimentation and erosion control measures and installations shall conform to the 2002 Connecticut Guidelines for Soil Erosion and Sediment Control.

1.2 GENERAL NOTES

A. The discharge of sediment-laden water from the project site is prohibited. All discharged water from dewatering operations shall discharge into approved dewatering measures as required by the latest revision of the local and state guidelines for soil erosion and sediment control.

B. The Contractor shall install all erosion control measures as depicted on the plans and as required to adhere to latest revision of the local and state guidelines for soil erosion and sediment control.

C. The Contractor shall also be responsible for inspecting and maintaining all erosion control measures until the project is completed.

1.3 SUBMITTALS

A. Provide product data for the following:

1. Erosion control blankets.
2. Filter fabric.
3. Silt fence.
4. Separation fabric.
5. Calcium chloride.
6. Bonded fiber matrix / hydraulically applied mulch.

PART 2 - PRODUCTS

2.1 EROSION CONTROL BLANKETS

A. Erosion control blankets shall be North American Green or Engineer-approved equal. The type of blanket shall be applicable to the use it is intended and/or as indicated on the Contract Documents.

2.2 FILTER FABRIC

A. When filter fabric is required, it shall conform to the requirements of TC MIRAFI Product 140N or an approved equal.

1. Grab Tensile Strength: 120 lbf (minimum); ASTM D 4632.
2. Tear Strength: 50 lbf (minimum); ASTM D 4533.
3. Puncture Resistance: 65 lbf (minimum); ASTM D 4833.
4. Flow Rate: 135 gal/min/ft^2 (minimum); ASTM D 4491.
5. Apparent Opening Size: No. 70 (maximum); ASTM D 4751.

2.3 SILT FENCE

A. When silt fence is required, it shall conform to the requirements of TC MIRAFI Product 100X or an approved equal.

1. Grab Tensile Strength: 124 lbf (minimum); ASTM D 4632.
2. Tear Strength: 65 lbf (minimum); ASTM D 4533.
3. Puncture Resistance: 60 lbf (minimum); ASTM D 4833.
4. Flow Rate: 10 gal/min/ft^2 (minimum; ASTM D 4491.
5. Apparent Opening Size: No. 30 (maximum); ASTM D 4751.

2.4 SEPARATION FABRIC

A. When separation fabric is required, it shall conform to the requirements of TC MIRAFI Product 500X or an approved equal.

1. Grab Tensile Strength: 200 lbf (minimum); ASTM D 4632.
2. Tear Strength: 75 lbf (minimum); ASTM D 4533.
3. Puncture Resistance: 90 lbf (minimum); ASTM D 4833.
4. Flow Rate: 5 gal/min/ft^2 (minimum); ASTM D 4491.
5. Apparent Opening Size: No. 40 (maximum); ASTM D 4751.

2.5 CALCIUM CHLORIDE

A. Calcium chloride shall conform to the requirements of AASHTO M 144. Either regular flake calcium chloride, Type 1, or concentrated flake, pellet or other granular calcium chloride, Type 2, may be used.

2.6 WATER

A. All water used shall be clean and free of harmful amounts of oil, salt, acids, alkalis, sugar, organic matter, and other substances incurious to the finished product, plant life, or the establishment of vegetation.

2.7 STONE

A. Refer to Division 31 Section "Earth Moving" for additional information.

2.8 SEEDING

A. Permanent Seeding: Refer to the Landscape Architect’s drawings and specifications for additional information.

B. Temporary Seeding: Refer to the latest revision of the local and state guidelines for soil erosion and sediment control for additional information.

2.9 BONDED FIBER MATRIX / HYDRAULICALLY APPLIED MULCH

A. Material shall conform to the manufacturer’s requirements as applicable to construction region and construction time period.

PART 3 - EXECUTION

3.1 ADDITIONAL INFORMATION AND REQUIREMENTS

A. Refer to the soil erosion and sediment control narrative and specification on the Contract Drawings for additional information and requirements.

3.2 EROSION CONTROL BLANKETS

A. Erosion control blankets shall be placed where indicated on the Contract Drawings, where directed by the erosion control supervisor and as required to adhere to the latest revision of the local and state guidelines for soil erosion and sediment control.

B. Erosion control blankets shall also be placed on all exposed cut/fill slopes to protect against rainfall, in areas where seed and mulch will not stay in place alone and where seeding is outside the growing season.

C. Grade and smooth the slope to provide good adhesion to soil surface.

D. When erosion control blankets are installed to enhance plant growth, apply fertilizer, lime, and seed prior to placing blankets.

E. Anchor erosion control blankets as recommended by the erosion control blanket manufacturer.

3.3 FILTER FABRIC

A. Inlet Protection:

1. Install filter fabric between the grate and frame of inlet structures that have the potential to receive construction stormwater.
2. Install filter fabric around subsurface drainage as required by the Contract Drawings.

3.4 SILT FENCE

A. Install silt fence as indicated on the Contract Drawings and per the latest revision of the local and state guidelines for soil erosion and sediment control. When two sections adjoin each other, they shall be overlapped by 6 inches, folded and stapled.

B. Inlet structures are to be surrounded by silt fence as indicated on the Contract Drawings.

C. All stockpile material (topsoil, borrow, etc.) shall have a silt fence constructed around the perimeter. Topsoil stockpiles left in place for a greater than 14 days shall be temporarily seeded to minimize erosion of the soil constituents and release of soluble nutrients. During windy conditions, stockpiled material shall be covered or watered appropriately to prevent wind erosion.

3.5 SEPARATION FABRIC

A. Install as indicated on the Contract Drawings.

3.6 CALCIUM CHLORIDE

A. Control dust through the application of calcium chloride or water. An average application of one pound of calcium chloride per square yard of exposed area should be considered for each treatment. The exact number of applications and amount of dust control shall be based upon field and weather conditions. It shall be spread in such a manner and with such devices so that uniform distribution is attained. Calcium chloride shall not be applied within 50 feet of a stream bank or wetland.

3.7 RESTORATION

A. As soon as construction is completed in a given area, it shall be top-soiled, seeded, fertilized and/or mulched as specified on the drawings and in Part 2 of this Specification.

B. The responsibility for satisfactory results on the work carried out under this item rests on the Contractor regardless of the prior approval of materials and methods on the part of the Engineer. The Contractor shall maintain the restored areas until such time as the work is accepted by the Owner. Maintenance shall include all regarding, refertilizing, reseeding, remulching, etc., which may be necessary in the opinion of the Owner and the Engineer.

3.8 CONSTRUCTION ENTRANCE

A. A stabilized pad of crushed stone located at any point where traffic will be entering or leaving the construction site to or from a public right-of-way or street or as shown on the drawings shall be constructed for the purpose of preventing the tracking of sediments onto public rights-of-way.

B. Design Criteria:

1. Use 1-1/2 to 2-1/2 inches of stone.
2. Use an 8 inch layer of stone.
3. Stone pad shall be full width of entrance.
4. Minimum length shall be 50 feet, unless otherwise authorized by the Engineer.

END OF SECTION 312005
03/07/11

February 28, 2011

SECTION 321216 - ASPHALT PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. State of Connecticut Department of Transportation, Standard Specifications for Roads, Bridges and Incidental Construction, latest edition.

1.2 SUMMARY

A. Section Includes:

1. Hot-mix asphalt patching.

1.3 DEFINITION

A. Hot-Mix Asphalt Paving Terminology: Refer to ASTM D 8 for definitions of terms.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.

1. Job-Mix Designs: For each job mix proposed for the Work.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified manufacturer and Installer.

B. Material Certificates: For each paving material, from manufacturer.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A paving-mix manufacturer registered with and approved by authorities having jurisdiction or the DOT of state in which Project is located.

B. Testing Agency Qualifications: Qualified according to ASTM D 3666 for testing indicated.

C. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of all governing authorities for asphalt paving work.

1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver pavement-marking materials to Project site in original packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacture, and directions for storage.

B. Store pavement-marking materials in a clean, dry, protected location within temperature range required by manufacturer. Protect stored materials from direct sunlight.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:

1. Prime Coat: Minimum surface temperature of 60 deg F.
2. Tack Coat: Minimum surface temperature of 60 deg F.
3. Slurry Coat: Comply with weather limitations in ASTM D 3910.
4. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.
5. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement.

PART 2 - PRODUCTS

2.1 AGGREGATES

A. General: Use materials and gradations that have performed satisfactorily in previous installations.

B. Coarse Aggregate: ASTM D 692, sound; angular crushed stone, crushed gravel, or cured, crushed blast-furnace slag.

C. Fine Aggregate: AASHTO M 29, sharp-edged natural sand or sand prepared from stone, gravel, cured blast-furnace slag, or combinations thereof.

1. For hot-mix asphalt, limit natural sand to a maximum of 20 percent by weight of the total aggregate mass.

2.2 ASPHALT MATERIALS

A. Asphalt Binder: AASHTO MP 1a, performance grade as required by state DOT specifications where the project is located.

B. Prime Coat: Asphalt emulsion prime coat complying with state DOT specifications where project is located.

C. Tack Coat: ASTM D 977 emulsified asphalt, or ASTM D 2397 cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application. Verify acceptance with state DOT where the project is located.

D. Water: Potable.

E. Undersealing Asphalt: ASTM D 3141, pumping consistency.

2.3 AUXILIARY MATERIALS

A. Herbicide: Commercial chemical for weed control, registered by the EPA. Provide in granular, liquid, or wettable powder form.

B. Sand: ASTM D 1073, Grade Nos. 2 or 3.

C. Joint Sealant: ASTM D 6690 or AASHTO M 324, Type II or III, hot-applied, single-component, polymer-modified bituminous sealant.

D. Pavement-Marking Paint: Comply with state DOT where the project is located.

1. Color: As determined by Architect.

2.4 MIXES

A. Hot-Mix Asphalt: Dense, hot-laid, hot-mix asphalt plant mixes approved by authorities having jurisdiction and complying with the following requirements:

1. Provide mixes with a history of satisfactory performance in geographical area where Project is located.
2. Surface Binder Course: Per state DOT where the project is located. Refer to drawings for additional information.
3. Surface Wearing Course: Per state DOT where the project is located. Refer to drawings for additional information.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that subgrade is dry and in suitable condition to begin paving.

B. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
2. Proof roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Engineer, and replace with compacted backfill or fill as directed.

C. Proceed with paving only after unsatisfactory conditions have been corrected.

3.2 PATCHING

A. Hot-Mix Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.

B. Portland Cement Concrete Pavement: Break cracked slabs and roll as required to reseat concrete pieces firmly.

1. Pump hot undersealing asphalt under rocking slab until slab is stabilized or, if necessary, crack slab into pieces and roll to reseat pieces firmly.
2. Remove disintegrated or badly cracked pavement. Excavate rectangular or trapezoidal patches, extending into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Recompact existing unbound-aggregate base course to form new subgrade.

C. Tack Coat: Apply uniformly to vertical surfaces abutting or projecting into new, hot-mix asphalt paving at a rate of 0.05 to 0.15 gal./sq. yd..

1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

D. Patching: Partially fill excavated pavements with hot-mix asphalt base mix and, while still hot, compact. Cover asphalt base course with compacted, hot-mix surface layer finished flush with adjacent surfaces.

E. Comply with City of New London requirements.

3.3 REPAIRS

A. Leveling Course: Install and compact leveling course consisting of hot-mix asphalt surface course to level sags and fill depressions deeper than 1 inch in existing pavements.

1. Install leveling wedges in compacted lifts not exceeding 3 inches thick.

B. Crack and Joint Filling: Remove existing joint filler material from cracks or joints to a depth of 1/4 inch.

1. Clean cracks and joints in existing hot-mix asphalt pavement.
2. Use emulsified-asphalt slurry to seal cracks and joints less than 1/4 inch wide. Fill flush with surface of existing pavement and remove excess.
3. Use hot-applied joint sealant to seal cracks and joints more than 1/4 inch wide. Fill flush with surface of existing pavement and remove excess.

3.4 SURFACE PREPARATION

A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.

B. Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.

1. Mix herbicide with prime coat if formulated by manufacturer for that purpose.

C. Prime Coat: Apply uniformly over surface of compacted unbound-aggregate base course at a rate of 0.15 to 0.50 gal./sq. yd.. Apply enough material to penetrate and seal but not flood surface. Allow prime coat to cure.

1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.
2. Protect primed substrate from damage until ready to receive paving.

D. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd..

1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.5 HOT-MIX ASPHALT PLACING

A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.

1. Place hot-mix asphalt base course in number of lifts and thicknesses as specified by the state DOT where the project is located.
2. Place hot-mix asphalt surface course in number of lifts and thicknesses as specified by the state DOT where the project is located.
3. Spread mix at minimum temperature of 250 deg F.
4. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes unless otherwise indicated.
5. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.

B. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.

1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete a section of asphalt base course before placing asphalt surface course.

C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.6 JOINTS

A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.

1. Clean contact surfaces and apply tack coat to joints.
2. Offset longitudinal joints, in successive courses, a minimum of 6 inches.
3. Offset transverse joints, in successive courses, a minimum of 24 inches.

4. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time.
5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
6. Compact asphalt at joints to a density within 2 percent of specified course density.

3.7 COMPACTION

A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.

1. Complete compaction before mix temperature cools to 185 deg F.

B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.

C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:

1. Average Density: Each course placed at a depth of 1-1/2 inches or greater shall have the mat and longitudinal joints compacted to a minimum of 92.0 percent and no more than 97.0 percent density as determined by AASHTO T209 (modified).

D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.

E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.

F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.

G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.8 INSTALLATION TOLERANCES

A. Pavement Thickness: Compact each course to produce the thickness indicated within the following tolerances:

1. Surface Binder Course: Plus or minus 1/2 inch.
2. Surface Wearing Course: Plus 1/4 inch, no minus.

B. Pavement Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:

1. Surface Binder Course: 1/4 inch.
2. Surface Wearing Course: 1/8 inch.

3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.

3.9 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

C. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.

D. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.

E. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to ASTM D 979.

1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 2041, and compacted according to job-mix specifications.
2. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM D 2726.

    a. One core sample will be taken for every 1000 sq. yd. or less of installed pavement, with no fewer than 3 cores taken.
    b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.

F. Replace and compact hot-mix asphalt where core tests were taken.

G. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.10 DISPOSAL

A. Except for material indicated to be recycled, remove excavated materials from Project site and legally dispose of them in an EPA-approved landfill.

1. Do not allow milled materials to accumulate on-site.

3.11 AS-BUILT DRAWINGS

A. The Contractor shall provide as-built drawings including as-built ties and markups on a monthly basis. As work progresses, all construction activities shall be documented. The record documents shall include:

1. All demolition and abandonment of underground utilities and structures.
2. Final documents (drawings and electronic files in AutoCAD format, latest edition), shall be submitted to the designated Owner's Representative not later than 30 days after substantial completion of the project. All comments shall be incorporated to the final documents within 14

days after receiving them from the Owner's Representative. The final record set (hard copy and the electronic files) shall be submitted to the Owner's Representative.

END OF SECTION 321216
03/07/11

February 28, 2011

SECTION 323113 - CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. State of Connecticut Department of Transportation, Standard Specifications for Roads, Bridges, and Incidental Construction, latest edition.

2.1 SUMMARY

A. Section Includes:

1. Chain-link fences.
2. Gates: swing.

3.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design chain-link fences and gates, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Chain-link fence and gate framework shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to ASCE/SEI 7:

1. Minimum Post Size: Determine according to ASTM F 1043 for framework up to 12 feet high, and post spacing not to exceed 6 feet.
2. Minimum Post Size and Maximum Spacing: Determine according to CLFMI WLG 2445, based on mesh size and pattern specified and on the following:

a. Wind Loads: 120.
b. Exposure Category: B.
c. Fence Height: 6 feet.
d. Material Group: IA, ASTM F 1043, Schedule 40 steel pipe.

C. Lightning Protection System: Maximum grounding-resistance value of 25 ohms under normal dry conditions.

1. Refer to Section “Grounding and Bonding” for additional requirements.

4.1 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for chain-link fences and gates.

1. Fence and gate posts, rails, and fittings.
2. Chain-link fabric, reinforcements, and attachments.
3. Barbed wire.
4. Gates and hardware.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work. Show accessories, hardware, gate operation, and operational clearances.

C. Samples for Initial Selection: For components with factory-applied color finishes.

D. Delegated-Design Submittal: For chain-link fences and gate framework indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

5.1 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified factory-authorized service representative.

B. Product Certificates: For each type of chain-link fence, and gate, from manufacturer.

C. Product Test Reports: For framing strength according to ASTM F 1043.

D. Field quality-control reports.

E. Warranty: Sample of special warranty.

6.1 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For the following to include in emergency, operation, and maintenance manuals:

1. Finishes.
2. Gate hardware.

7.1 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing fence grounding. Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Emergency Access Requirements: Comply with requirements of authorities having jurisdiction for gates with automatic gate operators serving as a required means of access.

8.1 PROJECT CONDITIONS

A. Field Measurements: Verify layout information for chain-link fences and gates shown on Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

9.1 WARRANTY

A. Special Warranty: Manufacturer's standard form in which Installer agrees to repair or replace components of chain-link fences and gates that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Faulty operation of gate operators and controls.
b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

1.1 CHAIN-LINK FENCE FABRIC

A. General: Provide fabric in one-piece heights measured between top and bottom of outer edge of selvage knuckle or twist. Comply with CLFMI Product Manual and with requirements indicated below:

1. Fabric Height: As indicated on Drawings.
2. Steel Wire Fabric: Wire with a diameter of 0.192 inch.
   a. Zinc-Coated Fabric: ASTM A 392, Type II, Class 2, 2.0 oz./sq. ft. with zinc coating applied after weaving.
   b. Mesh Size: 1 inch.

2.1 FENCE FRAMING

A. Posts and Rails: Comply with ASTM F 1043 for framing, including rails, braces, and line; terminal; and corner posts. Provide members with minimum dimensions and wall thickness according to ASTM F 1043 and ASTM F 1083 based on the following:

1. Heavy Industrial Strength: Material Group IA, round steel pipe, Schedule 40.

a. Line Post: 2.375 inches in diameter.
b. End, Corner and Pull Post: 2.875 inches in diameter.

2. Horizontal Framework Members: top and bottom rails complying with ASTM F 1043.

a. Top Rail: 1.66 inches in diameter.

3. Brace Rails: Comply with ASTM F 1043.
4. Metallic Coating for Steel Framing:

a. Type A, consisting of not less than minimum 2.0-oz./sq. ft. average zinc coating per ASTM A 123/A 123M or 4.0-oz./sq. ft. zinc coating per ASTM A 653/A 653M.

3.1 TENSION and BARBED WIRE

A. Metallic-Coated Steel Wire: 0.177-inch- diameter, marcelled tension wire complying with ASTM A 817 and ASTM A 824, with the following metallic coating:

1. Type II, zinc coated (galvanized) by hot-dip process, with the following minimum coating weight:
   a. Matching chain-link fabric coating weight.

4.1 SWING GATES

A. General: Comply with ASTM F 900 for gate posts and double swing gate types.

1. Gate Leaf Width: 36 inches.
2. Gate Fabric Height: To match fence height.

B. Pipe and Tubing:

1. Zinc-Coated Steel: Comply with ASTM F 1043 and ASTM F 1083; protective coating and finish to match fence framing.
2. Gate Posts: Round tubular steel.
3. Gate Frames and Bracing: Round tubular steel.

C. Frame Corner Construction: Assembled with corner fittings.

D. Extended Gate Posts and Frame Members: Extend gate posts and frame end members above top of chain-link fabric at both ends of gate frame as required to attach barbed tape assemblies.

E. Hardware:

1. Hinges: 180-degree inward, 180-degree outward swing.
2. Latches permitting operation from both sides of gate with provision for padlocking accessible from both sides of gate.
3. Lock: Manufacturer's standard.
4. Closer: Manufacturer's standard.

5.1 FITTINGS

A. General: Comply with ASTM F 626.

B. Post Caps: Provide for each post.

1. Provide line post caps with loop to receive tension wire or top rail.

C. Rail and Brace Ends: For each gate, corner, pull, and end post.

D. Rail Fittings: Provide the following:

1. Top Rail Sleeves: Round-steel tubing not less than 6 inches long.

2. Rail Clamps: Line and corner boulevard clamps for connecting top and bottom rails in the fence line-to-line posts.

E. Tension and Brace Bands: Pressed steel.

F. Tension Bars: Steel, length not less than 2 inches shorter than full height of chain-link fabric. Provide one bar for each gate and end post, and two for each corner and pull post, unless fabric is integrally woven into post.

G. Truss Rod Assemblies: Steel, hot-dip galvanized after threading rod and turnbuckle or other means of adjustment.

H. Tie Wires, Clips, and Fasteners: According to ASTM F 626.

1. Standard Round Wire Ties: For attaching chain-link fabric to posts, rails, and frames, complying with the following:

a. Hot-Dip Galvanized Steel: 0.148-inch- diameter wire; galvanized coating thickness matching coating thickness of chain-link fence fabric.

I. Finish:

1. Metallic Coating for Pressed Steel or Cast Iron: Not less than 1.2 oz. /sq. ft. zinc.

a. Polymer coating over metallic coating.

6.1 CAST-IN-PLACE CONCRETE

A. Concrete to be normal weight concrete with a 2,500 psi, 28-day minimum compressive strength; water-cement ratio 0.55 maximum (water content shall include surface water in aggregates); minimum cement content of 5-1/2 sacks per cubic yard, maximum ¾-inch aggregate, four +/- 1 inch slump; 6 percent air content by volume.

1. Portland Cemnet: ASTM C 150, Type I/II.
2. Normal Weight Aggregates: ASTM C33, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source.

a. Maximum Coarse Aggregate Size; ¾-inch nominal, unless otherwise noted.
b. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

3. Water: ASTM C94, potable.

7.1 GROUT AND ANCHORING CEMENT

A. Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout, recommended in writing by manufacturer, for exterior applications.

8.1 FENCE GROUNDING

A. Conductors: Bare, solid wire for No. 6 AWG and smaller; stranded wire for No. 4 AWG and larger.

1. Material above Finished Grade: Aluminum.
2. Material on or below Finished Grade: Copper.
3. Bonding Jumpers: Braided copper tape, 1 inch wide, woven of No. 30 AWG bare copper wire, terminated with copper ferrules.

B. Connectors and Grounding Rods: Comply with UL 467.

1. Connectors for Below-Grade Use: Exothermic welded type.
2. Grounding Rods: Copper-clad steel, 5/8 by 96 inches.

PART 3 - EXECUTION

1.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for a verified survey of property lines and legal boundaries, site clearing, earthwork, pavement work, and other conditions affecting performance of the Work.

1. Do not begin installation before final grading is completed unless otherwise permitted by Architect.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

2.1 PREPARATION

A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

3.1 INSTALLATION, GENERAL

A. Install chain-link fencing to comply with ASTM F 567 and more stringent requirements indicated.

1. Install fencing on established boundary lines inside property line.

4.1 CHAIN-LINK FENCE INSTALLATION

A. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.

B. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.

1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.

C. Terminal Posts: Locate terminal end, corner, and gate posts per ASTM F 567 and terminal pull posts at changes in horizontal or vertical alignment of 15 degrees or more.

D. Line Posts: Space line posts uniformly at 6 feet o.c.

E. Post Bracing and Intermediate Rails: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Diagonally brace terminal posts to adjacent line posts with truss rods and turnbuckles. Install braces at end and gate posts and at both sides of corner and pull posts.

1. Locate horizontal braces at midheight of fabric 72 inches or higher, on fences with top rail and at two-third fabric height on fences without top rail. Install so posts are plumb when diagonal rod is under proper tension.

F. Tension Wire: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Pull wire taut, without sags. Fasten fabric to tension wire with 0.120-inch- diameter hog rings of same material and finish as fabric wire, spaced a maximum of 24 inches o.c. Install tension wire in locations indicated before stretching fabric. Provide horizontal tension wire at the following locations:

1. Extended along top and bottom of fence fabric. Install top tension wire through post cap loops. Install bottom tension wire within 6 inches of bottom of fabric and tie to each post with not less than same diameter and type of wire.

G. Top Rail: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Run rail continuously through line post caps, bending to radius for curved runs and terminating into rail end attached to posts or post caps fabricated to receive rail at terminal posts. Provide expansion couplings as recommended in writing by fencing manufacturer.

H. Intermediate and Bottom Rails: Install and secure to posts with fittings.

I. Chain-Link Fabric: Apply fabric to outside of enclosing framework. Leave 1 inch between finish grade or surface and bottom selvage unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.

J. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull, and gate posts with tension bands spaced not more than 15 inches o.c.

K. Tie Wires: Use wire of proper length to firmly secure fabric to line posts and rails. Attach wire at one end to chain-link fabric, wrap wire around post a minimum of 180 degrees, and attach other end to chain-link fabric per ASTM F 626. Bend ends of wire to minimize hazard to individuals and clothing.

1. Maximum Spacing: Tie fabric to line posts at 12 inches o.c. and to braces at 24 inches o.c.

L. Fasteners: Install nuts for tension bands and carriage bolts on the side of the fence opposite the fabric side. Peen ends of bolts or score threads to prevent removal of nuts.

M. Privacy Slats: Install slats in direction indicated, securely locked in place.

1. Diagonally, for privacy factor of 80 to 85.

5.1 GATE INSTALLATION

A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

6.1 GROUNDING AND BONDING

A. Fence Grounding: Install at maximum intervals of 100 feet and as follows:

1. Fences within 100 Feet of Buildings, Structures, Walkways, and Roadways: Ground at maximum intervals of 50 feet.

a. Gates and Other Fence Openings: Ground fence on each side of opening.

1) Bond metal gates to gate posts.
2) Bond across openings, with and without gates, except openings indicated as intentional fence discontinuities. Use No. 2 AWG wire and bury it at least 18 inches below finished grade.

B. Fences Enclosing Electrical Power Distribution Equipment: Ground as required by IEEE C2 unless otherwise indicated.

C. Grounding Method: At each grounding location, drive a grounding rod vertically until the top is 6 inches below finished grade. Connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at the grounding location, including the following:

1. Make grounding connections to each barbed wire strand with wire-to-wire connectors designed for this purpose.
2. Make grounding connections to each barbed tape coil with connectors designed for this purpose.

D. Bonding Method for Gates: Connect bonding jumper between gate post and gate frame.

E. Connections: Make connections to minimize possibility of galvanic action or electrolysis. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
2. Make connections with clean, bare metal at points of contact.
3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
4. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

F. Bonding to Lightning Protection System: If fence terminates at lightning-protected building or structure, ground the fence and bond the fence grounding conductor to lightning protection down conductor or lightning protection grounding conductor complying with NFPA 780.

7.1 FIELD QUALITY CONTROL

A. Grounding-Resistance Testing: Engage a qualified testing agency to perform tests and inspections.

1. Grounding-Resistance Tests: Subject completed grounding system to a megger test at each grounding location. Measure grounding resistance no fewer than two full days after last trace of precipitation, without soil having been moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural grounding resistance. Perform tests by two-point method according to IEEE 81.

2. Excessive Grounding Resistance: If resistance to grounding exceeds specified value, notify Architect promptly. Include recommendations for reducing grounding resistance and a proposal to accomplish recommended work.
3. Report: Prepare test reports certified by a testing agency of grounding resistance at each test location. Include observations of weather and other phenomena that may affect test results.

8.1 ADJUSTING

A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

B. Lubricate hardware, gate operator, and other moving parts.

9.1 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's personnel to adjust, operate, and maintain chain-link fences and gates.

10.1 AS-BUILT DRAWINGS

A. The Contractor shall provide as-built drawings including as-built ties and markups on a monthly basis. As work progresses, all construction activities shall be documented. The record documents shall include:

1. All demolition and abandonment of underground utilities and structures.
2. Location, elevation, and type (size and quantity) of installed underground utilities and piping. Location, elevation, and type of existing exposed utilities during installation of new work, vaults, manholes, transformers, valves, above- and belowground conduits, walls, bridges, signs, fences, structural fill, and any other surface and subsurface elements as defined in the specifications.
3. The Contractor shall hire the services of a surveyor licensed in the sate where the work is being performed to determine parameters stated above of completed work and record the results and update the electronic files. As-builts shall include lateral and vertical (depth) locations of all utilities at 50 foot increments as well as swing ties.
4. Document installation with photographs in digital format, especially but not limited to, installation and restraint, tapping sleeves, joining of dissimilar materials, anchors and thrust blocks, valves and hydrants, bedding material, and pipe connections to buildings.
5. Final documents (drawings and electronic files in AutoCAD format, latest edition), shall be submitted to the designated Owner’s Representative not later than 30 days after substantial completion of the project. All comments shall be incorporated to the final documents within 14 days after receiving them from the Owner’s Representative. The final record set (hard copy and electronic files) shall be submitted to the Owner’s Representative.

END OF SECTION 323113
03/07/11

February 28, 2011

SECTION 329200 - TURF AND GRASSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Seeding.
2. Hydroseeding.
3. Turf renovation.
4. Erosion-control material(s).

B. Related Sections:

1. Division 31 Section "Site Clearing" for topsoil stripping and stockpiling.
2. Division 31 Section "Earth Moving" for excavation, filling and backfilling, and rough grading.

1.3 DEFINITIONS

A. Duff Layer: The surface layer of native topsoil that is composed of mostly decayed leaves, twigs, and detritus.

B. Finish Grade: Elevation of finished surface of planting soil.

C. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.

D. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.

E. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

F. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.

G. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or top surface of a fill or backfill before planting soil is placed.

H. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

I. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil, but in disturbed areas such as urban environments, the surface soil can be subsoil.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

1. Pesticides and Herbicides: Include product label and manufacturer's application instructions specific to this Project.

B. Certification of Grass Seed: From seed vendor for each grass-seed monostand or mixture stating the botanical and common name, percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.

1. Certification of each seed mixture for turfgrass sod. Include identification of source and name and telephone number of supplier.

C. Qualification Data: For qualified landscape Installer.

D. Product Certificates: For soil amendments and fertilizers, from manufacturer.

E. Material Test Reports: For standardized ASTM D 5268 topsoil, existing native surface topsoil, existing in-place surface soil and imported or manufactured topsoil.

F. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of turf during a calendar year. Submit before expiration of required initial maintenance periods.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape Installer whose work has resulted in successful turf establishment.

1. Professional Membership: Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association.
2. Experience: Five years' experience in turf installation in addition to requirements in Division 01 Section "Quality Requirements."
3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
4. Personnel Certifications: Installer's personnel assigned to the Work shall have certification in one of the following categories from the Professional Landcare Network:

    a. Certified Landscape Technician - Exterior, with installation, maintenance and irrigation specialty area(s), designated CLT-Exterior.
    b. Certified Turfgrass Professional, designated CTP.
    c. Certified Turfgrass Professional of Cool Season Lawns, designated CTP-CSL.

5. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site.

6. Pesticide Applicator: State licensed, commercial.

B. Soil-Testing Laboratory Qualifications: An independent laboratory or university laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.

C. Soil Analysis: For each unamended soil type, furnish soil analysis and a written report by a qualified soil-testing laboratory stating percentages of organic matter; gradation of sand, silt, and clay content; cation exchange capacity; sodium absorption ratio; deleterious material; pH; and mineral and plant-nutrient content of the soil.

1. Testing methods and written recommendations shall comply with USDA's Handbook No. 60.
2. The soil-testing laboratory shall oversee soil sampling, with depth, location, and number of samples to be taken per instructions from Architect. A minimum of three representative samples shall be taken from varied locations for each soil to be used or amended for planting purposes.
3. Report suitability of tested soil for turf growth.

    a. Based on the test results, state recommendations for soil treatments and soil amendments to be incorporated. State recommendations in weight per 1000 sq. ft. or volume per cu. yd. for nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory planting soil suitable for healthy, viable plants.
    b. Report presence of problem salts, minerals, or heavy metals, including aluminum, arsenic, barium, cadmium, chromium, cobalt, lead, lithium, and vanadium. If such problem materials are present, provide additional recommendations for corrective action.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Seed and Other Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws, as applicable.

B. Sod: Harvest, deliver, store, and handle sod according to requirements in "Specifications for Turfgrass Sod Materials" and "Specifications for Turfgrass Sod Transplanting and Installation" in TPI's "Guideline Specifications to Turfgrass Sodding." Deliver sod in time for planting within 24 hours of harvesting. Protect sod from breakage and drying.

C. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Accompany each delivery of bulk fertilizers, lime, and soil amendments with appropriate certificates.

1.7 PROJECT CONDITIONS

A. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with initial maintenance periods to provide required maintenance from date of Substantial Completion.

1. Refer to Part 2, 2.1 SEED.

B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions.

1.8 MAINTENANCE SERVICE

A. Initial Turf Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after each area is planted and continue until acceptable turf is established but for not less than the following periods:

1. Seeded Turf: 90 days from date of Substantial Completion.

a. When initial maintenance period has not elapsed before end of planting season, or if turf is not fully established, continue maintenance during next planting season.

2. Sodded Turf: 90 days from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SEED

A. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Journal of Seed Technology; Rules for Testing Seeds" for purity and germination tolerances.

B. Seed Species: Seed of grass species as follows, with not less than 95 percent germination, not less than 85 percent pure seed, and not more than 0.5 percent weed seed:

1. Seeding done prior to May 1st and September 1st to October 31st shall comply with the following mixture:

Creeping Red Fescue	35 Parts
Chewings Red Fescue	20 Parts
Kentucky 31 Tall Fescue	15 Parts
Baron Bluegrass	20 Parts
Rough Bluegrass	10 Parts

Sow this mixture at the rate of 4 lbs. per 1,000 sq. ft.

2. Seeding done at any other time of the year (May 1st to September 1st) and all seeding of slopes shall comply with the following mixture:

Creeping Red Fescue	35 Parts
Chewings Red Fescue	20 Parts
Kentucky 31 Tall Fescue	20 Parts
Domestic Ryegrass	25 Parts

Sow this mixture at the rate of 6 lbs. per 1,000 sq. ft.

2.2 INORGANIC SOIL AMENDMENTS

A. Lime: ASTM C 602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:

1. Class: T, with a minimum of 99 percent passing through No. 8 sieve and a minimum of 75 percent passing through No. 60 sieve.
2. Provide lime in form of ground dolomitic limestone.

B. Sulfur: Granular, biodegradable, containing a minimum of 90 percent sulfur, and with a minimum of 99 percent passing through No. 6 sieve and a maximum of 10 percent passing through No. 40 sieve.

C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.

D. Aluminum Sulfate: Commercial grade, unadulterated.

E. Perlite: Horticultural perlite, soil amendment grade.

F. Agricultural Gypsum: Minimum 90 percent calcium sulfate, finely ground with 90 percent passing through No. 50 sieve.

G. Sand: Clean, washed, natural or manufactured, and free of toxic materials.

H. Diatomaceous Earth: Calcined, 90 percent silica, with approximately 140 percent water absorption capacity by weight.

I. Zeolites: Mineral clinoptilolite with at least 60 percent water absorption by weight.

2.3 ORGANIC SOIL AMENDMENTS

A. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 3/4-inch sieve; soluble salt content of 5 to 10 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:

1. Organic Matter Content: 50 to 60 percent of dry weight.
2. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.

B. Sphagnum Peat: Partially decomposed sphagnum peat moss, finely divided or of granular texture, with a pH range of 3.4 to 4.8.

C. Muck Peat: Partially decomposed moss peat, native peat, or reed-sedge peat, finely divided or of granular texture, with a pH range of 6 to 7.5, and having a water-absorbing capacity of 1100 to 2000 percent.

D. Wood Derivatives: Decomposed, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture and free of chips, stones, sticks, soil, or toxic materials.

1. In lieu of decomposed wood derivatives, mix partially decomposed wood derivatives with ammonium nitrate at a minimum rate of 0.15 lb/cu. Ft. of loose sawdust or ground bark, or with ammonium sulfate at a minimum rate of 0.25 lb/cu. Ft. of loose sawdust or ground bark.

E. Manure: Well-rotted, unleached, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, and material harmful to plant growth.

2.4 FERTILIZERS

A. Bonemeal: Commercial, raw or steamed, finely ground; a minimum of 4 percent nitrogen and 10 percent phosphoric acid.

B. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.

C. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:

1. Composition: 1 lb/1000 sq. ft. of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.
2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.

D. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:

1. Composition: 20 percent nitrogen, 10 percent phosphorous, and 10 percent potassium, by weight.
2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.

2.5 PLANTING SOILS

A. Planting Soil: ASTM D 5268 topsoil, with pH range of 5.5 to 7, a minimum of 10 percent organic material content; free of stones 1 inch or larger in any dimension and other extraneous materials harmful to plant growth.

B. Planting Soil: Existing, native surface topsoil formed under natural conditions with the duff layer retained during excavation process and stockpiled on-site. Verify suitability of native surface topsoil to produce viable planting soil. Clean soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.

1. Supplement with imported planting soil when quantities are insufficient.
2. Verify planting soil meets requirements in Paragraph A. Provide amendments as required to meet local standards.

C. Planting Soil: Imported topsoil or manufactured topsoil from off-site sources. Obtain topsoil displaced from naturally well-drained construction or mining sites where topsoil occurs at least 4 inches deep; do not obtain from agricultural land, bogs or marshes.

1. Additional Properties of Imported Topsoil or Manufactured Topsoil: Screened and free of stones 1 inch or larger in any dimension; free of roots, plants, sod, clods, clay lumps, pockets of coarse sand, paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, building debris, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, acid, and other extraneous materials harmful to plant growth; free of obnoxious weeds and invasive plants

including quackgrass, Johnsongrass, poison ivy, nutsedge, nimblewill, Canada thistle, bindweed, bentgrass, wild garlic, ground ivy, perennial sorrel, and bromegrass; not infested with nematodes, grubs, other pests, pest eggs, or other undesirable organisms and disease-causing plant pathogens; friable and with sufficient structure to give good tilth and aeration. Continuous, air-filled, pore-space content on a volume/volume basis shall be at least 15 percent when moisture is present at field capacity. Soil shall have a field capacity of at least 15 percent on a dry weight basis.

2. Mix imported topsoil or manufactured topsoil with planting soil as described in Paragraph 4. Provide amendments as required to meet local standards.

2.6 MULCHES

A. Straw Mulch: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.

B. Sphagnum Peat Mulch: Partially decomposed sphagnum peat moss, finely divided or of granular texture, and with a pH range of 3.4 to 4.8.

C. Muck Peat Mulch: Partially decomposed moss peat, native peat, or reed-sedge peat, finely divided or of granular texture, with a pH range of 6 to 7.5, and having a water-absorbing capacity of 1100 to 2000 percent.

D. Compost Mulch: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1-inch sieve; soluble salt content of 2 to 5 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:

1. Organic Matter Content: 50 to 60 percent of dry weight.
2. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.

E. Fiber Mulch: Biodegradable, dyed-wood, cellulose-fiber mulch; nontoxic and free of plant-growth or germination inhibitors; with a maximum moisture content of 15 percent and a pH range of 4.5 to 6.5.

F. Nonasphaltic Tackifier: Colloidal tackifier recommended by fiber-mulch manufacturer for slurry application; nontoxic and free of plant-growth or germination inhibitors.

G. Asphalt Emulsion: ASTM D 977, Grade SS-1; nontoxic and free of plant-growth or germination inhibitors.

2.7 PESTICIDES

A. General: Pesticide, registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

B. Pre-Emergent Herbicide (Selective and Non-Selective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.

C. Post-Emergent Herbicide (Selective and Non-Selective): Effective for controlling weed growth that has already germinated.

2.8 EROSION-CONTROL MATERIALS

A. Erosion-Control Blankets: Biodegradable wood excelsior, straw, or coconut-fiber mat enclosed in a photodegradable plastic mesh. Include manufacturer's recommended steel wire staples. Refer to Specification Section 312001 for more information.

B. Erosion-Control Fiber Mesh: Biodegradable burlap or spun-coir mesh, a minimum of 0.92 lb/sq. yd., with 50 to 65 percent open area. Include manufacturer's recommended steel wire staples. Refer to Specification Section 312001 for more information.

C. Erosion-Control Mats: Cellular, non-biodegradable slope-stabilization mats designed to isolate and contain small areas of soil over steeply sloped surface. Include manufacturer's recommended anchorage system for slope conditions. Refer to Specification Section 312001 for more information.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to be planted for compliance with requirements and other conditions affecting performance.

1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
2. Do not mix or place soils and soil amendments in frozen, wet, or muddy conditions.
3. Suspend soil spreading, grading, and tilling operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
4. Uniformly moisten excessively dry soil that is not workable and which is too dusty.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Architect and replace with new planting soil.

3.2 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by planting operations.

1. Protect adjacent and adjoining areas from hydroseeding and hydromulching overspray.
2. Protect grade stakes set by others until directed to remove them.

B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.3 TURF AREA PREPARATION

A. Limit turf subgrade preparation to areas to be planted.

B. Newly Graded Subgrades: Loosen subgrade to a minimum depth of 6 inches. Remove stones larger than 1 inch in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.

1. Apply fertilizer directly to subgrade before loosening.
2. Thoroughly blend planting soil off-site before spreading or spread topsoil, apply soil amendments and fertilizer on surface, and thoroughly blend planting soil.

    a. Delay mixing fertilizer with planting soil if planting will not proceed within a few days.
    b. Mix lime with dry soil before mixing fertilizer.

3. Spread planting soil to a depth of 6 inches but not less than required to meet finish grades after light rolling and natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.

    a. Spread approximately 1/2 the thickness of planting soil over loosened subgrade. Mix thoroughly into top 2 inches of subgrade. Spread remainder of planting soil.
    b. Reduce elevation of planting soil to allow for soil thickness of sod.

C. Unchanged Subgrades: If turf is to be planted in areas unaltered or undisturbed by excavating, grading, or surface-soil stripping operations, prepare surface soil as follows:

1. Remove existing grass, vegetation, and turf. Do not mix into surface soil.
2. Loosen surface soil to a depth of at least 8 inches. Apply soil amendments and fertilizers according to planting soil mix proportions and mix thoroughly into top 4 inches of soil. Till soil to a homogeneous mixture of fine texture.

    a. Apply fertilizer directly to surface soil before loosening.

3. Remove stones larger than 1 inch in any dimension and sticks, roots, trash, and other extraneous matter.
4. Legally dispose of waste material, including grass, vegetation, and turf, off Owner's property.

D. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/2 inch of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit finish grading to areas that can be planted in the immediate future.

E. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

F. Before planting, obtain Engineer’s acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.4 PREPARATION FOR EROSION-CONTROL MATERIALS

A. Prepare area as specified in "Turf Area Preparation" Article.

B. For erosion-control mats, install planting soil in two lifts, with second lift equal to thickness of erosion-control mats. Install erosion-control mat and fasten as recommended by material manufacturer.

C. Fill cells of erosion-control mat with planting soil and compact before planting.

D. For erosion-control blanket or mesh, install from top of slope, working downward, and as recommended by material manufacturer for site conditions. Fasten as recommended by material manufacturer.

E. Moisten prepared area before planting if surface is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

3.5 SEEDING

A. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.

1. Do not use wet seed or seed that is moldy or otherwise damaged.
2. Do not seed against existing trees. Limit extent of seed to outside edge of planting saucer.

B. Sow seed at a total rate of not less than 8 lb/1000 sq. ft.

C. Rake seed lightly into top 1/8 inch of soil, roll lightly, and water with fine spray.

D. Protect seeded areas with slopes exceeding 1:4 with erosion-control blankets installed and stapled according to manufacturer's written instructions.

E. Protect seeded areas with erosion-control mats where shown on Drawings; install and anchor according to manufacturer's written instructions.

F. Protect seeded areas with slopes not exceeding 1:6 by spreading straw mulch. Spread uniformly at a minimum rate of 2 tons/acre to form a continuous blanket 1-1/2 inches in loose thickness over seeded areas. Spread by hand, blower, or other suitable equipment.

1. Anchor straw mulch by crimping into soil with suitable mechanical equipment.

G. Protect seeded areas from hot, dry weather or drying winds by applying compost mulch, peat mulch, planting soil within 24 hours after completing seeding operations. Soak areas, scatter mulch uniformly to a thickness of 3/16 inch, and roll surface smooth.

3.6 HYDROSEEDING

A. Hydroseeding: Mix specified seed, fertilizer, and fiber mulch in water, using equipment specifically designed for hydroseed application. Continue mixing until uniformly blended into homogeneous slurry suitable for hydraulic application.

1. Mix slurry with nonasphaltic or fiber-mulch tackifier per manufacturer's recommendations.
2. Apply slurry uniformly to all areas to be seeded in a one-step process. Apply slurry at a rate so that mulch component is deposited at not less than 1500-lb/acre dry weight, and seed component is deposited at not less than the specified seed-sowing rate.
3. Apply slurry uniformly to all areas to be seeded in a two-step process. Apply first slurry coat at a rate so that mulch component is deposited at not less than 500-lb/acre dry weight, and seed component is deposited at not less than the specified seed-sowing rate. Apply slurry cover coat of fiber mulch (hydromulching) at a rate of 1000 lb/acre.

3.7 TURF RENOVATION

A. Renovate existing turf.

B. Renovate existing turf damaged by Contractor's operations, such as storage of materials or equipment and movement of vehicles.

1. Reestablish turf where settlement or washouts occur or where minor regrading is required.
2. Install new planting soil as required.

C. Remove sod and vegetation from diseased or unsatisfactory turf areas; do not bury in soil.

D. Remove topsoil containing foreign materials such as oil drippings, fuel spills, stones, gravel, and other construction materials resulting from Contractor's operations, and replace with new planting soil.

E. Mow, dethatch, core aerate, and rake existing turf.

F. Remove weeds before seeding. Where weeds are extensive, apply selective herbicides as required. Do not use pre-emergence herbicides.

G. Remove waste and foreign materials, including weeds, soil cores, grass, vegetation, and turf, and legally dispose of them off Owner's property.

H. Till stripped, bare, and compacted areas thoroughly to a soil depth of 6 inches.

I. Apply soil amendments and initial fertilizers required for establishing new turf and mix thoroughly into top 4 inches of existing soil. Install new planting soil to fill low spots and meet finish grades.

J. Apply seed and protect with straw mulch as required for new turf.

K. Water newly planted areas and keep moist until new turf is established.

3.8 TURF MAINTENANCE

A. Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.

1. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace materials and turf damaged or lost in areas of subsidence.
2. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.
3. Apply treatments as required to keep turf and soil free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards.

B. Watering: Install and maintain temporary piping, hoses, and turf-watering equipment to convey water from sources and to keep turf uniformly moist to a depth of 4 inches.

1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.

2. Water turf with fine spray at a minimum rate of 1 inch per week unless rainfall precipitation is adequate.

C. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than 1/3 of grass height. Remove no more than 1/3 of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain the following grass height:

1. Mow perennial ryegrass to a height of 1 to 2 inches.
2. Mow Kentucky bluegrass, annual ryegrass and chewings red fescue to a height of 1-1/2 to 2 inches.
3. Mow turf-type tall fescue to a height of 2 to 3 inches.

D. Turf Postfertilization: Apply fertilizer after initial mowing and when grass is dry.

1. Use fertilizer that will provide actual nitrogen of at least 1 lb/1000 sq. ft. to turf area.

3.9 SATISFACTORY TURF

A. Turf installations shall meet the following criteria as determined by Engineer:

1. Satisfactory Seeded Turf: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. and bare spots not exceeding 3 by 3 inches.
2. Satisfactory Sodded Turf: At end of maintenance period, a healthy, well-rooted, even-colored, viable turf has been established, free of weeds, open joints, bare areas, and surface irregularities.

B. Use specified materials to reestablish turf that does not comply with requirements and continue maintenance until turf is satisfactory.

3.10 PESTICIDE APPLICATION

A. Apply pesticides and other chemical products and biological control agents in accordance with requirements of authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.

B. Post-Emergent Herbicides (Selective and Non-Selective): Apply only as necessary to treat already-germinated weeds and in accordance with manufacturer's written recommendations.

3.11 CLEANUP AND PROTECTION

A. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established.

C. Remove nondegradable erosion-control measures after grass establishment period.

END OF SECTION 329200
03/07/11

February 28, 2011

SECTION 330500 - COMMON WORK RESULTS FOR UTILITIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Piping joining materials.
2. Transition fittings.
3. Dielectric fittings.
4. Sleeves.
5. Identification devices.
6. Grout.
7. Flowable fill.
8. Piped utility demolition.
9. Piping system common requirements.
10. Equipment installation common requirements.
11. Concrete bases.
12. Metal supports and anchorages.

1.3 DEFINITIONS

A. Exposed Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions.

B. Concealed Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

C. PVC: Polyvinyl chloride plastic.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:

1. Dielectric fittings.
2. Identification devices.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.6 COORDINATION

A. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

B. Coordinate installation of identifying devices after completing covering and painting if devices are applied to surfaces.

C. Coordinate size and location of concrete bases. Formwork, reinforcement, and concrete requirements are specified in Section 033000 "Cast-in-Place Concrete."

PART 2 - PRODUCTS

2.1 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness, unless otherwise indicated.

a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

C. Solvent Cements for Joining Plastic Piping:

1. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
2. PVC to ABS Piping Transition: ASTM D 3138.

2.2 TRANSITION FITTINGS

A. Transition Fittings, General: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.

B. Transition Couplings NPS 1-1/2 and Smaller:

1. Underground Piping: Manufactured piping coupling or specified piping system fitting.

C. AWWA Transition Couplings NPS 2 and Larger:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Cascade Waterworks Mfg. Co.
b. Dresser, Inc.; DMD Div.
c. Ford Meter Box Company, Inc. (The); Pipe Products Div.
d. JCM Industries.
e. Smith-Blair, Inc.
f. Viking Johnson.

2. Description: AWWA C219, metal sleeve-type coupling for underground pressure piping.

D. Plastic-to-Metal Transition Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Spears Manufacturing Co.

2. Description: PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

2.3 SLEEVES

A. Mechanical sleeve seals for pipe penetrations are specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

B. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized, plain ends.

2.4 IDENTIFICATION DEVICES

A. General: Products specified are for applications referenced in other utilities Sections. If more than single type is specified for listed applications, selection is Installer's option.

B. Equipment Nameplates: Metal permanently fastened to equipment with data engraved or stamped.

1. Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and essential data.
2. Location: Accessible and visible.

2.5 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post hardening, volume adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

2.6 FLOWABLE FILL

A. Description: Low-strength-concrete, flowable-slurry mix.

1. Cement: ASTM C 150, Type I, portland.
2. Density: 115- to 145-lb/cu. ft..
3. Aggregates: ASTM C 33, natural sand, fine and crushed gravel or stone, coarse.
4. Water: Comply with ASTM C 94/C 94M.
5. Strength: 100 to 200 psig at 28 days.

PART 3 - EXECUTION

3.1 PIPED UTILITY DEMOLITION

A. Refer to Section 024119 "Selective Structure Demolition" for general demolition requirements and procedures.

B. Disconnect, demolish, and remove piped utility systems, equipment, and components indicated to be removed.

1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
2. Piping to Be Abandoned in Place: Drain piping. Fill abandoned piping with flowable fill, and cap or plug piping with same or compatible piping material.
3. Equipment to Be Removed: Disconnect and cap services and remove equipment.
4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make operational.
5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 PIPING INSTALLATION

A. Install piping according to the following requirements and utilities Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on the Coordination Drawings.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping to permit valve servicing.

E. Install piping at indicated slopes.

F. Install piping free of sags and bends.

G. Install fittings for changes in direction and branch connections.

H. Select system components with pressure rating equal to or greater than system operating pressure.

I. Sleeves are not required for core-drilled holes.

J. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves in new walls and slabs as new walls and slabs are constructed.

a. Steel pipe sleeves.

K. Verify final equipment locations for roughing-in.

L. Refer to equipment specifications in other Sections for roughing-in requirements.

3.3 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and utilities Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.4 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Install dielectric fittings at connections of dissimilar metal pipes.

3.5 EQUIPMENT INSTALLATION

A. Install equipment level and plumb, unless otherwise indicated.

B. Install equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference with other installations. Extend grease fittings to an accessible location.

C. Install equipment to allow right of way to piping systems installed at required slope.

3.6 IDENTIFICATION

A. Equipment: Install engraved plastic-laminate sign or equipment marker on or near each major item of equipment.

1. Lettering Size: Minimum 1/4 inch high for name of unit if viewing distance is less than 24 inches, 1/2 inch high for distances up to 72 inches, and proportionately larger lettering for greater distances. Provide secondary lettering two-thirds to three-fourths of size of principal lettering.
2. Text of Signs: Provide name of identified unit. Include text to distinguish among multiple units, inform user of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

B. Adjusting: Relocate identifying devices that become visually blocked by work of this or other Divisions.

3.7 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of base.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Section 033000 "Cast-in-Place Concrete."

3.8 GROUTING

A. Mix and install grout for equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

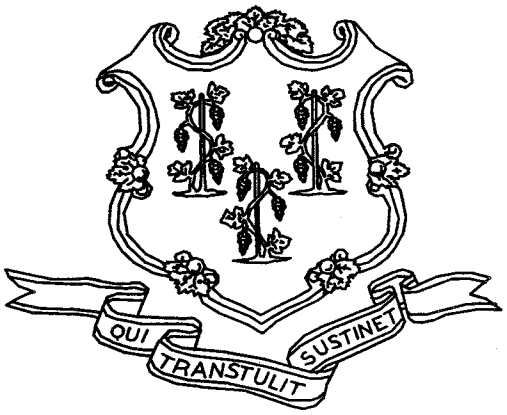
G. Place grout around anchors.

H. Cure placed grout.

END OF SECTION 330500
03/07/11

ASBESTOS INSPECTION REPORT

BOILER ROOM
ENFIELD ARMORY
1635 KING STREET
ENFIELD, CONNECTICUT 06082
DPW BUILDING NUMBER 12624
PROJECT #11MIL217-2401
APPENDIX 1



STATE OF CONNECTICUT
MILITARY DEPARTMENT

Prepared by:

ATC ASSOCIATES, INC.
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ATC PROJECT NUMBER 61.22573.0015 TASK 29

APRIL 30, 2010

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1.0 INTRODUCTION

ATC Associates, Inc. (ATC) of East Hartford, Connecticut was retained by the State of Connecticut Department of Public Works (CTDPW) to conduct a survey to identify asbestos-containing materials (ACM) located in the Boiler Room of the Enfield Armory at 1635 King Street, Enfield, Connecticut. The purpose of the investigation was to identify (ACM) prior to boiler replacement. The scope of the asbestos inspection included: surveying, sampling, and testing of suspect interior building materials affected by the boiler replacement.

The asbestos inspection was conducted by Mr. William Schaal of ATC on April 9, 2010. Mr. Schaal is a State of Connecticut Department of Public Health (CTDPH) licensed asbestos inspector (CTDPH license number 000639). The survey was performed as a walk-through visual inspection, combined with the collection and analysis of bulk samples.

2.0 ASBESTOS-CONTAINING MATERIALS SURVEY

Interior building components which were considered suspect ACM consist of pipe fittings, breeching insulation, fire brick and interior boiler residue.

2.1 ASBESTOS BULK SAMPLE COLLECTION/ANALYSIS PROCEDURE

Building materials considered suspect ACM were inspected and assessed using the methods presented in the United States Environmental Protection Agency AHERA regulations (40 CFR Part 763) and NESHAP regulations (40 CFR Part 61).

ATC collected bulk samples of building materials utilizing a sampling strategy that correlated with 40 CFR 763.86 as follows:

(a) *Surfacing materials.* An accredited inspector shall collect, in a statistically random manner that is representative of the homogeneous area, bulk samples from each homogeneous area of friable surfacing material that is not assumed to be ACM, and shall collect the samples as follows:

(1) At least three bulk samples shall be collected from each homogeneous area that is 1,000 ft^2 or less, except as provided in 40 CFR Part 763.87(c)(2).

(2) At least five bulk samples shall be collected from each homogeneous area that is greater than 1,000 ft^2 but less than or equal to 5,000 ft^2, except as provided in 40 CFR Part 763.87(c)(2).

(3) At least seven bulk samples shall be collected from each homogeneous area that is greater than 5,000 ft^2, except as provided in 40 CFR Part 763.87(c)(2).

(b) *Thermal system insulation.*

(1) Except as provided in paragraphs (b)(2) through (4) of this section and 40 CFR Part 763.87(c), an accredited inspector shall collect, in a randomly distributed manner, at least three bulk samples from each homogeneous area of thermal system insulation that is not assumed to be ACM.

(2) Collect at least one bulk sample from each homogeneous area of patched thermal system insulation that is not assumed to be ACM if the patched section is less than 6 linear or square feet.

(3) In a manner sufficient to determine whether the material is ACM or not ACM, collect bulk samples from each insulated mechanical system that is not assumed to be ACM where cement or plaster is used on fittings such as tees, elbows, or valves, except as provided under 40 CFR Part 763.87(c)(2).

(4) Bulk samples are not required to be collected from any homogeneous area where the accredited inspector has determined that the thermal system insulation is fiberglass, foam glass, rubber, or other non-ACM.

(c) *Miscellaneous materials.* In a manner sufficient to determine whether material is ACM or not ACM, an accredited inspector shall collect bulk samples from each homogeneous area of friable or non-friable miscellaneous material that is not assumed to be ACM.

The bulk samples collected during the survey were analyzed by AmeriSci (NVLAP #200546-0) located in New York, New York. The bulk samples were analyzed by Polarized Light Microscopy (PLM) with dispersion staining using the EPA method as defined in Perkins, R.L. and B.W. Harvey "Method for the Determination of Asbestos in Bulk Materials," July 1993, p.61 (EPA 600/M4-82-020 Method). Utilizing PLM, the microscopist is able to identify and distinguish between asbestos group minerals and other fibrous materials such as cellulose, mineral wool, fiberglass, or synthetic fibers. The quantities of each of these substances is estimated based on the procedures defined in the above-cited reference and are reported as a percentage.

The EPA recognizes the following as asbestos: Chrysotile, Crocidolite, Amosite, Tremolite, Actinolite, and Anthophyllite. To be classified as ACM, the material must be determined to contain greater than one percent (1%) asbestos. In order to consider a material to be non-ACM, all samples of a homogeneous type of material that are collected must be analyzed and all results must indicate the material to contain less than 1% asbestos by weight.

3.0 ASBESTOS-CONTAINING MATERIALS

The results of PLM laboratory analysis indicated that the following materials are asbestos-containing materials (ACM). A complete listing of all suspect materials sampled by ATC during this survey is included in Section 6.0. ACM are those materials that contain greater than 1% asbestos, and are as follows:

- Pipe Fitting Insulation at Boiler
- Breeching Insulation at Duct

The remaining materials which were sampled and tested were found to contain no detectable amounts of asbestos. Specifically, the following materials throughout the building were determined to be non-ACM:

- Interior Residue at Boiler
- Interior Firebrick at Boiler

Refer to Section 6.0, Bulk Sample Summary of Suspect Materials, for all suspect materials that were identified and sampled.

4.0 DISCUSSION AND RECOMMENDATIONS

EPA regulations require the removal of Regulated Asbestos-Containing Materials (RACM) prior to renovation or demolition activities. RACM is defined as (a) Friable ACM, (b) Category I non-friable ACM that has become friable, (c) Category I non-friable ACM that will be or has been subjected to sanding, grinding, cutting, or abrading, or (d) Category II non-friable ACM that has a high probability of becoming or has become crumbled, pulverized, or reduced to powder by the forces expected to act on the material in the course of demolition or renovation activities. The CTDPH defines "asbestos abatement" as removal, encapsulation, enclosure, renovation, repair, demolition, or other disturbance of ACM but does not include activities which are related to (A) the removal or repair of asbestos cement pipe and are performed by employees of a water company as defined in section 25-32a, or (B) the removal of non-friable ACM found exterior to a building or structure other than material defined as RACM in 40 CFR 61, the National Emission Standards for Hazardous Air Pollutants (NESHAP). Based upon these definitions, ACM identified in the building requires removal prior to renovation, demolition, or disturbance. The State of Connecticut Department of Environmental Protection (CTDEP) regulations require the proper disposal of all ACM, regardless of categorization.

5.0 LIMITATIONS

While ATC attempted to identify all ACM that could potentially be disturbed during renovation activities, some materials could not be sampled without destructive testing and some areas were inaccessible. Suspect materials inside walls, above fixed ceilings, and under flooring could not be accessed without demolition of finishes. Invasive testing should be conducted prior to renovation activities which may disturb ACM building components that are concealed.

As with all such assessments, the results of the sampling represent conditions found on the date of the survey and may not represent conditions found at other times. Additionally, this assessment was limited with respect to the specific parameters indicated above and should not be construed to be a comprehensive evaluation or a definitive representation of conditions within the facility. The information presented in this report is intended to be used as a guide to evaluate the need for further investigation or the need for modifications to the processes or procedures surveyed.

6.0 BULK SAMPLE SUMMARY OF SUSPECT MATERIALS

TABLE 6-1
BULK SAMPLE SUMMARY OF SUSPECT MATERIALS
BOILER ROOM
ENFIELD ARMORY
ENFIELD, CONNECTICUT

Sample Number	Location	Material	Asbestos (% Type)
040910-E-1A	**Boiler Room**	**Pipe Fitting Insulation @ Boiler**	**4% CH**
040910-E-1B	**Boiler Room**	**Pipe Fitting Insulation @ Boiler**	**NA/PS**
040910-E-1C	**Boiler Room**	**Pipe Fitting Insulation @ Boiler**	**NA/PS**
040910-E-2A	**Boiler Room**	**Breeching Insulation @ Duct**	**75% CH**
040910-E-2B	**Boiler Room**	**Breeching Insulation @ Duct**	**NA/PS**
040910-E-2C	**Boiler Room**	**Breeching Insulation @ Duct**	**NA/PS**
040910-E-3A	Boiler Room	Interior Residue @ Boiler	NAD
040910-E-3B	Boiler Room	Interior Residue @ Boiler	NAD
040910-E-4A	Boiler Room	Interior Firebrick @ Boiler	NAD
040910-E-4B	Boiler Room	Interior Firebrick @ Boiler	NAD

NAD = No Asbestos Detected
NA/PS = Not Analyzed/Positive Stop
CH = Chrysotile

7.0 BULK SAMPLE RESULTS/CHAIN-OF-CUSTODY FORMS

AmeriSci New York
117 EAST 30TH ST.
NEW YORK, NY 10016
TEL: (212) 679-8600 • FAX: (212) 679-3114

PLM Bulk Asbestos Report

ATC - E. Hartford, CT
Attn: Edward Fennell
290 Roberts Street
Suite 204
E. Hartford, CT 06108

Date Received 04/12/10 **AmeriSci Job #** 210042264
Date Examined 04/16/10 **P.O. #** 06-61-0138
Page 1 **of** 3
RE: 61.22573.0015 T 24; State Of CT - DPW; Enfield Armory; 1635 King St., Enfield, CT

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos
040910-E-1A 1	210042264-01 **Location:** Boiler, Pipe Fittitng @ Boiler	*Yes*	4 % (by CVES) by David W. Roderick on 04/16/10
Analyst Description: Grey, Homogeneous, Fibrous, Bulk Material **Asbestos Types:** Chrysotile 4.0 % **Other Material:** Cellulose 1 %, Fibrous glass 10 %, Non-fibrous 85 %			
040910-E-1B 1	210042264-02 **Location:** Boiler, Pipe Fittitng @ Boiler		NA/PS
Analyst Description: Bulk Material **Asbestos Types:** **Other Material:**			
040910-E-1C 1	210042264-03 **Location:** Boiler, Pipe Fittitng @ Boiler		NA/PS
Analyst Description: Bulk Material **Asbestos Types:** **Other Material:**			
040910-E-2A 2	210042264-04 **Location:** Boiler, Breeching Insulation @ Duct	*Yes*	75 % (by CVES) by David W. Roderick on 04/16/10
Analyst Description: Grey, Homogeneous, Fibrous, Bulk Material **Asbestos Types:** Chrysotile 75.0 % **Other Material:** Non-fibrous 25 %			
040910-E-2B 2	210042264-05 **Location:** Boiler, Breeching Insulation @ Duct		NA/PS
Analyst Description: Bulk Material **Asbestos Types:** **Other Material:**			

See Reporting notes on last page

AmeriSci Job #: **210042264**
Client Name: ATC - E. Hartford, CT

PLM Bulk Asbestos Report

61.22573.0015 T 24; State Of CT - DPW; Enfield Armory; 1635 King St., Enfield, CT

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos
040910-E-2C 2	210042264-06 **Location:** Boiler, Breeching Insulation @ Expansion Tank		NA/PS
Analyst Description: Bulk Material **Asbestos Types:** **Other Material:**			
040910-E-3A 3	210042264-07 **Location:** Boiler, Interior Residue @ Boiler	***No***	NAD (by CVES) by David W. Roderick on 04/16/10
Analyst Description: Brown, Homogeneous, Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Cellulose 2 %, Non-fibrous 98 %			
040910-E-3B 3	210042264-08 **Location:** Boiler, Interior Residue @ Boiler	***No***	NAD (by CVES) by David W. Roderick on 04/16/10
Analyst Description: Brown, Homogeneous, Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Cellulose 2 %, Non-fibrous 98 %			
040910-E-4A 4	210042264-09 **Location:** Boiler, Interior Fire Brick @ boiler	***No***	NAD (by CVES) by David W. Roderick on 04/16/10
Analyst Description: OffWhite, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100 %			
040910-E-4B 4	210042264-10 **Location:** Boiler, Interior Fire Brick @ boiler	***No***	NAD (by CVES) by David W. Roderick on 04/16/10
Analyst Description: OffWhite, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100 %			

See Reporting notes on last page

AmeriSci Job #: **210042264**
Client Name: ATC - E. Hartford, CT

PLM Bulk Asbestos Report

61.22573.0015 T 24; State Of CT - DPW; Enfield Armory; 1635 King St., Enfield, CT

Reporting Notes:

Analyzed by: David W. Roderick

*NAD/NSD =no asbestos detected; NA =not analyzed; NA/PS=not analyzed/positive stop; PLM Bulk Asbestos Analysis by EPA 600/M4-82-020 per 40 CFR 763 (NVLAP Lab Code 200546-0), ELAP PLM Method 198.1 for NY friable samples or 198.6 for NOB samples (NY ELAP Lab ID11480); Note:PLM is not consistently reliable in detecting asbestos in floor coverings and similar non-friable organically bound materials. NAD or Trace results by PLM are inconclusive, TEM is currently the only method that can be used to determine if this material can be considered or treated as non asbestos-containing in NY State (also see EPA Advisory for floor tile,FR 59,146,38970,8/1/94). National Institute of Standards and Technology Accreditation requirements mandate that this report must not be reproduced except in full without the approval of the lab. This PLM report relates ONLY to the items tested. AIHA Lab # 102843.

Reviewed By:_____ _____END OF REPORT_____

210042264

PLM

ATC Associates, Inc.

290 Roberts Street, Suite 204,
East Hartford, Connecticut 06108
Ph. 860.282.9924 • Fax 860.282.9826

Asbestos Bulk Sample Form

Date: 9 APR 10 Page 1 of 1

ATC Inspector: WILLIAM SOHAR	Client Name: STATE OF CT – DPW
Accreditation No.: 000639	Project No./Task No.: 61.22573.0015 T24
Survey Date: 9 APR 10	Client Contact: ED FENNELL
Signature:	Requested Completion Date: 16 APR 10
Laboratory Name: AMSRI – SCO	Requested turnaround time (circle) 3 hrs. same day 24 hrs. 48 hrs. 3 days 5 days 10 days 4 DAYS — No. Samples Collected 20 Analyzed
Building: ENFIELD ARMORY	Address: 1635 KING ST. ENFIELD CT

Room	Material Description / Location	Type S/TSI/Misc	Estimated Amt.	Friable yes/no	Condition (SD D ND)	Possible Reason for Damage	Damage Potential (NPD PD PSD)	Sample _of_ (homogeneous matls)		Field Number
BOILER	PIPE FITTING @ BOILER							1	3	040910-E-1A
"	"							2	3	040910-E-1B
"	"							3	3	040910-E-1C
BOILER	BREECHING INSULATION @ DUCT							1	3	040910-E-2A
"	"							2	3	040910-E-2B
"	"							3	3	040910-E-2C
BOILER	INTERIOR RESIDUE @ BOILER							1	2	040910-E-3A
"	"							2	2	040910-E-3B
BOILER	INTERIOR FIREBRICK @ BOILER							1	2	040910-E-4A
"	"							2	2	040910-E-4B

Comments (inaccessible areas, etc.):

STOP @ 1ST +
PLEASE FAX RESULTS TO ED FENNELL @ 860-282-9826

Notes
Damage Factors: Physical (sig dmg-dmg-no dmg) Water (extensive-moderate-slight-none) Deterioration (heavy-moderate-light-none) Friability (yes-no; hard-mod-soft surface)
Disturbance Factors: Proximity (<1ft- 1-6ft- >6ft) Accessibility (within reach-barely reachable-not reachable) Vibration (gym-music rm-auditorium-mechanical rm-elevator-other) Barriers (perm airtight-enclosed-encapsulated)
Ventilation (yes-no; if yes, type) Air conduits (air plenum - air shaft - elevator shaft - duct) Air movement (high-moderate-low) Texture (rough-pitted-moderate-smooth)

Relinquished By/Date: 9 Apr 10 Received By/Date: 4/12/10 - 1015
Relinquished By/Date: Received By/Date:
Relinquished By/Date: Received By/Date:

PROJECT #11MIL217-2401
Page 652 of 677

APPENDIX A

LICENSES AND CERTIFICATIONS

0001146 FP **PRSRT T4 0 1364 08042
WILLIAM E. SCHAAL
11 OAK FOREST DRIVE
MANCHESTER CT 06040

Dear Licensed/Certified Professional,
Attached you will find your validated license/certification for the coming year. Should you have any questions about your license/certificate renewal, please do not hesitate to write or call:

Department of Public Health (860) 509-7603
P.O. Box 340308
M.S.#12MQA http://www.dph.state.ct.us
Hartford, CT 06134-0308

Sincerely,

J. Robert Galvin, MD, MPH, MBA

J. ROBERT GALVIN, MD, MPH, COMMISSIONER
DEPARTMENT OF PUBLIC HEALTH

INSTRUCTIONS:

1. Detach and sign each of the cards on this form.
2. Display the large card in a prominent place in your office or place of business.
3. The wallet card is for you to carry on your person. If you do not wish to carry the wallet card, place it in a secure place.
4. The employer's copy is for persons who must demonstrate current licensure/certification in order to retain employment or privileges. The employee's card is to be presented to the employer and kept by them as a part of your personnel file. Only one copy of this card can be supplied to you.

STATE OF CONNECTICUT
DEPARTMENT OF PUBLIC HEALTH
PURSUANT TO THE PROVISIONS OF THE GENERAL STATUTES OF CONNECTICUT
THE INDIVIDUAL NAMED BELOW IS LICENSED
BY THIS DEPARTMENT AS A

ASBESTOS CONSULTANT - INSPECTOR

WILLIAM E. SCHAAL

LICENSE NO. 000639
CURRENT THROUGH 09/30/10
VALIDATION NO. 03-890845

SIGNATURE J. Robert Galvin, MD, MPH, MBA COMMISSIONER

EMPLOYER'S COPY

STATE OF CONNECTICUT
DEPARTMENT OF PUBLIC HEALTH

NAME
WILLIAM E. SCHAAL

VALIDATION NO.	LICENSE NO.	CURRENT THROUGH
03-890845	000639	09/30/10

PROFESSION
ASBESTOS CONSULTANT-INSPECTOR

SIGNATURE J. Robert Galvin, MD, MPH, MBA COMMISSIONER

CERTIFICATE OF ACHIEVEMENT

This certifies that

William E. Schaal

has successfully completed the

Asbestos Site Inspector Refresher Training
Asbestos Accreditation Under TSCA Title II
40 CFR Part 763

conducted by

ATC Associates Inc.
73 William Franks Drive
West Springfield, MA 01089
(413) 781-0070

Gregory J. Morsch

Principal Instructor

August 20, 2009
Date of Course

August 20, 2010
Expiration Date

Gregory J. Morsch

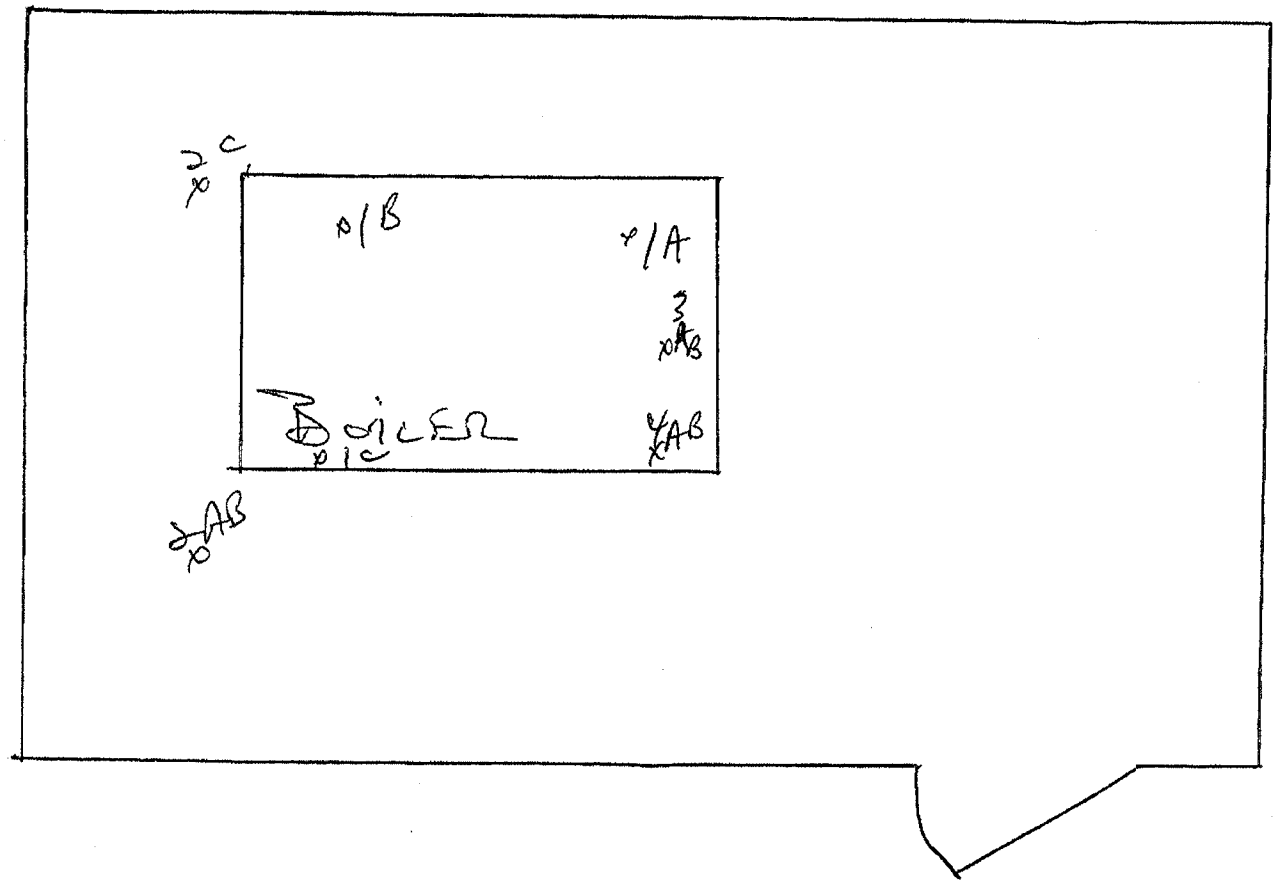
Regional Manager

SIAR-3204
Certificate Number

August 20, 2009
Examination Date

APPENDIX B

DRAWINGS



BOILER ROOM - ENFIELD ARMORY

ASBESTOS INSPECTION REPORT

BOILER ROOM
NORWALK ARMORY
290 NEW CANAAN ROAD
NORWALK, CONNECTICUT 06850
DPW BUILDING NUMBER 46416
PROJECT #11MIL217-2401
APPENDIX 2

STATE OF CONNECTICUT
MILITARY DEPARTMENT

Prepared by:

ATC ASSOCIATES, INC.
290 ROBERTS STREET - SUITE 301
EAST HARTFORD, CT 06108

ATC PROJECT NUMBER 61.22573.0015 TASK 24

MAY 4, 2010

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6.0 BULK SAMPLE SUMMARY OF SUSPECT MATERIALS

7.0 BULK SAMPLE RESULTS/CHAIN-OF-CUSTODY FORMS

APPENDIX A LICENSES AND CERTIFICATIONS

APPENDIX B DRAWINGS

1.0 INTRODUCTION

ATC Associates, Inc. (ATC) of East Hartford, Connecticut was retained by the State of Connecticut Department of Public Works (CTDPW) to conduct a survey to identify asbestos-containing materials (ACM) located in the Boiler Room of the Norwalk Armory at 290 New Canaan Road, Norwalk, Connecticut. The purpose of the investigation was to identify (ACM) prior to boiler replacement. The scope of the asbestos inspection included: surveying, sampling, and testing of suspect interior building materials affected by the boiler replacement.

The asbestos inspection was conducted by Mr. William Schaal of ATC on April 8, 2010. Mr. Schaal is a State of Connecticut Department of Public Health (CTDPH) licensed asbestos inspector (CTDPH license number 000639). The survey was performed as a walk-through visual inspection, combined with the collection and analysis of bulk samples.

2.0 ASBESTOS-CONTAINING MATERIALS SURVEY

Interior building components which were considered suspect ACM consist of pipe fitting insulation, textured plaster-like ceiling, pipe filler, red mastic, expansion joint and caulk.

2.1 ASBESTOS BULK SAMPLE COLLECTION/ANALYSIS PROCEDURE

Building materials considered suspect ACM were inspected and assessed using the methods presented in the United States Environmental Protection Agency AHERA regulations (40 CFR Part 763) and NESHAP regulations (40 CFR Part 61).

ATC collected bulk samples of building materials utilizing a sampling strategy that correlated with 40 CFR 763.86 as follows:

(a) *Surfacing materials.* An accredited inspector shall collect, in a statistically random manner that is representative of the homogeneous area, bulk samples from each homogeneous area of friable surfacing material that is not assumed to be ACM, and shall collect the samples as follows:

(1) At least three bulk samples shall be collected from each homogeneous area that is 1,000 ft^2 or less, except as provided in 40 CFR Part 763.87(c)(2).

(2) At least five bulk samples shall be collected from each homogeneous area that is greater than 1,000 ft^2 but less than or equal to 5,000 ft^2, except as provided in 40 CFR Part 763.87(c)(2).

(3) At least seven bulk samples shall be collected from each homogeneous area that is greater than 5,000 ft^2, except as provided in 40 CFR Part 763.87(c)(2).

(b) *Thermal system insulation.*

(1) Except as provided in paragraphs (b)(2) through (4) of this section and 40 CFR Part 763.87(c), an accredited inspector shall collect, in a randomly distributed manner, at least three bulk samples from each homogeneous area of thermal system insulation that is not assumed to be ACM.

(2) Collect at least one bulk sample from each homogeneous area of patched thermal system insulation that is not assumed to be ACM if the patched section is less than 6 linear or square feet.

(3) In a manner sufficient to determine whether the material is ACM or not ACM, collect bulk samples from each insulated mechanical system that is not assumed to be ACM where cement or plaster is used on fittings such as tees, elbows, or valves, except as provided under 40 CFR Part 763.87(c)(2).

(4) Bulk samples are not required to be collected from any homogeneous area where the accredited inspector has determined that the thermal system insulation is fiberglass, foam glass, rubber, or other non-ACM.

(c) *Miscellaneous materials.* In a manner sufficient to determine whether material is ACM or not ACM, an accredited inspector shall collect bulk samples from each homogeneous area of friable or non-friable miscellaneous material that is not assumed to be ACM.

The bulk samples collected during the survey were analyzed by AmeriSci (NVLAP #200546-0) located in New York, New York. The bulk samples were analyzed by Polarized Light Microscopy (PLM) with dispersion staining using the EPA method as defined in Perkins, R.L. and B.W. Harvey "Method for the Determination of Asbestos in Bulk Materials," July 1993, p.61 (EPA 600/M4-82-020 Method). Utilizing PLM, the microscopist is able to identify and distinguish between asbestos group minerals and other fibrous materials such as cellulose, mineral wool, fiberglass, or synthetic fibers. The quantities of each of these substances is estimated based on the procedures defined in the above-cited reference and are reported as a percentage.

The EPA recognizes the following as asbestos: Chrysotile, Crocidolite, Amosite, Tremolite, Actinolite, and Anthophyllite. To be classified as ACM, the material must be determined to contain greater than one percent (1%) asbestos. In order to consider a material to be non-ACM, all samples of a homogeneous type of material that are collected must be analyzed and all results must indicate the material to contain less than 1% asbestos by weight.

3.0 ASBESTOS-CONTAINING MATERIALS

The results of PLM laboratory analysis indicated that the following materials are asbestos-containing materials (ACM). A complete listing of all suspect materials sampled by ATC during this survey is included in Section 6.0. ACM are those materials that contain greater than 1% asbestos, and are as follows:

- Gray Expansion Joint
- Door Frame Caulk

The remaining materials which were sampled and tested were found to contain no detectable amounts of asbestos. Specifically, the following materials throughout the area were determined to be non-ACM:

- Fitting Insulation
- Textured Plaster-like Ceiling
- Pipe Filler
- Red Mastic

Refer to Section 6.0, Bulk Sample Summary of Suspect Materials, for all suspect materials that were identified and sampled.

4.0 DISCUSSION AND RECOMMENDATIONS

EPA regulations require the removal of Regulated Asbestos-Containing Materials (RACM) prior to renovation or demolition activities. RACM is defined as (a) Friable ACM, (b) Category I non-friable ACM that has become friable, (c) Category I non-friable ACM that will be or has been subjected to sanding, grinding, cutting, or abrading, or (d) Category II non-friable ACM that has a high probability of becoming or has become crumbled, pulverized, or reduced to powder by the forces expected to act on the material in the course of demolition or renovation activities. The CTDPH defines "asbestos abatement" as removal, encapsulation, enclosure, renovation, repair, demolition, or other disturbance of ACM but does not include activities which are related to (A) the removal or repair of asbestos cement pipe and are performed by employees of a water company as defined in section 25-32a, or (B) the removal of non-friable ACM found exterior to a building or structure other than material defined as RACM in 40 CFR 61, the National Emission Standards for Hazardous Air Pollutants (NESHAP). Based upon these definitions, ACM identified in the building requires removal prior to renovation, demolition, or disturbance. The State of Connecticut Department of Environmental Protection (CTDEP) regulations require the proper disposal of all ACM, regardless of categorization.

5.0 LIMITATIONS

While ATC attempted to identify all ACM that could potentially be disturbed during renovation activities, some materials could not be sampled without destructive testing and some areas were inaccessible. Suspect materials inside walls, above fixed ceilings, and under flooring could not be accessed without demolition of finishes. Invasive testing should be conducted prior to renovation activities which may disturb ACM building components that are concealed.

As with all such assessments, the results of the sampling represent conditions found on the date of the survey and may not represent conditions found at other times. Additionally, this assessment was limited with respect to the specific parameters indicated above and should not be construed to be a comprehensive evaluation or a definitive representation of conditions within the facility. The information presented in this report is intended to be used as a guide to evaluate the need for further investigation or the need for modifications to the processes or procedures surveyed.

6.0 BULK SAMPLE SUMMARY OF SUSPECT MATERIALS

TABLE 6-1
BULK SAMPLE SUMMARY OF SUSPECT MATERIALS
BOILER ROOM
NORWALK ARMORY
NORWALK, CONNECTICUT

Sample Number	Location	Material	Asbestos (% Type)
040810-N-1A	Boiler Room	Fitting Insulation	NAD
040810-N-1B	Boiler Room	Fitting Insulation	NAD
040810-N-1C	Boiler Room	Fitting Insulation	NAD
040810-N-2A	Boiler Room	Textured Plaster-like Ceiling – Skim Coat	NAD
040810-N-2B	Boiler Room	Textured Plaster-like Ceiling – Skim Coat	NAD
040810-N-2C	Boiler Room	Textured Plaster-like Ceiling – Skim Coat	NAD
040810-N-3A	Boiler Room	Textured Plaster-like Ceiling – Base Coat	NAD
040810-N-3B	Boiler Room	Textured Plaster-like Ceiling – Base Coat	NAD
040810-N-3C	Boiler Room	Textured Plaster-like Ceiling – Base Coat	NAD
040810-N-4A	Boiler Room	Light Gray Pipe Filler	NAD
040810-N-4B	Boiler Room	Light Gray Pipe Filler	NAD
040810-N-5A	Boiler Room	Dark Gray Pipe Filler	NAD
040810-N-5B	Boiler Room	Dark Gray Pipe Filler	NAD
040810-N-6A	Boiler Room	Tan Pipe Filler	NAD
040810-N-6B	Boiler Room	Tan Pipe Filler	NAD
040810-N-7A	Boiler Room	Red Mastic	NAD
040810-N-7B	Boiler Room	Red Mastic	NAD
040810-N-8A	**Boiler Room**	**Gray Expansion Joint**	**2% CH**
040810-N-8B	**Boiler Room**	**Gray Expansion Joint**	**NA/PS**

TABLE 6-1
BULK SAMPLE SUMMARY OF SUSPECT MATERIALS
BOILER ROOM
NORWALK ARMORY
NORWALK, CONNECTICUT

Sample Number	Location	Material	Asbestos (% Type)
040810-N-9A	Boiler Room	Door Frame Caulk	3% CH
040810-N-9B	Boiler Room	Door Frame Caulk	NA/PS

NAD = No Asbestos Detected
NA/PS = Not Analyzed/Positive Stop
CH = Chrysotile

7.0 BULK SAMPLE RESULTS/CHAIN-OF-CUSTODY FORMS

AMERI SCI

AmeriSci New York
117 EAST 30TH ST.
NEW YORK, NY 10016
TEL: (212) 679-8600 • FAX: (212) 679-3114

PLM Bulk Asbestos Report

ATC - E. Hartford, CT
Attn: Edward Fennell
290 Roberts Street
Suite 204
E. Hartford, CT 06108

Date Received 04/09/10 **AmeriSci Job #** 210041987
Date Examined 04/14/10 **P.O. #** 06-61-0138
Page 1 **of** 4

RE: 61.22573.0015 T24; State Of CT-DPW; Norwalk Armory 290 New Canaan Rd. Norwalk, CT

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos
040810-N-1A 1	210041987-01 **Location:** Boiler Fitting Insulation @ Drain	*No*	NAD (by CVES) by Ella Babayeva on 04/14/10
Analyst Description: OffWhite, Homogeneous, Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Cellulose Trace, Fibrous glass 20 %, Wollastonite 10 %, Non-fibrous 70 %			
040810-N-1B 1	210041987-02 **Location:** Boiler Fitting Insulation @ Drain	*No*	NAD (by CVES) by Ella Babayeva on 04/14/10
Analyst Description: OffWhite, Homogeneous, Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Cellulose 3 %, Fibrous glass 27 %, Wollastonite 5 %, Non-fibrous 65 %			
040810-N-1C 1	210041987-03 **Location:** Boiler Fitting Insulation @ Drain	*No*	NAD (by CVES) by Ella Babayeva on 04/14/10
Analyst Description: OffWhite, Homogeneous, Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Cellulose 5 %, Fibrous glass 25 %, Wollastonite 10 %, Non-fibrous 60 %			
040810-N-2A 2	210041987-04 **Location:** Boiler Textured Plaster-Like Ceiling - Skim Coat	*No*	NAD (by CVES) by Ella Babayeva on 04/14/10
Analyst Description: OffWhite/Grey, Homogeneous, Non-Fibrous, Cementitious, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100 %			
040810-N-2B 2	210041987-05 **Location:** Boiler Textured Plaster-Like Ceiling - Skim Coat	*No*	NAD (by CVES) by Ella Babayeva on 04/14/10
Analyst Description: OffWhite/Grey, Homogeneous, Non-Fibrous, Cementitious, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100 %			

See Reporting notes on last page

AmeriSci Job #: **210041987**
Client Name: ATC - E. Hartford, CT

PLM Bulk Asbestos Report

61.22573.0015 T24; State Of CT-DPW; Norwalk Armory 290 New Canaan Rd. Norwalk, CT

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos
040810-N-2C 2	210041987-06 **Location:** Boiler Textured Plaster-Like Ceiling - Skim Coat	*No*	NAD (by CVES) by Ella Babayeva on 04/14/10
Analyst Description: OffWhite/Grey, Homogeneous, Non-Fibrous, Cementitious, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100 %			
040810-N-3A 3	210041987-07 **Location:** Boiler Plaster-Like Ceiling Base Coat	*No*	NAD (by CVES) by Ella Babayeva on 04/14/10
Analyst Description: Tan, Homogeneous, Non-Fibrous, Cementitious, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100 %			
040810-N-3B 3	210041987-08 **Location:** Boiler Plaster-Like Ceiling Base Coat	*No*	NAD (by CVES) by Ella Babayeva on 04/14/10
Analyst Description: Tan, Homogeneous, Non-Fibrous, Cementitious, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100 %			
040810-N-3C 3	210041987-09 **Location:** Boiler Plaster-Like Ceiling Base Coat	*No*	NAD (by CVES) by Ella Babayeva on 04/14/10
Analyst Description: Tan, Homogeneous, Non-Fibrous, Cementitious, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100 %			
040810-N-4A 4	210041987-10 **Location:** Boiler Light Gray Pipe Filler-Above Floor	*No*	NAD (by CVES) by Ella Babayeva on 04/14/10
Analyst Description: Light Grey, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100 %			
040810-N-4B 4	210041987-11 **Location:** Boiler Light Gray Pipe Filler-Above Floor	*No*	NAD (by CVES) by Ella Babayeva on 04/14/10
Analyst Description: Light Grey, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100 %			

See Reporting notes on last page

AmeriSci Job #: **210041987**
Client Name: ATC - E. Hartford, CT

PLM Bulk Asbestos Report

61.22573.0015 T24; State Of CT-DPW; Norwalk Armory 290 New Canaan Rd. Norwalk, CT

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos
040810-N-5A 5	210041987-12 **Location:** Boiler Dark Gray Pipe Filler-Above Floor	***No***	NAD (by CVES) by Ella Babayeva on 04/14/10
Analyst Description: Dark Grey, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100 %			
040810-N-5B 5	210041987-13 **Location:** Boiler Dark Gray Pipe Filler-Above Floor	***No***	NAD (by CVES) by Ella Babayeva on 04/14/10
Analyst Description: Dark Grey, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100 %			
040810-N-6A 6	210041987-14 **Location:** Boiler Tan Pipe Filler @ Floor	***No***	NAD (by CVES) by Ella Babayeva on 04/14/10
Analyst Description: Tan, Homogeneous, Non-Fibrous, Cementitious, Bulk Material **Asbestos Types:** **Other Material:** Cellulose Trace, Fibrous glass Trace, Non-fibrous 100 %			
040810-N-6B 6	210041987-15 **Location:** Boiler Tan Pipe Filler @ Floor	***No***	NAD (by CVES) by Ella Babayeva on 04/14/10
Analyst Description: Tan, Homogeneous, Non-Fibrous, Cementitious, Bulk Material **Asbestos Types:** **Other Material:** Cellulose Trace, Fibrous glass Trace, Non-fibrous 100 %			
040810-N-7A 7	210041987-16 **Location:** Boiler Red Mastic @ Pipe Above Floor	***No***	NAD (by CVES) by Ella Babayeva on 04/14/10
Analyst Description: Red, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Cellulose Trace, Fibrous glass 5 %, Non-fibrous 95 %			
040810-N-7B 7	210041987-17 **Location:** Boiler Red Mastic @ Pipe Above Floor	***No***	NAD (by CVES) by Ella Babayeva on 04/14/10
Analyst Description: Red, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Cellulose Trace, Fibrous glass 10 %, Non-fibrous 90 %			

See Reporting notes on last page

AmeriSci Job #: **210041987**
Client Name: ATC - E. Hartford, CT

PLM Bulk Asbestos Report

61.22573.0015 T24; State Of CT-DPW; Norwalk Armory 290 New Canaan Rd. Norwalk, CT

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos
040810-N-8A 8	210041987-18 **Location:** Boiler Gray Expansion Joint	***Yes***	2 % (by CVES) by Ella Babayeva on 04/14/10
Analyst Description: Grey, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** Chrysotile 2.0 % **Other Material:** Non-fibrous 98 %			
040810-N-8B 8	210041987-19 **Location:** Boiler Gray Expansion Joint		NA/PS
Analyst Description: Bulk Material **Asbestos Types:** **Other Material:**			
040810-N-9A 9	210041987-20 **Location:** Boiler Door Frame Caulk	***Yes***	3 % (by CVES) by Ella Babayeva on 04/14/10
Analyst Description: Grey, Homogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** Chrysotile 3.0 % **Other Material:** Non-fibrous 97 %			
040810-N-9B 9	210041987-21 **Location:** Boiler Door Frame Caulk		NA/PS
Analyst Description: Bulk Material **Asbestos Types:** **Other Material:**			

Reporting Notes:

Analyzed by: Ella Babayeva Ella Babayeva

*NAD/NSD =no asbestos detected; NA =not analyzed; NA/PS=not analyzed/positive stop; PLM Bulk Asbestos Analysis by EPA 600/M4-82-020 per 40 CFR 763 (NVLAP Lab Code 200546-0), ELAP PLM Method 198.1 for NY friable samples or 198.6 for NOB samples (NY ELAP Lab ID11480); Note:PLM is not consistently reliable in detecting asbestos in floor coverings and similar non-friable organically bound materials. NAD or Trace results by PLM are inconclusive, TEM is currently the only method that can be used to determine if this material can be considered or treated as non asbestos-containing in NY State (also see EPA Advisory for floor tile,FR 59,146,38970,8/1/94). National Institute of Standards and Technology Accreditation requirements mandate that this report must not be reproduced except in full without the approval of the lab. This PLM report relates ONLY to the items tested. AIHA Lab # 102843.

Reviewed By:_____ END OF REPORT

210041987

PLM

ATC Associates, Inc

290 Roberts Street, Suite 204,
East Hartford, Connecticut 06108
Ph. 860.282.9924 • Fax 860.282.9826

Asbestos Bulk Sample Form

Date 8APR10 Page 1 of 2

ATC Inspector: WILLIAM SCHARR	Client Name: STATE OF CT - DPW
Accreditation No.: 000639	Project No./Task No.: 61.22573.0015 T24
Survey Date: 8APR10	Client Contact: ED FENNELL
Signature:	Requested Completion Date: 15APR10
Laboratory Name: AMRRI-Sci	Requested turnaround time (circle) 3 hrs. same day 24 hrs. 48 hrs. 3 days 5 days 10 days — No. Samples Collected 21 Analyzed
Building: NORWALK ARMORY	Address: 290 NEW CANAAN RD. NORWALK CT.

Room	Material Description / Location	Type S/TSI/Misc	Estimated Amt.	Friable yes/no	Condition (SD D ND)	Possible Reason for Damage	Damage Potential (NPD PD PSD)	Sample _of _ (homogeneous matls)		Field Number
BOILER	FITTING INSULATION @ DRAIN							1	3	040810-N-1A
"	"	"						2	"	040810-N-1B
"	"	"						3	"	040810-N-1C
BOILER	TEXTURED PLASTER-LIKE	CEILING - SKIM COAT						1	3	040810-N-2A
"	"	"						2	"	040810-N-2B
"	"	"						3	"	040810-N-2C
BOILER	PLASTER-LIKE CEILING	-BASE COAT						1	3	040810-N-3A
"	"	"						2	"	040810-N-3B
"	"	"						3	"	040810-N-3C
BOILER	LIGHT GRAY PIPE FILLER	-ABOVE FLOOR						1	2	040810-N-4A
"	"	"						2	2	040810-N-4B
BOILER	DARK GRAY PIPE FILLER - ABOVE FLOOR							1	2	040810-N-5A
"	"	"						2	2	040810-N-5B
BOILER	TAN PIPE FILLER @ FLOOR							1	2	040810-N-6A
"	"	"						2	2	040810-N-6B
BOILER	RED MASTIC @ PIPE ABOVE FLOOR							1	2	040810-N-7A
"	"	"						2	2	040810-N-7B

Comments (inaccessible areas, etc.):

STOP @ 1ST +
PLEASE FAX RESULTS TO ED FENNELL @ 860-282-9826

Notes
Damage Factors: Physical (sig dmg-mdrg-no dmg)
Disturbance Factors: Proximity (<1ft- 1-3ft- >3ft) Ventilation (yes-no; if yes, type)
Water (extensive-moderate-slight-none) Accessibility (within reach-barely reachable-not reachable) Air conduits (air plenum - air shaft - elevator shaft - duct)
Deterioration (heavy-moderate-light-none) Vibration (gym-music rm-auditorium-mechanical rm-elevator-other) Air movement (high-moderate-low)
Friability (yes-no; hard-mod-soft surface) Barriers (perm airtight-enclosed-encapsulated) Texture (rough-pitted-moderate-smooth)

Relinquished By/Date: 8Apr10
Relinquished By/Date:
Relinquished By/Date:

Received By/Date: 4/9 1145
Received By/Date:
Received By/Date:

PROJECT #11MIL217-2401

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210041987

PLM

ATC Associates, Inc.

290 Roberts Street, Suite 204,
East Hartford, Connecticut 06108
Ph. 860.282.9924 • Fax 860.282.9826

Asbestos Bulk Sample Form

Date: 8 APR 10 Page 2 of 2

ATC Inspector: WILLIAM SCHARZ	Client Name: STATE of CT – DPW
Accreditation No: 000639	Project No./Task No.: 61.22573.0015 T24
Survey Date: 8 APR 10	Client Contact: ED FENNELL
Signature:	Requested Completion Date: 15 APR 10
Laboratory Name: AMERI-SCI	Requested turnaround time (circle) 3 hrs. same day 24 hrs. 48 hrs. 3 days 5 days 10 days — No. Samples Collected 21 Analyzed
Building: NORWALK ARMORY	Address: 390 NEW CANAAN AVE, NORWALK, CT

Room	Material Description / Location	Type S/TSI/Misc	Estimated Amt.	Friable yes/no	Condition (SD D ND)	Possible Reason for Damage	Damage Potential (NPD PD PSD)	Sample _of_ (homogeneous matls)		Field Number
BOILER	GRAY EXPANSION JOINT							1	2	040810-N-8A
"	"							2	2	040810-N-8B
BOILER	DOOR FRAME CAULK							1	2	040810-N-9A
"	"							2	2	040810-N-9B

Comments (inaccessible areas, etc.):

STOP @ 1ST 4
PLEASE FAX TO ED FENNELL @ 860-282-9826

Notes
Damage Factors: Physical (sig dmg-dmg-no dmg) Water (extensive-moderate-slight-none) Deterioration (heavy-moderate-light-none) Friability (yes-no; hard-mod-soft surface)
Disturbance Factors: Proximity (<5ft-1-6ft->6ft) Accessibility (within reach-barely reachable-not reachable) Vibration (gym-music rm-auditorium-mechanical rm-elevator-other) Barriers (perm airtight-enclosed-encapsulated)
Ventilation (yes-no; if yes, type) Air conduits (air plenum - air shaft - elevator shaft - duct) Air movement (high-moderate-low) Texture (rough-pitted-moderate-smooth)

Relinquished By/Date: 8 Apr 10 Received By/Date: 4/9 1148
Relinquished By/Date: Received By/Date:
Relinquished By/Date: Received By/Date:

APPENDIX A

LICENSES AND CERTIFICATIONS

0001146 FP **PRSRT T4 0 1364 06042
WILLIAM E. SCHAAL
11 OAK FOREST DRIVE
MANCHESTER CT 06040

Dear Licensed/Certified Professional,
Attached you will find your validated license/certification for the coming year. Should you have any questions about your license/certificate renewal, please do not hesitate to write or call:

Department of Public Health **(860) 509-7603**
P.O. Box 340308
M.S.#12MQA **http://www.dph.state.ct.us**
Hartford, CT 06134-0308

Sincerely,

J. Robert Galvin MD, MPH, MBA

J. ROBERT GALVIN, MD, MPH, COMMISSIONER
DEPARTMENT OF PUBLIC HEALTH

INSTRUCTIONS:

1. Detach and sign each of the cards on this form.
2. Display the large card in a prominent place in your office or place of business.
3. The wallet card is for you to carry on your person. If you do not wish to carry the wallet card, place it in a secure place.
4. The employer's copy is for persons who must demonstrate current licensure/certification in order to retain employment or privileges. The employer's card is to be presented to the employer and kept by them as a part of your personnel file. Only one copy of this card can be supplied to you.

STATE OF CONNECTICUT
DEPARTMENT OF PUBLIC HEALTH
PURSUANT TO THE PROVISIONS OF THE GENERAL STATUTES OF CONNECTICUT
THE INDIVIDUAL NAMED BELOW IS LICENSED
BY THIS DEPARTMENT AS A

ASBESTOS CONSULTANT-INSPECTOR

WILLIAM E. SCHAAL

LICENSE NO.
000639
CURRENT THROUGH
09/30/10
VALIDATION NO.
03-890845

SIGNATURE

J. Robert Galvin MD, MPH, MBA
COMMISSIONER

EMPLOYER'S COPY

STATE OF CONNECTICUT
DEPARTMENT OF PUBLIC HEALTH

NAME
WILLIAM E. SCHAAL

VALIDATION NO.	LICENSE NO.	CURRENT THROUGH
03-890845	000639	09/30/10

PROFESSION
ASBESTOS CONSULTANT-INSPECTOR

SIGNATURE

J. Robert Galvin MD, MPH, MBA
COMMISSIONER

CERTIFICATE OF ACHIEVEMENT

This certifies that

William E. Schaal

has successfully completed the

Asbestos Site Inspector Refresher Training
Asbestos Accreditation Under TSCA Title II
40 CFR Part 763

conducted by

ATC Associates Inc.
73 William Franks Drive
West Springfield, MA 01089
(413) 781-0070

Gregory J. Morsch

Principal Instructor

August 20, 2009

Date of Course

August 20, 2010

Expiration Date

Gregory J. Morsch

Regional Manager

SIAR-3204

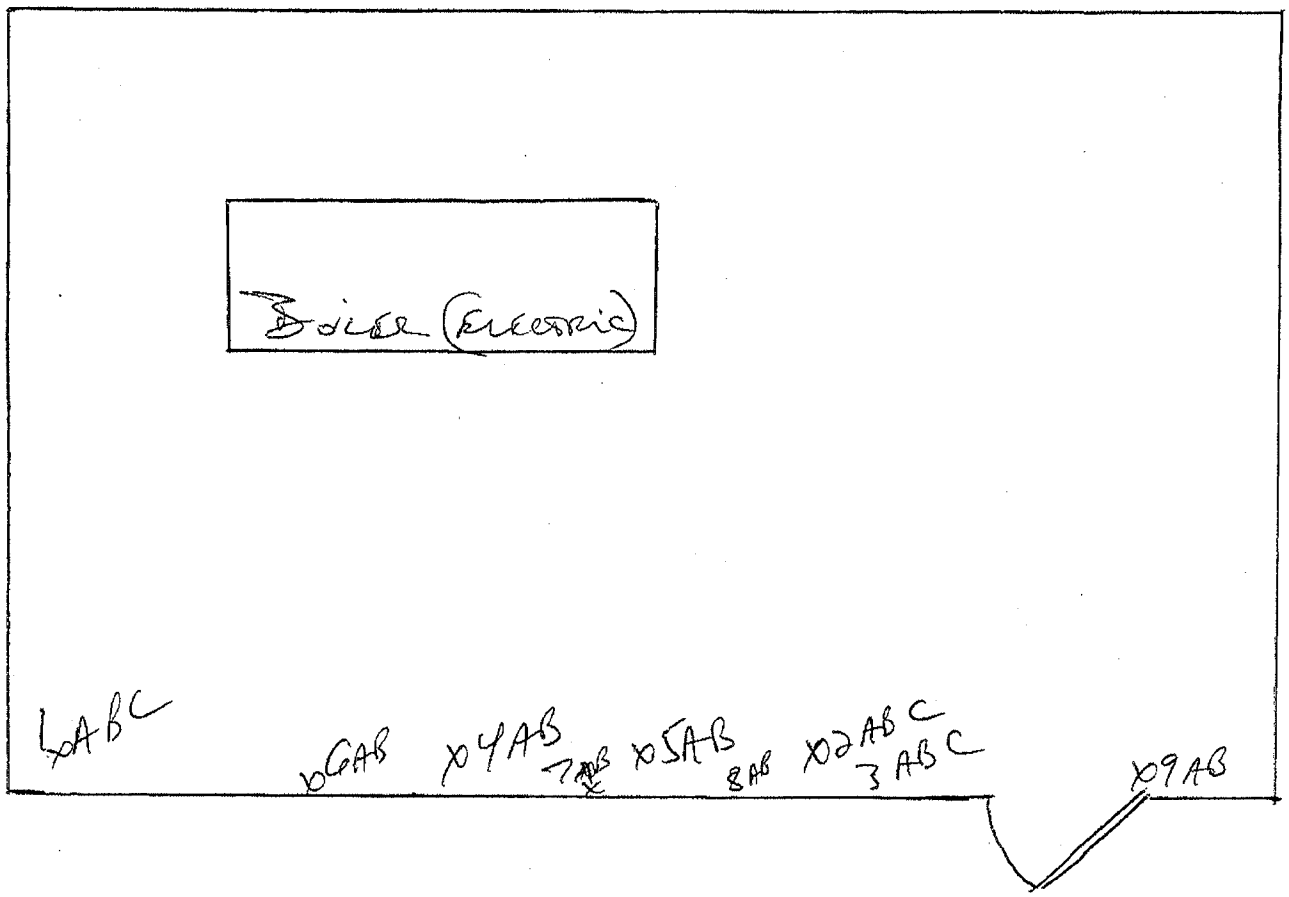
Certificate Number

August 20, 2009

Examination Date

APPENDIX B

DRAWINGS



Boiler Room - Norwalk Armory