STATE OF UTAH - DEPARTMENT OF ADMINISTRATIVE SERVICES

Division of Facilities Construction and Management

DFCM

STANDARD LOW BID PROJECT

September 26, 2005

MAMMOTH CREEK FISH HATCHERY FILTRATION BUILDING

DIVISION OF WILDLIFE RESOURCES

HATCH, UTAH

DFCM Project Number 04007520

Sunrise Engineering

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Current copies of the following documents are hereby made part of these contract documents by reference. These documents are available on the DFCM web site at http://dfcm.utah.gov or are available upon request from DFCM.

DFCM General Conditions dated May 25, 2005.
DFCM Application and Certification for Payment dated May 25, 2005.

Technical Specifications : 9-5-05
Drawings: 9-5-05

The Agreement and General Conditions dated May 25, 2005 have been updated from versions that were formally adopted and in use prior to this date. The changes made to the General Conditions are identified in a document entitled Revisions to General Conditions that is available on DFCM's web site at http://dfcm.utah.gov

NOTICE TO CONTRACTORS

Sealed bids will be received by the Division of Facilities Construction and Management (DFCM) for:

MAMMOTH CREEK FISH HATCHERY FILTRATION BUILDING
DIVISION OF WILDLIFE RESOURCES – HATCH, UTAH
DFCM PROJECT NO: 04007520

Bids will be in accordance with the Contract Documents that will be available at 8:00 AM on Monday, September 26, 2005, and distributed in electronic format only on CD's from DFCM, 4110 State Office Building, SLC, Utah and on the DFCM web page at http://dfcm.utah.gov. Approved plan repositories may obtain a hard copy set from Sunrise Engineering, upon paying a deposit of $100. For questions regarding this project, please contact Lynn Hinrichs, DFCM, at 801-538-3255. No others are to be contacted regarding this bidding process. The construction budget for this project is $266,000.

A pre-bid meeting will be held at the Mammoth Creek Fish Hatchery, Hatch, Utah at 10:00 AM on Friday, October 7, 2005. All bidders wishing to bid on this project are required to attend this meeting.

Bids will be received until the hour of 3:30 PM on Thursday, October 13, 2005 at DFCM, 4ll0 State Office Building, Salt Lake City, Utah 84114. Bids will be opened and read aloud in the DFCM Conference Room, 4110 State Office Building, Salt Lake City, Utah. NOTE: Bids must be received at 4110 State Office Building by the specified time.

Bid security, in the amount of five percent (5%) of the bid, must be submitted as stated in the Instruction to Bidders.

The Division of Facilities Construction and Management reserves the right to reject any or all bids or to waive any formality or technicality in any bid in the interest of DFCM.

DIVISION OF FACILITIES CONSTRUCTION AND MANAGEMENT
Marla Workman, Contract Coordinator
4110 State Office Building, Salt Lake City, Utah 84114

PROJECT SCHEDULE

PROJECT NAME:	**MAMMOTH CREEK FISH HATCHERY FILTRATION BUILDING DIVISION OF WILDLIFE RESOURCES – HATCH, UTAH**			
DFCM PROJECT NO.	**04007520**			
Event	**Day**	**Date**	**Time**	**Place**
Advertisement Placed	Sunday	September 25, 2005		Multi-Media
Bidding Documents Available	Monday	September 26, 2005	8:00 AM	DFCM, 4110 State Office Bldg, SLC, UT or DFCM web site *
Pre-bid Site Meeting	Friday	October 7, 2005	10:00 AM	Mammoth Creek Fish Hatchery, Hatch, UT
Last Day to Submit Questions	Monday	October 10, 2005	4:00 PM	DFCM, 4110 State Office Bldg, SLC, UT or DFCM web site *
Final Addendum Issued	Tuesday	October 11, 2005	4:00 PM	DFCM, 4110 State Office Bldg, SLC, UT or DFCM web site *
Prime Contractors Turn In Bid and Bid Bond / Bid Opening in DFCM Conference Room	Thursday	October 13, 2005	3:30 PM	DFCM, 4110 State Office Bldg, SLC, UT
Sub-contractor List Due	Friday	October 14, 2005	3:30 PM	DFCM, 4110 State Office Bldg, SLC, UT

*** DFCM's web site address is http://dfcm.utah.gov**

BID FORM

NAME OF BIDDER _____ DATE _____

To the Division of Facilities Construction and Management
4110 State Office Building
Salt Lake City, Utah 84114

The undersigned, responsive to the "Notice to Contractors" and in accordance with the "Instructions to Bidders", in compliance with your invitation for bids for the **MAMMOTH CREEK FISH HATCHERY FILTRATION BUILDING – DIVISION OF WILDLIFE RESOURCES – HATCH, UTAH DFCM PROJECT NO. 04007520** and having examined the Contract Documents and the site of the proposed Work and being familiar with all of the conditions surrounding the construction of the proposed Project, including the availability of labor, hereby proposes to furnish all labor, materials and supplies as required for the Work in accordance with the Contract Documents as specified and within the time set forth and at the price stated below. This price is to cover all expenses incurred in performing the Work required under the Contract Documents of which this bid is a part:

I/We acknowledge receipt of the following Addenda: _____

For all work shown on the Drawings and described in the Specifications and Contract Documents, I/we agree to perform for the sum of:

_____ DOLLARS ($_____)
(In case of discrepancy, written amount shall govern)

I/We guarantee that the Work will be Substantially Complete within **90 calendar days** after receipt of the Notice to Proceed, should I/we be the successful bidder, and agree to pay liquidated damages in the amount of **$75.00** per day for each day after expiration of the Contract Time as stated in Article 3 of the Contractor's Agreement.

This bid shall be good for 45 days after bid opening.

Enclosed is a 5% bid bond, as required, in the sum of _____

The undersigned Contractor's License Number for Utah is _____.

Upon receipt of notice of award of this bid, the undersigned agrees to execute the contract within ten (10) days, unless a shorter time is specified in the Contract Documents, and deliver acceptable Performance and Payment bonds in the prescribed form in the amount of 100% of the Contract Sum for faithful performance of the contract.

The Bid Bond attached, in the amount not less than five percent (5%) of the above bid sum, shall become the property of the Division of Facilities Construction and Management as liquidated damages for delay and additional expense caused thereby in the event that the contract is not executed and/or acceptable l00% Performance and Payment bonds are not delivered within the time set forth.

Type of Organization:

_____
(Corporation, Partnership, Individual, etc.)

Any request and information related to Utah Preference Laws:

_____

Respectfully submitted,

_____
Name of Bidder

ADDRESS:

_____

_____

_____
Authorized Signature

INSTRUCTIONS TO BIDDERS

1. Drawings and Specifications, Other Contract Documents

Drawings and Specifications, as well as other available Contract Documents, may be obtained as stated in the Notice to Contractors.

Any person or firm that fails to return the complete set of Drawings and Specifications, or other contract documents, in good condition within ten (10) days after the time set for receiving bids, will forfeit the deposit. Notwithstanding this, if the Contract Documents are provided on a compact disc, the compact disc does not need to be returned.

2. Bids

Before submitting a bid, each contractor shall carefully examine the Contract Documents, shall visit the site of the Work; shall fully inform themselves as to all existing conditions and limitations; and shall include in the bid the cost of all items required by the Contract Documents. If the bidder observes that portions of the Contract Documents are at variance with applicable laws, building codes, rules, regulations or contain obvious erroneous or uncoordinated information, the bidder shall promptly notify the DFCM Representative and the necessary changes shall be accomplished by Addendum.

The bid, bearing original signatures, must be typed or handwritten in ink on the Bid Form provided in the procurement documents and submitted in a sealed envelope at the location specified by the Notice to Contractor's prior to the deadline for submission of bids. It is your responsibility to allow for the time needed to park in Capitol Hill as recent construction activity has made the parking more difficult. Identification is required to enter the building.

Bid bond security, in the amount of five percent (5%) of the bid, made payable to the Division of Facilities Construction and Management, shall accompany bid. THE BID BOND MUST BE ON THE BID BOND FORM PROVIDED IN THE PROCUREMENT DOCUMENTS IN ORDER TO BE CONSIDERED AN ACCEPTABLE BID.

If the bid bond security is submitted on a bid bond form other than DFCM's required bid bond form, and the bid security meets all other legal requirements, the bidder will be allowed to provide an acceptable bid bond by the close of business on the next business day following notification by DFCM of submission of a defective bid bond security. NOTE: A cashier's check cannot be used as a substitute for a bid bond.

3. Contract and Bond

The Contractor's Agreement will be in the form bound in the specifications. The Contract Time will be as indicated in the bid. The successful bidder, simultaneously with the execution of the Contract Agreement, will be required to furnish a performance bond and a payment bond, both bearing original

signatures, upon the forms provided in the procurement documents. The performance and payment bonds shall be for an amount equal to one hundred percent (100%) of the contract sum and secured from a company that meets the requirements specified in the requisite forms. Any bonding requirements for subcontractors will be specified in the Supplementary General Conditions.

4. Listing of Subcontractors

Listing of Subcontractors shall be as summarized in the "Instructions and Subcontractor's List Form", which are included as part of these Contract Documents. The Subcontractors List shall be delivered to DFCM or faxed to DFCM at (801)538-3677 within 24 hours of the bid opening. Requirements for listing additional subcontractors will be listed in the Contract Documents.

DFCM retains the right to audit or take other steps necessary to confirm compliance with requirements for the listing and changing of subcontractors. Any contractor who is found to not be in compliance with these requirements is subject to a debarment hearing and may be debarred from consideration for award of contracts for a period of up to three years.

5. Interpretation of Drawings and Specifications

If any person or entity contemplating submitting a bid is in doubt as to the meaning of any part of the drawings, specifications or other Contract Documents, such person shall submit to the DFCM Project Manager a request for an interpretation thereof. The person or entity submitting the request will be responsible for its prompt delivery. Any interpretation of the proposed documents will be made only by addenda duly issued and a copy of such addenda will be mailed or delivered to each person or entity receiving a set of documents. Neither the DFCM nor A/E will be responsible for any other explanations or interpretations of the proposed documents. A/E shall be deemed to refer to the architect or engineer hired by DFCM as the A/E or Consultant for the Project.

6. Addenda

Any Addenda issued during the time of bidding shall become part of the contract Documents made available to the bidders for the preparation of the bid, shall be covered in the bid, and shall be made a part of the Contract.

7. Award of Contract

The Contract will be awarded as soon as possible to the lowest, responsive and responsible bidder, based on the lowest combination of base bid and acceptable prioritized alternates, provided the bid is

reasonable, is in the interests of the State of Utah to accept and after applying the Utah Preference Laws in U.C.A. Title 63, Chapter 56. DFCM reserves the right to waive any technicalities or formalities in any bid or in the bidding. Alternates will be accepted on a prioritized basis with Alternate 1 being highest priority, Alternate 2 having second priority, etc.

8. DFCM Contractor Performance Rating

As a contractor completes each DFCM project, DFCM, the architect/engineer and the using agency will evaluate project performance based on the enclosed "DFCM Contractor Performance Rating" form. The ratings issued on this project will not affect this project but may affect the award on future projects.

9. Licensure

The Contractor shall comply with and require all of its subcontractors to comply with the license laws as required by the State of Utah.

10. Right to Reject Bids

DFCM reserves the right to reject any or all Bids.

11. Time is of the Essence

Time is of the essence in regard to all the requirements of the Contract Documents.

12. Withdrawal of Bids

Bids may be withdrawn on written request received from bidder prior to the time fixed for opening. Negligence on the part of the bidder in preparing the bid confers no right for the withdrawal of the bid after it has been opened.

13. Product Approvals

Where reference is made to one or more proprietary products in the Contract Documents, but restrictive descriptive materials of one or more manufacturer(s) is referred to in the Contract Documents, the products of other manufacturers will be accepted, provided they equal or exceed the standards set forth in the drawings and specifications and are compatible with the intent and purpose of the design, subject to the written approval of the A/E. Such written approval must occur prior to the deadline established for the last scheduled addenda to be issued. The A/E's written approval will be in an issued addendum. If the descriptive material is not restrictive, the products of other manufacturers specified will be accepted without prior approval provided they are compatible with the intent and purpose of the design as determined by the A/E.

14. Financial Responsibility of Contractors, Subcontractors and Sub-subcontractors

Contractors shall respond promptly to any inquiry in writing by DFCM to any concern of financial responsibility of the contractor, subcontractor or sub-subcontractor.

15. Debarment

By submitting a bid, the Contractor certifies that neither it nor its principals, including project and site managers, have been, or are under consideration for, debarment or suspension, or any action that would exclude such from participation in a construction contract by any governmental department or agency. If the Contractor cannot certify this statement, attach to the bid a detailed written explanation which must be reviewed and approved by DFCM as part of the requirements for award of the Project.

BID BOND

(Title 63, Chapter 56, U. C. A. l953, as Amended)

KNOW ALL PERSONS BY THESE PRESENTS:

That _____ hereinafter referred to as the "Principal," and_____, a corporation organized and existing under the laws of the State of _____, with its principal office in the City of _____ and authorized to transact business in this State and U. S. Department of the Treasury Listed, (Circular 570, Companies Holding Certificates of Authority as Acceptable Securities on Federal Bonds and as Acceptable Reinsuring Companies); hereinafter referred to as the "Surety," are held and firmly bound unto the STATE OF UTAH, hereinafter referred to as the "Obligee," in the amount of $_____ (5% of the accompanying bid), being the sum of this Bond to which payment the Principal and 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 to Obligee the accompanying bid incorporated by reference herein, dated as shown, to enter into a contract in writing for the_____ _____ Project.

NOW, THEREFORE, THE CONDITION OF THE ABOVE OBLIGATION IS SUCH, that if the said principal does not execute a contract and give bond to be approved by the Obligee for the faithful performance thereof within ten (10) days after being notified in writing of such contract to the principal, then the sum of the amount stated above will be forfeited to the State of Utah as liquidated damages and not as a penalty; if the said principal shall execute a contract and give bond to be approved by the Obligee for the faithful performance thereof within ten (10) days after being notified in writing of such contract to the Principal, then this obligation shall be null and void. It is expressly understood and agreed that the liability of the Surety for any and all defaults of the Principal hereunder shall be the full penal sum of this Bond. The Surety, for value received, hereby stipulates and agrees that obligations of the Surety under this Bond shall be for a term of sixty (60) days from actual date of the bid opening.

PROVIDED, HOWEVER, that this Bond is executed pursuant to provisions of Title 63, Chapter 56, Utah Code Annotated, 1953, as amended, and all liabilities on this Bond shall be determined in accordance with said provisions to same extent as if it were copied at length herein.

IN WITNESS WHEREOF, the above bounden parties have executed this instrument under their several seals on the date indicated below, the name and corporate seal of each corporate party being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

DATED this _____ day of _____, 20_____ .

Principal's name and address (if other than a corporation):

_____

_____

By:_____

Title: _____

Principal's name and address (if a corporation):

_____

_____

By:_____

Title: _____

(Affix Corporate Seal)

Surety's name and address:

_____

_____

By: _____

Attorney-in-Fact (Affix Corporate Seal)

STATE OF _____)
) ss.
COUNTY OF _____)

On this ____ day of _____, 20_____, personally appeared before me _____, whose identity is personally known to me or proved to me on the basis of satisfactory evidence, and who, being by me duly sworn, did say that he/she is the Attorney-in-fact of the above-named Surety Company, and that he/she is duly authorized to execute the same and has complied in all respects with the laws of Utah in reference to becoming sole surety upon bonds, undertakings and obligations, and that he/she acknowledged to me that as Attorney-in-fact executed the same.

Subscribed and sworn to before me this _____ day of _____, 20_____.
My Commission Expires: _____
Resides at: _____

_____
NOTARY PUBLIC

Agency: _____
Agent: _____
Address: _____
Phone:

Approved As To Form: May 25, 2005
By Alan S. Bachman, Asst Attorney General

INSTRUCTIONS AND SUBCONTRACTORS LIST FORM

The three low bidders, as well as all other bidders that desire to be considered, are required by law to submit to DFCM within 24 hours of bid opening a list of **ALL** first-tier subcontractors, including the subcontractor's name, bid amount and other information required by Building Board Rule and as stated in these Contract Documents, on the following basis:

PROJECTS UNDER $500,000 - ALL SUBS $20,000 OR OVER MUST BE LISTED
PROJECTS $500,000 OR MORE - ALL SUBS $35,000 OR OVER MUST BE LISTED

- Any additional subcontractors identified in the bid documents shall also be listed.
- The DFCM Director may not consider any bid submitted by a bidder if the bidder fails to submit a subcontractor list meeting the requirements of State law.
- List subcontractors for base bid as well as the impact on the list that the selection of any alternate may have.
- Bidder may not list more than one subcontractor to perform the same work.
- Bidder must list "Self" if performing work itself.

LICENSURE:

The subcontractor's name, the type of work, the subcontractor's bid amount, and the subcontractor's license number as issued by DOPL, if such license is required under Utah Law, shall be listed. Bidder shall certify that all subcontractors, required to be licensed, are licensed as required by State law. A subcontractor includes a trade contractor or specialty contractor and does not include suppliers who provide only materials, equipment, or supplies to a contractor or subcontractor.

BIDDER LISTING 'SELF' AS PERFORMING THE WORK:

Any bidder that is properly licensed for the particular work and intends to perform that work itself in lieu of a subcontractor that would otherwise be required to be on the subcontractor list, must insert the term 'Self' for that category on the subcontractor list form. Any listing of 'Self' on the sublist form shall also include the amount allocated for that work.

'SPECIAL EXCEPTION':

A bidder may list 'Special Exception' in place of a subcontractor when the bidder intends to obtain a subcontractor to perform the work at a later date because the bidder was unable to obtain a qualified or reasonable bid under the provisions of U.C.A.Section 63A-5-208(4). The bidder shall insert the term 'Special Exception' for that category of work, and shall provide documentation with the subcontractor list describing the bidder's efforts to obtain a bid of a qualified subcontractor at a reasonable cost and why the bidder was unable to obtain a qualified subcontractor bid. The Director must find that the bidder complied in good faith with State law requirements for any 'Special Exception' designation, in order for the bid to be considered. If awarded the contract, the Director shall supervise the bidder's efforts to obtain a qualified subcontractor bid. The amount of the awarded contract may not be adjusted to reflect the actual amount of the subcontractor's bid. Any listing of 'Special Exception' on the sublist form shall also include amount allocated for that work.

GROUNDS FOR DISQUALIFICATION:

The Director may not consider any bid submitted by a bidder if the bidder fails to submit a subcontractor list meeting the requirements of State law. Director may withhold awarding the contract to a particular bidder if one or more of the proposed subcontractors are considered by the Director to be unqualified to do the Work or for such other reason in the best interest of the State of Utah. Notwithstanding any other provision in these instructions, if there is a good faith error on the sublist form, at the sole discretion of the Director, the Director may provide notice to the contractor and the contractor shall have 24 hours to submit the correction to the Director. If such correction is submitted timely, then the sublist requirements shall be considered met.

CHANGES OF SUBCONTRACTORS SPECIFICALLY IDENTIFIED ON SUBLIST FORM:

Subsequent to twenty-four hours after the bid opening, the contractor may change its listed subcontractors only after receiving written permission from the Director based on complying with all of the following criteria.

(1) The contractor has established in writing that the change is in the best interest of the State and that the contractor establishes an appropriate reason for the change, which may include, but not is not limited to, the following reasons: the original subcontractor has failed to perform, or is not qualified or capable of performing, and/or the subcontractor has requested in writing to be released.
(2) The circumstances related to the request for the change do not indicate any bad faith in the original listing of the subcontractors.
(3) Any requirement set forth by the Director to ensure that the process used to select a new subcontractor does not give rise to bid shopping.
(4) Any increase in the cost of the subject subcontractor work is borne by the contractor.
(5) Any decrease in the cost of the subject subcontractor work shall result in a deductive change order being issued for the contract for such decreased amount.
(6) The Director will give substantial weight to whether the subcontractor has consented in writing to being removed unless the Contractor establishes that the subcontractor is not qualified for the work.

EXAMPLE:

Example of a list where there are only four subcontractors:

TYPE OF WORK	SUBCONTRACTOR, "SELF" OR "SPECIAL EXCEPTION"	SUBCONTRACTOR BID AMOUNT	CONT. LICENSE #
ELECTRICAL	ABCD Electric Inc.	$350,000.00	123456789000
LANDSCAPING	"Self"	300,000.00	123456789000
CONCRETE (ALTERNATE #1)	XYZ Concrete Inc	298,000.00	987654321000
MECHANICAL	"Special Exception" (attach documentation)	Fixed at: 350,000.00	(TO BE PROVIDED AFTER OBTAINING SUBCONTRACTOR)

PURSUANT TO STATE LAW - SUBCONTRACTOR BID AMOUNTS CONTAINED IN THIS SUBCONTRACTOR LIST SHALL NOT BE DISCLOSED UNTIL THE CONTRACT HAS BEEN AWARDED.

SUBCONTRACTORS LIST

PROJECT TITLE: _____

Caution: You must read and comply fully with instructions.

TYPE OF WORK	SUBCONTRACTOR, "SELF" OR "SPECIAL EXCEPTION"	SUBCONTRACTOR BID AMOUNT	CONT. LICENSE #

We certify that:

1. This list includes all subcontractors as required by the instructions, including those related to the base bid as well as any alternates.
2. We have listed "Self" or "Special Exception" in accordance with the instructions.
3. All subcontractors are appropriately licensed as required by State law.

FIRM: _____

DATE: _____ SIGNED BY: _____

NOTICE: FAILURE TO SUBMIT THIS FORM, PROPERLY COMPLETED AND SIGNED, AS REQUIRED IN THESE CONTRACT DOCUMENTS, SHALL BE GROUNDS FOR DFCMS REFUSAL TO ENTER INTO A WRITTEN CONTRACT WITH BIDDER. ACTION MAY BE TAKEN AGAINST BIDDERS BID BOND AS DEEMED APPROPRIATE BY DFCM. ATTACH A SECOND PAGE IF NECESSARY.

FUGITIVE DUST PLAN

The Contractor will fill out the form and file the original with the Division of Air Quality and a copy of the form with the Division of Facilities Construction & Management, prior to the issuance of any notice to proceed.

The Contractor will be fully responsible for compliance with the Fugitive Dust Control Plan, including the adequacy of the plan, any damages, fines, liability, and penalty or other action that results from noncompliance.

Utah Division of Air Quality *April 20, 1999*
GUIDANCE THAT MUST BE CONSIDERED IN DEVELOPING AND SUBMITTING A DUST CONTROL PLAN FOR COMPLIANCE WITH R307-309-3, 4, 5, 6, 7

Source Information:

1. Name of your operation (source): provide a name if the source is a construction site.

2. Address or location of your operation or construction site.

3. UTM coordinates or Longitude/Latitude of stationary emission points at your operation.

4. Lengths of the project, if temporary (time period).

5. Description of process (include all sources of dust and fugitive dust). Please, if necessary, use additional sheets of paper for this description. Be sure to mark it as an attachment.

6. Type of material processed or disturbed.

7. Amount of material processed (tons per year, tons per month, lbs./hr., and applicable units).

8. Destination of product (where will the material produced be used or transported, be specific, provide address or specific location), information needed for temporary relocation applicants.

9. Identify the individual who is responsible for the implementation and maintenance of fugitive dust control measures. List name(s), position(s) and telephone number(s).

10. List, and attach copies of any contract lease, liability agreement with other companies that may, or will, be responsible for dust control on site or on the project.

Description of Fugitive Dust Emission Activities
(Things to consider in addressing fugitive dust control strategies.)

1. Type of activities (drilling and blasting, road construction, development construction, earth moving and excavation, handling and hauling materials, cleaning and leveling, etc).

2. List type of equipment generating the fugitive dust.

3. Diagram the location of each activity or piece of equipment on site. Please attach the diagram.

4. Provide pictures or drawings of each activity. Include a drawing of the unpaved/paved road network used to move loads "on" and "off" property.

5. Vehicle miles travels on unpaved roads associated with the activity (average speed).

6. Type of dust emitted at each source (coal, cement, sand, soil, clay, dust, etc.)

7. Estimate the size of the release area at which the activity occurs (square miles). For haul or dirt roads include total miles of road in use during the activity.

Description of Fugitive Dust Emission Controls on Site

Control strategies must be designed to meet 20% opacity or less on site (a lesser opacity may be defined by Approval Order conditions or federal requirements such as NSPS), and control strategies must prevent exceeding 10% opacity from fugitive dust at the property boundary (site boundary) for compliance with R307-309-3.

1. Types of ongoing emission controls proposed for each activity, each piece of equipment, and haul roads.

2. Types of additional dust controls proposed for bare, exposed surfaces (chemical stabilization, synthetic cover, wind breaks, vegetative cover, etc).

3. Method of application of dust suppressant.

4. Frequency of application of dust suppressant.

5. Explain what triggers the use of a special control measure other than routine measures already in place, such as covered loads or measures covered by a permit condition (increase in opacity, high winds, citizen complaints, dry conditions, etc).

6. Explain in detail what control strategies/measures will be implemented off-hours, i.e., Saturdays/Sundays/Holidays, as well as 6 PM to 6 AM each day.

Description of Fugitive Dust Control Off-site

Prevent, to the maximum extent possible, deposition of materials, which may create fugitive dust on public and private paved roads in compliance with R307-309-5, 6, 7.

1. Types of emission controls initiated by your operation that are in place "off" property (application of water, covered loads, sweeping roads, vehicle cleaning, etc.).

2. Proposed remedial controls that will be initiated promptly if materials, which may create fugitive dust, are deposited on public and private paved roads.

Submit the Dust Control Plan to:

Executive Secretary
Utah Air Quality Board
POB 144820
15 North 1950 West
Salt Lake City, Utah 84114-4820

Phone: (801) 536-4000
FAX: (801) 536-4099

Fugitive Dust Control Plan Violation Report

When a source is found in violation of R307-309-3 or in violation of the Fugitive Dust Control Plan, the course must submit a report to the Executive Secretary within 15 days after receiving a Notice of Violation. The report must include the following information:

1. Name and address of dust source.

2. Time and duration of dust episode.

3. Meteorological conditions during the dust episode.

4. Total number and type of fugitive dust activities and dust producing equipment within each operation boundary. If no change has occurred from the existing dust control plan, the source should state that the activity/equipment is the same.

5. Fugitive dust activities or dust producing equipment that caused a violation of R-307-309-3 or the sources dust control plan.

6. Reasons for failing to control dust from the dust generating activity or equipment.

7. New and/or additional fugitive dust control strategies necessary to achieve compliance with R307-309-3, 4, 5, 6, or 7.

8. If it can not be demonstrated that the current approved Dust Control Plan can result in compliance with R307-309-3 through 7, the Dust Control Plan must be revised so as to demonstrate compliance with 307-309-3 through 7. Within 30 days of receiving a fugitive dust Notice of Violation, the source must submit the revised Plan to the Executive Secretary for review and approval.

Submit the Dust Control Plan to:

Executive Secretary
Utah Air Quality Board
POB 144820
15 North 1950 West
Salt Lake City, Utah 84114-4820

Phone: (801) 536-4000
FAX: (801) 536-4099

Attachments: DFCM Form FDR R-307-309, Rule 307-309

CONTRACTOR'S AGREEMENT

FOR:

_____
_____
_____

THIS CONTRACTOR'S AGREEMENT, made and entered into this ____ day of _____, 20__, by and between the DIVISION OF FACILITIES CONSTRUCTION AND MANAGEMENT, hereinafter referred to as "DFCM", and _____, incorporated in the State of _____ and authorized to do business in the State of Utah, hereinafter referred to as "Contractor", whose address is _____.

WITNESSETH: WHEREAS, DFCM intends to have Work performed at _____ _____.

WHEREAS, Contractor agrees to perform the Work for the sum stated herein.

NOW, THEREFORE, DFCM and Contractor for the consideration provided in this Contractor's Agreement, agree as follows:

ARTICLE 1. SCOPE OF WORK. The Work to be performed shall be in accordance with the Contract Documents prepared by _____ and entitled "_____."

The DFCM General Conditions ("General Conditions") dated May 25, 2005 on file at the office of DFCM and available on the DFCM website, are hereby incorporated by reference as part of this Agreement and are included in the specifications for this Project. All terms used in this Contractor's Agreement shall be as defined in the Contract Documents, and in particular, the General Conditions.

The Contractor Agrees to furnish labor, materials and equipment to complete the Work as required in the Contract Documents which are hereby incorporated by reference. It is understood and agreed by the parties hereto that all Work shall be performed as required in the Contract Documents and shall be subject to inspection and approval of DFCM or its authorized representative. The relationship of the Contractor to the DFCM hereunder is that of an independent Contractor.

ARTICLE 2. CONTRACT SUM. The DFCM agrees to pay and the Contractor agrees to accept in full performance of this Contractor's Agreement, the sum of _____ _____ DOLLARS AND NO CENTS ($_____.00), which is the base bid, and which sum also includes the cost of a 100% Performance Bond and a 100%

Payment Bond as well as all insurance requirements of the Contractor. Said bonds have already been posted by the Contractor pursuant to State law. The required proof of insurance certificates have been delivered to DFCM in accordance with the General Conditions before the execution of this Contractor's Agreement.

ARTICLE 3. TIME OF COMPLETION AND DELAY REMEDY. The Work shall be Substantially Complete within _____ (___) calendar days after the date of the Notice to Proceed. Contractor agrees to pay liquidated damages in the amount of $_____ per day for each day after expiration of the Contract Time until the Contractor achieves Substantial Completion in accordance with the Contract Documents, if Contractor's delay makes the damages applicable. The provision for liquidated damages is: (a) to compensate the DFCM for delay only; (b) is provided for herein because actual damages can not be readily ascertained at the time of execution of this Contractor's Agreement; (c) is not a penalty; and (d) shall not prevent the DFCM from maintaining Claims for other non-delay damages, such as costs to complete or remedy defective Work.

No action shall be maintained by the Contractor, including its or Subcontractor or suppliers at any tier, against the DFCM or State of Utah for damages or other claims due to losses attributable to hindrances or delays from any cause whatsoever, including acts and omissions of the DFCM or its officers, employees or agents, except as expressly provided in the General Conditions. The Contractor may receive a written extension of time, signed by the DFCM, in which to complete the Work under this Contractor's Agreement in accordance with the General Conditions.

ARTICLE 4. CONTRACT DOCUMENTS. The Contract Documents consist of this Contractor's Agreement, the Conditions of the Contract (DFCM General Conditions, Supplementary and other Conditions), the Drawings, Specifications, Addenda and Modifications. The Contract Documents shall also include the bidding documents, including the Notice to Contractors, Instructions to Bidders/ Proposers and the Bid/Proposal, to the extent not in conflict therewith and other documents and oral presentations that are documented as an attachment to the contract.

All such documents are hereby incorporated by reference herein. Any reference in this Contractor's Agreement to certain provisions of the Contract Documents shall in no way be construed as to lessen the importance or applicability of any other provisions of the Contract Documents.

ARTICLE 5. PAYMENT. The DFCM agrees to pay the Contractor from time to time as the Work progresses, but not more than once each month after the date of Notice to Proceed, and only upon Certificate of the A/E for Work performed during the preceding calendar month, ninety-five percent (95%) of the value of the labor performed and ninety-five percent (95%) of the value of materials furnished in place or on the site. The Contractor agrees to furnish to the DFCM invoices for materials purchased and on the site but not installed, for which the Contractor requests payment and agrees to

safeguard and protect such equipment or materials and is responsible for safekeeping thereof and if such be stolen, lost or destroyed, to replace same.

Such evidence of labor performed and materials furnished as the DFCM may reasonably require shall be supplied by the Contractor at the time of request for Certificate of Payment on account. Materials for which payment has been made cannot be removed from the job site without DFCM's written approval. Five percent (5%) of the earned amount shall be retained from each monthly payment. The retainage, including any additional retainage imposed and the release of any retainage, shall be in accordance with UCA 13-8-5 as amended. Contractor shall also comply with the requirements of UCA 13-8-5, including restrictions of retainage regarding subcontractors and the distribution of interest earned on the retention proceeds. The DFCM shall not be responsible for enforcing the Contractor's obligations under State law in fulfilling the retention law requirements with subcontractors at any tier.

ARTICLE 6. INDEBTEDNESS. Before final payment is made, the Contractor must submit evidence satisfactory to the DFCM that all payrolls, materials bills, subcontracts at any tier and outstanding indebtedness in connection with the Work have been properly paid. Final Payment will be made after receipt of said evidence, final acceptance of the Work by the DFCM as well as compliance with the applicable provisions of the General Conditions.

Contractor shall respond immediately to any inquiry in writing by DFCM as to any concern of financial responsibility and DFCM reserves the right to request any waivers, releases or bonds from Contractor in regard to any rights of Subcontractors (including suppliers) at any tier or any third parties prior to any payment by DFCM to Contractor.

ARTICLE 7. ADDITIONAL WORK. It is understood and agreed by the parties hereto that no money will be paid to the Contractor for additional labor or materials furnished unless a new contract in writing or a Modification hereof in accordance with the General Conditions and the Contract Documents for such additional labor or materials has been executed. The DFCM specifically reserves the right to modify or amend this Contractor's Agreement and the total sum due hereunder either by enlarging or restricting the scope of the Work.

ARTICLE 8. INSPECTIONS. The Work shall be inspected for acceptance in accordance with the General Conditions.

ARTICLE 9. DISPUTES. Any dispute, PRE or Claim between the parties shall be subject to the provisions of Article 7 of the General Conditions. DFCM reserves all rights to pursue its rights and remedies as provided in the General Conditions.

ARTICLE 10. TERMINATION, SUSPENSION OR ABANDONMENT. This Contractor's Agreement may be terminated, suspended or abandoned in accordance with the General Conditions.

ARTICLE 11. DFCM'S RIGHT TO WITHHOLD CERTAIN AMOUNT AND MAKE USE THEREOF. The DFCM may withhold from payment to the Contractor such amount as, in DFCM's judgment, may be necessary to pay just claims against the Contractor or Subcontractor at any tier for labor and services rendered and materials furnished in and about the Work. The DFCM may apply such withheld amounts for the payment of such claims in DFCM's discretion. In so doing, the DFCM shall be deemed the agent of Contractor and payment so made by the DFCM shall be considered as payment made under this Contractor's Agreement by the DFCM to the Contractor. DFCM shall not be liable to the Contractor for any such payment made in good faith. Such withholdings and payments may be made without prior approval of the Contractor and may be also be prior to any determination as a result of any dispute, PRE, Claim or litigation.

ARTICLE 12. INDEMNIFICATION. The Contractor shall comply with the indemnification provisions of the General Conditions.

ARTICLE 13. SUCCESSORS AND ASSIGNMENT OF CONTRACT. The DFCM and Contractor, respectively bind themselves, their partners, successors, assigns and legal representatives to the other party to this Agreement, and to partners, successors, assigns and legal representatives of such other party with respect to all covenants, provisions, rights and responsibilities of this Contractor's Agreement. The Contractor shall not assign this Contractor's Agreement without the prior written consent of the DFCM, nor shall the Contractor assign any moneys due or to become due as well as any rights under this Contractor's Agreement, without prior written consent of the DFCM.

ARTICLE 14. RELATIONSHIP OF THE PARTIES. The Contractor accepts the relationship of trust and confidence established by this Contractor's Agreement and covenants with the DFCM to cooperate with the DFCM and A/E and use the Contractor's best skill, efforts and judgment in furthering the interest of the DFCM; to furnish efficient business administration and supervision; to make best efforts to furnish at all times an adequate supply of workers and materials; and to perform the Work in the best and most expeditious and economic manner consistent with the interests of the DFCM.

ARTICLE 15. AUTHORITY TO EXECUTE AND PERFORM AGREEMENT. Contractor and DFCM each represent that the execution of this Contractor's Agreement and the performance thereunder is within their respective duly authorized powers.

ARTICLE 16. ATTORNEY FEES AND COSTS. Except as otherwise provided in the dispute resolution provisions of the General Conditions, the prevailing party shall be entitled to reasonable attorney fees and costs incurred in any action in the District Court and/or appellate body to enforce this Contractor's Agreement or recover damages or any other action as a result of a breach thereof.

IN WITNESS WHEREOF, the parties hereto have executed this Contractor's Agreement on the day and year stated hereinabove.

CONTRACTOR: _____

_____
Signature Date

Title: _____

_____
Please type/print name clearly

State of _____)
)
County of _____)

On this ____ day of _____, 20____, personally appeared before me, _____, whose identity is personally known to me (or proved to me on the basis of satisfactory evidence) and who by me duly sworn (or affirmed), did say that he (she) is the _____ (title or office) of the firm and that said document was signed by him (her) in behalf of said firm.

_____
Notary Public

(SEAL)

My Commission Expires _____

APPROVED AS TO AVAILABILITY OF FUNDS:

_____
Financial Manager, Date
Division of Facilities Construction and Management

DIVISION OF FACILITIES CONSTRUCTION AND MANAGEMENT

_____
_____ Date
Manager -
Capital _____

APPROVED AS TO FORM:
ATTORNEY GENERAL
May 25, 2005
By: Alan S. Bachman
Asst Attorney General

APPROVED FOR EXPENDITURE:

_____
Division of Finance Date

PERFORMANCE BOND

(Title 63, Chapter 56, U. C. A. 1953, as Amended)

That _____ hereinafter referred to as the "Principal" and _____, a corporation organized and existing under the laws of the State of _____, with its principal office in the City of _____ and authorized to transact business in this State and U. S. Department of the Treasury Listed (Circular 570, Companies Holding Certificates of Authority as Acceptable Securities on Federal Bonds and as Acceptable Reinsuring Companies); hereinafter referred to as the "Surety," are held and firmly bound unto the State of Utah, hereinafter referred to as the "Obligee, " in the amount of _____ _____ DOLLARS ($_____) for the payment whereof, the said Principal and Surety bind themselves and their heirs, administrators, executors, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has entered into a certain written Contract with the Obligee, dated the _____ day of _____, 20____, to construct _____ in the County of _____, State of Utah, Project No. _____, for the approximate sum of _____ _____ Dollars ($_____), which Contract is hereby incorporated by reference herein.

NOW, THEREFORE, the condition of this obligation is such that if the said Principal shall faithfully perform the Contract in accordance with the Contract Documents including, but not limited to, the Plans, Specifications and conditions thereof, the one year performance warranty, and the terms of the Contract as said Contract may be subject to Modifications or changes, then this obligation shall be void; otherwise it shall remain in full force and effect.

No right of action shall accrue on this bond to or for the use of any person or corporation other than the state named herein or the heirs, executors, administrators or successors of the Owner.

The parties agree that the dispute provisions provided in the Contract Documents apply and shall constitute the sole dispute procedures of the parties.

PROVIDED, HOWEVER, that this Bond is executed pursuant to the Provisions of Title 63, Chapter 56, Utah Code Annotated, 1953, as amended, and all liabilities on this Bond shall be determined in accordance with said provisions to the same extent as if it were copied at length herein.

IN WITNESS WHEREOF, the said Principal and Surety have signed and sealed this instrument this _____ day of _____, 20_____.

WITNESS OR ATTESTATION:

_____

PRINCIPAL:

_____

By: _____ (Seal)

Title: _____

WITNESS OR ATTESTATION:

_____

SURETY:

_____

By: _____

Attorney-in-Fact (Seal)

STATE OF _____)
) ss.
COUNTY OF _____)

On this _____ day of _____, 20___, personally appeared before me _____, whose identity is personally known to me or proved to me on the basis of satisfactory evidence, and who, being by me duly sworn, did say that he/she is the Attorney in-fact of the above-named Surety Company and that he/she is duly authorized to execute the same and has complied in all respects with the laws of Utah in reference to becoming sole surety upon bonds, undertakings and obligations, and that he/she acknowledged to me that as Attorney-in-fact executed the same.

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

My commission expires: _____

Resides at: _____

_____

NOTARY PUBLIC

Agency: _____
Agent: _____
Address: _____
Phone: _____

Approved As To Form: May 25, 2005
By Alan S. Bachman, Asst Attorney General

DFCM FORM 1b 052505

PAYMENT BOND

(Title 63, Chapter 56, U. C. A. l953, as Amended)

KNOW ALL PERSONS BY THESE PRESENTS:

That _____ hereinafter referred to as the "Principal," and _____ _____, a corporation organized and existing under the laws of the State of _____authorized to do business in this State and U. S. Department of the Treasury Listed (Circular 570, Companies Holding Certificates of Authority as Acceptable Securities on Federal Bonds and as Acceptable Reinsuring Companies); with its principal office in the City of _____, hereinafter referred to as the "Surety," are held and firmly bound unto the State of Utah hereinafter referred to as the "Obligee," in the amount of _____ Dollars ($_____) for the payment whereof, the said Principal and Surety bind themselves and their heirs, administrators, executors, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has entered into a certain written Contract with the Obligee, dated the _____ day of _____, 20____, to construct _____ in the County of _____, State of Utah, Project No. _____ for the approximate sum of _____ _____ Dollars ($_____), which contract is hereby incorporated by reference herein.

NOW, THEREFORE, the condition of this obligation is such that if the said Principal shall pay all claimants supplying labor or materials to Principal or Principal's Subcontractors in compliance with the provisions of Title 63, Chapter 56, of Utah Code Annotated, l953, as amended, and in the prosecution of the Work provided for in said Contract, then, this obligation shall be void; otherwise it shall remain in full force and effect.

That said Surety to this Bond, for value received, hereby stipulates and agrees that no changes, extensions of time, alterations or additions to the terms of the Contract or to the Work to be performed thereunder, or the specifications or drawings accompanying same shall in any way affect its obligation on this Bond, and does hereby waive notice of any such changes, extensions of time, alterations or additions to the terms of the Contract or to the Work or to the specifications or drawings and agrees that they shall become part of the Contract Documents.

PROVIDED, HOWEVER, that this Bond is executed pursuant to the provisions of Title 63, Chapter 56, Utah Code Annotated, 1953, as amended, and all liabilities on this Bond shall be determined in accordance with said provisions to the same extent as if it were copied at length herein.

IN WITNESS WHEREOF, the said Principal and Surety have signed and sealed this instrument this _____ day of _____, 20____.

WITNESS OR ATTESTATION:

_____

PRINCIPAL:

_____

By: _____
(Seal)

Title: _____

WITNESS OR ATTESTATION:

_____

SURETY:

_____

By: _____
Attorney-in-Fact (Seal)

STATE OF _____)
) ss.
COUNTY OF _____)

On this _____ day of _____, 20_____, personally appeared before me _____ _____, whose identity is personally known to me or proved to me on the basis of satisfactory evidence, and who, being by me duly sworn, did say that he/she is the Attorney-in-fact of the above-named Surety Company, and that he/she is duly authorized to execute the same and has complied in all respects with the laws of Utah in reference to becoming sole surety upon bonds, undertakings and obligations, and that he/she acknowledged to me that as Attorney-in-fact executed the same.

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

My commission expires: _____
Resides at: _____

_____
NOTARY PUBLIC

Agency: _____
Agent: _____
Address: _____
Phone: _____

Approved As To Form: May 25, 2005
By Alan S. Bachman, Asst Attorney General

DFCM FORM 1b 052505

STATE OF UTAH - DEPARTMENT OF ADMINISTRATIVE SERVICES

Division of Facilities Construction and

DFCM

CHANGE ORDER #_____

CONTRACTOR:

ARCHITECT:

AGENCY OR INSTITUTION:
PROJECT NAME:
PROJECT NUMBER:
CONTRACT NUMBER:
DATE:

CONSTRUCTION CHANGE DIRECTIVE NO.	PROPOSAL REQUEST NO.	AMOUNT		DAYS	
		INCREASE	DECREASE	INCREASE	DECREASE

	Amount	Days	Date
ORIGINAL CONTRACT			
TOTAL PREVIOUS CHANGE ORDERS			
TOTAL THIS CHANGE ORDER			
ADJUSTED CONTRACT			

DFCM and Contractor agree that the terms, contract sum, scope of the Work and time specified in this Change Order shall constitute the full accord and satisfaction, and complete adjustment to the Contract and includes all direct and indirect costs and effects related to, incidental to, and/or reasonably implied from such change in the contract terms, sum, scope of the Work and time.

Contractor:_____
Date

Architect/Engineer:_____
Date

Agency or Institution:_____
Date

DFCM: _____
Date

Funding Verification:_____
Date

Page _____ of _____page(s)

DFCM FORM 1b 052505

STATE OF UTAH - DEPARTMENT OF ADMINISTRATIVE SERVICES

Division of Facilities Construction and

DFCM

CERTIFICATE OF SUBSTANTIAL COMPLETION

PROJECT _____ PROJECT NO: _____

AGENCY/INSTITUTION _____

AREA ACCEPTED _____

The Work performed under the subject Contract has been reviewed on this date and found to be Substantially Completed as defined in the General Conditions; including that the construction is sufficiently completed in accordance with the Contract Documents, as modified by any change orders agreed to by the parties, so that the State of Utah can occupy the Project or specified area of the Project for the use for which it is intended.

The DFCM accepts the Project or specified area of the Project as Substantially Complete and will assume full possession of the Project or specified area of the Project at _____ (time) on _____ (date).

The DFCM accepts the Project for occupancy and agrees to assume full responsibility for maintenance and operation, including utilities and insurance, of the Project subject to the itemized responsibilities and/or exceptions noted below:

_____

_____

A list of items to be completed or corrected is attached hereto. The failure to include an item on it does not alter the responsibility of the Contractor to complete all the Work in accordance with the Contract Documents, including authorized changes thereof.

The Contractor shall complete or correct the Work on the list of items appended hereto within _____ calendar days from the above date of issuance of this Certificate. The amount withheld pending completion of the list of items noted and agreed to shall be: $_____.

_____ by: _____
CONTRACTOR (include name of firm) DATE

_____ by: _____
A/E DATE

_____ by: _____
USING INSTITUTION OR AGENCY DATE

_____ by: _____
DFCM DATE

cc: Parties Noted
DFCM, Director

SPECIFICATIONS

FOR THE

DIVISION OF WILDLIFE RESOURCES
MAMMOTH CREEK HATCHERY
INFLOW FILTRATION,
2005

Prepared by:

SUNRISE ENGINEERING, INC.
25 East 500 North
Fillmore, Utah 84631
Tel: (435) 743-6151
Fax: (435) 743-7900

SPECIFICATIONS
for the
DIVISION OF WILDLIFE RESOURCES
MAMMOTH CREEK HATCHERY
INFLOW FILTRATION
2005

Prepared by:

Sunrise Engineering, Inc.
25 East 500 North
Fillmore, Utah 84631
Tel: (435) 743-6151
Fax: (435) 743-7900

LICENSED PROFESSIONAL ENGINEER
No. 375477
9-9-05
ROBERT W. WORLEY
STATE OF UTAH

Robert W. Worley, P.E.
State of Utah, 375477
Project Engineer

Date: August 4, 2005

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FOR
SUNRISE ENGINEERING
STANDARD SPECIFICATIONS FOR CONSTRUCTION

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March 20, 2002

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8.5 Progress Payments.
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8.5.4 Owner and Consultant Not Liable.
8.5.5 Certificate, Payment or Use Not Acceptance of Improper Work.
8.6 Payment Upon Substantial Completion.
8.7 Partial Occupancy or Use.
8.7.1 In General.
8.7.2 Inspection.
8.7.3 Not Constitute Acceptance.
8.8 Final Completion and Final Payment.
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9.1.5 Consultant Observing.
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10.2 Safety of Persons and Property.
- 10.2.1 Contractor Responsibility.
- 10.2.2 Safety Program, Precautions.
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- 11.1.3 Configurations.
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13.4.1 In General.
13.4.2 Contractor Obligations.
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13.5 Owners Right to Stop the Work.

GENERAL CONDITIONS

ARTICLE 1. GENERAL PROVISIONS.

1.1 BASIC DEFINITIONS.

ADDENDA. "Addenda" means the written or graphic instruments issued prior to the opening of Bids which clarify, correct or change the bidding documents or the Contract Documents.

BID. "Bid" means the offer or proposal of the bidder submitted on the prescribed form setting forth the prices for the Work to be performed.

BONDS. "Bonds" mean the bid bond, performance and payment bonds and other instruments of security.

CHANGE ORDER. "Change Order" means a written instrument signed by the Owner and Contractor, stating their agreement for changes of the Contract as specified on the required Owner's change order form.

CLAIM. "Claim" means a demand or assertion by one of the parties seeking, as a matter of right, modification, adjustment or interpretation of Contract terms, payment of money, extension of time or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. A Request for Equitable Adjustment (REA) shall not be considered a "claim." If a Request for Equitable Adjustment is denied in whole or in part, a claim may be filed in accordance with Article 4 of these General Conditions.

CONSULTANT (including all design professionals). "Consultant" means the person lawfully licensed to practice architecture or engineering or an entity lawfully practicing architecture or engineering identified as such in the Consultant's Agreement and is referred to throughout the Contract Documents as if singular in number. The term "Consultant" also means the Consultant's representative and its consultants. When these General Conditions are part of a Contract in which the design professional is an interior designer, landscape Consultant or other design professional, the term "Consultant" as used in these General Conditions shall be deemed to refer to such design professional. A license is not required when the type of design professional is one which is not subject to a professional license, but such professional must meet the prevailing standards in the State of Utah for such practice.

CONSTRUCTION CHANGE DIRECTIVE. A "Construction Change Directive" means a written order signed by the Owner, directing a change in the Work and stating a proposed basis for adjustment, if any, in the Contract Sum or Contract Time, or both. The Owner may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions or other revisions; even if it may impact the Contract Sum and Contract Time.

CONTRACT. The Contract Documents form the Contract for Construction. The term "Contract" represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations or agreements, either written or oral. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Consultant and Contractor, (2) between the Owner and a Subcontractor or (3) between any persons or entities other than the Owner and Contractor.

CONTRACT DOCUMENTS. The term "Contract Documents" means the Contractor's Agreement between the Owner and Contractor (hereinafter referred to as "Contractor's Agreement"), the Conditions of the Contract (General, Supplementary and other Conditions), the Drawings, Specifications, Addenda, other documents listed in the Contractor's Agreement and Modifications issued after execution of the Contractor's Agreement. The Contract Documents shall also include the bidding documents, including the Instructions to Bidders, Notice to Contractors and the Bid Form, to the extent not in conflict with the other above-stated Contract Documents and other documents and oral presentations as part of the Selection which are documented as an attachment to the Contract.

CONTRACT SUM. The term "Contract Sum" means the Contract Sum as stated in the Contractor's Agreement and, including authorized and signed adjustments to this agreement (modifications), is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents.

CONTRACT TIME. "Contract Time", unless otherwise provided in the Contract Documents, means the period of time, including authorized and signed adjustments (modifications), stated in the Contract Documents for Substantial Completion of the Work.

CONTRACTOR. The Contractor is the person or entity identified as such in the Contractor's Agreement and is referred to throughout the Contract Documents as if singular in number. The term "Contractor" means the Contractor or the Contractor's authorized representative. When separate contracts are awarded for different portions of the Project or other construction or operations on the site, the term "Contractor" in the Contract Documents in each case, shall mean the Contractor who executes each separate Owner-Contractor Agreement.

DAY. The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

DEFECTIVE. "Defective" is an adjective which when modifying the word "Work" refers to Work that does not conform to the Contract Documents, or does not meet the requirements of any inspection, referenced standard, code, test or approval referred to in the Contract Documents, or has been damaged.

DIRECTOR. "Director" means the Director of the Division of Facilities Construction and Management unless the context requires otherwise. Director may include a designee selected by the Director for the particular function referred to in the General Conditions.

DRAWINGS. The "Drawings" are the graphic and pictorial portions of the Contract Documents, wherever located and whenever issued, showing the design, location and dimensions of the Work, and generally include the drawings, elevations, sections, details, schedules and diagrams.

FIELD ORDER. "Field Order" means a written order issued by the Owner or the Consultant which directs minor changes in the Work in accordance with Article 7 but which does not involve a change in the Contract Price or the Contract Time.

INSPECTION. The word "inspection" or its derivatives shall mean a review of the Project, including but not limited to a visual review of the Work completed to date to ascertain if the Work is in accordance with the Contract Documents, including all applicable building codes and construction standards.

MODIFICATION. A "Modification" is (1) a Change Order (2) Construction Change Directive or (3) Field Order. The Contract may be amended or modified only by (1) a written amendment executed by both the Owner and Contractor, or (2) by a Modification.

NOTICE TO PROCEED. A "Notice to Proceed" is a document prepared by the Owner and by its terms authorizes the Contractor to commence Work on the Project. It is deemed issued upon being sent by the Owner to the Contractor's specified address within the bid or proposal.

OWNER. "Owner" or pronoun used in place thereof, means the State of Utah, as represented by the Division of Facilities Construction and Management of the Department of Administrative Services. The Owner is referred to throughout the Contract Documents as if singular in number.

OWNER'S DESIGNATED REPRESENTATIVE. "Owner's Designated Representative" means the Owner's Program Director or other representative as assigned by the Owner.

PARTIAL USE. "Partial Use" means placing a portion of the Work in service for the purpose for which it is intended (or a related purpose) before reaching Substantial Completion for all the Work. This partial use does not constitute "substantial completion".

PRODUCT DATA. "Product Data" means illustrations, standard schedules, performance charts, instructions, brochures, diagrams and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.

PROJECT. The "Project" means the total construction of the Work performed under the Contract Documents.

PROJECT MANUAL (FOR CONSTRUCTION). The "Project Manual" is the volume assembled for the Work and may include the bidding requirements, sample forms, General or Supplementary Conditions of the Contract and Specifications.

REQUEST FOR EQUITABLE ADJUSTMENT. A "Request for Equitable Adjustment" (REA) is an informal request to resolve matters. It shall not be considered a "claim." If a Request for Equitable Adjustment is denied in whole or in part, a claim may be filed in accordance with Article 4 of these General Conditions.

SAMPLES. "Samples" mean physical examples, which illustrate materials, equipment or workmanship and establish standards by which the Work will be judged.

SHOP DRAWINGS. "Shop Drawings" means drawings, diagrams, schedules and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier or distributor to illustrate some portion of the Work.

SPECIFICATIONS. The "Specifications" are that portion of the Contract Documents consisting of the written requirements for materials, equipment, construction systems, standards, installation and workmanship for the Work, and performance of related systems and services.

SUBCONTRACTOR. "Subcontractor" means the person or entity that has a direct contract with the Contractor or with another Subcontractor to provide labor or materials for the work. Notwithstanding the foregoing, the text in which the term is used may provide for the exclusion of Subcontractors of other Subcontractors or the exclusion of suppliers. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or authorized representative of the Subcontractor. The Term "Subcontractor" does not include a separate contractor or subcontractors of a separate contractor.

SUBSTANTIAL COMPLETION. "Substantial Completion" is the date certified by the Consultant in accordance with Paragraph 9.2 and means the date the Work or designated portion thereof is sufficiently complete, and any lack of completion or performance does not reasonably interfere with the

Owner's intended use of the Project, in accordance with the Contract Documents so that the Owner can occupy and use the Work for its intended use.

SUPPLEMENTARY CONDITIONS OR SUPPLEMENTARY GENERAL CONDITIONS. "Supplementary Conditions" or "Supplementary General Conditions" means the part of the Contract Documents which amends or supplements these General Conditions.

WORK. The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all labor, materials, equipment and services provided, or to be provided, by the Contractor to fulfill the Contractor's obligations.

1.2 OWNERSHIP AND USE OF CONSULTANT'S DRAWINGS, SPECIFICATIONS AND OTHER DOCUMENTS. All Drawings, Specifications and other documents prepared by the Consultant are and shall remain the property of the Owner, and Owner shall retain all common law, statutory and other reserved rights with respect thereto. Said documents were prepared and are intended for use as an integrated set for the Project which is the subject of this Contractor's Agreement. They shall not be modified or used on any other project without the prior written consent of the Owner and Consultant. Any such nonpermissive use or modification, by Contractor, the Contractor's Subcontractors at any tier or anyone for whose acts the Contractor is liable, shall be at Contractor's sole risk. Contractor shall hold harmless and indemnify the Owner from and against any and all claims, actions, suits, costs, damages, loss, expenses and attorney fees arising out of such non-permissive use or modification by the Contractor. The Contractor and Subcontractors are granted a limited license to use and reproduce applicable portions of the Drawings, Specifications and other documents prepared by the Consultant appropriate to and for use in the execution of their Work under the Contract Documents. All copies made under this license shall bear the statutory copyright notice, if any, shown on the Drawings, Specifications and other documents prepared by the Consultant. Submittals or distributions necessary to meet official regulatory requirements or for other purposes relating to completion of the Project are not to be construed as a publication in derogation of the Owner's copyright or other reserved rights.

ARTICLE 2. OWNER.

2.1 INFORMATION AND SERVICES REQUIRED OF THE OWNER.

2.1.1 OWNER'S DESIGNATED REPRESENTATIVE. The Owner shall designate an Owner's Designated Representative authorized to act in the Owner's behalf with respect to the Project. The Owner or such authorized representative shall render decisions within a reasonable time pertaining to documents submitted by the Consultant and/or Contractor in order to avoid a compensable delay in the orderly and sequential progress of the Project.

2.1.2 SPECIALISTS AND INSPECTORS. The Owner will provide certified building inspection services in accordance with the adopted Building Codes. This includes 'routine' and 'special' inspections unless noted in the Consultant Agreement. The Owner may assign an inspector or specialist to note deviations from, or necessary adjustments to, the Contract Documents or to report deficiencies or defects in the Work. The inspector or specialist's activities in no way relieves the Contractor of the responsibilities set forth in the Contract Documents.

2.1.3 SURVEYS AND LEGAL DESCRIPTION. The Owner shall furnish surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site. The Contractor shall review this information, including the surveys and any provided soils tests, and compare such information with observable physical conditions and the Contract Documents.

2.1.4 PROMPT INFORMATION AND SERVICES. Upon receipt of a written request from the Contractor, the Owner shall furnish information or services under the Owner's control with reasonable promptness to avoid delay in orderly progress of the Work.

2.1.5 COPIES OF DRAWINGS AND PROJECT MANUALS (FOR CONSTRUCTION). Unless otherwise provided in the Contract Documents, the Contractor will be furnished, free of charge, such copies of Drawings and Project Manuals (for construction) as are reasonably necessary for execution of the Work. Owner's Web Page may also provide referenced documents for the Project.

2.1.6 OTHER DUTIES. The foregoing is in addition to other duties and responsibilities of the Owner enumerated herein and especially those in respect to Article 6 (Construction by Owner or by Separate Contractors), Article 8 (Payments and Completion) and Article 11 (Insurance and Bonds).

ARTICLE 3. CONTRACTOR

3.1 REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTRACTOR.

3.1.1 REVIEWING CONTRACT DOCUMENTS, INFORMATION, REPORTING ERRORS, INCONSISTENCIES OR OMISSIONS. The Contractor shall carefully study and compare the Contract Documents with each other and with information furnished by the Owner pursuant to Paragraph 2.1 hereinabove and shall at once report to the Owner and Consultant errors, inconsistencies or omissions discovered. The Contractor shall not be liable to the Owner or Consultant for damage resulting from errors, inconsistencies or omission in the Contract Documents, unless the Contractor recognized such error, inconsistency or omission or a Contractor of ordinary skill and expertise for the type of Work involved would have readily so recognized such error, inconsistency or omission, and the Contractor failed to report such to the Owner and Consultant. If the Contractor performs any construction activity without such notice to the Owner and Consultant and resolution of the error, inconsistency or omission, the Contractor shall assume appropriate responsibility for such performance and shall bear an appropriate amount of the attributable costs for correction.

3.1.2 FIELD CONDITIONS. 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, or information which a Contractor of ordinary skill and expertise for the type of Work involved would have known, before commencing activities. Errors, inconsistencies or omissions discovered shall be reported to the Owner and Consultant at once. If the Contractor performs any construction activity without such notice to the Owner and Consultant and resolution of the error, inconsistency or omission, the Contractor shall assume appropriate responsibility for such performance and shall bear an appropriate amount of the attributable costs for correction.

3.1.3 PERFORM IN ACCORDANCE WITH DOCUMENTS AND SUBMITTALS. The Contractor shall perform the Work in accordance with the Contract Documents and submittals approved pursuant to Paragraph 3.9 hereinbelow.

3.1.4 PERFORMANCE TO PRODUCE THE COMPLETE SYSTEM AND INTENDED RESULTS. Performance by the Contractor shall be required to the extent consistent with the Contract Documents and reasonably inferable from the Contract Documents as being necessary to allow the system to function within its intended use.

3.1.5 INTENT AND HIERARCHY. The Contract Documents should be read as a whole and wherever possible, the provisions should be construed in order that all provisions are operable. The intent of the contract Documents is to include all items necessary for the proper execution and completion of the

Work by the Contractor. The Contract Documents are complimentary, and what is required by one Document or provisions thereof shall be as binding as if required by all the Documents or provisions thereof. In case of an irreconcilable conflict between provisions within a Contract Document or between Contract Documents, the following priorities shall govern as listed below:

(1) A particular Modification shall govern over all Contract Document provisions or Modifications issued prior to said particular Modification.

(2) Attachments resulting from the Selection process including any management plan or documented interview information.

(3) A particular Addendum shall govern over all other Contract Document provisions issued prior to said particular Addendum. Subsequent Addenda shall govern over all prior Addenda.

(4) The Supplementary General Conditions shall govern over the General Conditions.

(5) These General Conditions shall govern over all other Contract Documents except for the Supplementary General Conditions, Addenda, Modifications and Attachments resulting from the selection process.

(6) The drawings and specifications shall not govern over any of the documents listed above.

(7) In case of a conflict or ambiguity within the same level of hierarchy of described documents, Owner reserves the right to select the most stringent requirement unless the preponderance of the contract indicates the less stringent requirement.

3.1.6 DIVIDING WORK AND CONTRACTOR REPRESENTATION. Organization of the specifications into division, 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. Contractor represents that the Subcontractors, Sub-subcontractors, manufacturers and suppliers engaged or to be engaged by it are and will be familiar with the requirements for performance by them of their obligations.

3.1.7 PLANNING AND PRIORITY. The Contractor shall plan and schedule its work to facilitate the Project and shall maintain a work schedule to place proper priority to sequence work to complete the project timely.

3.2 SUPERVISION AND CONSTRUCTION PROCEDURES.

3.2.1 SUPERVISION AND CONTROL. The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for and have control over the construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under the Contract, except to the extent that the Contract Documents expressly and specifically state otherwise.

3.2.2 RESPONSIBILITY. The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors, and their agents and employees, and other persons performing portions of the Work under a contract with the Contractor or on behalf of the Contractor.

3.2.3 NOT RELIEVED OF OBLIGATIONS. The Contractor shall not be relieved of obligations to perform the Work in accordance with the Contract Documents either by activities or duties of

the Owner or its agents in the Owner's administration of the Contract, or by tests, inspections or approvals required or performed by persons other than the Contractor.

3.2.4 INSPECTIONS AND APPROVALS.

(1) The Contractor is responsible for requesting inspections for various stages and portions of the Work required under the Contract Documents in a timely manner.

(2) If any of the Work is required to be inspected or approved by the terms of the Contract Documents by any public authority, the Contractor shall timely request such inspection or approval to be performed in accordance with Article 9. Except as provided in Article 9, work shall not proceed without any required inspection and the associated authorization to proceed. Contractor shall promptly notify Owner if the inspector fails to appear at the site.

3.3 LABOR AND MATERIALS.

3.3.1 PAYMENT BY CONTRACTOR. Except to the extent it is otherwise stated in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipments, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities, supplies, consumables and services necessary for the proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

3.3.2 DISCIPLINE AND COMPETENCE. The Contractor shall enforce strict discipline and good order among the Contractor's employees, its Subcontractors, agents, representatives and other persons performing under the Contract Documents. The Contractor shall not permit employment of unfit persons or persons not skilled in tasks assigned to them.

3.4 TAXES AND OTHER PAYMENTS TO GOVERNMENT. The Contractor shall pay sales, consumer, use, employment-related and similar taxes related to the Work or portions thereof provided by the Contractor which are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect.

3.5 PERMITS, FEES, NOTICES, LABOR AND MATERIALS.

3.5.1 PERMITS AND FEES. Unless required in the Supplementary General Conditions or an Addendum, it will not be necessary for the Contractor to obtain or pay for local building permits, plan check fees, electrical permits, plumbing permits, connection fees, or impact fees, nor will it be necessary to pay fees for inspections pertaining thereto.

3.5.2 COMPLIANCE WITH PUBLIC AUTHORITIES, NOTICES. The Contractor shall comply with and give notices required by laws, ordinances, resolutions, rules, regulations and lawful orders of public authorities bearing on the performance of the Work.

3.5.3 CORRELATION OF CONTRACT DOCUMENTS AND ENACTMENTS. It is not the Contractor's responsibility to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, resolutions, building codes, and rules and regulations. However, if the Contractor observes, or if such is readily observable to a Contractor of ordinary skill and expertise for the type of Work involved, that a portion of the Contract Documents is at variance therewith, the Contractor shall promptly notify the Consultant and Owner in writing, and necessary changes shall be accomplished by appropriate Modification.

3.5.4 FAILURE TO GIVE NOTICE. If the Contractor, or any Subcontractor thereof performs Work without complying with the requirements of Paragraph 3.5.3 hereinabove, the Contractor

shall assume appropriate responsibility for such Work and shall bear the appropriate amount of the attributable costs.

3.6. SUPERINTENDENT. The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project site during performance of the Work. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor. Important communications shall be confirmed in writing. Other communications shall be similarly confirmed on written request in each case.

3.7 TIME AND CONTRACTOR'S CONSTRUCTION SCHEDULES.

3.7.1 PROGRESS AND COMPLETION.

(1) TIME IS OF THE ESSENCE; COMPLETE WITHIN CONTRACT TIME. Time is of the essence. By executing the Contractor's Agreement, the Contractor confirms that the Contract Time is adequate to perform the Work. The Contractor shall proceed expeditiously with adequate forces to achieve Substantial Completion within the Contract Time.

(2) NOTICE TO PROCEED AND INSURANCE. The Contractor shall not prematurely commence operations on the site or elsewhere prior to the issuance of a Notice to Proceed by the Owner or prior to the effective date of insurance required by Article 11 to be furnished by the Contractor, whichever is the latter.

3.7.2 SCHEDULE PREPARATION. The Contractor, promptly after being awarded the Contract, shall prepare and submit for the Owner's and Consultant's review a reasonably detailed CPM schedule for the Work. The schedule shall indicate the order, sequence, and interdependence of all items known to be necessary to complete the Work including construction, procurement, fabrication, and delivery of materials and equipment, submittals and approvals of samples, shop drawings, procedures, or other documents. Work items of the Owner, other Contractors, utilities and other third parties that may affect or be affected by the Contractor shall be included. If the Owner is required, by the Contract Documents, to furnish any materials, equipment, or the like, to be incorporated into the Work by the Contractor, Contractor shall submit, with the first schedule submittal, a letter clearly indicating the dates that such items are required at the Project Site. The critical path should be identified, including the critical paths for interim completion dates and milestones. The CPM schedule shall be developed using Primavera, MS Project, or Suretrack unless otherwise authorized by the Owner's Designated Representative. The Contractor's schedule shall be updated at least once a month and submitted with each pay request,

3.7.3 INITIAL CONTRACT TIME. Unless otherwise specified in the bidding documents, the initial Contract Time is the time proposed by the Contractor and accepted by the Owner in the selection process.

3.7.4 INTERIM COMPLETION DATES AND MILESTONES. The schedule must include contractually specified interim completion dates and milestones. The milestone completion dates indicated are considered essential to the satisfactory performance of this Contract and to the coordination of all Work on the Project. The milestone dates listed are not intended to be a complete listing of all Work under this Contract or of interfaces with other Project Contractors.

3.7.5 SCHEDULE CONTENT REQUIREMENTS. The schedule shall indicate an early completion date for the Project that is no later than the Project's required completion date. The schedule, including all activity duration's shall be given in calendar days. The Schedule shall also indicate all of the following:

(1) Interfaces with the work of outside contractors (e.g., utilities, power and with any separate Contractor);

(2) Description of activity including activity number/numbers;

(3) Estimated duration time for each activity;

(4) Early start, late start, early finish, late finish date, and predecessor/successors including stop-start relationships with lead and lag time for each activity;

(5) Float available to each path of activities;

(6) Actual start date for each activity begun;

(7) Actual finish date for each activity completed;

(8) The percentage complete of each activity in progress or completed;

(9) Identification of all critical path activities;

(10) The critical path for the Project, with said path of activities being clearly and easily recognizable on the time-scaled network diagram. The path(s) with the least amount of float must be identified. Unless otherwise authorized by the Owner's Designated Representative, no more than 40% of all activities may be identified as critical path items. The relationship between non-critical activities and activities on the critical path shall be clearly shown on the network diagram;

(11) Unless otherwise authorized by the Owner's Designated Representative, all activities on the schedule representing construction on the site may not have a duration longer than 14 days. Construction items that require more than 14 days to complete must be broken into identifiable activities on the schedule with durations less than 14 days. The sum of these activities represents the total length required to complete that construction item; and

(12) Additional requirements as specified in the Supplemental General Conditions.

3.7.6 OWNER'S RIGHT TO TAKE EXCEPTIONS. The Owner reserves the right to take reasonable exception to activity duration, activity placement, construction logic or time frame for any element of the Work to be scheduled.

3.7.7 FLOAT TIME. Float or slack time is defined as the amount of time between the earliest start date and the latest start date or between the earliest finish date and the latest finish date of a chain of activities on the Schedule. By a proposal request or modification delivered to the Contractor, the Owner has the right to use the float time for non-critical path activities until the Contractor has reallocated such time on a newly submitted schedule.

3.7.8 INITIAL SCHEDULE SUBMISSION. No progress payments will be approved until the Contractor has submitted a Project detailed CPM schedule covering the first 90 days of the Work with a general CPM schedule for the entire project. The detailed schedule for the entire project is to be completed prior to the second pay request unless otherwise authorized in writing by the Owner's Designated Representative.

3.7.9 UPDATES. Prior to any approval of a pay request, the Owner, Consultant and Contractor shall review the Contractor's schedule compared to the Work completed. The Owner approves the amount of Work completed as supported by the schedule of values. If necessary, the Contractor shall then update and submit to the Owner the schedule with the pay request; all of which in accordance with the Owner's approval. All updates shall be provided in electronic and hard copy formats. At each scheduled meeting

with the Owner's Designated Representative, the Contractor shall provide a "three week look ahead" with long lead items identified.

3.7.10 SCHEDULE OF SUBMITTALS. The Contractor shall prepare and keep current, for the Consultant's and Owner's review, a schedule of submittals required under the Contract Documents which is coordinated with the Contractor's construction schedule and allows the Consultant a reasonable time to review the submittals. This submittal schedule is to be included as part of the construction schedule. Submittals requiring expedited review must be clearly identified as such in the schedule of submittals.

3.7.11 SCHEDULE RECOVERY. If the Work represented by the critical path falls behind more than 7 days, the project schedule shall be redone within 14 days showing how the Contractor shall recover the time. A narrative that addresses the changes in the schedule from the previously submitted schedule shall be submitted along with the schedule in both hard copy (appropriate report formats to be determined by the Owner's Designated Representative) and electronic copy. The Contractor shall comply with the most recent schedules.

3.7.12 SCHEDULE CHANGES AND MODIFICATIONS.

(1) CONTRACT TIME CHANGE REQUIRES MODIFICATION. The Contract Time may only be shortened or extended by a written modification fully executed by the Owner.

(2) CONTRACTOR REORDERING, RESEQUENCING AND CHANGING ACTIVITY DURATIONS. Should the Contractor, after approval of the complete detailed construction network, desire to change his plan of construction, he shall submit his requested revisions to the Owner and the Consultant along with a written statement of the revisions including a description of the sequence and duration changes for rescheduling the work, methods of maintaining adherence to intermediate milestones and the contract completion date and the reasons for the revisions. If the requested changes are acceptable to the Owner, which acceptance shall not be unreasonably withheld, they will be incorporated into the Schedule in the next reporting period.

If after submitting a request for change in the Contract Schedule, the Owner does not agree with the request, the Owner will schedule a meeting with the Contractor to discuss the differences.

(3) CHANGES IN CONTRACT TIME. The critical path schedule as the term is used in the provisions herein shall be based on the current version of the Contractor's schedule for the Project and accepted by the Owner just prior to the commencement of the modification, asserted delay, suspension or interruption. If the Contractor believes it is entitled to an extension of Contract Time under the Contract Documents, the Contractor shall submit to the Owner's Designated Representative an analysis ("Requested Time Adjustment Schedule") in accordance with the Contract Documents for time extensions. The "Requested Time Adjustment Schedule" shall include "fragnets" that represent the added or changed work to the Schedule. The impact on unchanged activities caused by the changes and/or delays being analyzed shall be included in these fragnets.

A "fragnet" as used in these General Conditions and when used in the context of project scheduling is a subset of project activities that are inter-related by predecessor and successor relationships that are tied into the main schedule with identified start and completion points. Each fragnet may or may not be on the critical path. An entire schedule consists of a series of inter-related fragnets.

3.7.13 EXCUSABLE DELAY.

(1) IN GENERAL. If the Contractor is delayed at any time in progress of the Work on the critical path schedule by an act or neglect of the Owner or other causes beyond the Contractor's control or by other causes which the Owner determines may justify delay, then the Contract Time shall be

extended by Change Order. The Contractor shall immediately take all steps reasonably possible to lessen the adverse impact of such delay. Notwithstanding the above, to the extent any of the causes for delay were caused by the Contractor, reasonably foreseeable by the Contractor or avoidable by the Contractor, then to such extent the delay shall not be cause for extension of the Contract Time.

The determination of the total number of days extension will be based upon the current construction schedule in effect at the inception of the change and/or delay and upon all data relevant to the extension as it exists in the project record. Once approved, such data shall be incorporated in the next monthly update of the schedule.

Contractor acknowledges and agrees that delays in work items which, according to the schedule analysis, do not affect any milestone dates or the Contract completion dates shown on the CPM at the time of the delay, will not be the basis for a contract extension.

(2) **WEATHER-RELATED EXCUSABLE DELAYS.** Completion time will not be extended for normal bad weather or any weather that is reasonably foreseeable at the time of entering into the contract. The time for completion as stated in the contract documents includes due allowance for calendar days on which Work cannot be performed out of doors. The Contractor acknowledges that it may lose days due to weather conditions. Contract time may be extended at no cost to the Owner if all of the following are met which must be established by the Contractor:

(a) That the weather prevented Work from occurring that is on the critical path for the project based upon a critical path schedule previously submitted to the Owner and to the extent accepted by the Owner;

(b) There are no concurrent delays attributed to the Contractor;

(c) The Contractor took all reasonable steps to alleviate the impact of the weather and took reasonable attempts to prevent the delay and despite such reasonable actions of Contractor, the weather impacted the critical path as described above; and

(d) one of the following occurred:

1. The weather was catastrophic, such as a tornado, hurricane, severe wind storm, severe hail storm; or

2. Based on the full history of information published from the closest station as indicated from the Western Regional Climate Center (Desert Research Institute 2215 Raggio Parkway Reno, Nevada 89512, and as may be described on their website at http://www.wrcc.dri.edu/summary/), one or more of the following occurred:

a. For any day between November 1 and March 31, the minimum temperature fell below the average minimum temperature plus the extreme low temperature recorded for the month divided by 2.

b. For any day between November 1 and March 31, the maximum temperature fell below the monthly average for the minimum temperature.

c. The daily precipitation exceeded 75% of the historical one day maximum for the month.

d. The snowfall for the month exceeded 175% of the historical average snow fall for the month.

3.7.14 COMPENSABLE DELAY, SUSPENSION OR INTERRUPTION.

(1) BASIC CONDITIONS. In addition to the other requirements of the Contract Documents, a compensable delay, suspension or interruption of the work occurs only when the following are met:

(a) is wholly unanticipated by the parties at the time of execution of the Contractor's Agreement or is caused by the breach of a fundamental obligation of the Contract Documents attributable to the Owner; and

(b) the Contractor files an REA or claim under Article 4 and such is received by the Owner and said continuation affects the Contract Time as indicated by the Project's critical path schedule.

(2) COMPENSABLE DELAY FORMULA. To the extent of the compensable delay, the Contractor's total entitlement for all compensable delay damages is the computed result of the following formula: Contract Sum divided by Contract Time (in calendar days); the result of which is then multiplied by 0.05; and the result of which is multiplied by the number of calendar days of compensable days allowed under these General Conditions that are beyond the Contract Time.

(3) PERIOD OF COMPENSABLE DELAY, SUSPENSION OR INTERRUPTION. The length and extent of compensable delay, shall be determined, with the use of the Project's critical path schedule, by ascertaining the number of additional days to the Contract Time that are needed in order to perform the Work in accordance with the Contract Documents as a result of the continuation of the aforesaid delay, suspension or interruption after receipt of the REA or claim by the Owner under Article 4 and following the requirements of 3.7.12.

(4) CONCURRENT DELAY. Notwithstanding any other provision of these General Conditions, to the extent a non-compensable delay occurs at the same time as a compensable delay, the Owner shall not be responsible for any compensation for the period of the non-compensable delay.

3.7.15 TIME EXTENSION REQUESTS. Any time extension shall be requested within 21 days after the Contractor knew or should have known about the delay and shall be supported by the critical path schedule analysis.

3.7.16 LIQUIDATED DAMAGES.

(1) IN GENERAL. Should the Contractor fail to complete the Work within the Contract Time, there shall be deducted from any amount due or that may become due the Contractor, the sum as stated in the Contractor's Agreement. Such sum is fixed and agreed upon by the Owner and Contractor as liquidated damages due the Owner by reason of the inconvenience and added costs of administration, engineering, supervision and other costs resulting from the Contractor's default, and not as a penalty. Actual damages related to delay can not be ascertained at the time of execution of the Contract. To the extent that the liquidated damages exceed any amounts that would otherwise be due the Contractor, the Contractor shall be liable for such excess to the Owner. Owner may seek enforcement of such obligation by legal action, and if such is necessary, shall recover the related costs and attorney fees. Notwithstanding any other provision of these General Conditions, the availability of liquidated damages to the Owner shall not limit the Owner's right to seek damages or other remedies available under law or equity to the extent such damages or remedies are not based upon delay.

(2) NO WAIVER OF OWNER'S RIGHTS. Permitting the Contractor to continue any part of the Work after the time fixed for completion or beyond any authorized extension thereof, shall in no way operate as a waiver or estoppel on the part of the Owner of any of its rights under the Contract Documents, including the right to liquidated damages or any other remedies or compensation.

3.8 DOCUMENTS AND SAMPLES AT THE SITE, CERTIFYING "AS-BUILTS". The Contractor shall maintain at the site for the Owner, one record copy of the Drawings, Specifications, Addenda, Change Orders and other Modifications, in good order and marked weekly to record changes and selections made during construction, as well as approved Shop Drawings, Product Data, Samples and similar submittals. These aforesaid items shall be available to the Consultant and shall be delivered to the Consultant for submittal to the Owner upon completion of the Work, signed by the Contractor, certifying that they show complete and exact "as-built" conditions, stating sizes, kind of materials, vital piping, conduit locations and similar matters. All notes of encountered or changed conditions shall be included.

3.9 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

3.9.1 NOT CONTRACT DOCUMENTS. Shop Drawings, Product Data, Samples and similar submittals are not Contract Documents. The submittal shall demonstrate, for those portions of the Work for which the submittal is required, the way the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents.

3.9.2 PROMPTNESS. The Contractor shall review, approve and submit to the Consultant, Shop Drawings, Product Data, Samples and similar submittals required by the Contract Documents with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the Owner or of separate contractors.

3.9.3 NOT PERFORM UNTIL CONSULTANT APPROVES. The Contractor shall perform no portion of the Work requiring submittal and review of Shop Drawings, Product Data, Samples or similar submittals until the respective submittal has been approved in writing by the Consultant. Such Work shall be in accordance with the approved submittals.

3.9.4 REPRESENTATIONS BY CONTRACTOR. By approving and submitting Shop Drawings, Product Data, Samples and similar submittals, the Contractor represents that the Contractor has determined and verified materials, field measurements and field construction criteria related thereto, and has checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

3.9.5 CONTRACTOR'S LIABILITY. The Contractor shall not be relieved of responsibility for deviations from the requirements of the Contract Documents by the Consultant's approval of Shop Drawings, Product Data, Samples or similar submittals unless the Contractor has specifically informed the Consultant in writing of such deviation at the time of the submittal and the Consultant has given written approval to the specific deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples or similar submittals by the Consultant's review and comment.

3.9.6 DIRECT SPECIFIC ATTENTION TO REVISIONS. The Contractor shall direct specific attention in writing to all revisions on resubmitted Shop Drawings, Product Data, Samples or similar submittals, except those requested by the Consultant and indicated on previous submittals.

3.9.7 INFORMATIONAL SUBMITTALS. Informational submittals upon which the Consultant is not expected to take responsive action may be so identified in the Contract Documents.

3.9.8 RELIANCE ON PROFESSIONAL CERTIFICATION. When professional certification of performance criteria of materials, systems or equipment is required by the Contract Documents, the Owner and Consultant shall be entitled to rely upon the accuracy and completeness of such calculations and certifications. If a professional stamp is required, the professional shall be licensed in the State of Utah unless otherwise approved by the Owner in writing. Likewise, the Contractor is entitled to rely upon the accuracy and completeness of the calculations made by the Consultant in developing the

Contract Documents, unless a Contractor of ordinary skill and expertise for the type of Work involved would know that such is inaccurate or incomplete and therefore must immediately notify the Owner.

3.10 USE OF SITE.

3.10.1 IN GENERAL. The Contractor shall confine operations at the site to areas permitted by the Contract Documents, law, ordinances, resolutions, rules and regulations, and permits and shall not unreasonably encumber the site with materials or equipment. Contractor shall take all reasonable means to secure the site protect the site and the Work from any damage. The site shall be left free and clear of refuse, equipment, materials, etc. and the site shall not be subject to spilled liquids and chemicals, toxic or otherwise. Should such an incident occur while the Contractor has control of the site, the Contractor shall be responsible to clean the site and pay all associated costs, fines and penalties. Notwithstanding this, Contractor is not responsible for any damage to the site or the Work to the extent caused by the Owner or the Owner's agents.

3.10.2 ACCESS TO NEIGHBORING PROPERTIES. The Contractor shall not, except as provided in the Contract Documents or with the Owner's advance written consent when necessary to perform the Work, interfere with access to properties neighboring the Project site by the owners of such properties and their respective tenants, agents, invitees and guests.

3.11 ACCESS TO WORK. The Contractor shall provide the Owner and Consultant access to the Work in preparation and progress, wherever located.

3.12 ROYALTIES AND PATENTS. The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of patent rights and shall hold the Owner and Consultant harmless from loss on account thereof, but shall not be responsible for such defense or loss when a particular design, process or product of a particular manufacturer or manufacturers is required by the Contract Documents. However, if the Contractor has reason to believe that the required design, process or product is an infringement of a patent, the Contractor shall be responsible for such loss unless such information is promptly furnished to the Owner.

3.13 INDEMNIFICATION.

3.13.1 IN GENERAL.

(1) To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the State of Utah, the State of Utah's institutions, agencies, departments, divisions, authorities, and instrumentalities, boards, commissions, elected or appointed officers, employees, agents, authorized volunteers (hereinafter the above listing of entities and persons is referred to an "indemnities") from and against every kind and character of claims, damages, losses and expenses, including but not limited to attorneys' fees, and including those events covered under the blanket Contractual Liability Coverage required under the Contract Documents, arising out of or resulting from any act or omission in the performance of the Work including the work of all the Subcontractors and their employees, provided that any such claim, damage, loss or expense is caused in whole or in part by the negligent or wrongful act or omission of the Contractor, any Subcontractor, and their employees, provided that any such claim, damage loss or expense is caused in whole or in part by the negligent or intentional act or omission of the Contractor, any Subcontractor, or anyone directly or indirectly employed or the agent of any of them or anyone for whose acts any of them may be liable, regardless of whether or not it is caused in part by a party indemnified hereunder. The Contractor shall defend all actions brought upon such matters to be indemnified hereunder and pay all costs and expenses incidental thereto, but the State of Utah shall have the right, at its option, to participate in the defense of any such action without relieving the Contractor of any obligation hereunder. Notwithstanding any of the above, to the extent the Contractor is complying with a written directive from the Owner, that is not based on the Contractor's recommendation, the

Contractor shall not be held liable under the indemnification provision of this Agreement if the Contractor has promptly disagreed with the written directive by delivering such objection to the Owner in writing.

(2) Such obligation shall not be construed to negate, abridge, or otherwise reduce any other right or obligation of indemnity which would otherwise exist as to any party or person under Contract Documents.

(3) In claims against any person or entity indemnified under this Paragraph 3.13 by an employee of the Contractor, Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, the indemnification obligation under this Paragraph 3.13 shall not be limited by a limitation on amount or type of damages, compensation or benefits payable by or for the Contractor or Subcontractor under workers' or workmen's compensation acts, disability benefits acts or other employee benefit acts.

ARTICLE 4. ADMINISTRATION OF THE CONTRACT.

4.1 CONSULTANT'S ADMINISTRATION OF THE CONTRACT.

4.1.1 IN GENERAL. The Consultant assists the Owner with the administration of the Contract as described in the Contract Documents. The Consultant shall have the authority to act on behalf of the Owner only to the extent provided in the Contract Documents or Consultant's Agreement.

4.1.2 SITE VISITS.

(1) Site visits or inspections by the Consultant, the Owner or any Owner representative shall in no way limit or affect the Contractor's responsibility to comply with all the requirements and the overall design concept of the Contract Documents as well as all applicable laws, statutes, ordinances, resolutions, codes, rules, regulations, orders and decrees.

(2) WRITTEN REPORT. The Consultant shall promptly submit to the Owner a written report subsequent to each site visit.

4.1.3 COMMUNICATIONS FACILITATING CONTRACT ADMINISTRATION. Except as authorized by the Owner's Designated Representative or as otherwise provided in the Contract Documents, including these General Conditions, the Consultant and Contractor shall communicate through the Owner's Designated Representative on issues regarding the timing of the Work, cost of the Work or scope of the Work. Contractor shall comply with communication policies agreed upon at any pre-construction meeting with the Owner. Communications by and with the Consultant's sub-consultants shall be through the Consultant. Communications by and with Subcontractors shall be through the Contractor. Communications by and with separate contractors shall be through the Owner.

4.1.4 CONSULTANT MAY REJECT WORK, ORDER INSPECTION, TESTS. The Consultant shall have the responsibility and authority to reject Work which, based upon the Consultant's knowledge or what may be reasonably inferred from the Consultant's site observations and review of data, does not conform to the Contract Documents. Whenever the Consultant considers it necessary or advisable for implementation of the intent of the Contract Documents, the Consultant shall have the responsibility and authority to require additional inspections or testing of the Work in accordance with the provisions of the Contract Documents, whether or not such Work is fabricated, installed or completed, provided, however, the Consultant must obtain the Owner's prior written approval of any such additional inspections or testing. However, neither this authority of the Consultant nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Consultant to the Contractor, Subcontractors, their agents or employees or other persons performing portions of the Work, including separate contractors. If the Contractor disputes the rejection of any Work and the correction

thereof shall involve additional cost or time, it shall be the Owner's option to accept such Work whether it be conforming or nonconforming.

4.1.5 CONSULTANT REVIEW CONTRACTOR'S SUBMITTALS.

(1) Contractor shall submit shop drawings, product data, and samples and other submittals required by the Contract Documents to the Consultant as required by the approved submittal schedule.

(2) The Consultant shall review and approve or take other appropriate action upon Contractor's submittals such as Shop Drawings, Product Data and Samples, but only for the purpose of checking for conformance with the information and design concepts expressed in the Contract Documents. Consultant action taken on a submittal shall not constitute a Modification of this Agreement.

(3) The Consultant's action shall be taken no later than 15 days following Consultant's receipt of the submittal, unless agreed to otherwise by Contractor and Owner, in order to avoid a delay in the Work of the Contractor or of separate contractors while allowing sufficient time in the Consultant's professional judgment to permit adequate review.

(4) Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents.

(5) The Consultant's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Article 3 and Paragraph 9.4 of these General Conditions.

(6) The Consultant's review shall not constitute approval of safety precautions or, unless otherwise specifically stated by the Consultant, of any construction means, methods, techniques, sequences or procedures.

(7) The Consultant's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

(8) When professional certification of performance characteristics of materials, systems or equipment is required by the Contract Documents, the Consultant shall be entitled to rely upon such certifications to establish that the materials systems or equipment will meet the performance criteria required by the Contract Documents.

4.1.6 CONSULTANT PREPARE CHANGE ORDERS, DIRECTIVES, AND FIELD ORDERS. The Consultant shall prepare Change Orders and Construction Change Directives with specific documentation and data for the Owner's approval and execution in accordance with the Contract Documents, and may issue Field Orders not involving an adjustment in the Contract Sum or an extension of the Contract Time which are not inconsistent with the intent of the Contract Documents.

4.2 REQUEST FOR EQUITABLE ADJUSTMENT.

4.2.1 FILING REA. Contractor may file a Request for Equitable Adjustment (REA) within twenty (21) days after the Contractor first recognizes or should have recognized the condition giving rise to the REA, whichever occurs first. Failure to so file an REA or a Claim as provided for below shall be considered a waiver of the right to pursue the REA or a claim at any later point. Contractor may file a written request for equitable adjustment (REA) by delivery to the Owner's Designated Representative in an effort to resolve matters that arise on the Project.

4.2.2 CONTENT. In order to facilitate the resolution of the matter, the Requests for Equitable Adjustment should state the specific grounds relied upon and the specific relief requested.

4.2.3 ONLY GENERAL CONTRACTOR MAY FILE. Only a General Contractor shall have the right to file a Request for Equitable Adjustment with the Owner. No subcontractor at any tier shall have the right to file a Request for Equitable Adjustment with the Owner or maintain any claim on its own against the Owner. Any Subcontractor right to equitable adjustment or claim, may only be with the General Contractor.

4.2.4 CONTINUING CONTRACT PERFORMANCE. Pending final resolution of a Request for Equitable Adjustment, unless otherwise agreed upon in writing, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents.

4.2.5 SPECIAL ADDITIONAL REQUIREMENTS:

(1) CONCEALED OR UNKNOWN CONDITIONS. If the REA relates to conditions encountered at the site which are (a) unknown and reasonably unforeseeable subsurface or otherwise concealed physical conditions which differ materially from those indicated in the Contract Documents or (b) unknown physical conditions of an unusual nature, which differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall give notice to the Owner and Consultant of such conditions within three working days and shall not disturb those conditions without written authorization from the Owner.

(a) HISTORICAL AND ARCHEOLOGICAL CONSIDERATIONS. In the event of discovery of any underground man-made object, object associated with humans or animals, or suspected archeological artifact; work must cease until DFCM can make an appraisal of its historical significance. A significant archeological discovery would be treated contractually as an unknown site condition. Contractor cooperation with the archeologists is a requirement of this contract.

(2) INCREASE IN CONTRACT SUM. If the REA relates to a request to increase the contract sum and the Contractor claims the work is not included within the already executed contract and modifications, then the Contractor shall process the REA and have written approval from the Owner prior to proceeding with the work sought to be an extra.

(3) INCREASE IN CONTRACT TIME. The provisions of this Section and Sections 3.7.12, 3.7.13, and 3.7.14 apply. In case of a continuing delay only one REA is necessary.

4.2.6 RESOLUTION OF REA.

(1) The Owner's Designated Representative shall attempt to resolve the issues of the Request for Equitable Adjustment with the Contractor. The Owner's Designated Representative may request a written analysis by the Consultant with a reasonable deadline. The Consultant shall comply with any such request.

(2) The Owner's Designated Representative shall provide a decision to the Contractor within 30 days unless such time period is extended by both the Contractor and Owner. Failure of the Owner's Designated Representative to provide the decision within thirty (30) days, shall be deemed a denial of the REA.

4.3 CLAIMS.

4.3.1 TIME PERIOD FOR FILING CLAIM.

(1) IF REA IS FILED AND DENIED. If an REA is denied by the Owner's Designated Representative in whole or in part, the Contractor may file a written claim with the Director of the Division of Facilities Construction Management, certified mail, return receipt requested, within twenty-one (21) days of such denial. Failure to so file a written claim within said period shall be considered a waiver of the right to pursue the claim.

(2) WHEN REA PROCEDURE IS NOT USED. If the Contractor chooses to not file an REA, and wishes to proceed to a claim directly, a claim must be filed within twenty (21) days after the Contractor first recognizes or should have recognized the condition giving rise to the claim, whichever occurs first. Failure to so file the claim within said period shall be considered a waiver of the right to pursue the claim at any later point. The claim shall be made by written notice sent certified mail, return receipt requested, to the owner's designated representative.

4.3.2 CONTENT REQUIREMENTS. All claims shall state the specific grounds relied upon and the specific relief requested. Detailed records supporting the Claim need not accompany the Claim, but must be maintained and made available, to the extent such records are customarily maintained and would be discoverable in a Utah court of law, within a reasonable time upon request.

4.3.3 ONLY GENERAL CONTRACTOR MAY FILE. Only a General Contractor shall have the right to file a Claim with the Owner. No subcontractor at any tier shall have the right to file a Claim with the Owner or maintain any claim on its own against the Owner. Any Subcontractor rights to equitable adjustment or a claim, may only be with the General Contractor.

4.3.4 CONTINUING CONTRACT PERFORMANCE. Pending final resolution of a Claim, unless otherwise agreed upon in writing, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents.

4.3.5 PAYMENTS OF UNDISPUTED AMOUNTS. Pending final resolution of a claim, the Owner shall pay the undisputed portion of the claim.

4.3.6 SCHEDULING HEARING OR PANEL. If unresolved by the Owner's Designated Representative within 21 days of filing the claim with the Director, the matter shall be scheduled for an informal hearing with the Director or the Director's designee. The Director may also elect to have a panel report to the Director on the Request for Equitable Adjustment. If such panel is used, the Claimant must cooperate with reasonable requests of the panel in providing relevant information and documents or said claim shall be considered waived.

4.3.7 DIRECTOR (OR DESIGNEE) DECISION. The Director or the Director's designee shall prepare and send to the parties, a written decision, certified mail, return receipt requested, no later than ninety (90) days from the date the Owner's Designated Representative received the claim by certified mail. This time period may be extended by a reasonable request from the Owner based upon additional time being needed to finalize expert reports and/or investigations.

4.3.8 ASSESSMENT OF COSTS. If the Claim is denied and determined to be made in bad faith or is frivolous, by the Director or the Director's designee, the Contractor may be assessed the costs, or a portion thereof, of such review including the fee of any experts, design professional, attorney and staff costs.

4.4 APPEAL OF DIRECTOR (OR DESIGNEE'S) DECISION. The claim may be further pursued with the Utah Procurement Appeals Board or the Third Judicial District Court in accordance with Utah law.

4.5 MEDIATION. Claims not resolved as hereinabove described and any and all other claims or disputes arising out of or related to this Contract, the parties' performance hereunder, or the parties' relationship as created by this Contract, shall be submitted to mediation prior to initiation of litigation. Mediation of any such other claim or dispute may be demanded by either party at any time upon written notice to the other party as herein provided. In furtherance of this Contract to mediate, the parties shall: (i) select a mutually-acceptable mediator; (ii) exchange discoverable documents which either reasonably believes to be relevant and material to the issue(s) in dispute and necessary to an effective mediation; (iii) engage and cooperate in such further discovery as they may agree or which the mediator suggests may be necessary to facilitate an effective mediation; (iv) exchange written position papers which state their position in the dispute and outline the subject matter and substance of the anticipated testimony of individuals having personal knowledge of the facts underlying the dispute, and; (v) mediate in good faith. In the event the parties are unable to agree upon a mediator, the mediator shall be appointed by a court of competent jurisdiction. Witness expenses shall be borne by the party producing the witness. Mediator fees and expenses shall be paid equally by the parties. The mediator shall have the same immunity as is available to federal district court judges.

ARTICLE 5. SUBCONTRACTORS.

5.1 AWARD OF SUBCONTRACTS AND OTHER CONTRACTS FOR PORTIONS OF THE WORK.

5.1.1 APPROVAL REQUIRED.

(1) Listing of Subcontractors shall be as required by U.C.A. 63A-5-208 as amended and/or as stated in the Contract Documents, including but not limited to the "DFCM Subcontractors List Form".

(2) The Contractor shall not contract with a proposed person or entity to whom the Owner has made a reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

5.1.2 BUSINESS AND LICENSING REQUIREMENTS. All Subcontractors used by the Contractor shall comply with all applicable business and licensing requirements.

5.1.3 SUBSEQUENT CHANGES. After the lapse of twenty-four (24) hours from the bid opening, the Contractor may change its listed Subcontractors only in accordance with Rule R 23-1 and the Contract Documents and with written approval of the Director of the Division of Facilities Construction and Management.

5.1.4 BONDING OF SUBCONTRACTORS. Subcontractors as identified by Owner in the procurement documents, may be required to submit performance and payment bonds to cover the full extent of their portion of the Work. This provision does not in any way limit the right of the Contractor to have subcontractors at any tier be required to have a performance and/or payment bond.

5.2 SUBCONTRACTUAL RELATIONS.

5.2.1 COMPLY WITH CONTRACT DOCUMENTS. By appropriate enforceable agreement, the Contractor shall require each Subcontractor to be bound to the Contractor by the terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities which the Contractor, by these Documents, assumes towards the Owner and Consultant.

5.2.2 RIGHTS. Each Subcontractor agreement shall preserve and protect the rights of the Owner and Consultant under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the Subcontractor agreement, the benefit of all rights and remedies against the Contractor that the Contractor, by the Contract Documents, has against the Owner.

5.2.3 SUB-SUBCONTRACTORS. The Contractor shall require each Subcontractor to enter into similar agreements with its Subcontractors which complies with the requirements of Subparagraphs 5.2.1 and 5.2.2 hereinabove.

5.2.4 DOCUMENT COPIES. The Contractor shall make available to each proposed Subcontractor, prior to execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound. Subcontractors shall similarly make copies of applicable portions of the Contract Documents available to their respective proposed Subcontractors.

5.3 CONTINGENT ASSIGNMENT OF SUBCONTRACTS.

5.3.1 CONDITIONS FOR ASSIGNMENT TO OWNER. Each subcontract agreement for a subcontractor at any tier for a portion of the Work is assigned by the Contractor to the Owner provided that the assignment is effective only after termination of the Contract by the Owner for cause pursuant to Paragraph 13.2 or stoppage of the Work by Owner pursuant to Paragraph 13.5, and only for those subcontract agreements which the Owner accepts by notifying the Subcontractor in writing. The subcontract shall be equitably adjusted to meet the new conditions of the work.

ARTICLE 6. CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

6.1 OWNER'S RIGHT TO PERFORM CONSTRUCTION AND TO AWARD SEPARATE CONTRACTS.

6.1.1 IN GENERAL. The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and to award separate contracts in connection with other portions of the Project or other construction or operations on the site under Conditions of the Contract identical or substantially similar to these including those portions related to insurance and waiver of subrogation. If the Contractor has a compensable Claim due to such action by Owner, Contractor shall make such Claim in accordance with Article 4.

6.1.2 COORDINATION AND REVISIONS. The Owner shall provide for coordination of the activities of the Owner's own forces and of each separate Contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with other separate contractors and the Owner in reviewing their construction schedules when directed to do so. The Contractor shall make any revisions to the construction schedule and Contract Sum deemed necessary after a joint review and agreement by the Owner. The construction schedules shall then constitute the schedules to be used by the Contractor, separate contractors and the Owner until subsequently revised.

6.2 MUTUAL RESPONSIBILITY.

6.2.1 CONTRACTOR COORDINATION. The Contractor shall afford the Owner and separate contractor(s) a reasonable opportunity for delivery and storage of their materials and equipment and performance of their activities and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.

6.2.2 REPORTING PROBLEMS TO OWNER. If part of the Contractor's Work depends on work by the Owner or a separate contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly report to the Owner apparent defects in workmanship that would render it unsuitable for proper execution. Failure of the Contractor to make said report shall constitute an acknowledgment that the Owner's or separate contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work, except as to defects in workmanship not then reasonably discoverable.

6.2.3 COSTS. Costs caused by delays or by improperly timed activities or defective construction shall be borne by the responsible party in accordance with the Contract Documents.

6.2.4 CONTRACTOR REMEDIAL WORK. The Contractor shall promptly remedy damage caused by the Contractor to completed or partially completed Work or to property of the Owner or separate contractors and subcontractors as provided in Subparagraph 10.2.6.

ARTICLE 7. MODIFICATIONS.

7.1 MODIFICATIONS.

7.1.1 IN GENERAL. Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Construction Change Directive or Field Order, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.

7.1.2 BY WHOM ISSUED. A Change Order or Construction Change Directive shall be issued by the Owner. A Field Order is issued by the Consultant or by the Owner.

7.1.3 PERFORMANCE REQUIREMENTS. Changes in the Work shall be performed under applicable provisions of the Contract Documents, and the Contractor shall proceed promptly, unless otherwise provided in the Change Order, Construction Change Directive or Field Order.

7.1.4 ADJUSTING UNIT PRICES. If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are so changed in a proposed Change Order or Construction Change Directive that application of such unit prices to quantities of Work proposed will cause a substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

7.2 CHANGE ORDERS.

7.2.1 ADJUSTING SUM. If the Change Order provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:

(1) mutual acceptance of a fixed sum properly itemized and supported by sufficient substantiating data to permit evaluation;

(2) unit prices stated in the Contract Documents or subsequently agreed upon;

(3) cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee with the Contractor providing, in such form as the Consultant may prescribe, an itemized accounting with appropriate supporting data; or

(4) as provided in Subparagraph 7.2.2 hereinbelow.

7.2.2 OWNER RESOLUTION OF SUM AND STANDARDS. If the Contractor and Owner do not agree on any of the above methods for adjustment of the Contract Sum, the adjustment shall

be determined on the basis of reasonable actual costs and savings as demonstrated by an itemized accounting with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Subparagraph shall be limited to the following:

(1) all direct and indirect costs of labor; including workers compensation insurance, social security and other federal and state payroll based taxes, and payroll based fringe benefits paid by Contractor so long as they are reasonable and no higher than that charged to other clients;

(2) costs of materials, on-site temporary facilities, supplies and equipment (except hand tools) required for or incorporated into the work;

(3) rental costs of machinery, equipment, tools (except hand tools), and on-site temporary facilities, whether rented from the Contractor or others;

(4) costs of permits and other fees, sales, use or similar taxes related to the Work;

(5) additional costs of field supervision and field office personnel directly attributable to the change; and

(6) overhead and profit by the following liquidated formula which is not a penalty but a reasonable calculation agreed upon at the time of execution of the Contractor's Agreement, and provided by formula herein due to the fact that the actual amount due for said overhead and profit cannot easily be ascertained at the time of such execution. The markups in 7.2.2(6)(a) and (b) are to cover the Contractor's additional payment and performance bond premiums, insurance premiums not specified under 7.2.2(1), home office overhead and profit. Overhead and profit includes, but is not limited to the Contractor's Project Manager and Cost Estimator. Each request for pricing shall stand on its own and not be combined with other requests for pricing in determining the allowed markup described below. A particular request for pricing shall include all items reasonably related together and determinable at the time of the request. If several unrelated requests for pricing are grouped together in a single Change Order, each request for pricing will be considered separately for purposes of calculating the markup under the following formula:

(a) A markup of 15% shall be applied to the cost of each individual change up to $20,000 in cost, but in no case shall the markup be less than $150;

(b) A markup of 10% shall be applied to the portion of the cost of each individual charge in excess of $20,000;

(c) Subcontractors at any tier shall be entitled to markup their costs related to a Change Order with the same percentages as specified in 7.2.2(6)(a) and (b) above, except that the minimum markup shall be $50 for any individual change.

7.2.3 AGREEMENT; CHANGE ORDER ISSUED. When the Owner and the Contractor agree on the adjustment in the Contract Time and/or Contract Sum, the agreed to adjustment shall be incorporated in an appropriate Change Order.

7.2.4 DISAGREEMENTS; CLAIMS PROCESS STILL APPLIES; CONSTRUCTION CHANGE DIRECTIVE MAY BE ISSUED. If there is no agreement with the adjustment in Contract Time and/or Contract Sum, then the disagreement is still subject to the Article 4 claims resolution process. A Construction Change Directive may be issued in the interim.

7.2.5 CREDITS. The amount of credit to be allowed by the Contractor to the Owner for a deletion or change which results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Consultant.

7.3 CONSTRUCTION CHANGE DIRECTIVES.

7.3.1 WHEN USED. A Construction Change Directive may be issued in the case of an immediate need for the Work to commence.

7.3.2 PROCEED WITH WORK AND NOTIFY OWNER ABOUT ADJUSTMENT METHOD. Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Owner of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contact Sum or Contract Time. Any disagreement is still subject to the requirements of the claims resolution process in Article 4 hereinabove.

7.3.3 RESOLUTION OF CONSTRUCTION CHANGE DIRECTIVES. Contractor and Owner shall use best efforts to promptly reach an agreement as to the impact of the Construction Change Directive on the Contract Sum and Contract Time and have such agreement reflected in a Change Order. If the Owner is not able to reach agreement with the Contractor, the Owner shall prepare a proposed Change Order which shall become effective as a Change Order 21 days after notification to the Contractor unless the Contractor files a claim under Article 4 before the expiration of the 21 days.

7.3.4 INTERIM PAYMENTS BY OWNER. Pending final determination of cost to the Owner, Owner shall pay any amount not disputed by the Owner of the estimated cost indicated on the Construction Change Directive as the Work under the Construction Change Directive progresses.

7.4 FIELD ORDER. The Consultant will have the authority to order minor changes in the Work not involving adjustment in the Contract Sum or extension of the Contract Time and not inconsistent with the intent of the Contract Documents. Such changes shall be effected by written order and shall be binding on the Owner and Contractor. The Contractor shall carry out such written orders promptly. If the Contractor wishes to contend that said minor change does involve an adjustment in the Contract Sum and/or Contract Time, the Contractor shall promptly notify the Owner of the Contractor's position regarding compensation and time. If such contention is not resolved with the Owner, the Contractor may file a Claim in accordance with Article 4.

ARTICLE 8. PAYMENTS AND COMPLETION.

8.1 SCHEDULE OF VALUES.

8.1.1 SCHEDULE OF VALUES. Before the first Application for Payment, the Contractor shall submit to the Consultant a schedule of values allocated to various portions of the Work, prepared in such form and supported by such data to substantiate its accuracy as the Consultant may require. This schedule, unless objected to by the Consultant, shall be used as a basis for reviewing the Contractor's Applications for Payment. The Contractor shall not be entitled to payment until receipt and acceptance of the Schedule of Values.

8.1.2 FORM. The schedule of values shall be prepared in such a manner that each major item of the Work and each subcontracted item of the Work is shown as a separate line item on AIA Document G703, Application and Certification for Payment, Continuation Sheet, or other form acceptable to the Owner.

8.2 APPLICATIONS FOR PAYMENT.

8.2.1 IN GENERAL. The Contractor shall submit to the Consultant an itemized Application for Payment for Work completed in accordance with the schedule of values and that reflects retainage as provided for in the Contractor's Agreement. Such application shall be notarized and supported by such data

substantiating the Contractor's right to payment as the Owner or Consultant may require. Said data may include, but is not limited to, copies of requisitions from Subcontractors.

(1) Such applications may include requests for payment pursuant to 7.3.4.

(2) Such applications may not include requests for payment of amounts the Contractor does not intend to pay to a Subcontractor because of a dispute or other reason.

8.2.2 PAYMENT FOR MATERIAL AND EQUIPMENT. Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner and Consultant, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, and shall include applicable insurance, storage and transportation to the site for such materials and equipment stored off the site. The Owner may require copies of invoices or other suitable documentation.

8.2.3 WARRANTY OF TITLE. The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time for payment. The Contractor further warrants that upon submittal of an Application for Payment, all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information and belief, be free and clear of liens, claims, security interests or encumbrances in favor of the Contractor, Subcontractors, or other persons or entities making a claim by reason of having provided labor, materials and/or equipment relating to the Work.

8.2.4 HOLDBACK BY OWNER. Notwithstanding anything to the contrary contained in the Contract Documents, the Owner may, as a result of the claims resolution process, withhold any payment to the Contractor hereunder if and for so long as the Contractor fails to perform any of its obligations hereunder or otherwise is in default under any of the Contract Documents.

8.3 CERTIFICATES FOR PAYMENT.

8.3.1 ISSUED BY CONSULTANT. The Consultant shall within ten (10) days after receipt of the Contractor's Application for Payment, either issue to the Owner a Certificate for Payment, with a copy to the Contractor, for such amount as the Consultant determines due, or notify the Contractor and Owner in writing of the Consultant's reasons for withholding certification in whole or in part as provided in Subparagraph 8.4.1. If the Consultant fails to act within said ten (10) day period, the Contractor may file the Application for Payment directly with the Owner's Designated Representative and the Owner will thereafter have twenty (20) days from the date of the Owner's receipt to resolve the amount to be paid and to pay the undisputed amount. The accuracy of the Contractor's Applications for Payment shall be Contractor's responsibility, not Consultant's.

8.3.2 CONSULTANT'S REPRESENTATIONS. The Consultant's issuance of a Certificate for Payment shall constitute a representation to the Owner that to the best of the Consultant's knowledge, information and belief, based upon the Consultant's observations at the site, the data comprising the Application for Payment, and what is reasonably inferable from the observations and data, that the Work has progressed to the point indicated in the Application and that the quality of the work is in accordance with the Contract Documents. The foregoing representations are subject to minor deviations from the Contract Documents correctable prior to completion and to specific qualifications expressed by the Consultant. The issuance of a Certificate for Payment will further constitute a representation that the Contractor is entitled to payment in the amount certified. However, the issuance of a Certificate for Payment shall not be a representation that the Consultant has (a) made exhaustive or continuous on-site

inspections to check the quality or quantity of the Work, (b) reviewed construction means, methods, techniques, sequences or procedures, (c) reviewed copies of requisitions received from Subcontractors and material suppliers and other data requested by the Owner to substantiate the Contractor's right to payment, (d) ascertained how or for what purpose the Contractor used money previously paid on account of Contract Sum, or (e) any duty to make such inquiries.

8.4 DECISIONS TO WITHHOLD CERTIFICATION.

8.4.1 WHEN WITHHELD. The Consultant may decide not to certify payment and may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Consultant's judgment the representations to the Owner required in Subparagraph 8.3.2 above can not be made or under Subparagraph 8.2.4 above. If the Consultant is unable to certify payment in the amount of the Application, the Consultant shall notify the Contractor and Owner as provided in Subparagraph 8.3.1 above. If the Contractor and Consultant can not agree on a revised amount, the Consultant shall promptly issue a Certificate for Payment for the amount to which the Consultant makes such representations to the Owner. The Consultant may also decide not to certify payment or, because of subsequently discovered evidence or observations, may nullify the whole or part of a Certificate for Payment previously issued, to such extent as may be necessary in the Consultant's opinion to protect the Owner from loss because of:

(1) defective Work not remedied;

(2) third party claims filed or reasonable evidence indicating probable filing of such claims;

(3) failure of the Contractor to make payments properly to Subcontractors or for labor, materials or equipment;

(4) reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;

(5) damage to the Owner or another contractor;

(6) reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or

(7) failure to carry out the Work in accordance with the Contract Documents.

8.4.2 CERTIFICATION ISSUED WHEN REASONS FOR WITHHOLDING REMOVED. When the reasons stated in Subparagraph 8.4.1 for withholding certification are removed, certification will be made for such related amounts.

8.4.3 CONTINUE WORK EVEN IF CONTRACTOR DISPUTES CONSULTANT'S DETERMINATION. If the Contractor disputes any determination by the Consultant or the result of the claims resolution process with regard to any Certification of Payment, the Contractor nevertheless shall expeditiously continue to prosecute the Work.

8.4.4 OWNER NOT IN BREACH. The Owner shall not be deemed to be in breach of this Contract by reason of the withholding of any payment pursuant to any provision of the Contract Documents provided the Owner's action or such withholding is consistent with the results of the claims resolution process.

8.5 PROGRESS PAYMENTS.

8.5.1 IN GENERAL. Except as provided in Paragraph 8.3.1, the Owner shall pay any undisputed amount within thirty (30) days of the date that the application for payment was submitted to the Consultant. In no event shall Owner be required to pay any disputed amount.

8.5.2 CONTRACTOR AND SUBCONTRACTOR RESPONSIBILITY. The Contractor shall promptly pay each Subcontractor, upon receipt of payment from the Owner, out of the amount paid to the Contractor on account of such Subcontractor's portion of the Work, the amount to which said Subcontractor is entitled. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payment to its Subcontractors in a similar manner.

8.5.3 INFORMATION FURNISHED BY CONSULTANT TO SUBCONTRACTOR. The Consultant shall, on request, furnish to the Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Consultant and Owner on account of portions of the Work done by such Subcontractor.

8.5.4 OWNER AND CONSULTANT NOT LIABLE. Neither the Owner or Consultant shall have an obligation to pay, monitor or enforce the payment of money to a Subcontractor, except to the extent as may otherwise be required by law.

8.5.5 CERTIFICATE, PAYMENT OR USE NOT ACCEPTANCE OF IMPROPER WORK. A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work that is not in accordance with the Contract Documents.

8.6 PAYMENT UPON SUBSTANTIAL COMPLETION. Upon Substantial Completion of the Work or designated portion thereof and upon application by the Contractor and certification by the Consultant, the Owner shall make payment, reflecting adjustment in retainage, if any, for such Work or portion thereof as provided in the Contract Documents. To the extent allowed by law, the Owner may retain up to 200% of the fair market value of the work that has not been completed in accordance with the Contract Documents.

8.7 PARTIAL OCCUPANCY OR USE.

8.7.1 IN GENERAL. The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, and authorized by public authorities having jurisdiction over the Work. Such partial occupancy or use may commence whether or not the portion is Substantially Complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of the warranties required by the Contract Documents. When the Contractor considers a portion to be substantially complete, the Contractor shall prepare and submit a list to the Consultant as previously provided for herein. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. Contractor shall have continuing responsibility to protect the site and the Work during such partial occupancy and shall be responsible for damage except to the extent caused solely by the Owner during such partial occupancy or use.

The stage of progress of the Work shall be determined by written agreement between the Owner and Contractor.

8.7.2 INSPECTION. Immediately prior to such partial occupancy or use, the Owner, Contractor and Consultant shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

8.7.3 NOT CONSTITUTE ACCEPTANCE. Except to the extent it is agreed upon in writing by the Owner, partial occupancy or use of a portion or portion of the Work shall not constitute acceptance of Work not complying with the requirement of the Contract Documents.

8.8 FINAL COMPLETION AND FINAL PAYMENT.

8.8.1 CERTIFICATE FOR PAYMENT. The Consultant's final Certificate for Payment shall constitute a further representation that conditions listed in Subparagraph 8.8.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

8.8.2 CONDITIONS FOR FINAL PAYMENT. Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Consultant the following to the extent required by the Owner:

(1) an affidavit that payrolls, bills for material 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;

(2) a current or additional 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, by certified mail, return receipt requested, has been given to the Owner;

(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;

(4) if requested by surety in a timely manner or by Owner, consent of surety, to final payment;

(5) Receipt of Record Drawings, Specifications, Addenda, Change Orders and other Modifications maintained at the site; the warranties, instructions, operation and maintenance manuals, and training videos required to be furnished by the Contract Documents;

(6) 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 Owner may require consent of Surety to the final payment. If such liens, claims, security interests or encumbrances remain 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 attorneys' fees; and

(7) A written statement demonstrating how the Contractor will distribute interest earned on retention to Subcontractors as required by Section 13.8.5, U.C.A.

8.8.3 WAIVER OF CLAIMS: FINAL PAYMENT. The making of final payment shall constitute a waiver of Claims by the Owner except those arising from:

(1) liens, Claims, security interests or encumbrances arising out of the Contract and unsettled;

(2) failure of the Work to comply with the requirements of the Contract Documents;

(3) terms of warranties required by the Contract Documents; or

(4) the one-year warranty period and any corrected Work.

8.8.4 DELAYS NOT CONTRACTOR'S FAULT. 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, the Owner shall, upon application by the Contractor and certification by the Consultant, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed and accepted. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of claims. Unless otherwise stated by the Owner in writing, the making of final payment shall constitute a waiver of claims by the Owner as provided in Subparagraph 8.8.3 of these General Conditions for that portion of that Work fully completed and accepted by the Owner.

8.8.5 WAIVER BY ACCEPTING FINAL PAYMENT. Acceptance of final payment by the Contractor or a Subcontractor shall constitute a waiver of Claims by that payee except those Claims previously made in writing and identified by that payee as unsettled at the time of final Application for Payment. Such waivers shall be in addition to the waiver described in Subparagraph 8.8.3 of these General Conditions.

ARTICLE 9. TESTS AND INSPECTIONS, SUBSTANTIAL AND FINAL COMPLETION, UNCOVERING, CORRECTION OF WORK AND WARRANTY PERIOD.

9.1 TESTS AND INSPECTIONS.

9.1.1 IN GENERAL. Tests, inspections and approvals of portions of the Work required by the Contract Documents or by laws, ordinances, rules, regulations, resolutions or orders of public authorities having jurisdiction shall be made at an appropriate time. Unless otherwise specifically set forth in the Contract Documents or agreed to by the Owner in writing, the Owner shall contract for such tests, inspections and approvals with an independent entity, or with the appropriate public authority, and the Owner shall bear all related costs of tests, inspections and approvals except as provided in 9.1.2 below. If any of the Work is required to be inspected or approved by the terms of the Contract Documents by any public authority, the Contractor shall, at least two working days prior to the time of the desired inspection, and following the procedures established by the Owner, request such inspection or approval to be performed. The Contractor shall give the Consultant timely notice of when and where tests and inspections are to be made so that the Consultant may observe such procedures.

9.1.2 FAILURE OF AN INSPECTOR TO APPEAR. Work shall not proceed without any required inspection and the associated authorization to proceed unless the following procedures and requirements have been met:

(1) The inspection or approval was requested in a timely manner as provided in Subparagraph 9.1.1;

(2) The Contractor received written confirmation by fax or other means that the inspection was scheduled;

(3) The Contractor has contacted or attempted to contact the inspector to confirm that the inspector is unable to perform the inspection as scheduled;

(4) If the inspector has confirmed that it is unable to perform the inspection as scheduled or if the Contractor is unable to contact the inspector, the contractor shall attempt to contact the State Building Official or other authority having jurisdiction; and

(5) The Contractor has documented the condition of the work prior to being covered through photos or other means.

9.1.3 NONCONFORMING WORK. If such procedures for testing, inspection or approval under Subparagraphs 9.1.1 reveal failure of portions of the Work to comply with the requirements established by the Contract Documents, the Contractor shall bear all costs made necessary by such failure including those of repeated procedures and compensation for the Owner's expenses, including the cost of retesting for verification of compliance if necessary, until the Owner accepts the Work in question as complying with the requirements of the Contract Documents.

9.1.4 CERTIFICATES. Required certificates of testing, inspection or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Consultant.

9.1.5 CONSULTANT OBSERVING. If the Consultant is to observe tests, inspections or approvals required by the Contract Documents, the Consultant shall do so with reasonable promptness and, where practicable, at the normal place of testing.

9.1.6 PROMPTNESS. Tests, inspections and arrangements for approvals conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

9.2 INSPECTIONS: SUBSTANTIAL AND FINAL.

9.2.1 SUBSTANTIAL COMPLETION INSPECTION. Prior to requesting a substantial completion inspection, the Contractor shall prepare a comprehensive initial punchlist, including unresolved items from prior inspections, for review by the Owner and Consultant to determine if the Project is ready for a substantial completion inspection. If the Owner determines that the initial punchlist indicates that the Project is not substantially complete, the initial punchlist will be returned to the Contractor with written comments. If the Owner determines that the initial punchlist indicates that the Project may be substantially complete, the Consultant shall promptly organize and perform a Substantial Completion inspection in the presence of the Owner and all appropriate authorities.

(1) If the Consultant reasonably determines that the initial punchlist prepared by the Contractor substantially understates the amount of the Work remaining to be completed and the Project is not substantially complete, the Consultant shall report this promptly to the Owner, and upon concurrence of the Owner, the Contractor will be assessed the costs of the inspection and punchlist preparation incurred by the Consultant and the Owner.

(2) When the Work or designated portion thereof is Substantially Complete, the Consultant shall prepare a Certificate of Substantial Completion which shall establish the date of Substantial Completion; shall establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the work and insurance; and shall fix the time within which the Contractor shall finish all items on the punchlist accompanying the Certificate. If there is a punchlist, the Contractor shall proceed promptly to complete and correct items on the list. Failure to include an item on the punchlist does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

(3) Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof except to the extent as provided otherwise in the Contract Documents or if such warranty is related to an item where the work is not

complete. Such warranty documents shall state the length of the warranty, which must comply with the Contract Documents.

(4) The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in such Certificate.

(5) Except to the extent the Owner's designated representative otherwise approves in advance and in writing, the Contractor shall submit the following documents in order to achieve Substantial Completion: written warranties, guarantees, operation and maintenance manuals, and all complete as-built drawings. The Contractor must also provide or obtain any required approvals for occupancy. The Contractor is responsible for the warranty of all Work, whether performed by it or by its Subcontractors at any tier.

9.2.2 FINAL COMPLETION INSPECTION. Prior to requesting a final inspection, the Contractor shall verify all punchlist items are corrected/completed. Once all punchlist items are corrected/completed the Contractor shall notify the Owner and request a final inspection. The Owner shall notify the Consultant and perform a final inspection. Two final inspections may be allowed due to required weather changes required to complete some items. When all punchlist items are completed a final pay request will be provided by the Contractor, authorized by the Consultant and processed by the Owner.

9.3 UNCOVERING OF WORK.

9.3.1 UNCOVER UNINSPECTED WORK. Except as provided in Subparagraph 9.3.3, if a portion of the Work is covered prior to an Inspector's approval to proceed, it must, be uncovered for the Inspector's inspection and be replaced at the Contractor's expense without change in the Contract Time.

9.3.2 OBSERVATION PRIOR TO COVERING. Except as provided in Subparagraph 9.3.3, if the Owner or the Consultant has requested in writing to observe conditions prior to any Work being covered or if such observation is specified in the Contract Documents, and the Work is covered without such observation, the Contractor shall be required to uncover and appropriately replace the Work at the Contractor's expense without change in the Contract Time. If the Contractor requests an inspection and the Owner or Consultant, including any inspector of each, does not appear, the Contractor shall immediately notify the Owner of such lack of appearance, but shall not cover the Work without such inspection.

9.3.3 WHEN AN INSPECTOR FAILS TO APPEAR OR CONSULTANT OR OWNER DID NOT MAKE PRIOR REQUEST. If work is performed by the Contractor without an inspection as provided in Subparagraph 9.1.2 or if a portion of the Work has been covered which the Consultant or Owner has not specifically requested to observe prior to its being covered or such observation is not specified by the Contract Documents, the Consultant or Owner may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, costs of uncovering and replacement, shall, by appropriate Change Order, be charged to the Owner. If such Work is not in accordance with the Contract Documents, the Contractor shall pay such costs unless the condition was caused by the Owner or a separate contractor in which event the Owner shall be responsible for payment of such costs.

9.4 CORRECTION OF WORK AND WARRANTY PERIOD.

9.4.1 CONTRACTOR CORRECT THE WORK. The Contractor shall correct Work rejected by the Consultant, Inspector or Owner, or failing to conform to the requirements of the Contract Documents, whether observed before or after Substantial Completion and whether or not fabricated, installed or completed. The Contractor shall bear the costs of correcting such rejected Work, including additional testing and inspections and compensation for the Consultant's and Inspector's services and expenses made necessary thereby.

9.4.2 WARRANTY AND CORRECTION AFTER SUBSTANTIAL COMPLETION. If within one year after the date of Substantial Completion of the Work or designated portion thereof, or after the date for commencement of warranties established under Subparagraph 9.2.1 or by terms of an applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, including failure to perform for its intended purpose, the Contractor shall correct it promptly after receipt of written notice from the Owner to do so unless the Owner has previously given the Contractor a written acceptance of such condition. The period of one year shall be extended with respect to portions of the Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual performance of the Work. This obligation of the Contractor under this Subparagraph 9.4.2 shall be operative notwithstanding the acceptance of the Work under the Contract, the final certificate of payment, partial or total occupancy and/or termination of the Contract. The Owner shall give notice of observed defects with reasonable promptness, however, failure to give such notice shall not relieve the Contractor of its obligation to correct the Work at the cost that the Contractor would have incurred if the Owner did so report with reasonable promptness. All corrected Work shall be subject to a one-year warranty period the same in all respects as the original Work, except that such warranty period shall commence from the time of Substantial Completion of the corrected Work. This warranty period does not affect the Owner's right to pursue any available remedies against Contractor.

9.4.3 REMOVAL OF WORK.

(1) The Contractor shall promptly remove from the premises all Work that the Owner and/or the Consultant determines as being in nonconformance with the Contract Documents, whether incorporated or not.

(2) The Contractor shall promptly replace and re-execute the Work in accordance with the Contract Documents and without expense to the Owner.

(3) The Contractor shall bear the expense of correcting destroyed or damaged construction, whether completed or partially completed, of the Owner or of other contractors destroyed or damaged by such removal or replacement.

(4) If the Contractor does not remove such condemned Work within a reasonable time, fixed by written notice, the Owner may have the materials removed and stored at the expense of the Contractor.

(5) If the Contractor does not correct the nonconforming Work within a reasonable time, fixed by written notice, the Owner may correct it in accordance with Paragraph 13.2.2 of these General Conditions.

9.4.4 NOT LIMIT OTHER OBLIGATIONS. Nothing contained in this Paragraph 9.4 shall be construed to establish a period of limitation with respect to other obligations which the Contractor may have under the Contract Documents. Establishment of the time period of one year as described in Paragraph 9.4.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

9.5 ADDITIONAL WARRANTIES.

9.5.1 IN GENERAL. In addition to any other provisions of this Article 9, the following warranties shall apply:

(1) The Contractor warrants to the Owner that materials and equipment furnished under the Contract will be of good quality and new, except to the extent otherwise required or expressly permitted by the Contract Documents.

(2) The Contractor also warrants to the Owner that the Work will be free from defects not inherent in the quality required or permitted and that the Work will conform with the requirements of the Contract Documents. Work not conforming to said requirements, including substitutions not properly approved and authorized, may be considered defective at the Owner's option.

9.5.2 EXCLUSION. Unless due to the negligent or intentional act or omission of the Contractor or those under the Contractor's control, or as otherwise stated in the Contract Documents, the Contractor's warranty excludes remedy for damage or defect caused by abuse, modifications not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear under normal usage.

9.5.3 FURNISH EVIDENCE ON REQUEST. If requested by the Consultant or Owner, the Contractor shall furnish satisfactory evidence as to the type and quality of materials and equipment.

9.6 ACCEPTANCE OF NONCONFORMING WORK. If the Owner prefers to accept Work which is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum shall be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

ARTICLE 10. PROTECTION OF PERSONS AND PROPERTY.

10.1 SAFETY PRECAUTIONS AND PROGRAMS.

10.1.1 CONTRACTOR RESPONSIBILITY. The Contractor shall be solely responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the performance of the Contract.

10.1.2 HAZARDOUS MATERIALS. In the event the Contractor encounters on the site material reasonably believed to be asbestos or polychlorinated biphenyl (PCB) or any other hazardous waste or substance which may endanger the health of those persons performing the Work or being on the site, which has not been rendered harmless, the Contractor shall immediately stop Work in the area affected and report the condition to the Owner and Consultant by phone with a follow-up document in writing. The Work in the affected area shall be resumed in the absence of asbestos, polychlorinated biphenyl (PCB) or said hazardous waste or substance, or when it has been rendered harmless according to the Federal and State health standards. Except to the extent provided otherwise in the Contract Documents, the Contractor shall not be required to perform without consent, any Work relating to asbestos, polychlorinated biphenyl (PCB) or any other hazardous waste or substance.

10.2 SAFETY OF PERSONS AND PROPERTY.

10.2.1 CONTRACTOR RESPONSIBILITY. The Contractor shall take reasonable precautions for the safety of, and shall provide reasonable protection to prevent damage, injury or loss to:

(1) employees on the Work and other persons who may be affected thereby;

(2) the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody or control of the Contractor or a Subcontractor; and

(3) other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.

10.2.2 SAFETY PROGRAM, PRECAUTIONS. The Contractor shall institute a safety program at the start of construction to minimize accidents. Said program shall continue to the final completion of the Project and conform to applicable laws and regulations including the Utah Occupational Safety and Health Rules and Regulations as published by the Utah Industrial Commission - UOSH Division. The Contractor shall post signs, erect barriers, and provide those items necessary to implement the safety program. As soon as the Contractor proceeds with the Work, the Contractor shall have all workers and all visitors on the site wear safety hard hats and obey all safety rules and regulations and statutes. The Contractor shall post a sign in a conspicuous location indicating the necessity of wearing hard hats and the Contractor shall loan such hats to visitors.

10.2.3 COMPLIANCE WITH LAWS. The Contractor shall give notices and comply with applicable laws, ordinances, rules, regulations and lawful orders of public authorities bearing on safety of persons or property or their protection from damage, injury or loss. In particular, the Contractor shall comply with all applicable provisions of Federal, Owner and municipal safety laws, rules and regulations as well as building codes to prevent accidents or injury to persons on, about, or adjacent to the premises where the Work is being performed.

10.2.4 ERECT AND MAINTAIN SAFEGUARDS. The Contractor shall erect and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards, promulgating safety regulations and notifying owners and users of adjacent sites and utilities.

10.2.5 UTMOST CARE. When use or storage of explosives or other hazardous materials or equipment or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel.

10.2.6 PROMPT REMEDY. The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Subparagraph 10.2.1 of these General Conditions caused in whole or in part by the Contractor, a Subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under said Subparagraph 10.2.1, except to the extent such damage or loss is directly due to errors in the Contract Documents or caused by agents or employees of the Consultant or Owner. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Paragraph 3.13 of these General Conditions.

10.2.7 SAFETY DESIGNEE. The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner and Consultant.

10.2.8 LOAD SAFETY. The Contractor shall not load or permit any part of the construction or site to be loaded so as to endanger its safety.

10.2.9 OFF-SITE RESPONSIBILITY. In addition to its other obligations under this Article 9, the Contractor shall, at its sole cost and expense, promptly repair any damage or disturbance to walls, utilities, streets, ways, sidewalks, curbs and the property of third parties (including municipalities and other governmental agencies) resulting from the performance of the Work, whether by it or by its Subcontractors at any tier. The Contractor shall not cause materials, including soil and debris, to be placed or left on streets or ways.

10.3 EMERGENCIES. In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Paragraph 4.3 and Article 7 of these General Conditions.

ARTICLE 11. INSURANCE AND BONDS.

11.1 LIABILITY INSURANCE.

11.1.1 OCIP. If required in the Supplementary General Conditions, the Contractor shall comply with the State of Utah's Owner Controlled Insurance Program (OCIP).

11.1.2 IN GENERAL. To protect against liability, loss and/or expense arising from damage to property or injury or death of any person or persons incurred in any way out of, in connection with or resulting from the Work provided hereunder, Contractor shall obtain and maintain in force during the entire period of this Contract without interruption, at its own expense, the following insurance from insurance companies authorized to do business in the State of Utah in a form and content satisfactory to the Owner and rated "A" or better with a financial size category of (a) Class X or larger where the Contract Sum is $1,000,000 or greater or (b) Class VII or larger where the Contract Sum is under $1,000,000. Said rating and financial size category shall be as published by A.M. Best Company at the time the Contract is executed.

(1) Workers' Compensation Insurance and Employers' Liability Insurance. Worker's Compensation Insurance shall cover full liability under the Worker's Compensation Laws of the jurisdiction in which the Project is located at the statutory limits required by said jurisdiction's laws. Employer's Liability Insurance shall provide the following limits of liability: $100,000 for each accident; $500,000 for Disease-Policy Limit; and $100,000 for Disease-Each Employee. The Contractor shall require all Subcontractors to take and maintain similar policies of Workers' Compensation Insurance.

(2) Commercial General Liability Insurance and/or Comprehensive General Liability Insurance, including coverage for premises/operations, explosion, collapse and underground hazards, products/completed operations, contractual (including this Contract), and personal injury, including employees, with limits of not less than $1,000,000 each occurrence, and not less than $2,000,000 general aggregate and $2,000,000 products/completed operations aggregate. Aggregate limit shall be designated as applying to this Contract. If this insurance coverage is written on a "claims-made" basis, the certificate of insurance required below shall so indicate and the policy shall contain an extended reporting period provision or similar "tail" provision such that claims reported up to three (3) years beyond the date of Substantial Completion of this Contract are covered. Such Commercial General Liability Insurance must provide coverage for explosion, collapse and underground hazards. Said certificate shall state that the policy required by this paragraph has been endorsed to name the State of Utah and DFCM as Additional Insureds.

(3) Comprehensive Automobile Liability Insurance including owned, hired and non-owned automobiles with limits not less than $1,000,000 any one accident or loss.

(4) Aircraft Use. Contractor using its own aircraft, or employing aircraft in connection with the Work performed under this Agreement shall maintain Aircraft Liability Insurance with a combined single limit of not less than $1,000,000 per occurrence. Said certificate shall state that the policy required by this paragraph has been endorsed to name the State of Utah and DFCM as Additional Insureds.

(5) Owners Protective Liability Insurance with limits of not less than $1,000,000 shall be purchased and maintained by Contractor. The State of Utah and all institutions, agencies, departments,

authorities and instrumentalities, and while acting within the scope of their duties, all of its elected or appointed officers, agents, employees and authorized volunteers as well as members of governing bodies, boards, commissions and advisory committees, shall be named as insureds, but, only in respect to the Work to be performed under this Contract.

11.1.3 CONFIGURATIONS. Any policy required by this section may be arranged under a single policy for the full limit required, or by a combination of underlying policies with the balance provided by an Excess or Umbrella Liability Policy.

11.1.4 CONTRACTOR LIABILITY. Irrespective of the requirements as to insurance to be carried by Contractor as provided herein; insolvency, bankruptcy or failure of any insurance company to pay all claims accruing, shall not be held to relieve Contractor of any obligations hereunder.

11.1.5 CERTIFICATE, NOTICE REQUIREMENTS, ADDITIONAL INSURED. Before the Contract Agreement is executed, certificates evidencing coverages as specified above are in effect, shall be furnished to the Owner. Such insurance certificates shall contain provisions that no cancellation, material change therein or non-renewal shall become effective except upon thirty (30) days prior written notice to the Owner as evidenced by return receipt, certified mail sent to Owner. The Contractor shall notify the Owner within thirty (30) days of any claims(s) against the Contractor, and if such claim(s) exceed 20% of the applicable required insured limits, the Owner may require the Contractor to re-instate the policy to provide full protection at the original limits. For any risk not covered by the Owner's protective liability insurance policy or the worker's compensation policies, the State of Utah shall be named as an additional insured party, as primary coverage and not contributing.

11.1.6 DEDUCTIBLE LIABILITY. Any and all deductibles in the above described policies shall be assumed by, for the account of, and at sole risk of Contractor.

11.1.7 ALTERNATIVE COVERAGE. The Owner's Risk Manager may approve alternative forms of insurance to those stated above based on a finding of reasonable unavailability.

Any type of insurance or any increase of limits of liability not described in this Agreement which the Contractor requires for its own protection or on account of any statute, rule or regulation, shall be its own responsibility and at its own expense.

The carrying of any insurance required by this Agreement shall in no way be interpreted as relieving the Contractor or Subcontractors of any other responsibility or liability under this Agreement or any applicable law, statute, rule, regulation or order.

Contractor shall not violate or knowingly permit to be violated any of the provisions of the policies on insurance required under these General Conditions.

11.2 "BUILDER'S RISK" PROPERTY INSURANCE.

11.2.1 IN GENERAL. Owner shall provide "Builder's Risk" property insurance to protect Owner, as well as all Contractors and Subcontractors, and include them as insureds, with respect to Work performed hereunder at Owner's own cost and expense, according to the policies and forms currently in force with insurance carriers selected by Owner's Risk Manager or issued by the Owner Risk Management Fund. Owner's Risk Manager shall furnish, upon request, all parties in interest with copies of said policies authenticated by authorized agents of the insurers or the Owner Risk Management Fund.

11.2.2 INSPECTIONS, RECOMMENDATIONS. Owner, the Division of Risk Management and the Builder's Risk insurers shall have the right to inspect the Work. The Contractor shall comply with reasonable risk control recommendations made by insurers or the Division of Risk Management. Such

inspections or recommendations do not relieve the Contractor of any of its responsibilities under the Contract Documents.

11.2.3 DEDUCTIBLE. The above described "Builders Risk" policies shall be subject to a total deductible of $5,000 per loss occurrence, which shall be assumed by all Contractors or Subcontractors, in proportion to their share of the total amount of an insured loss occurrence.

11.2.4 ADJUSTED WITH AND PAYABLE TO RISK MANAGER AS TRUSTEE. Any insured property loss is to be adjusted with the Owner's Risk Manager, and made payable to the Owner's Risk Manager as trustee for the Contractor and Subcontractors, as their interests may appear, subject to the requirements of any applicable loss payable clause.

11.2.5 WAIVER. Contractor, including all Subcontractors, and Owner hereby waive all rights against each other for damages caused by perils insured against under the "Builder's Risk" insurance provided by Owner, except such rights as Contractor may have to the proceeds of such insurance held by the Owner's Risk Manager as trustee. The Owner and the Contractor each shall require similar waivers from their contractors, subcontractors, subconsultants and agents, at any tier.

11.2.6 SPECIAL HAZARDS. Owner shall bear the risk of loss, delay and/or damage due to earthquake and/or flood and may either insure or self-insure that risk. If the Contractor requests in writing that insurance for other special hazards be included in the "Builder's Risk" policy, the Owner's Risk Manager shall, if possible, include such insurance in the policy and the cost thereof shall be charged to the Contractor by Change Order.

11.3 PERFORMANCE BOND AND PAYMENT BOND. The Contractor shall submit and maintain in full force and effect as required by law and the Contract Documents, at its own expense, on forms provided by the Division of Facilities Construction and Management, and include as part of the quoted total all costs involved in securing and furnishing, the bonds listed below, based on the completed cost of the Contract and effective upon execution of the Contract. Said bonds shall be from surety companies which are authorized to do business in the State of Utah, listed in the U. S. Department of Treasury Circular 570, Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies, and acting within the limitation listed therein.

11.3.1 A full 100 percent performance bond covering the faithful execution of the Contract in accordance with the Contract Documents; and

11.3.2 A full 100 percent payment bond covering payment of all obligations arising under the Contract Documents, for the protection of each person supplying labor, service, equipment, or material for the performance of the Work.

ARTICLE 12. MISCELLANEOUS PROVISIONS.

12.1 CONSULTANT'S RESPONSIBILITIES. These General Conditions are not intended to provide an exhaustive or complete list of the Consultant's responsibilities. A separate agreement between the Owner and Consultant incorporates these General Conditions by reference.

12.2 SUCCESSORS AND ASSIGNS. The Owner and Contractor respectively bind themselves, their partners, successors, assigns and legal representatives to the other party hereto and to partners, successors, assigns and legal representatives of such other party in respect to covenants, agreements and obligations contained in the Contract Documents. The Contractor shall not assign the Contract without the prior written consent of the Owner, nor shall the Contractor assign any amount due or to become due as well as any rights under the Contract, without prior written consent of the Owner.

12.3 WRITTEN NOTICE.

12.3.1 PERSONAL DELIVERY AND REGISTERED OR CERTIFIED MAIL. Written notice shall be deemed to have been duly served if delivered in person to the individual or a member of the firm or entity or to an officer of the corporation for which it was intended, or if delivered at or sent by registered or certified mail, return receipt requested, to the last business address known to the party giving notice.

12.3.2 FAX. Notwithstanding any other provision of these General Conditions, written notice shall also be deemed to have been duly served by verified use of a FAX system by using the known and operative calling number. Service by use of the FAX system is encouraged when timely notice will benefit the Owner, Consultant or Contractor. Notice shall be considered complete and verified upon the sending and confirmation of delivery using the FAX system, if on the same day notice is also sent by registered or certified mail, return receipt requested, to the last business address known to the party giving notice, confirming the FAX delivery.

12.4 RIGHTS AND REMEDIES.

12.4.1 NOT LIMIT. Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights and remedies otherwise imposed or available by law.

12.4.2 NOT WAIVER. Except as expressly provided elsewhere in the Contract Documents, no action or failure to act by the Owner, Consultant or Contractor shall constitute a waiver of a right or duty afforded them under the Contract Documents, nor shall such action or failure to act constitute approval or acquiescence in a breach thereunder, except as any of the above may be specifically agreed to in writing. In no case shall the Contractor or any Subcontractors be entitled to rely upon any waiver of any of these General Conditions unless agreed to in writing by the Owner.

12.5 COMMENCEMENT OF STATUTORY LIMITATION PERIOD.

12.5.1 BEFORE SUBSTANTIAL COMPLETION. Except as provided in 12.5.4 below, as to acts or failures to act occurring prior to the relevant date of Substantial Completion, any applicable statute of limitations shall commence to run and any alleged cause of action shall be deemed to have accrued in any and all events not later than such date of Substantial Completion.

12.5.2 BETWEEN SUBSTANTIAL COMPLETION AND FINAL CERTIFICATION FOR PAYMENT. Except as provided in 12.5.4 below, as to acts or failures to act occurring subsequent to the relevant date of Substantial Completion and prior to issuance of the final Certification for Payment, any applicable statute of limitations shall commence to run and any alleged cause of action shall be deemed to have accrued in any and all events not later than the date of issuance of the final Certification for Payment.

12.5.3 AFTER FINAL CERTIFICATION FOR PAYMENT. Except as provided in 12.5.4 below, as to acts or failures to act occurring after the relevant date of issuance of the final Certificate for Payment, any applicable statute of limitations shall commence to run and any alleged cause of action shall be deemed to have accrued in any and all events not later than the date of any act or failure to act by the Contractor pursuant to any warranty provided under Article 9 the date of any correction of the Work or failure to correct the Work by the Contractor under 9.4.2, or the date of actual commission of any other act or failure to perform any duty or obligation by the Contractor or Owner, whichever occurs last.

12.5.4 EXCEPTION. Notwithstanding any other provision of this Paragraph 12.5 to the contrary, no applicable statute of limitations shall be deemed to have commenced with respect to any portion of the Work which is not in accordance with the requirements of the Contract Documents, which would not be visible or apparent upon conducting a reasonable investigation, and which is not discovered

by the Owner until after the date which, but for this Subparagraph 12.5.4, would be the date of commencement of the applicable statute of limitations; the applicable statute of limitations instead shall be deemed to have commenced on the date of such discovery by the Owner.

12.6 NOT DISCRIMINATE, NO SEXUAL HARASSMENT. Pursuant to the laws of the State of Utah, the Contractor, Subcontractors, or anyone for whose act any of them may be liable, will take affirmative action to not discriminate against any employee or applicant for employment because of race, creed, color, sex, religion, ancestry or national origin. To the extent applicable, said persons will comply with all provisions of Executive Order No. 11246 dated September 24, 1965 and rules, regulations, orders, instructions, designations and other directives promulgated pursuant thereto. Contractor, Subcontractors, or anyone for whose act any of them may be liable, shall not act in any manner as would violate the laws, regulations and policies of the United States or the State of Utah prohibiting sexual harassment.

12.7 APPLICABLE LAWS. The applicable laws and regulations of the State of Utah, as well as any applicable local laws and regulations not superceded by State law, shall govern the execution of the Wok embodied in the Contract Documents as well as the interpretation of the Contract Documents.

12.8 CAPITALIZATION. Terms capitalized in these General Conditions include those which are (1) specifically defined, (2) the title of numbered articles and identified references to Paragraphs , Subparagraphs and Clauses in the document or (3) the titles of referenced documents published by the American Institute of Architects and other organizations.

12.9 INTERPRETATION. In the interest of brevity, the Contract Documents frequently omit modifying words such as "all" and "any" and articles such as "the" and "an", but the fact that a modification or an article is absent from the statement and appears in another is not intended to affect the interpretation of either statement.

12.10 VENUE. In case of any dispute, which may arise under the Contract Documents, the place of venue shall be in the County of Salt Lake, Utah, unless otherwise agreed to by all the parties in writing.

12.11 SEPARABILITY. The invalidity of any part, paragraph, subparagraph, phase, provision or aspect of the Contract documents shall not impair or affect in any manner the validity, enforceability or effect of the remainder of the Contract Documents.

12.12 CONSTRUCTION OF WORDS. Unless otherwise stated in the Contract Documents, words, which have well-known technical or construction industry meanings, shall be construed as having such recognized meanings. Unless the context requires otherwise, all other technical words shall be construed in accordance with the meaning normally established by the particular, applicable profession or industry. All other words, unless the context requires otherwise, shall be construed with an ordinary, plain meaning.

12.13 NO THIRD PARTY RIGHTS. These General Conditions create rights and duties only as between Subcontractors, Owner and Contractor, and Owner and Consultant. Nothing contained herein shall be deemed as creating third party beneficiary contract rights or other actionable rights or duties as between Contractor and Consultant, or as between Owner, Contractor, or Consultant on the one hand, and any other person or entity.

ARTICLE 13. TERMINATION OR SUSPENSION OF THE CONTRACT.

13.1 TERMINATION BY CONTRACTOR.

13.1.1 IN GENERAL. If the Work is stopped for a period of sixty (60) days through no act or fault of the Contractor or a Subcontractor, or their agents or employees or any other persons performing

portions of the Work under contract with any of the above, the Contractor, may terminate the Contract in accordance with 13.1.2 hereinbelow for any of the following reasons:

(1) because the Owner has persistently failed to fulfill fundamental Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work;

(2) issuance of an order of a court or other public authority having jurisdiction, except that where the Contractor has standing, the Contractor must cooperate in efforts to stay and/or appeal such order;

(3) an act of government, such as a declaration of national emergency, making material unavailable; or

(4) unavoidable casualties or other similar causes as listed in Subparagraph 13.2.2(2) hereinbelow.

13.1.2 NOTICE. If one of the reasons for termination in 13.1.1 hereinabove exist, the Contractor may, upon ten (10) additional days' written notice to the Owner and Consultant, and such condition giving cause for termination still not cured, terminate the Contract and recover from the Owner payment for Work executed and for proven loss with respect to materials, equipment, tools, and construction equipment and machinery, including reasonable overhead, profit and damages.

13.2 TERMINATION BY THE OWNER FOR CAUSE.

13.2.1 IN GENERAL. The Owner may terminate the Contract if the Contractor fails to cure any of the following within a period of ten (10) days (or longer if the Owner so approves in writing) after receipt of notice from the Owner specifying the cause for termination:

(1) The Contractor persistently or repeatedly refuses or fails to supply enough properly skilled workers or proper materials;

(2) The Contractor fails to make payment to Subcontractors for materials or labor in accordance with the respective agreements between the Contractor and the Subcontractors;

(3) The Contractor persistently disregards laws, ordinances, or rules, regulations, resolutions or orders of a public authority having jurisdiction; or

(4) The Contractor fails to perform the Work within the time specified in the Contract Documents or any authorized extension thereof or the Contractor fails to make progress with the Work as to endanger such compliance;

(5) The Contractor fails to perform the Work in accordance with the Contract Documents;

(6) The Contractor fails to respond promptly to the financial responsibility inquiry under the Contractor's Agreement;

(7) As permissible by law for a reason to terminate, the Contractor is adjudged bankrupt;

(8) As permissible by law for a reason to terminate, the Contractor should make a general assignment for the benefit to creditors;

(9) As permissible by law for a reason to terminate, the Contractor should have a receiver appointed on account of the Contractor's insolvency; or

(10) The Contractor is in breach of a material provision of the Contract Documents.

13.2.2 OWNER'S RIGHT TO CARRY OUT THE WORK.

(1) If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a ten (10) day period (or longer if approved by the Owner in writing) after receipt of written notice from the Owner to cure such default or neglect, the Owner may without prejudice to other remedies the Owner may have, correct such deficiencies, including taking over the Work and prosecuting the same to completion, by contract or otherwise, and may take possession of, and utilize in completing the Work, such materials, appliances and plant as may be on the site of the Work and necessary for its proper completion. In such case, the Owner shall offset from payments then or thereafter due the Contractor the cost of correcting such deficiencies, including compensation for the Consultant, Owner's staff and legal counsel's additional services and expenses made necessary by such default, neglect or failure. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner. The Contractor shall continue performance of the Contract to the extent not terminated.

(2) Except with respect to defaults of Subcontractors, the Contractor shall not be liable for any excess costs if the failure to perform the Contract arises out of causes beyond the control and without the fault or negligence of the Contractor or anyone for whom the Contractor may be liable. Such causes may include, but are not limited to, acts of God or of the public enemy, acts of the Owner or federal government in either their sovereign or contractual capacity, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes, and unusually severe weather; but in every case the failure to perform must be beyond the control and without the fault or negligence of the Contractor or anyone for whom the Contractor may be liable. If the failure to perform is caused by the default of a Subcontractor, and if such default arises out of causes beyond the control of both the Contractor and the Subcontractor, and without the fault or negligence of either of them or anyone for whom either may be liable, the Contractor shall not be liable for any excess costs for failure to perform unless the supplies or services to be furnished by the Subcontractor were obtainable from other sources in sufficient time to permit the Contractor to meet the required delivery or completion schedule.

13.2.3 ITEMS REQUIRED TO BE TRANSFERRED OR DELIVERED. The Owner may require the Contractor to transfer title and deliver to the Owner, in the manner and to the extent directed by the Owner:

(1) Any completed portion of the Work; and

(2) Any partially completed portion of the Work and any parts, tools, dies, jigs, fixtures, drawings, information, and contract rights (hereinafter called "construction materials") as the Contractor has specifically produced or specifically acquired for the performance of such part of this Contract as has been terminated; and the Contractor shall, upon direction of the Owner, protect and preserve property in the possession of the Contractor in which the Owner has an interest.

13.2.4 PAYMENT. When the Owner terminates the Contract for one or more of the reasons stated in Subparagraph 13.2.1, the Owner may withhold payment and/or pursue all available remedies.

13.2.5 OWNER PROTECTION IF LIENABLE. When the subject property is lienable, the Owner may withhold from amounts otherwise due the Contractor for such completed Work or construction materials such sum as the Owner determines to be necessary to protect the Owner against loss because of outstanding liens or claims for former lien holders.

13.2.6 CREDITS AND DEFICITS. If the unpaid balance of the Contract Sum exceeds the full cost of finishing the Work, including compensation for the Consultant's services and expenses made necessary thereby, such excess shall be paid to the Contractor. If such cost exceeds the unpaid balance, the Contractor shall pay the difference to the Owner obligation for payment shall survive the termination of the Contract.

13.2.7 IF CONTRACTOR FOUND NOT IN DEFAULT OR EXCUSABLE. If, after notice of termination of the Contract under the provisions of this clause, it is determined for any reason that the Contractor was not in default under the provisions of this clause, or that the default was excusable under the provisions of this clause, the rights and obligations of the parties shall be the same as if the notice of termination had been issued pursuant to the termination for convenience provisions.

13.2.8 RIGHTS AND REMEDIES NOT EXCLUSIVE. The rights and remedies of the Owner provided in this Paragraph 13.2 shall not be exclusive and are in addition to any other rights and remedies provided by law or under this Contract.

13.3 SUSPENSION, DELAY OR INTERRUPTION OF WORK BY THE OWNER FOR CONVENIENCE.

13.3.1 BY OWNER IN WRITING. The Owner may in writing and without cause, order the Contractor to suspend, delay or interrupt the Work in whole or in part for such period of time as the Owner may determine to be appropriate for the convenience of the Owner.

13.3.2 TIME PERIOD FOR CLAIMS. Any Claim by the Contractor for adjustment under this Paragraph 13.3 must be asserted by the Contractor, in writing, within twenty-one (21) days from the date of termination of such suspension, delay or interruption; provided that the Owner may, in its sole discretion, receive and act upon any such Claim asserted at any time prior to final payment under this Contract.

13.3.3 ADJUSTMENTS. Any adjustment in Contract Sum and Time shall be in accordance with Articles 3, 4, and 7.

13.4 TERMINATION FOR CONVENIENCE OF THE OWNER.

13.4.1 IN GENERAL. The performance of Work under this Contract may be terminated by the Owner in accordance with this Paragraph 13.4 in whole, or from time to time, in part, whenever the Owner shall determine that such termination is in the best interest of the Owner or any person for whom the Owner is acting under this Contract. Any such termination shall be effected by delivery to the Contractor of a notice of termination specifying the extent to which performance of Work under the Contract is terminated, and the date upon which such termination becomes effective.

13.4.2 CONTRACTOR OBLIGATIONS. After receipt of a notice of termination, and except as otherwise directed by the Owner in writing, the Contractor shall:

(1) Stop work under the Contract on the date and to the extent specified in the notice of termination;

(2) Place no further orders or subcontracts for materials, services or facilities, except as may be necessary for completion of such portion of the Work under the Contract as is not terminated;

(3) Terminate all orders and subcontracts to the extent that they relate to performance of Work terminated by the notice of termination;

(4) Assign to the Owner in the manner, at the times, and to the extent directed by the Owner, all of the right, title and interest of the Contractor under the orders and subcontracts so terminated, in which case the Owner shall have the right, in its discretion, to settle or pay any or all claims arising out of the termination of such orders and subcontracts;

(5) Settle all outstanding liabilities and all claims arising out of such termination of orders and subcontracts, with the approval or ratification of the Owner, which approval or ratification shall be final for all the purposes of this Paragraph 13.4;

(6) Transfer title and deliver to the Owner in the manner, at the times, and to the extent, if any, directed by the Owner:

(a) The fabricated or unfabricated parts, work in process, completed work, supplies, and other material produced as a part of, or acquired in connection with the performance of the Work terminated by the notice of termination; and

(b) The completed or partially completed drawings, information, and other property which, if the Contract had been completed, would have been required to be furnished to the Owner;

(7) Use best efforts to sell, in the manner, at the times, to the extent, and at the price or prices directed or authorized by the Owner, any property of the types referred to in Subparagraph 13.4.2(6) above; provided, however, that the Contractor:

(a) Shall not be required to extend credit to any purchaser; and

(b) May acquire any such property under the conditions prescribed by and at a price or prices approved by the Owner; and provided further that the proceeds of any such transfer of or disposition shall be applied in reduction of any payments to be made by the Owner to the Contractor under this Contract or shall otherwise be credited to the price or cost of the Work covered by this Contract or paid in such other manner as the Owner may direct;

(8) Complete performance of such part of the Work as shall not have been terminated by the notice of termination; and

(9) Take such action as may be necessary, or as the Owner may direct, for the protection and preservation of the property related to this Contract which is in the possession of the Contractor in which the Owner has or may acquire an interest.

13.4.3 TERMINATION CLAIM. After receipt of a notice of termination, the Contractor shall submit to the Owner a termination claim, in the form and with certification prescribed by the Owner. Such claim shall be submitted promptly but in no event not later than sixty (60) days from the effective date of termination.

13.4.4 AGREED UPON PAYMENT. Subject to the provisions of Paragraph 13.4.3 above, the Contractor and the Owner may agree upon the amount to be paid to the Contractor by reason of the total or partial termination of Work pursuant to this Paragraph 13.4.

13.4.5 PAYMENT NOT AGREED UPON. In the event of the failure of the Contractor and the Owner to agree, as provided in Subparagraph 13.4.4, upon the whole amount to be paid to the Contractor by reason of the termination of Work pursuant to this Paragraph 13.4, the Owner shall pay to the Contractor the amounts determined by the Owner as follows, but without duplication of any amounts agreed upon in accordance with Subparagraph 13.4.4:

(1) With respect to all Contract Work performed prior to effective date of the notice of termination, the total (without duplication of any items) of:

(a) The cost of such Work including undisputed Claim amounts;

(b) The cost of terminating, settling and paying claims arising out of the termination of Work under subcontracts or orders as provided in Subparagraph 13.4.2(5) above, exclusive of the amounts paid or payable on account of supplies or materials delivered or services furnished by Subcontractors prior to the effective date of the notice of termination under this Contract, which amounts shall be included in the cost on account of which payment is made under 13.4.5(1)(a) above;

(c) A sum, as overhead and profit on 13.4.5(1)(a) above, determined by the Owner to be fair and reasonable;

(d) The reasonable cost of the preservation and protection of property incurred pursuant to Paragraph 13.4.2(9); and any other reasonable cost incidental to termination of Work under this Contract, including expenses incidental to the determination of the amount due to the Contractor as the result of the termination of Work under this Contract.

(2) The total sum to be paid to the Contractor under 13.4.5(1) above shall not exceed the total Contract Sum as reduced by the amount of payments otherwise made and as further reduced by the Contract price of work not terminated. Except for normal spoilage, and except to the extent that the Owner shall have otherwise expressly assumed the risk of loss, there shall be excluded from the amounts payable to the Contractor under 13.4.5(1) above, the fair value of property which is destroyed, lost, stolen, or damaged so as to become undeliverable to the Owner, or to a buyer pursuant to Subparagraph 13.4.2(7).

13.4.6 DEDUCTIONS. In arriving at the amount due the Contractor under this Paragraph 13.4, there shall be deducted:

(1) All unliquidated advance or other payments on account theretofore made to the Contractor, applicable to the terminated portion of this Contract;

(2) Any Claim which the Owner may have against the Contractor in connection with this Contract; and

(3) The agreed price for, or the proceeds of sale of, any materials, supplies, or other things acquired by the Contractor or sold, pursuant to the provisions of this clause, and not otherwise recovered by or credited to the Owner.

13.4.7 PARTIAL TERMINATION. If the termination hereunder be partial, the Contractor may file with the Owner a Claim for an equitable adjustment of the amounts specified in the Contract relating to the continued portion of the Contract and such equitable adjustment as may be agreed upon shall be made in such amounts. Any Claim by the Contractor for an equitable adjustment under this Subparagraph 13.4.7 must be filed within sixty (60) days from the effective date of the notice of termination.

13.4.8 PARTIAL PAYMENTS. The Owner may, from time to time, under such terms and conditions as it may prescribe, make partial payments and payments on account against costs incurred by the Contractor in connection with the terminated portion of this Contract whenever, in the opinion of the Owner the aggregate of such payments shall be within the amount to which the Contractor will be entitled hereunder. If the total of such payments is in excess of the amount finally agreed or determined to be due under this Paragraph 14.4, such excess shall be payable by the Contractor to the Owner upon demand, together with interest at a rate equal to the average rate at the time being received from the investment of state funds, as determined by the State Treasurer, for the period until the date such excess is repaid to the Owner; provided, however, that no interest shall be charged with respect to any such excess payment

attributable to a reduction in the Contractor's claim by reason of retention or other disposition of termination inventory until ten (10) days after the date of such retention or disposition, or such later date as determined by the Owner by reason of the circumstances.

13.4.9 PRESERVE AND MAKE AVAILABLE RECORDS. Unless otherwise provided for in this Contract, or by applicable statute, the Contractor shall, from the effective date of termination until the expiration of three years after final settlement under this Contract, preserve and make available to the Owner at all reasonable times at the office of the Contractor, but without direct charge to the Owner, all books, records, documents and other evidence bearing on the costs and expenses of the Contractor under this Contract and relating to the Work terminated hereunder, or, to the extent approved by the Contracting officer, photographs, micrographs, or other authentic reproductions thereof.

13.5 OWNERS RIGHT TO STOP THE WORK. If the Contractor fails to correct Work which is not in accordance with the requirements of the Contract Documents as required by Paragraph 9.4 or fails to carry out Work in accordance with the Contract Documents, the Owner, by written order signed personally or by an agent specifically so empowered by the Owner in writing, may order the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity.

01019.1 DESCRIPTION

This Section covers measurement and payment practices utilized by Sunrise Engineering in performing its contract management services according to the requirements of these Specifications and other parts of the Contract Documents.

01019.2 MEASUREMENT

01019.2.1 METHODS

The method of measurement and computations to be used in determination of quantities of material furnished, and of work performed under the Contract, will be those methods generally recognized as conforming to good engineering practice.

When items of improvement, equipment, or service referred to herein as "work" are shown on the plans and/or called for in the specifications for the Contractor to furnish, install, or provide, the items of work shall be measured and paid for in one of two ways. First, if the item of work is considered incidental to other items in the Bid Schedule, no separate measurement and payment shall be made and no separate bid item in the bid schedule will appear. In this case measurement and payment for this work shall be included by the Contractor in other bid items on the bid schedule. Second, when shown separately on the bid schedule, the item of work shall be measured as called for in the specifications and paid for at the contract unit price for that work.

01019.2.2 ACCURATE PRICING

The Bidder shall include a price for all bid items in the Bid Schedule and the Schedule of Values if required. Failure to do so may render the Bid non-responsive and may cause its rejection. All bids will be checked for errors. In the event the total "amount" indicated on the Bid schedule for a bid item does not equal the product of the unit price times the estimated quantity, the unit price shall govern, and the amount will be corrected accordingly. In the event the Bid Total does not agree with the sum of the prices bid on the individual bid items, the individual item prices shall govern and the total for the Bid schedule will be corrected accordingly. The Contractor shall be bound by any such corrections. For "Lump Sum" bid items, where applicable, the total shown on the Schedule of Values shall equal the amount entered for the corresponding bid item on the Bid schedule.

01019.2.3 U.S. STANDARD MEASURE

All work completed under this Contract will be measured by U.S. standard measure for the units described herein. Work performed by the Contractor will be measured in those units in accordance with the procedure described herein.

01019.2.4 MEASUREMENT BY ENGINEER

Since the quantities appearing on the Bid Schedules are approximate only and are prepared for the comparison of bids, all work and materials are subject to measurement by the Engineer. Measurement of work performed by the Contractor on Bid items with unit prices other than "lump sum" will be for the actual quantities of work performed and accepted, or material furnished in accordance with the Contract. In the case of lump sum bid items, the Engineer will verify that all of the work represented by the bid item has been completed.

01019.2.5 VARIATIONS IN QUANTITIES OF WORK

The scheduled quantities of work to be done and materials to be furnished may each be increased, decreased, or omitted at the Owner's discretion.

01019.2.6 MEASUREMENT BY LUMP SUM

The term "Lump Sum" when used as a unit of measurement for a structure or separate component of a structure shall include all work necessary to complete that entire structure or component, including all necessary fittings and accessories delineated by the pay limits as shown on the Drawings. If no pay limits are shown on the Drawings, then the structure or component shall include all fittings and accessories within 5-feet of the item.

01019.2.7 MEASUREMENT BY LINEAL FOOT

All work measured by the lineal foot shall be measured parallel to the centerline. For water and gas piping, no deduction will be made for valve, fittings or carrier pipe. For sewer collection piping, measurement shall be to the inside surface of connecting manholes. Piping connected to structures, except headwalls, shall be measured to a point five (5) feet outside of that structure, unless indicated otherwise on the Drawings.

A station, when used as a unit of measurement, will be 100 lineal feet.

Items measured by the lineal foot; such as pipe culverts, guardrail, under-drains, etc., will be measured parallel to the base or foundations upon which structures are placed.

The thickness of plates and galvanized sheet used in the manufacture of corrugated metal pipe, metal plate pipe culverts and arches, and metal cribbing will be specified and measured in decimal fractions of inches.

01019.2.8 MEASUREMENT BY AREA

Area computations will be made from actual horizontal and transverse measurements made on the site of the work.

Structures will be measured to the neat lines shown on the plans or as altered to fit site conditions.

Lumber will be measured by the thousand feet board measure (M.F.B.M.) actually incorporated in the structure. Measurement will be based on nominal widths and thickness and the extreme length of each piece.

01019.2.9 MEASUREMENT BY VOLUME

In computing volumes of excavation, the average end area method will be used unless the Engineer and Contractor agree, in writing, to an alternate method.

Materials to be measured by volume or by load count shall be hauled in approved vehicles and measured at the point of delivery. Vehicles for this purpose may be of any size or type, provided the body is shaped so the actual volume may be readily and accurately determined.

When liquid bituminous materials are measured by the gallon or ton, volumes will be measured at 60° F, or will be corrected to the volume of 60 degrees F, using ASTM D 1250 for asphalt or ASTM D 633 for tars. When bituminous materials are shipped by truck or transport, net certified weights or volume subject to correction for loss or foaming, may be used for computing quantities.

01019.2.10 MEASUREMENT BY WEIGHT

The term "ton" will mean the short ton of 2,000 pounds avoirdupois.

When measurement units require weighing materials for payment, the Contractor shall be responsible for providing weight measurement from commercial certified scales or from scales provided at the job site which are certified in the state wherein the work is located.

Cement will be measured by the ton or hundredweight.

01019.2.11 CONVERSION OF WEIGHT TO VOLUME

When requested by the Contractor and approved by the Engineer in writing, materials specified to be measured by the cubic yard may first be weighed and the weight converted to cubic yards for payment purposes. Factors for conversion from weight measurement to volume measurement will be determined by the Engineer and agreed to by the Contractor before this method of measurement of quantities is used.

01019.2.12 SPECIFIC MANUFACTURED ITEMS

When standard manufactured items are specified; such as fence, wire, plates, rolled shapes, pipe conduit, etc., and these items are identified by gauge, unit, weight, section dimensions, etc., such identification will be considered to be nominal weights or dimensions. Unless more stringently controlled by tolerance in cited specifications, manufacturing tolerances established by the industries involved will be accepted.

01019.2.13 RENTAL EQUIPMENT

Rental of equipment will be measured in hours of actual working time and necessary traveling time of the equipment within the limits of the project. If equipment is ordered held on the project on a standby basis by the Engineer, the agreed rental rate, minus the labor and fuel costs, will be paid.

01019.2.14 MEASUREMENT BY EACH

All work measured by each shall be an an individual or single unit.

01019.3 PAYMENT

01019.3.1 SCOPE OF PAYMENT

The Contractor shall receive and accept compensation provided in the Contract as full payment for:

- Furnishing all materials, labor, equipment, tools, transportation and incidentals required for completion of work.
- All loss or damage due to the nature of the work, action of the elements and unforeseen difficulties until final acceptance by the Engineer, subject to the provisions of the General Conditions.
- All costs arising from any infringement of a patent, trademark or copyright.
- Bids shall include all sales tax and all other applicable fees.

01019.3.2 NON-PAYMENT

No payment will be made for:

- Work which is in excess of that described in the Contract Documents.

- Removal and replacement of defective work.
- Loss of anticipated profits.

01019.3.3 LUMP SUM

The term "lump sum", when used as a unit for payment, shall include all work required to complete the item, including all necessary fittings and accessories, as described in the Bid Schedule.

01019.3.4 FULL PAYMENT

The Contractor shall receive and accept compensation provided for in the Contract as full payment for furnishing all materials and for performing all work under the Contract in a complete and acceptable manner and for all risk, loss, damage or expense of whatever character arising out of the nature of the work or the execution thereof.

01019.3.5 VARIATION IN QUANTITY OF WORK

When the final and accepted quantity of an item of work varies from the original quantity in the Bid Schedule but is within twenty-five (25) percent of that quantity, whether more or less, the Contractor shall accept payment at the unit price shown on the Bid Schedule for the actual quantity of work performed, which shall constitute payment in full for that item. If the variation in the quantity of an item of work shown on the Bid Schedule exceeds twenty-five (25) percent of the original quantity, whether more or less, an adjustment of unit price may be negotiated. Any adjustment resulting from such negotiation shall be authorized by Change Order in accordance with the General Conditions.

The Owner reserves the right to make variations in quantities by adding to, or deleting from, quantities listed in the bid schedule in order to match the total bid with the money available in the budget.

01030.1 DESCRIPTION

This section covers project meetings including the pre-construction meeting and other progress and/or work coordination meetings conducted to provide communication and awareness to all parties associated with the Contract.

01030.2 PRE-CONSTRUCTION CONFERENCE

Prior to the commencement of work at the site, a pre-construction conference will be held at a mutually agreed time and place to be arranged by the Engineer. The Engineer shall also provide notification to all parties expected to attend the meeting. Attendees will include the following:

- Engineer
- Project Inspector
- Owner/Owner's Representative
- Contractor/Contractor's Representative/ Subcontractors as appropriate
- Governmental Representatives as appropriate (State, County, Municipal, etc.)
- Manufacturer/Supplier Representatives/Adjoining Contractors, as appropriate.
- Utility Service Representatives as appropriate.

01030.2.1 Unless previously submitted to the Engineer, the Contractor shall bring to the conference one copy each of the following:

- Contract construction schedule in accordance with the General Conditions.
- Procurement schedule of major equipment and materials and items requiring long lead-time.
- Shop Drawings, samples or substitution proposals for items proposed as substitutions or "or equal" items.
- Schedule of work that includes the anticipated monthly payment amounts during the contract.
- A Schedule of Values of work to be paid for as lump sum items where partial payment is anticipated.

01030.2.2 The purpose of the conference is to designate responsible personnel and establish a working relationship. Matters requiring coordination will be discussed and procedures for handling such matters established. The agenda may include but not be limited to the following items:

- Contractor's Work Schedule.
- Transmittal, review, distribution and approval of Contractor's submittals.
- Processing of applications for payment.
- Maintaining records and documents.
- Critical work sequencing.
- Field decisions and Change Orders.
- Use of project site, office and storage areas, security, housekeeping, and Owner's needs.
- Major equipment deliveries and priorities.
- Interpretation of Drawings and Specifications.
- Contractor's responsibilities for safety, first-aid and sanitation.

01030.2.3 The Engineer will preside at the pre-construction conference and will arrange for keeping minutes and distributing them to all attendees to the meeting.

01030.3 PROGRESS/COORDINATION MEETINGS

01030.3.1 The Contractor shall conduct regular on-site progress and coordination meetings at least weekly and at other times as requested by Engineer or as required by progress of the work. The Contractor, Engineer, and all Subcontractors active on the site shall be represented at each meeting. The Contractor may, at its discretion, request attendance by representatives of its suppliers, manufacturers, and other Subcontractors. The Contractor shall be responsible for providing written notification to those deemed necessary for attendance at least 36 hours prior to the time set for the meeting.

01030.3.2 The Contractor shall preside at the meetings and maintain a file of minutes of the proceedings. The purpose of the meetings will be to review the progress of the work, maintain coordination of effort, discuss changes in scheduling, and resolve other problems which may develop.

01090.1 DESCRIPTION

Wherever in these Specifications references are made to the standards, specifications, or other published data of the various national, regional, or local organizations, such organizations may be referred to by their acronyms or abbreviations only. As a guide to the user of these Specifications, the following acronyms or abbreviations, which may appear herein, shall have the meanings indicated below.

01090.1.1 DEFINITIONS OF ABBREVIATIONS AND ACRONYMS

AAR	Association of American Railroads
AASHTO	American Association of the State Highway and Transportation Officials
ACI	American Concrete Institute
ADC	Air Diffusion Council
AGA	American Gas Association
AGC	Associated General Contractors
AGMA	American Gear Manufacturers Association
AI	The Asphalt Institute
AIA	American Institute of Architects
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AMCA	Air Movement and Control Association
ANSI	American National Standards Institute, Inc.
APWA	American Public Works Association
ARI	Air Conditioning and Refrigeration Institute
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating, and Air-Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASPE	American Society of Plumbing Engineers
ASQC	American Society of Quality Control
ASSE	American Society of Sanitary Engineers
ASTM	American Society for Testing and Materials
AWS	American Welding Society
AWWA	American Water Works Association
BLM	Bureau of Land Management (U.S. Department of Interior)
CDA	Copper Development Association
CEMA	Conveyor Equipment Manufacturer's Association
CGA	Compressed Gas Association
CFR	Code of Federal Regulations
CISPI	Cast Iron Soil Pipe Institute
CLFMI	Chain Link Fence Manufacturer's Institute
CMA	Concrete Masonry Association
CS	Commercial Standard of NBS (U.S. Dept. of Commerce)
CTI	Cooling Tower Institute
DIP	Ductile Iron Pipe
EIA	Electronic Industries Association
EPA	U. S. Environmental Protection Agency
ETL	Electrical Test Laboratories
FEMA	Federal Emergency Management Administration
FERC	Federal Energy Regulatory Commission
FS	Forest Service (U.S. Department of Agriculture)
FWS	Fish and Wildlife Service
GI	Galvanized Iron
IAPMO	International Association of Plumbing and Mechanical Officials
ICBO	International Conference of Building Officials

ID	Inside Diameter
IEEE	Institute of Electrical and Electronics Engineers
IES	Illuminating Engineering Society
IMC	International Mechanical Code
IME	Institute of Makers of Explosives
IPC	International Plumbing Code
ISA	Instrument Society of America
ISO	International Organization for Standardization
MBMA	Metal Building Manufacturer's Association
NACE	National Association of Corrosion Engineers
NBS	National Bureau of Standards
NEBB	National Environmental Balancing Bureau
NEC	National Electrical Code
NEMA	National Electrical Manufacturer's Association
NFGC	National Fuel Gas Code
NFPA	National Fire Protection Association
NFPA	National Forest Products Association
NRCS	Natural Resources Conservation Service (U.S. Department of Agriculture) (formerly SCS)
NSF	National Sanitation Foundation
OD	Outside Diameter
OSHA	Occupational Safety and Health Administration
PCA	Portland Cement Association
PDI	Plumbing and Drainage Institute
PE	Polyethylene
PVC	Polyvinyl Chloride
RWMA	Resistance Welder Manufacturer's Association
SAE	Society of Automotive Engineers
SMACNA	Sheet Metal and Air Conditioning Contractor's National Association
SSPWC	Standard Specification for Public Works Construction
UBC	Uniform Building Code
UL	Underwriters Laboratories, Inc.
UMC	Uniform Mechanical Code
UPC	Uniform Plumbing Code
UPRR	Union Pacific Railroad
USDARD	Rural Development (U.S. Department of Agriculture) (formerly Farmers Home Administration)
WCRSI	Western Concrete Reinforcing Steel Institute
WRI	Wire Reinforcement Institute, Inc.
WWPA	Western Wood Products Association

01090.2 REFERENCED WORKS, CODES AND STANDARDS

Whenever references to specifications, codes, standards and other publications are made to these Specifications, the following rules shall apply:

01090.2.1 TITLES OF SECTIONS AND PARAGRAPHS

Titles of sections and/or paragraphs shown in these Specifications are for convenience of reference only, and do not form a part of the Specification.

01090.2.2 APPLICABLE PUBLICATIONS

Whenever references in these specifications are made to published specifications, codes, standards, or other requirements, it shall be understood that unless a date is specified, only the latest edition

of these specifications, codes, and/or standards which have been published as of the date that the work is advertised for bids, shall apply; except to the extent that said standards or requirements may be in conflict with applicable laws, ordinances, or governing codes. No requirements set forth herein or shown on the Drawings shall be waived because of any provision of, or omission from, said standards or requirements.

01090.2.3 SPECIALISTS AND SPECIAL ASSIGNMENTS

In certain instances, specification text requires (or implies) that specific work is to be assigned to specialists or expert entities, who must be engaged for the performance of that work. Such direction shall be recognized as special requirements and is not intended to interfere with local union jurisdiction settlements and similar conventions. Such assignments are intended to establish which party or entity involved in a specific unit of work is recognized as "expert" and qualified for the assignment of the work. Nevertheless, the final responsibility for fulfilling this assignment remains with the Contractor.

01090.2.4 BUILDING CODES

Reference herein to "Building Code" shall mean the Uniform Building Code issued by the International Conference of Building Officials (ICBO). The latest edition of the code as approved and used by the local agency as of the date of award, as adopted by the agency having jurisdiction, shall apply to the work herein, including all addenda, modifications, amendments, or other lawful changes thereto.

01090.2.5 OSHA

01090.2.5.1 OSHA REGULATIONS - References herein to "OSHA Regulations for Construction" shall mean Title 29, Part 1926, Construction Safety and Health Regulations, Code of Federal Regulations (OSHA), including all changes and amendments thereto.

01090.2.5.2 OSHA STANDARDS - References herein to "OSHA Standards" shall mean Title 29, Part 1910, Occupational Safety and Health Standards of the U.S. Code of Federal Regulations, including all changes and amendments thereto.

01090.2.6 DOT STANDARDS/SPECIFICATIONS

References to "State DOT Specifications" or "State DOT Requirements" shall mean the Specifications for Excavation on State Highway Right-of-Way and/or Standard Specifications for Road and Bridge Construction, including all amendments thereto, issued by the State agency responsible for highways wherein the Contract is located and any other written requirements or provisions issued by that agency which are contained in these Contract Documents.

01090.2.7 FEDERAL PIPELINE SAFETY STANDARDS

Reference to "Federal Pipeline Safety Standards" shall mean Title 29, Parts 191 and 192, Federal Pipeline Safety Minimum Standards, U.S. Code of Federal Regulations including all changes and amendments thereto.

01090.2.8 STATE GAS PIPELINE SAFETY STANDARDS

References to "State Gas Pipeline Safety Standards" shall mean the appropriate section/s of the legal code or regulations adopted in the State wherein the work is located, including all changes and amendments thereto.

01090.3 STANDARDS IMPOSED BY OTHER AGENCIES OR ORGANIZATIONS

01090.3.1 PROPERTY BELONGING TO OTHER AGENCIES OR ORGANIZATIONS

Construction may occur on property owned or administered by agencies or organizations other than the Owner, such as federal and/or state departments of transportation, the U. S. Forest Service, the U. S. Bureau of Land Management, the U.S. Fish and Wildlife, counties, canal companies, irrigation companies, utility companies, other federal and state agencies, municipal governments, etc. Work which is to take place on such property may be required to be in accordance with special construction requirements of that agency or organization as well as these specifications.

01090.3.2 ADDITIONAL INFORMATION AND SPECIFICATIONS

Information will be provided on the plans to indicate areas of the Work which fall on property owned or administered by agencies and organizations other than the Owner. Specifications from agencies which are affected by the work will be provided in the Appendix to the Contract Documents. Those specifications provided in the Appendix shall be considered part of the Contract Documents and the Contractor shall include sufficient compensation in its bid to cover the work required for compliance thereto.

01090.4 CONFLICTS

In case of conflict between codes, reference standards, Drawings and the other Contract Document, the most stringent requirements shall govern. All conflicts shall be brought to the attention of the Engineer for clarification and directions prior to ordering or providing any materials or labor required therefrom. The Contractor shall assume the most stringent requirements apply when preparing bids for this Contract.

01200.1 DESCRIPTION

The purpose of this section is to clarify certain aspects of the Project and the Contract that must be taken into consideration and completed before final acceptance of the Work can be given. These items include cleanup, demonstration of acceptable performance of equipment and facilities furnished and installed, submittals, payment for all work completed, issuance of final acceptance documentation, accepted repair and restoration of work and materials found defective during the warranty period. Specific instructions are provided herein for completion of the Work in such a manner that it will be fully acceptable and that the Contractor will be eligible for receipt of final payment.

01200.1.1 RELATED WORK AND REFERENCED SECTIONS

Not used.

01200.1.2 SUBMITTALS

Section 01300 - Submittals
See paragraph 01200.3.5 below.

01200.1.3 DEFINITIONS

Not used.

01200.2 MATERIALS

Not used.

01200.3 CONSTRUCTION REQUIREMENTS

01200.3.1 CLEANUP

The Owner will not give final acceptance of the Work until the Contractor has satisfactorily complied with the finishing and cleanup requirements contained in these Contract Documents and with any applicable local regulations. The Contractor shall accomplish the cleanup operations so as to leave the work site in an orderly, acceptable, and presentable condition.

01200.3.2 REPAIR AND RESTORATION

All major and minor damage to improvements and finished surfaces resulting from the Contractor's performance of the Work, whether to materials and equipment located on the project site or to those constructed under this Contract, shall be repaired to an original, or like-new, condition before final acceptance will be provided by the Engineer and Owner. Where damage to surfaces or materials can not be sufficiently repaired or restored, in the opinion of the Engineer, the Contractor may be required to replace the entire surface covering or structural member to achieve an original or like-new condition of the surface or material.

01200.3.3 TESTING

All performance and operational testing of facilities and equipment required by the Contract Documents, together with any required supportive documentation, shall be completed by the Contractor and approved by the Engineer prior to final acceptance of the Work.

01200.3.4 ACCEPTANCE FROM PROPERTY OWNER

The Contractor shall obtain a written release from each property owner on whose property work has been required by these Contract Documents. Such release shall indicate the property Owner's approval of the restoration and/or replacement of all disturbed improvements, surfaces and structures. Any request made to the Contractor by a private property owner, and determined to be unreasonable in the opinion of the Engineer, may be waived by the Owner.

01200.3.5 SUBMITTAL OF MANUFACTURER'S DOCUMENTATION

All guarantees and warranties, operation and maintenance manuals or brochures, or other materials furnished to the Contractor by the manufacturer for any equipment or material used for the Work shall be delivered to the Owner in protective 3-ring binders. Retainage held to the Contractor in accordance with the General Conditions of the Contract Documents will not be released until such documentation is submitted. See Section 01300 for more detail regarding O&M manuals.

01200.3.6 FINAL ACCEPTANCE

01200.3.6.1 CONTRACTOR'S STATEMENT OF COMPLETION - When the Contractor has completed the Work under this contract, including all of the Contractor's testing and clean-up, the Contractor shall inform the Engineer in writing that the Work has been completed and request a final inspection by the Engineer. The Engineer will then conduct a final inspection with the Owner and representatives of the pertinent funding and regulatory agencies. If items are found by the Engineer to be incomplete or not in compliance with the contract requirements, the Engineer will inform the Contractor of such items. After the Contractor has completed these items, the procedure shall then be the same as described above for the Contractor's statement of completion and request a final inspection.

01200.3.6.2 NOTICE OF FINAL ACCEPTANCE - After the Engineer has determined that all work required under the Contract Documents has been completed and that all of the considerations specified herein above are satisfactorily concluded, the Engineer will recommend to the Owner, in writing, that final acceptance of the entire Work under this contract be made as of the date of the Engineer's final inspection. The Owner and Engineer will then indicate formal approval and acceptance of the Work by issuing the "Notice of Final Acceptance" form.

01200.3.6.3 NO PARTIAL ACCEPTANCE - Unless otherwise required by Special Provisions, partial acceptance of any portion of the Work will not be made. While Substantial Completion notice can be issued in accordance with the General Conditions to allow use of completed work for its intended purpose, no acceptance other than the final acceptance of all completed work will be made. No inspection or approval or Notice of Substantial Completion pertaining to specific parts of the work shall be construed as final acceptance of any part until written final acceptance of all work is issued.

01200.4 METHOD OF MEASUREMENT

Not used.

01200.5 BASIS OF PAYMENT

Not used.

01300.1 DESCRIPTION

This section covers procedures to be followed by the Contractor when providing information to the Owner and/or Engineer to obtain approval of materials, equipment, procedures, etc. described in the Specifications and Drawings.

01300.2 SHOP DRAWINGS AND MATERIALS SUBMITTALS

01300.2.1 NUMBER OF COPIES OF SUBMITTALS

The Contractor shall furnish six (6) copies of each shop drawing and pertinent materials information sheet to the Engineer for review. Following review and approval, two copies shall be returned to the Contractor for his records, two shall be retained by the Engineer for inspection and verification purposes, and two shall go to the Owner as working and archival records.

01300.2.2 SHOP DRAWINGS

01300.2.2.1 CONTRACTOR REVIEW - The Contractor's shop drawing submittals shall be reviewed by a qualified representative of the Contractor, prior to submission to the Engineer. Such review shall be made to ensure the accuracy and compliance with the technical requirements and performance described and illustrated in the Drawings and Specifications.

01300.2.2.2 CONTENT - Shop drawings shall include drawings, pictures and sketches with sufficient details and explanations to reflect the Contractor's interpretations of components and required configurations not shown on the drawings, so that a documented record of such can be approved for incorporation in the Work. These drawings shall be accurate, distinct, and complete and shall contain all required information, including satisfactory identification of items and unit assemblies in relation to the Drawings and/or Specifications.

01300.2.2.3 TIMELY SUBMITTAL - Shop drawings shall be submitted sufficiently in advance to allow the Engineer not less than ten regular working days for examining the drawings.

01300.2.2.4 ENGINEER APPROVAL - When the shop drawings are approved by the Engineer, two sets of copies will be returned to the Contractor marked "Approved", "Revise as Noted", "Rejected", "Approved Except as Noted", or similar notification. If changes or corrections are necessary, one set will be returned to the Contractor with such changes or corrections indicated by a brief statement, and the Contractor shall correct and resubmit the drawings, in triplicate, to the Engineer.

Fabrication work shall not commence until the Engineer has reviewed the pertinent shop drawing/s and returned copies to the Contractor marked either "Approved" or "Approved - Except as Noted". Corrections indicated on such submittals shall be considered as changes necessary to meet the requirements of the Contract Documents and shall not be taken as the basis of claims for extra work.

Approval of shop drawings will not be required for reinforcing steel that is detailed by the Contractor in accordance with the Plans and Specifications. Any change from the Plans and Specifications made by the Contractor in any aspect of the Work shall be approved by the Engineer in a written Change Order prior to any work being altered from that already approved for construction.

001300.2.3 MATERIALS INFORMATION SUBMITTALS

In keeping with 01300.2.1 above, the Contractor shall assemble and submit six (6) original copies of each manufacturer's catalog cuts and materials information sheets pertaining to materials and equipment to be furnished and installed in the Work. Photocopies of the catalog cuts and information sheets will not be acceptable as submittals without prior authorization from Engineer.

01300.2.4 CONTRACTOR LIABILITY

The Contractor shall assume all responsibility and risk for any re-work or other costs resulting from errors in Contractor submittals. The Contractor shall be responsible for showing accurate dimensions and details of connections required to ensure the function of the equipment and/or component of the Work being illustrated.

01300.3 SAMPLES

01300.3.1 NUMBER OF SUBMITTALS

Whenever requested by the Engineer, the Contractor shall submit at least one sample of each item or material indicated in the Specifications to the Engineer for inspection and acceptance and do so at no additional cost to the owner.

01300.3.2 TIMELY AND ORDERLY SUBMITTAL

Samples shall be submitted sufficiently in advance of placement of orders that the Engineer shall have not less than ten regular working days for examining and testing the material for acceptance prior to delivery to the job site. Samples shall be submitted in an orderly sequence and appropriately identified so that dependent materials or equipment can be assembled and reviewed without causing delays in the work or mistakes in their identity.

01300.3.3 SELECTION OF COLORS AND TEXTURES

Unless otherwise specified, the Owner and the Engineer will select all colors and textures of specified items from the manufacturer's standard colors and standard materials, products, or equipment lines.

01300.4 OPERATIONS AND MAINTENANCE MANUALS

01300.4.1 STRUCTURE OF OPERATIONS AND MAINTENANCE MANUALS

The Contractor shall furnish to the owner four (4) identical sets of Operations and Maintenance manuals. Each set shall consist of one or more volumes, each of which shall be bound in a standard size, 3-ring, loose-leaf, vinyl plastic, hard cover binder suitable for bookshelf storage. Binder ring size shall not exceed 2.5 inches. A table of contents shall be provided which indicates all equipment in the Operations and Maintenance manuals.

01300.4.2 CONTENTS

The Contractor shall include in the Operations and Maintenance Manuals the following information for each item of mechanical, electrical, and instrumentation equipment:

- Care and maintenance of all finished exposed surfaces.

- Complete operating instructions, including location of controls, special tools or other equipment required, related instrumentation, and other equipment needed for operation.
- Preventive maintenance procedures and schedules.
- Complete parts lists, by generic title, identification number, and catalog number, complete, with exploded views of each assembly.
- Disassembly and reassembly instructions.
- Name and location of nearest supplier and spare parts warehouse.
- Name and location of manufacturer.
- Recommended start-up, testing and troubleshooting procedures.
- Prints of the record drawings, including diagrams and schematics, as required under the electrical and instrumentation portions of these specifications.

01300.4.3 SCHEDULE OF DELIVERY

Operations and Maintenance manuals shall be submitted in final form to the owner before seventy-five (75) percent of the Work is completed. Any discrepancies found by the owner and Engineer in the Operations and Maintenance manuals shall be corrected by the Contractor prior to final acceptance of the project.

01300.5 SCHEDULE OF VALUES

At the time of the pre-construction conference, the Contractor shall submit a Schedule of Values of the Work measured as lump sum bid items. On the Schedule, those items shall be subdivided into component parts in sufficient detail as to form a basis for determining progress payments during construction. Quantities, and/or prices, shown on the Schedule shall equal the total contract price for each lump sum item. Information provided on the Schedule will be reviewed and approved by the Engineer when found acceptable. That information will then be incorporated into the data used for preparing the Application for Payment by the Engineer.

01300.6 CONTRACT CONSTRUCTION SCHEDULE

A construction schedule, prepared in accordance with requirements of the General Conditions, shall be submitted to the Engineer at the pre-construction conference. Unless required otherwise in Special Provisions, such schedule shall show the anticipated time of completion, approximate start dates of identifiable segments of the Work, and anticipated value of the work expected to be completed in monthly time periods within the contract period.

01300.7 PROCUREMENT SCHEDULE

At the time of the pre-construction meeting (see Section 01030), the Contractor shall submit a procurement schedule to the Engineer. This plan shall include all equipment and materials required for the Work included in the Contract that are not readily available and will require off-site manufacture and lead time which can affect the progress of the Work. The plan shall show at least the following information:

- Equipment/Material Name

- Anticipated amount of time for ordering, manufacturing, and shipping to Work site.
- Anticipated dates for ordering, receiving and installing.

01300.8 CONSTRUCTION PHOTOGRAPHY RECORDS

When required in the Contract Documents and prior to commencement of any of the Work, the Contractor shall prepare colored video photography records of all areas of the Contract work site and provide copies of such records to the Engineer. Such records shall become the property of the owner and may be used for determining the condition of work site/s and degree of restoration required for completion of the Work (see also Section 2000).

01400.1 DESCRIPTION

This section covers quality control of all work and activities on the part of the Owner, the Engineer, and the Contractor, to ensure compliance with these Specifications and the requirements of the Contract.

01400.2 ASSIGNMENT OF RESPONSIBILITY

01400.2.1 THE CONTRACTOR

The Contractor has primary responsibility for ensurance of quality control of the Work provided under the Contract. Therefore, any omission or failure on the part of the Engineer to notify the Contractor of, or to condemn defective work and/or materials at the time of construction shall not be taken as acceptance of the work or materials, and the Contractor will be required to correct any defective work or materials prior to final acceptance.

01400.2.2 THE OWNER AND ENGINEER

The Engineer will endeavor to locate any errors or defective materials or workmanship, and call them to the attention of the Contractor prior to subsequent work being performed. However, the Engineer is under no obligation to do so, and neither the Owner, nor the Engineer shall be held liable for errors, or defective material, or defective workmanship performed by the Contractor and not discovered by the Engineer prior to subsequent work being performed.

01400.2.3 CORRECTIONS

Prior to execution of the Agreement, the Engineer may correct errors and omissions to these Contract Documents by issuing Addenda. After execution of the Agreement, correction of errors, omissions or other changes necessitated shall be made in accordance with the General Conditions (Section 00700).

01400.3 QUALITY OF MATERIALS

01400.3.1 COMPLIANCE WITH SPECIFICATIONS

All materials and equipment incorporated in the Work shall be of new manufacture and shall be of the grade and quality described by these Specifications and the Special Provisions.

01400.3.2 SPECIFIED MATERIALS

Where a specific brand or manufacturer's equipment, model, system, or etc. is specified in these Specifications, no intention is made to be exclusive or limit competition, but rather to set forth the minimum standards for quality and performance.

01400.3.3 SUBSTITUTION OF MATERIALS

The Engineer, in accordance with the General Conditions (Section 00700.8), may allow substitution of equipment or materials. The Owner reserves the right to reject substitutions if, in his opinion, the proposed substitutions will not achieve comparable equipment installation and performance standards.

01400.4 QUALITY OF WORK

All workmanship incorporated in the Work covered by the Contract is to be of the grade and quality described by these Specifications and the Special Provisions.

01400.5 INSPECTION

01400.5.1 AUTHORITY AND DUTIES OF INSPECTOR

01400.5.1.1 AUTHORITY - Inspectors representing the Engineer are authorized to inspect all work performed and all materials furnished and to reject defective material and any work that is improperly performed, subject to the final decision of the Engineer. This authority extends to all or any part of the Work, including the preparation, fabrication, or manufacture of any materials or equipment to be used for completion of the Work. The Inspector is not authorized to alter or waive the provisions of these Specifications or other provisions of the Contract Documents. The Engineer may delegate additional authority to the Inspector when such action is determined to be necessary.

01400.5.1.2 DUTIES - Inspectors keep the Engineer informed as to the progress of the Work and the manner in which it is performed. Inspectors are also assigned to call the Contractor's attention to any observed nonconformance with the Contract Documents. The Inspector will not act as foreman for the Contractor.

01400.5.2 INSPECTION OF MATERIALS

01400.5.2.1 TESTING - In accordance with the Contract Documents and at the option of the Engineer, materials to be supplied under this contract will be tested and/or inspected either at their place of origin or at the site of the Work. The Contractor shall give the Engineer written notification well in advance of actual readiness of materials to be tested and/or inspected at the point of origin. Satisfactory tests and inspections at the point of origin shall not be construed as a final acceptance of the material nor shall it preclude re-testing or re-inspection at the site of the Work.

01400.5.2.2 SAMPLES - The Contractor shall furnish such samples of materials as are requested by the Engineer, without charge. No material shall be incorporated into the Work until the Engineer has approved it (see Section 01300).

01400.5.3 CONTRACTOR LIABILITY

The inspection of the Work shall not relieve the Contractor of any of its obligations to fulfill its contract as herein provided, and unsuitable materials may be rejected notwithstanding that such unsatisfactory performance may have been overlooked and accepted or estimated for payment.

CHARACTER OF WORKERS, METHODS AND EQUIPMENT — SECTION 01500

01500.1 DESCRIPTION

Covers requirements for aptness, competency, quality, and quantity in the labor, equipment, tools, and materials supplied by the Contractor for execution of the Work.

01500.2 REQUIREMENTS

In order to bring the Work to completion in the manner and on the time schedule required by the Contract Documents, the Contractor shall provide sufficient labor and equipment with adequate training and capability as follows:

- The Contractor shall employ sufficient labor and equipment with adequate training and capability for executing the Work to full completion in the manner and time required by these Specifications.

- All workers shall have sufficient skill and experience to perform properly the work assigned to them. Workers engaged in special work or skilled work shall have appropriate training and sufficient experience in such work, in the opinion of the Engineer, to perform all work properly and satisfactorily.

- Any person employed by the Contractor or by any Subcontractor who, in the opinion of the Engineer, does not perform their work in a proper and skillful manner or is intemperate or disorderly shall, at the written request of the Engineer, be removed forthwith by the Contractor or Subcontractor employing such person. Such person(s) shall not be employed again in any portion of the Work without the approval of the Engineer. When such action is considered, and if requested by that employee, a hearing attended by the employee, Engineer, and Contractor shall be conducted before final dismissal action is taken.

- Should the Contractor fail to remove such person or persons as required above or fail to furnish suitable and sufficient personnel for the proper execution of the Work, the Engineer may suspend the Work by written notice until such order is complied with.

- All equipment, which is proposed to be used on the Work, shall be of sufficient size and in such mechanical condition, in the opinion of the Engineer, as to produce a satisfactory quality of Work. Equipment used on any portion of the Work shall be fitted with appropriate protective devices in accordance with OSHA and other applicable safety regulations such that no injury to employees, the Work, or to adjacent property will result from its use.

- When the specific methods and equipment to be used by the Contractor in accomplishing the Work are not described in the Contract Documents, the Contractor is free to use any methods or equipment that will accomplish the Work in conformity with the requirements of this Contract.

01510.1 DESCRIPTION

This section covers measures and instructions for prevention of damage to existing structures and utilities, whether above ground or underground, during execution of the Work of the Contract.

01510.2 PROTECTION OF EXISTING UTILITIES

01510.2.1 INTEGRITY OF UTILITIES

The Contractor shall be responsible for safeguarding and maintaining the integrity of all conflicting utilities. This responsibility includes securing the assistance of available utility location services in the area in which the Work is being performed. The Engineer has attempted to show the location of all utilities anticipated to conflict with the Work. However, when a conflicting utility line is discovered that was not shown on the plans, the Contractor shall contact the utility's owner and notify the Engineer immediately for resolution of the conflict. When realignment or relocation of the Work, or relocation of the conflicting utility is deemed necessary, the Engineer shall give direction in writing for the Contractor to proceed. Work resulting from such direction may be treated as a changed condition, and appropriate authorization and payment will be made in accordance with the General Conditions.

01510.2.2 LOCATING UTILITIES

It shall be the responsibility of the Contractor to locate and expose or identify all existing utilities, both underground and overhead, for the purpose of preventing damage to them. The Contractor shall notify all concerned utility offices at least 48 hours in advance of construction operations in which a utility agency's facilities may be involved. This shall include, but not be limited to, irrigation water, culinary water, telephone, gas, and electric.

01510.2.3 CHANGES TO UTILITIES

The Contractor shall be responsible for any and all changes to, or re-connections to, public utility facilities encountered or interrupted during execution of the Work, and all costs related thereto shall be borne by the Contractor. The Contractor shall negotiate with, and pay, the respective utility agency for work it must do in connection with moving, repairing, or restoring its utility(s). The Contractor shall further make all necessary notifications, scheduling, coordination, and management of details related to any such interference. The potential or projected cost of any public utility interference shall be included in the Contractor's price covering the major Contract Item to which the interference or changes are attributable.

01510.2.4 MAINTENANCE OF SERVICE

01510.2.4.1 CONTINUOUS SERVICE - Unless otherwise required in the Contract Documents, all utilities, both underground and overhead, shall be maintained in continuous service throughout the entire contract period. The Contractor shall be responsible and liable for any damages to or interruption of service caused by the construction.

01510.2.4.2 ACCIDENTAL INTERRUPTION OF SERVICE - In the event of interruption of other utility services as a result of accidental breakage, the Contractor shall promptly notify the appropriate responsible authority. The Contractor shall then cooperate with that authority in restoration of service as soon as possible, and shall bear all cost of repair. In no case shall interruption of any water or other utility service be allowed outside working hours unless the Engineer has issued prior authorization. When changeover of service connections to new utility lines becomes necessary, interruptions of individual services for periods of up to 8 hours will be allowed providing 24 hour advance notice has been given to affected users.

01510.2.4.3 TEMPORARY INTERRUPTION AND RELOCATION - If the Contractor desires to temporarily or permanently relocate or shut down any utility or appurtenance, the Contractor shall make the necessary arrangements and agreements with the owner or operator of the respective utility and shall be completely responsible for all costs concerned with the relocation or shutdown and reconstruction. Shutdown and relocation and/or reconstruction shall be subject to inspection and approval by the Engineer and the owner of the utility.

01510.3 PROTECTION OF PROPERTY AND EXISTING STRUCTURES

01510.3.1 REMOVAL OR RELOCATION OF PROPERTY - All property removed or relocated by the Work shall be reconstructed in its original or new location as soon as possible. Restoration of existing property or facilities shall be to a condition as good or better than its original condition.

01510.3.2 DAMAGE TO PROPERTY - All property damaged by the Contractor, whether inside or outside the limits of easements provided by the Owner, shall be the responsibility of the Contractor. All such damages shall be repaired with like material and restored to its original condition, or better. Such repair or restoration shall be accomplished at the Contractor's expense without additional compensation from the Owner.

01510.4 PROTECTION OF PAVED SURFACES

To avoid unnecessary damage to paved surfaces, tracked equipment shall use rubber cleats or paving pads when operating on or crossing all existing paved surfaces unless authorized otherwise in writing by the Engineer.

01510.5 RIGHTS-OF-WAY AND EASEMENTS

01510.5.1 MINIMAL DISTURBANCE OF RIGHTS-OF-WAY - When construction easements have been obtained by the Owner, the Contractor shall take appropriate measures to minimize disturbances to surface improvements within the easements. The Contractor shall obtain a signed release from each property owner, approving restoration work in the construction easements across its respective property/s.

01510.5.2 CONSTRUCTION AREAS - The Contractor shall confine construction operations to the area within the dedicated rights-of-way for public thoroughfares or within areas for which construction easements have been obtained, unless the Contractor has made separate special agreements with the affected property owners in advance.

01510.5.3 PROPERTY OWNER NOTIFICATION - The Contractor shall give at least 48 hours advance notification of commencement of construction to property owners having land on which construction will take place. During all construction operations, the Contractor shall construct and maintain such facilities as may be required to provide access by all property owners to their property. No one shall be cut off from access to their property for a period exceeding eight (8) hours unless the Contractor has made special arrangements with the affected persons. The Contractor shall grade all disturbed surfaces required for motor vehicle traffic at least daily unless directed otherwise in the Contract Documents or in writing by the Engineer.

01520.1 DESCRIPTION

This Section includes requirements that shall be followed by the Contractor, to protect the environment, while performing work under this contract. The Contractor shall also comply with any applicable additional requirements made by federal, state, or local government agencies.

01520.1.1 RELATED WORK AND REFERENCED SECTIONS

Section 00700 – General Conditions, paragraph 32 (for RDA funded projects)

01520.1.2 SUBMITTALS

Section 01300 – Submittals

01520.1.3 DEFINITIONS

Not used.

01520.2 MATERIALS

Not used.

01520.3 CONSTRUCTION REQUIREMENTS

01520.3.1 EXPLOSIVES AND BLASTING

The use of explosives on the work will not be permitted unless approved otherwise in the Contract Documents or in writing by the Engineer.

01520.3.2 DUST ABATEMENT

01520.3.2.1 CONTROL MEASURES - The Contractor shall furnish all labor, equipment, water and means required to provide effective dust control and abatement measures. Control measures shall be applied as often as necessary and wherever directed in writing by the Engineer, to prevent construction operations from producing dust in amounts that may be damaging to property, vegetation, or animals, or detrimental to persons within reasonable proximity of the work site.

01520.3.2.2 HAUL ROUTES AND WORK SITES - The Contractor shall identify haul routes or material handling areas, outside of the Work site, whereon dust may be generated, and shall exercise appropriate measures to abate any dust problem caused by its operation. Such dust abatement measures shall be taken immediately when observed or when required in writing by the Engineer.

01520.3.3 STORM AND GROUND WATER

01520.3.3.1 CONTROL MEASURES - The Contractor shall provide and maintain, at all times during construction, ample means and devices to promptly remove all water entering the Work, whether the water is surface or ground water. Water removed by the Contractor shall be directed into ponds or areas separated from live streams or drainage ways, to keep sediment from entering live water.

01520.3.3.2 DRAINAGE PATTERNS - In excavation, fill, and grading operations, the Contractor shall take care, to disturb the existing drainage pattern as little as possible. Particular care shall be taken not to direct drainage water onto private property or into streets or drainage ways inadequate for the increased flow.

01520.3.3.3 FORDING OF WATERWAYS - Fording of live streams or any body of live water to accomplish the Work shall not be permitted. Mechanized equipment also shall not be operated in live water to accomplish the Work unless authorized in writing by the Engineer, or in the Contract Documents.

01520.3.3.4 FILLING OF WATERWAYS - The Engineer will not approve the filling of any ditches, washes, drainage ways, streams, wetlands, or other surface waters by the Contractor to accomplish the Work unless specific instructions are included in the Contract Documents which will provide for how the affected drainages or surface waters are to be treated.

01520.3.4 NOISE ABATEMENT

In or near inhabited areas, particularly residential areas, the Contractor's operations shall be performed in a manner to prevent noise from becoming a nuisance or problem. Particular consideration shall be given to noise generated by repair and service activities during the night hours.

01520.3.5 CHEMICALS

All chemicals and/or petroleum based products used during project construction or furnished for project shall be handled, applied and disposed of in strict accordance with the printed instructions of the manufacturer and regulations enforced by Federal, State and Local health authorities.

01520.3.6 WASTE AND SURPLUS MATERIALS DISPOSAL

01520.3.6.1 CLEAN WORK SITE - The Contractor shall keep the work site, haul roads and other areas of use in a neat, clean condition, free from any accumulation of surplus materials. It shall be the responsibility of the Contractor, at its own expense, to remove and legally dispose of all surplus materials resulting from all Work activities performed in accordance with the Contract Documents.

01520.3.6.2 SURPLUS MATERIAL - Surplus material includes, but is not limited to, salvaged materials and equipment that otherwise would have been abandoned in place, rocks too large to be used as backfill, wood and other organic or unsuitable materials, trash, rubbish, and waste products of any nature, and any other debris generated by the Work.

01520.3.6.3 REGULATORY COMPLIANCE - Disposal of surplus materials shall be accomplished in accordance with all local codes, laws, ordinances, and all applicable safety laws (particularly to the requirements of Part 1926 of the OSHA Safety and Health Standards for Construction) in affect at the approved disposal site. In no case shall it be acceptable for any surplus material to be disposed of in streams, marshes or wetlands.

01520.3.6.4 APPROVAL OF DISPOSAL - The Engineer will not approve any disposal operation, which creates an unsightly and/or unsanitary nuisance. The Contractor shall maintain disposal sites in a reasonable condition of appearance during construction. When designated and/or public disposal sites are unavailable, written approval must be obtained from the Engineer to dispose of any surplus materials on any other site. All disposal sites are subject to approval by the Engineer. The Contractor shall secure permission and all permits required for use of any dumpsite not previously arranged and designated by the Owner. The Contractor shall retain copies, and provide copies upon request, of all disposal permits and/or agreements obtained for the Contract Work.

01520.3.6.5 SCHEDULED REMOVAL - The Contractor shall establish regular intervals of collection and disposal of surplus materials during construction. Stockpiling of surplus materials for later disposal will not be approved or allowed.

01520.3.7 OPEN BURNING

Open burning of materials may be allowed only in strict accordance with all regulations in effect for the area at which the burning would be performed, and the Contractor shall obtain any necessary permits from the appropriate governing entity prior to the start of burning. The Contractor shall not allow fire to spread beyond the material intended for burning. No accumulation of residue from burning shall remain on or adjacent to the construction site, without written approval of the Engineer.

01520.3.8 SANITATION

01520.3.8.1 TOILETS - The Contractor shall provide fixed or portable chemical toilets for employee use in conformance with the requirements of Part 1926 of the OSHA Standards for Construction and when public toilets are not available or within fifteen (15) minutes walking distance of the Work site.

01520.3.8.2 COLLECTION OF WASTES - The Contractor shall be responsible for daily collection of all sanitary and organic wastes. All wastes and refuse from sanitary facilities provided by the Contractor shall be disposed of away from the site in accordance with all laws and regulations pertaining thereto.

01520.3.9 HAZARDOUS MATERIAL

01520.3.9.1 REGULATORY COMPLIANCE - Disposition of any hazardous material or toxic or hazardous waste shall be made in accordance with the requirements and regulations administered by the State agency wherein the Work site is located.

01520.3.9.2 ABNORMAL CONDITONS - Abnormal conditions include, but are not limited to, the following: buried barrels with liquid or solid contents; buried or above ground tanks with liquid contents; obnoxious odors; excessively hot earth; stained and discolored soils; smoke; unidentifiable powders, sludge, pellets; or any other similar condition.

01520.3.9.3 DISCOVERY AND NOTIFICATION - If any abnormal conditions are encountered during construction, which indicate the presence of a hazardous material, toxic, or hazardous waste, the Contractor shall immediately suspend work in the area of the discovery and notify the Engineer and treat the situation with extreme caution. The Contractor's operation in the area of discovery shall not resume until so directed by the Engineer; however, the Contractor shall continue working in other areas of the project, unless otherwise directed by the Engineer.

01520.3.9.4 DISPOSAL - When it becomes necessary for the Contractor to dispose of discovered materials, the work may be considered a change and administered in accordance with the General Conditions. Should the disposition of discovered waste material require special procedures or handling by certified personnel, the Contractor will make all such arrangements. When it becomes necessary to obtain permits for transporting or handling discovered material, the Owner will obtain the permits.

01520.3.9.5 SPILLS AND NOTIFICATION - In the event of spills of petroleum-based products or hazardous wastes by the Contractor, the Contractor shall immediately notify the Engineer. The Contractor shall also notify the appropriate State environmental enforcement agency, unless the spill consists of less than one (1) gallon of petroleum based products. In no case will notification be made later

than 24 hours after the discovery of the spill. In addition, written notification shall also be made within 5 calendar days of the discovery.

01520.3.9.6 COST OF CLEANUP - All costs for cleanup and disposal of hazardous materials due to spills, inappropriate handling, or negligence of the Contractor shall be borne by the Contractor.

01520.3.10 ENVIRONMENTAL COMPLIANCE

01520.3.10.1 REGULATORY COMPLIANCE - The Contractor shall comply with the applicable requirements of the National Historic Preservation Act as it relates to the preservation of ALL environmental resources. Clearance for protection of environmental resources located within the designated Work site is the responsibility of the Owner and such clearance has been obtained for the Contract, unless provided for otherwise in the Contract Documents.

01520.3.10.2 DISCOVERY OF HISTORIC/ARCHEOLOGICAL OBJECTS – The Contractor shall observe the following:

- DISCOVERY AND NOTIFICATION - If a suspected or unsuspected historic, archeological, or paleontological item, feature, or site is encountered, construction operations shall be immediately stopped in the vicinity of the discovery and the Engineer shall be notified of the nature and exact location of the findings. The Contractor shall not damage the discovered objects and shall provide written confirmation of the discovery to the Engineer within two (2) calendar days.

- RESTRICTION OF CONSTRUCTION - Should operations in the vicinity of a discovery be restricted, the Engineer will keep the Contractor informed concerning the status of the restriction. The Contractor should be aware that the time necessary for the Owner to negotiate the handling of the discovered is variable and is dependent on the nature and condition of the circumstances. It is possible that a delay of as much as three weeks in the vicinity of the discovery can be expected. The Engineer will inform the Contractor when the restriction is terminated. Changes required to accommodate delay or Work resulting from the discovery will be authorized in accordance with the General Conditions.

01520.3.11 OPERATIONS OUTSIDE OF THE PROJECT SITE

In the event the Contractor chooses to use any site or means of obtaining resources beyond those provided as part of the Contract, the Contractor shall retain the services of a qualified, certified environmental consultant to produce a research design or plan for obtaining any and all necessary environmental clearances for such use. The Contractor shall provide the plan to the Engineer for review and approval, as required, following which the plan shall be implemented. The Contractor shall submit evidence of environmental clearances and compliance before commencing any activities within the extended use area. At a minimum, clearances will include those listed below. Additional clearances may be required as necessary.

01520.3.11.2 CULTURAL RESOURCES (Archeological and Historic) - Clearance may require consultation with the State Historic Preservation Office.

01520.3.11.3 THREATENED AND ENDANGERED SPECIES - Compliance may require written clearance from the U.S. Fish and Wildlife Service.

01529.3.11.4 FLOOD PLAINS – May require consultation with the Federal Emergency Management Agency (FEMA) or corresponding state agency.

01520.3.11.5 WETLANDS AND OTHER BODIES OF WATER – May require consultation with the Army Corps of Engineers and/or appropriate state agency.

The Contractor is cautioned that obtaining environmental clearances can be costly and time consuming.

01520.4 METHOD OF MEASUREMENT

Not used.

01520.5 BASIS OF PAYMENT

Not used.

01560.1 DESCRIPTION

Construction staking procedures and responsibilities are broadly defined in the General Conditions and specific information is provided in this Section to define those procedures and responsibilities indicated in the General Conditions.

01560.2 QUALITY CONTROL

All construction staking, whether provided by the Contractor or the Owner, will be supervised by a land surveyor registered in the state in which the Work is located. Surveys will be performed consistent with professional practices and precision generally conducted by surveyors licensed in that state. Complete, legible survey notes will be maintained by the surveyors which show the locations and measurements required to establish construction staking. Such documents shall also provide information to identify the project, location of survey, date of survey, land surveyor's name and registration number. Copies of the Contractor's survey documentation shall be made available to the Owner upon request.

01560.3 OWNER RESPONSIBILITY

01560.3.1 FIELD LOCATION POINTS

Unless otherwise indicated in the Contract Documents, the Owner shall provide information on the Drawings and sufficient surveyed points in the field to locate all features and components of the Contract. Typically, field location points will be established to consist of the following:

01560.3.1.1 PRESSURE LINES - When pressure lines are located in established streets or areas with sufficient referencing features (curb, sidewalks, fence lines, etc.), no staking will be provided and location information shall be provided on the Drawings. When pressure lines are located in areas without sufficient referencing features, stakes will be set to establish the pipe centerline at 100-foot intervals. Where sloping of lines is critical (drain lines, etc.) cut stakes will be provided to indicate flow line elevation at beginning and ends of such lines.

01560.3.1.2 SEWER AND OPEN CHANNEL FLOW LINES AND MANHOLES - Manhole centerline locations will be shown with horizontal offset stakes and cut stakes to indicate the elevation of the flow line. In addition, cut stakes will be set to provide horizontal locations and grade 100-feet upstream on lines flowing into manholes.

01560.3.1.3 TANKS - Circular tank centerline location will be staked and a benchmark (grade) stake will be provided to establish floor top elevation. Exterior corners of rectangular tanks will be staked and a benchmark will be established for establishing floor top. Stakes locating rectangular tank corners will also be provided offset reference stakes.

01560.3.1.4 BUILDINGS AND OTHER STRUCTURES - Two reference points with offset reference stakes will be provided to establish horizontal location of one wall or the centerline. A benchmark (grade) stake will also be provided to establish vertical elevations of the building/structure/s components.

01560.3.1.5 ROADWAYS - In all roadway construction, offset stakes that identify location of the centerline of road will be set at intervals not to exceed 100-feet. When roadway construction requires specific grading, stakes will be set at the beginning points of cuts and fills with offset reference stakes. Hubs will be set to actual finished grades at the top edges of the subgrade and at each consecutive course of surfacing base. Hubs with offset reference stakes will be set on the centerline at the upstream and downstream lip of the flowline of all drainage pipes and structures. Staking intervals for roads with specified grading shall not exceed 100 feet in tangent sections and 50 feet in curved sections. When curbing and/or sidewalks are constructed along roadways, offset stakes with horizontal and vertical

referencing information will be set at intervals of not more than 50 feet. Bench marks for checking and establishing vertical elevations shall be set at intervals not more than 1000 feet apart.

01560.3.1.6 PONDS AND LAGOONS - Offset stakes which identify the centerline and cut/fill stakes with offset reference stakes will be set at intervals of not more than 100 feet as well as at the beginning and end of all curved sections of banks. At least one benchmark shall be provided for each cell of the pond for establishing and verifying vertical elevations.

01560.3.2 COST OF ERRORS

The Owner shall be responsible for the accuracy of any staking, measurements, grades and alignment set by its own surveys. The Owner shall cover costs resulting from staking errors attributable to the Owner's survey.

01560.4 CONTRACTOR RESPONSIBILITY

01560.4.1 ESTABLISHMENT OF GRADES, ETC.

The Contractor shall establish any grades, elevations and distances required for its construction operation from the control staking provided by the Owner and described above. The Contractor shall advise the Owner of anticipated conditions which will affect location of offset stakes and protect the control staking from its construction operation. Where control staking has been damaged or obliterated by the Contractor's operation, replacement of the staking shall be made in accordance with the provisions of the General Conditions.

01560.4.2 ERRORS IN CONSTRUCTION STAKING

When the Contractor observes discrepancies or errors in the control staking, such problems shall immediately be brought to the attention of the Engineer, and the Engineer shall take corrective action as necessary to resolve the problem.

01560.4.3 ACCURACY IN CONTRACTOR SURVEYING

The Contractor shall be responsible for the accuracy of any staking, measurements, grades, and alignments set by its own surveys. Any costs resulting from staking errors attributable to the Contractor shall be borne by the Contractor. The Engineer reserves the discretionary right to check the Contractor's staking, grades and measurements randomly at any time. When such checking is to be exercised, the Engineer will notify the Contractor of the location and the time at which the checking will commence. The Contractor shall then stop any respective part of the Work in progress until the Engineer has notified the Contractor that the checking has been completed and the Work has been found to be in accordance with requirements of the Contract Documents.

01580.1 DESCRIPTION

In general, the Contractor is responsible for providing and maintaining access to the Work, handling and storing of materials and equipment, safety and security within the Work site, and coordination and cooperation with the Owner, its representatives, governing authorities and other contractors working for the Owner in accordance with the provisions of the General Conditions. This section contains specific requirements which apply to these responsibilities.

01580.1.1 RELATED WORK AND REFERENCED SECTIONS

Section 02005 – Traffic Control

01580.1.2 SUBMITTALS

Not used.

01580.1.3 DEFINITIONS

Not used.

01580.2 WORK SITE ACCESS

01580.2.1 INVESTIGATION OF WORK SITE AREA

The Contractor shall make its own investigation of the condition of available public and private roads and of clearances, restrictions, bridge load limits, and other limitations affecting ingress and egress to the site of the work.

01580.2.2 HAUL ROADS

It shall be the Contractor's responsibility to construct and maintain any new haul roads required for its construction operations.

01580.2.3 USE OF PUBLIC STREETS AND ALLEYWAYS

Nothing herein shall be construed to entitle the Contractor to the exclusive use of any public street, alleyway, or parking area during the performance of the Work, unless shown otherwise in the Contract Documents.

01580.2.4 CLOSURE OF PUBLIC ROADWAYS

No street, road, or highway shall be closed to the public without first obtaining permission from the proper governmental authorities and the Engineer. Where excavation is being performed in streets or highways, one lane in each direction shall be kept open to traffic at all times, unless otherwise authorized by the Contract Documents or the Engineer. Toe boards, or other measures, may be required by the Engineer to retain excavated material when deemed necessary.

01580.2.5 INTERFERENCE WITH UTILITIES

The Contractor shall so conduct operations as not to interfere unnecessarily with the infrastructure of utility companies or other agencies in such streets, alleyways, or parking areas.

01580.3 PUBLIC SAFETY AND ACCESS

Fire hydrants, approaches to fire stations, police stations and hospitals on or adjacent to the Work shall be kept accessible at all times. Appropriate measures shall be taken by the Contractor, to assure the use of sidewalks, and the proper functioning of all gutters, sewer inlets, water mains, drainage facilities and other infrastructure.

The Contractor's responsibility for Work safety or liability for Work site accidents is not lessened by the presence of the Engineer or his or another inspector performing monitoring of Work site safety conditions.

See also Section 02005 – Traffic Control.

01580.4 CONTRACTOR'S USE OF THE WORK SITE

The Contractor's use of the Work site shall be limited to its construction operations. Written approval by the Engineer will be required for any other use of the site, such as material and equipment storage, personnel vehicle parking, on-site fabrication facilities and field office.

01580.5 OFF-SITE STORAGE

The Contractor shall make arrangements for, bear any use costs associated with, and obtain written permission from the Engineer prior to using any off-site storage or shop areas or facilities determined necessary for execution of the Work. Storage facilities shall be equipped with fences and/or lockable entries that will prevent entry by unauthorized parties. Before off-site storage facilities are placed in use, the Contractor shall provided the Owner keys or combinations to locking devices used to secure the facility.

01580.6 COOPERATION WITH OTHER CONTRACTORS

Prior to authorizing other contractors to work on or adjacent to the Work site, the Owner shall notify the Contractor in writing and provide the name and address of the contractor, the name of its supervisor, a description of the work to be performed, and a schedule which shows the dates and planned segments of the work to be completed by the other contractor. In the event that conflicts or interferences occur between the Contractor and the other contractor's operation, the Engineer shall be notified immediately. The Engineer shall then take appropriate action needed to resolve the problem.

DIVISION 2

SITEWORK

02000.1 DESCRIPTION

This section describes preparatory work and materials necessary for obtaining clearances for the Work; moving personnel, equipment, supplies and incidentals to the Project Site; quality control; clean-up; temporary utilities and quarters; permits, bonds and insurance; dust abatement, storm water control, and noise abatement; waste and rubbish disposal and control; sanitation; and project close-out operations.

02000.1.1 RELATED WORK AND REFERENCED SECTIONS

Section 01200 - Contract Closeout
Section 01510 - Protection of Existing Property
Section 01520 - Environmental Controls
Section 02005 - Traffic Control

02000.1.2 SUBMITTALS

02000.1.2.1 VISUAL RECORDS - The Contractor shall furnish at least one copy of all visual records, as described below in 02000.3.2, to the Owner. If the Owner has more exacting requirements for visual records, those requirements shall be detailed in the Special Provisions to these Specifications.

02000.1.2.2 SERVICE CONNECTION LOCATION AND DOCUMENTATION - The Contractor shall deliver all signed tie-sheets (see 02000.3.3 below) to the Engineer not less than forty-eight hours prior to when the service connection is to be installed.

02000.1.3 DEFINITIONS

Sign - A complete assembly including panel and posts, with fasteners, installed at designated locations.

Video Record - Photography on videocassette tapes of areas potentially liable for disturbance as a result of the Work required by this Contract.

Service Connection Interview & Documentation - Interviews with potential system users and the documentation of location data for service connections to the respective property from utility lines being installed under this Contract.

Tie Sheets - Forms provided by the Engineer for use in documenting the location of service connection/s of system users.

Service Connection - Piping extending from the main utility line to the property line, or designated connecting point, of any user of the system.

02000.2 MATERIALS

02000.2.1 SIGN PANELS

5/8-inch thick (A or B) exterior grade plywood sheets with best quality exterior enamel paint for face painting and lettering, fastened to posts with at least four 1/2-inch galvanized bolts.

02000.2.2 POSTS

4x4 Cedar or treated Pine commercial fence posts at least eight-feet long or as shown on the Drawings.

02000.2.3 VISUAL RECORD

Records shall be made on professional quality, standard VHS format videotape. Tapes shall be provided with protective covers and shall be labeled to indicate the area covered by the photography.

02000.3 CONSTRUCTION REQUIREMENTS

02000.3.1 PROJECT SIGN

The Contractor shall provide project signs, which includes furnishing all materials and labor to fabricate, deliver, install and maintain any and all project identification signs as detailed on Drawings and at location(s) shown thereon.

02000.3.2 VISUAL RECORDS

Prior to any disturbance of the area, the Contractor shall produce a video photography of all areas, including but not limited to right-of-ways, streets and roadways, haul-roads and access routes, storage areas, construction sites, and buildings or structures, which will be, or may be, affected by the Work. Such photography will be of a quality to allow accurate determination of location, size, and condition of existing features and improvements taken prior to any occupancy or execution of Work by the Contractor.

02000.3.3 SERVICE CONNECTION LOCATION AND DOCUMENTATION

Unless called for differently, the Contractor shall contact and interview the owners of all properties indicated on the Drawings and obtain from them sufficient information for location of workable service connections for each property. The Contractor shall document those locations on the tie sheets and obtain a confirmation signature from the connection owner.

02000.4 METHOD OF MEASUREMENT

02000.4.1 MOBILIZATION

Mobilization shall be measured by the lump sum.

02000.4.2 PROJECT SIGN

Measurement for project signs shall be made by counting each sign installed and accepted.

02000.4.3 VISUAL RECORDS

Pre-Construction Photography shall be measured by the lump sum.

02000.4.4 SERVICE CONNECTION DOCUMENTATION

Service Connection Documentation shall be measured by the lump sum.

02000.5 BASIS OF PAYMENT

2000.5.1 The accepted quantity(s) shall be paid for at the contract unit price for:

PAYMENT ITEM	UNIT
Mobilization	Lump Sum
Project Sign	Each
Pre-Construction Video	Lump Sum
Service Connection Documentation	Lump Sum

02000.5.2 PAYMENT SCHEDULE

The amount bid or identified in a schedule of values for Mobilization shall not exceed 10% of the total contract bid amount. The following payment schedule percentages shall be based on amount bid or identified in a schedule of values for Mobilization up to a maximum of 10% of the total contract bid. Any portion of the mobilization bid amount which exceeds 10% of the total contract bid amount, will be paid to the Contractor after final acceptance of the Work, with the last mobilization payment. (See "overage amount" in the payment schedule table below).

Partial payments for Mobilization will be made in accordance with the payment schedule table below.

MOBILIZATION PAYMENT SCHEDULE

Payment	Amount	When Paid
1ST	25% of mobilization	With first partial payment after 3% of the original contract amount earned by the Contractor.
2ND	25% of mobilization	When amount earned by Contractor is 10% of the original contract price.
3RD	25% of mobilization	When amount earned by Contractor is 50% of the original contract price.
4TH (last)	25% of mobilization + "overage amount"	When project is complete and accepted.

02015.1 DESCRIPTION

This section covers the removal of vegetation, debris, and other obstacles from the defined rights-of-way and limits of the project area and/or construction work site.

02015.1.2 RELATED WORK

Section 01510 - Protection of Existing Properties
Section 02200 - Trench Excavation and Backfill
Section 02500 - Removal and Replacement of Surface Improvements
Section 02900 - Landscaping

02015.1.3 DEFINITIONS

Clearing - consists of removal and disposal of trees, stumps, logs, limbs, sticks, vegetation, rubbish, debris and other material on the natural ground surface.

Grubbing - consists of removing and disposing of roots (one-inch and larger diameter), tree stumps, buried logs, debris, and other underground obstructions.

02015.2 MATERIALS

Not used

02015.3 CONSTRUCTION REQUIREMENTS

Clear, grub, remove and dispose of all trees, vegetation and debris within the staked limits of the roadways, trenches, channels, easements, embankments, structures, and other designated areas. Do not injure or damage trees, shrubs, or other vegetation and objects to remain intact as designated by the Engineer or the Owner. Such items are to be fully protected from injury at the Contractor's expense.

02015.3.1 CLEARING

Areas within the limits of excavation and embankment slope stakes shall be cleared.

Tree branches extending over the area to be cleared and which hang within 12 feet of the ground surface shall be cut off in a neat and workmanlike manner. When such branch removal is necessary, the Contractor shall remove other adjacent branches on the tree under the direction of the Engineer so as to present a balanced appearance. Scars resulting from the removal of branches shall be treated with a heavy coat of approved tree sealant.

02015.3.2 GRUBBING

Grub all areas within the limits described as follows:

02015.3.2.1 FOR CONSTRUCTION OF ROADWAYS - Grub the area between the limits of the excavation and embankment slope stakes to a depth of two (2) feet below natural ground level to remove all stumps, roots, buried logs and other underground debris. However, when the roadway embankment already is two feet or more above the natural ground level, stumps cut less than 6 inches above natural ground, together with roots and other non-perishable obstructions, may remain in place.

02015.3.2.2 FOR CONSTRUCTION OF PONDS OR LAGOONS AND STRUCTURES - completely grub the pond area within the boundaries of the dikes or structures to a depth of two (2) feet and remove all stumps, roots, buried logs and other underground debris. Grubbing of this area shall include removal of the top 6-inches of organic laden topsoil and stockpiling it for later distribution over areas shown in the Contract Documents or directed by the Engineer.

02015.3.3 BACKFILLING

All stump holes, cuts, depressions and other holes resulting from clearing and grubbing operations within areas designated to receive pipelines, structures, or embankments shall be backfilled and compacted to the density of the surrounding ground.

02015.3.4 DISPOSAL

The Contractor shall dispose of all materials resulting from clearing and grubbing operations as required in the Contract Documents and in accordance with Section 01520 of these Specifications.

02015.3.5 MARKERS, MONUMENTS AND DATA POINTS

Land monuments, property markers or official datum points shall be protected until their removal is approved. When movement of monuments or markers is deemed necessary and approved by the Engineer, all such monuments or markers shall be carefully referenced for re-establishment before removing.

02015.4 METHOD OF MEASUREMENT

02015.4.1 SEPARATE PAYMENT

Measurement for "Clear and Grub" shall be made either as lump sum or by counting the number of acres. to the nearest tenth (10th), of area actually cleared and grubbed within the limits shown on the Drawings or as directed and approved by the Engineer. For areas where ponds or lagoons are to be constructed, this measurement shall include the removal and stockpiling of the first six (6) inches of topsoil in addition to grubbing to the required depths.

02015.4.2 NO MEASUREMENT

02015.4.2.1 NO PAY ITEM FOR CLEAR & GRUB - When the Bid Schedule does not contain a pay item for "Clear and Grub", then that work will be considered incidental to other Work items which require clearing and grubbing and no separate measurement shall be made.

02015.4.2.2 ROADWAY EXCAVATION and/or BORROW - Material used for filling depressions will be measured separately only when "Roadway Excavation" and/or "Borrow" appear as separate pay items on the Bid Schedule. Measurement will be made by counting the number of cubic yards of material moved and placed as designated on the Drawings or as directed and approved by the Engineer. If "Roadway Excavation" or "Borrow" are not included in the Bid Schedule, material used for filling depressions will not be measured separately, but will be considered incidental to the Work.

02015.5 BASIS OF PAYMENT

The accepted quantities will be paid for at the contract unit price.

PAYMENT ITEM	UNIT
Clear and Grub	Lump Sum
Clear and Grub	10th of Acre

02020.1 DESCRIPTION

Furnish and provide labor and equipment for investigation of existing miscellaneous pipelines, wires or cables, and other miscellaneous sub-surface features as required by the Engineer.

02020.1.1 RELATED WORK

Section 01510 - Protection of Existing Improvements

02020.1.2 SUBMITTALS

Not used.

02020.1.3 DEFINITIIONS

Not used.

02020.2 MATERIALS

The Contractor shall provide a backhoe and qualified operator; laborer with hand shovel: appropriate fuel and lubricants, necessary equipment servicing materials; and appropriate equipment for transporting the backhoe to perform the investigation. The backhoe shall be a rubber tired CASE 580 backhoe, or an approved unit of equivalent or greater size and capacity, having accumulated not more than 5,000 hours operating time.

02020.3 CONSTRUCTION REQUIREMENTS

02020.3.1 EXPOSURE BY EXCAVATION

When directed by the Engineer, the Contractor shall excavate and expose miscellaneous pipelines, structural features, soil materials and other underground features which may be present at the work site. The location and extent of exposure shall be determined on site by the Engineer. Designation of such areas shall be made in writing, usually in the form of a Work Order, by the Engineer.

02020.3.2 REPLACEMENT OF EXCAVATED MATERIALS

Work required hereunder shall include replacement of excavated materials sufficiently to restore the site to a safe condition as determined by the Engineer. Full restoration of materials such as pavement, concrete slabwork, sod, etc., in the investigated area will be accomplished in accordance with the Contract Documents and as directed by the Engineer.

02020.4 METHOD OF MEASUREMENT

02020.4.1 MEASUREMENT BY HOURS OF WORK

Measurement of subsurface investigation shall be made by counting the actual number of hours of work completed by the machine and operator to investigate miscellaneous underground features as required by the Engineer. No allowance of time will be made for transporting the backhoe to and from the job site when the backhoe is located on the site of the Contract.

02020.4.2 MEASUREMENT FOR OTHER ITEMS OF WORK

When restoration of the excavated area requires provision of pavement, concrete slabwork, sod, etc., separate measurement will be made for those materials in accordance with the respective requirement(s) for measurement of that item in the Contract Documents.

02020.5 BASIS OF PAYMENT

The accepted quantity of work will be paid for at the contract unit price of:

PAYMENT ITEM	UNIT
Subsurface Investigation	Hour

When provision of designated materials is required for restoration of the excavation, payment for such materials shall be made in accordance with the respective provisions of the Contract documents.

02105.1 DESCRIPTION

This section covers obtaining permission, permits, clearances, etc.; as necessary to develop source(s), purchasing or manufacturing, loading, hauling, placing and compacting earthwork materials described herein, as shown on the Drawings and/or required by these Specifications.

02105.1.1 RELATED WORK

Section 02200 - Trench Excavation and Backfill

02105.1.2 SUBMITTALS

When the Bid Schedule indicates quantities of materials described in this section in excess of 50 cubic yards or 50 tons, or when requested otherwise by the Engineer, the Contractor shall provide test results from a certified independent laboratory which has sampled and performed the prescribed test(s) for those materials.

02105.1.3 DEFINITIONS

Granular Material - Material for which the sum of plasticity index (AASHTO T-90) and the percent of material passing a No. 200 sieve (AASHTO T-27) shall not exceed 23.

Silt - Material which passes the No. 200 (AASHTO T-11) sieve and has a plasticity index not greater than 10.

Clay - Material which passes the No. 200 sieve and has a plasticity index greater than 10.

Bedding - Materials placed immediately around and adjacent to pipe installed in trenches.

Borrow - Material obtained from a source away from the site on which installed and/or excavated and used to supplement insufficient quantities of material required.

02105.2 MATERIALS

02105.2.1 ON-SITE TRENCH OR STRUCTURAL BACKFILL

On-site trench or structural backfill consists of material excavated during trenching or foundation excavation which is free of cinders, ashes, wood, vegetation, frozen or other deleterious material or rocks with a maximum particle size not greater than 6-inches. Material may be required to be processed or transported along the excavation.

02105.2.2 IMPORTED TRENCH OR STRUCTURAL BACKFILL

Imported trench or structural backfill consists of granular material obtained from sources indicated on the Drawings, designated in the Special Provisions or approved by the Engineer. Borrow materials shall be free of cinders, ashes, wood, vegetative matter, frozen or other deleterious matter with a maximum particle size not greater than 6-inches. Pit Run Borrow may be used as backfill in trenches, excavations for structures, in roadway subgrades, or as otherwise shown on the plans or called for by the Engineer. Material may be processed or may be pit run.

02105.2.3 ON-SITE PIPE BEDDING

On-site pipe bedding consists of material excavated during the trenching operation which is free of cinders, ashes, wood, vegetation, frozen or other deleterious material or rocks with a maximum

particle size not greater than that shown below in Table 1. Material may be required to be processed or transported along the trenching operation.

02105.2.4 IMPORTED PIPE BEDDING

Imported pipe bedding consists of granular material excavated from an approved borrow source which is free of cinders, ashes, wood, vegetation, frozen or other deleterious material or rocks with a maximum particle size not greater than that shown in Table 1 below. Material may be processed or may be pit run.

Table 1 - MAXIMUM PARTICLE SIZE FOR PIPE BEDDING

Pipe	Size
Corrugated Metal and Welded Steel	1"
Polyethylene, Galvanized Steel and PVC	3/4" in Utah or 1"in other states
Ductile Iron, Cast Iron, Concrete, and HDPE	2"

02105.2.5 SAND

Sand shall be graded granular material which passes a 3/8-inch sieve, with not more than 10 percent passing the No. 200 sieve (AASHTO T-27) and free from cinders, ashes, wood, vegetation, frozen or other deleterious material.

02105.2.6 UNTREATED BASE COURSE

Untreated base course consists of processed natural gravel and crushed rock with an approved soil binder without any deleterious materials, tested in accordance with AASHTO T-27 and T-11 which meets the gradation requirements in Table 2 below.

Table2 - PARTICLE SIZE FOR UNTREATED BASE COURSE

Sieve Size	Percent Passing
1-inch	100
½-inch	70-90
#4	40-60
#16	20-40
#200	5-12

02105.2.7 BITUMINOUS SURFACING

Plant mix bituminous material, with maximum particle size not greater than 3/4-inch, meeting the requirements of Section 02511 of these Specifications.

02105.2.8 DRAIN GRAVEL

Drain gravel consists of washed natural gravel or crushed rock, with a maximum particle size of 1-inch, with not more than 40 percent passing the No. 4 sieve, with 100 percent being retained on the No. 10 sieve, and without any deleterious material.

02105.2.9 RIPRAP

Riprap consists of durable, angular, sound and hard field or quarry stones free from cracks and structural defects. Source of supply shall be approved by the Engineer. Fifty percent of the stones shall be of sizes between one-half and two-thirds of the riprap layer thickness shown on the

Drawings. Not more then 10-percent of the stones by weight shall be of a size less than one-tenth of the riprap layer thickness shown on the Drawings and the specific gravity of the stones must range between 2.5 and 2.82 (AASHTO T-85). Durability of the stones shall be in excess of 40 percent (AASHTO T-210).

02105.2.10 SUBGRADE GRANULAR FILL

Subgrade granular fill consists of well graded granular soils with a maximum of 50 percent passing the No. 4 sieve and a maximum of 20 percent passing the No. 200 sieve and no materials greater than 4-inches in diameter.

02105.3 CONSTRUCTION REQUIREMENTS

02105.3.1 LOCAL GOVERNMENT SPECIFICATIONS

Differences may exist between the requirements of these Specifications for sitework materials such as backfill, bedding, untreated base course and bituminous surface course, and those of local government entities. Such differences may affect Contract prices; therefore, when Contract Work falls within the boundaries of any local government, the Contractor shall make himself aware of that entity's specifications for those materials. If differences exist between those specifications and these, unless otherwise approved by the Engineer, the more stringent ones shall apply.

02105.3.2 BORROW AND DISPOSAL SITES

The Contractor shall, at its own expense, secure all necessary access and borrow sites for acquisition or removal and to dispose of excess backfill or waste materials, unless otherwise shown on the Drawings.

02105.3.3 ON-SITE MATERIALS

Unless otherwise shown on the Drawings or directed by the Engineer, on-site pipe bedding and trench backfill will be used for installation of all pipe. In areas where suitable on-site material is not available, other material, which meets these Specifications, will be used when shown on the Drawings, provided for in these Contract Documents or approved by the Engineer.

02105.3.4 SCALES

When ton weight is to be used to determine quantities of earthwork materials used, the Contractor shall provide his own scales or access to other scales at his own cost. Scales shall be certified accurate. Include certification in submittals.

02105.4 METHOD OF MEASUREMENT

02105.4.1 NO MEASUREMENT

On-Site Pipe Bedding and On-site Trench or Structural Backfill will be considered part of the items for piping or excavation associated with structures included in the Bid Schedule and no separate measurement for these materials will be made.

02105.4.2 SEPARATE MEASUREMENT

02105.4.2.1 IMPORTED MATERIALS – Quantities of imported pipe bedding and imported trench or structural backfill shall be determined by measuring the lineal feet (lineal feet of trench requiring imported materials) of imported material in place and accepted. This measurement shall include

furnishing all necessary materials and equipment, labor, hauling, placement, compaction, and testing to produce an acceptable trench fill.

No allowance will be made for bedding and backfill materials required to fill voids caused by trenching operations, which exceed the dimensions shown on the Drawings.

02105.4.2.2 SAND – Quantities of sand shall be determined in cubic yards in place, calculated by multiplying the measured length of trench by the measured depth of bedding by the pay width shown on the Drawings, or as directed by the Engineer in the field.

No allowance will be made for materials required to fill voids caused by trenching operations, which exceed the dimensions shown on the Drawings.

02105.4.2.3 UNTREATED BASE COURSE - Quantities of untreated base course shall be determined in cubic yards in place, calculated by multiplying the measured length by neat line dimension shown on the drawings. If no neat lines are shown on the drawings, then the cubic yard calculations shall be determined by actual measurements in the field in place.

02105.4.2.4 BITUMINOUS SURFACING – Quantities of the respective compacted thickness of bituminous surfacing shall be determined in square yards by multiplying the length of material in place and accepted by the pay width shown on the Drawings, or as directed by the Engineer in the field.

02105.4.2.5 DRAIN GRAVEL - Quantities of drain gravel shall be determined in cubic yards calculated by multiplying the measured length by the measured depth of bedding in place by the pay width shown on the Drawings, or as directed by the Engineer in the field.

02105.4.2.6 RIPRAP - Quantities of riprap shall be determined in cubic yards by multiplying the measured length by the measured breadth by the measured average depth of material in place and accepted.

02105.4.2.7 SUBGRADE GRANULAR FILL - Quantities of subgrade granular fill shall be determined in cubic yards by multiplying the measured length by the measured breadth by the measured depth of material in place and accepted.

02105.5 BASIS OF PAYMENT

The accepted quantity shall be paid for at the contract unit price for:

PAYMENT ITEM	UNIT
Imported Trench or Structural Backfill	Lineal Foot
Imported Pipe Bedding	Lineal Foot
Sand	Cubic Yard
Untreated Base Course	Cubic Yard
Bituminous Surfacing (Thickness)	Square Yard
Drain Gravel	Cubic Yard
Riprap	Cubic Yard
Subgrade Granular Fill	Cubic Yard

02200.1 DESCRIPTION

This section covers furnishing of equipment, labor, and materials to clear, excavate, backfill and compact trenches for utilities. Excavation and backfill for piping appurtenances such as manholes, inlets, transition structures, junction structures, vaults, thrust blocks, valve boxes, catch basins, etc., shall be included, as also shall be restoration of the disturbed ground surface in accordance with the Contract Documents.

02200.1.1 RELATED WORK

Section 02005 - Traffic Control
Section 01510 - Protection of Existing Properties
Section 02015 - Clearing and Grubbing
Section 02105 - Earthwork Materials
Section 02208 - Flowable Backfill
Section 02222 - Water Pipe Installation
Section 02224 - Sewer Pipe and Manhole Installation
Section 02315 - Casing Installation by Boring and Jacking
Section 02320 - Casing Pipe Installation by Open Trench
Section 02500 - Removal and Replacement of Surface Improvements
Section 02900 - Landscaping
Section 02204 - Water for Construction

02200.1.2 SUBMITTALS

02200.1.2.1 MOISTURE DENSITY TESTING AND GRADATION DETERMINATIONS - A documentation system shall be maintained by the Contractor to record results from all moisture/density testing and gradation determinations. Records of these tests shall show the following information as a minimum:

- Date of test.
- Type of test.
- Name of person performing test.
- Location of sample taken.
- Results of test and comparison with specified value required for compliance.

Upon completion of each gradation test or moisture/density test, a copy of the record for the respective test shall be delivered to the Engineer within one (1) working day following the completion.

02200.1.2.2 COMPLIANCE TESTING - Documentation shall also be made, in field diaries, of all compliance tests performed by the Contractor. Documentation shall be made available to the Engineer upon request.

02200.1.3 DEFINITIONS

Trench Width - Shall not be more than 18 inches greater than the outside diameter of the pipe being installed at a point 12 inches above the top of the pipe unless otherwise shown on the Drawings. The width of the trench above that level shall be the minimum width required for safe working conditions, sheeting, bracing and for proper installation of the work.

Trench Grade - The vertical elevation of the flowline of the pipe being installed in the trench.

Open Trench - Shall include trench sections which have been excavated and are awaiting completion of pipe installation, backfill, compaction or installation of a temporary surface.

Surface Restoration - Shall include the Work required to restore the ground surface disturbed for trench excavation. Replacement of road surfacing, planting and landscaping removed for trench excavation, will not be considered as trench excavation and backfilling.

Consolidated Backfill - A condition of backfilling for which a specified compaction density is required. Maximum lift, prior to compaction, for consolidated backfill shall be 8 inches unless otherwise approved by the Engineer.

Unconsolidated Backfill - A condition of backfilling for which no compaction density is specified and the required compaction effort is layer placing and then compacting by wheel rolling or use of compacting equipment. Lifts of up to 24 inches are allowed for unconsolidated backfill.

Unclassified Excavation - A determination for excavating whereby no consideration will be given to different kinds of materials that are encountered.

02200.2 MATERIALS

Not used.

02200.3 CONSTRUCTION REQUIREMENTS

02200.3.1 PERMITS

For work which is to take place within state and/or federal road and highway rights-of-way, the Contractor shall be responsible for obtaining all required encroachment and construction permits prior to beginning any work within the rights-of-way.

All work in any city, town or county public right-of-way will also require an approved excavation permit from that entity. The Contractor shall be responsible for obtaining all required encroachment and construction permits prior to beginning any work within the rights-of-way.

02200.3.2 CLEARING AND GRUBBING

On areas outside of established roadways, the area to be disturbed by the trenching operation shall be cleared and grubbed in accordance with Section 02015 prior to beginning the trenching operation.

02200.3.3 EXCAVATION

02200.3.3.1 UNCLASSIFIED EXCAVATION - All excavation for this project shall be unclassified excavation, unless otherwise determined by the Engineer.

02200.3.3.2 STAKING - Location staking of piping will be provided by the Owner in accordance with the provisions of Section 1560 unless indicated otherwise in the Contract Documents.

02200.3.3.3 EXPOSURE OF UNDERGROUND FEATURES - Before any trench excavation is started, the Contractor shall locate and expose all existing underground utilities, structures, etc., which may interfere with, or conflict with, the trench being excavated. In case of conflicts, the Contractor shall make adjustments in the location of the excavation at the direction of the Engineer. Such adjustments shall be made at no additional cost to the Owner.

02200.3.3.4 The Contractor shall perform all excavation to the depth specified in the Drawings and/or as required to accomplish the Work. During the excavation operations, excavated materials which are suitable for use as backfill for trenches or around structures, shall be piled separately at sufficient distance from the edge of the excavation to be out of the way of equipment and to prevent slides and cave-ins from embankment overloading. All excavated materials not suitable for, or not required for, fill or backfill shall be separated and removed promptly from the site of the Work and disposed in an approved site in accordance with Section 1520.

02200.3.3.5 PUBLIC TRAVEL - Materials excavated within roadways, regardless of their disposition, shall be piled in such manner that will cause the minimum of inconvenience to public travel and always allow for emergency vehicle passage.

02200.3.3.6 OPEN TRENCH - At no time shall the Contractor allow more than 500 cumulative feet of trench to be open for the overall project, unless otherwise approved by the Engineer.

02200.3.3.7 SHORING - Shoring and/or trench boxes shall be used wherever needed to protect workers and adjacent structures and property of the Work in accordance with OSHA requirements. The arrangement of bracing of shoring shall not be set so as to stress any portion of completed work.

02200.3.3.8 BARRICADING OPEN WORK - Excavations left open at the end of the work day shall be surrounded by barricades and warning tape.

02200.3.4 EXCAVATION IN ROCK

02200.3.4.1 SOLID ROCK EXCAVATION – If:

- The Contract Documents contain provisions for "Solid Rock Excavation", and
- If rock has been encountered in the excavation, and
- If the Contractor has made three attempts to remove the rock using a "Kelly" or similar type ripper having not less than 235 fly wheel horsepower, then

the excavation of such material will be considered as "solid rock excavation".

02200.3.4.2 BLASTING - When blasting is deemed necessary for rock removal, the Contractor shall comply with all applicable State and Local laws, ordinances, and provisions for blasting safety and obtain written approval from the Engineer prior to starting of drilling and/or blasting operations.

In all cases, blasting shall be performed by experienced, qualified blasters. The Contractor is responsible for any and all damage caused by blasting, and blasting will not be allowed within 15 feet of any existing structures.

02200.3.5 OVER-EXCAVATION

02200.3.5.1 UNAUTHORIZED OVER-EXCAVATION - Care shall be taken to not excavate below the depth required by the Drawings. Any unauthorized over-excavation shall be refilled and compacted with material meeting the requirements of Section 02105 and approved for use by the Engineer at the expense of Contractor.

02200.3.5.2 ROCK - Whenever rock is encountered in the trench bottom, the trench shall be over-excavated a minimum of 6 inches below the design elevation of the bottom. of the pipe. The over-excavated portion of the trench shall be filled with approved bedding material and the bedding compacted, all at the expense of the Contractor, unless otherwise approved by the Engineer and the Owner.

02200.3.5.3 UNSTABLE NATIVE FORMATIONS - The Contractor shall notify the Engineer if soft, spongy, or otherwise unstable native formations, that are not suitable for structure or pipeline foundations, are encountered in excavations. In the event the Engineer determines that the existing foundation materials are unacceptable, the Contractor will be directed to over-excavate, remove and replace the unsuitable soil materials. The over-excavation shall be backfilled with approved select materials and compacted in accordance with the requirements described herein. Such situation will be considered as a changed condition and the Contractor will be compensated in accordance with Subsection 00700.13 of the General Conditions.

02200.3.6 PIPELINE ACCESSORY INSTALLATION

02200.3.6.1 EXCAVATION FOR ACCESSORIES - The Contractor may excavate to place the sides of manholes, vaults, valve boxes, inlet structures, catch basins or other accessory structures directly against the excavated surface, provided that the faces of the excavation are firm and unyielding and are at all points outside the structure lines shown on the plans. If the native material is such that it will not stand without sloughing, the Contractor shall over-excavate to place the structure and this over-excavation shall be backfilled and compacted, using the same material required for the adjoining pipeline trench.

02200.3.6.2 ACCESSORY SUPPORT - To prevent displacement of valve boxes and other accessory structures, trench backfill shall be compacted to at least 95% of maximum density as determined by AASHTO T-99 for 6 feet along the trench on each side of the box or structure.

02200.3.7 TRENCH BOTTOM PREPARATION

The bottom of the trench shall be accurately graded to provide uniform bearing and support for each section of the pipe. Bell or coupling holes shall be made in accordance with the recommendations of the pipe manufacturer after the trench bottom has been graded. Such depressions shall be of sufficient width to provide clearance for connecting and/or bolting. Holes for depressions shall be excavated only as necessary to permit proper joining of pipe sections.

02200.3.8 SURFACE IMPROVEMENTS

When surface improvements must be removed, or are damaged or disturbed by the Work, their removal and restoration shall be accomplished by the Contractor in accordance with Sections 01510 and 02500 of these Specifications.

02200.3.9 PROTECTION OF EXISTING UTILITIES

The Contractor shall protect all existing utilities, either above or below ground, in accordance with the provisions of Section 01510 of these Specifications.

02200.3.10 IRRIGATION DITCHES, PIPES AND STRUCTURES

The Contractor shall contact the owners of all irrigation facilities to be encountered by the work and make arrangements for construction clearances and/or facility shutdown schedules. All irrigation ditches, dikes, headgates, pipe, valves, culverts, etc., damaged or removed by the Contractor shall be restored by the Contractor to their original condition, or better, in accordance with Section 02500 of these Specifications, at no additional cost to the Owner.

02200.3.11 BUILDING FOUNDATIONS AND STRUCTURES

Where trenches are located adjacent to building foundations and structures, the Contractor shall take all necessary precaution against damage to such facilities. Water settling of backfill material

in trenches adjacent to structures will not be permitted unless authorized in writing by the Engineer. The Contractor shall be liable for any damage caused by the construction, and shall restore or replace damaged property in accordance with Section 02500 of these Specifications.

02200.3.11.1 SIDEWALK, CURB AND GUTTER - Where sidewalk, curb, and gutter exist, excavation may be made by tunneling provided the following requirements are met. Excavation shall be vertical and as near to the curb or sidewalk as possible. The length of the tunnel shall not exceed the width of the sidewalk, curb and gutter. Where a separate sidewalk and curb exist, an excavation shall be made between the sidewalk and the curb. At least three feet of undisturbed earth shall be left under the sidewalk. Where the excavation does not meet these requirements, a section of sidewalk from joint to joint shall be removed and replaced.

Gas Lines and Water Lines may be jacked, augured or jetted under sidewalk, curb and gutter provided the resulting hole diameter does not exceed one (1) inch plus the outside diameter of the pipe installed.

Backfill of Sidewalk Tunnels. Where the sidewalk has been tunneled, the hole shall be filled from each end with earth compacted with mechanical tampers to 90% of AASHTO T-180, Method C. A 3'-0" section of trench on each side of the tunnel and any space between the sidewalk and curb shall be backfilled with mechanically compacted earth as specified.

02200.3.12 WATER

02200.3.12.1 WATER FLOW - The Contractor's operation shall always ensure the free flow of water in gutters, culverts, and natural watercourses. In irrigated land areas, excavated materials shall be piled on the downhill sides of trenches.

02200.3.12.2 GROUNDWATER – Unless provided with geotechnical information by the Owner, the Contractor shall have the responsibility of determining the presence and location of groundwater at the work site.

02200.3.12.3 DEWATERING - Grading and other protective measures shall be performed as necessary to prevent surface or ground water from flowing into trenches or other excavations. Any water accumulated therein during construction, from surface or from underground sources, shall be promptly removed by pumping or by other approved methods at the Contractor's expense.

Unless given as a separate item in the Bid Schedule, dewatering shall be performed at the expense of the Contractor. When geotechnical information is given, groundwater must be in excess of ± 2 feet before a change in work will be considered.

02200.3.12.4 INSTALLATION IN WATER - No backfill, subgrade materials, concrete or masonry footings, foundations, floors, equipment, or pipe shall be placed or laid in water. Water shall not be allowed to rise over such work for at least 24 hours following the pour or placement of any concrete or mortar used in the work. Water shall not be allowed to rise unequally against structure walls for a period of 14 days following concrete placement or masonry erection.

Groundwater or surface water in piping trenches shall not be allowed to enter and flow through the piping while installation of pipe is in progress.

02200.3.12.5 DISPOSAL - The Contractor shall dispose of all water from the work in a suitable manner without damage to adjacent property

02200.3.13 BEDDING AND PIPELINES

02200.3.13.1 USE OF ON-SITE MATERIALS - Unless directed otherwise in these Specifications, on-site materials complying with Section 02105 shall be used for bedding. If an act, or failure to act on the part of the Contractor creates a need to use imported bedding materials, the Contractor shall bear the cost of all additional excavation, transportation and installation for new bedding, and for removal and disposal of unacceptable materials, as required to correct that situation.

02200.3.13.2 INSUFFICIENT ON-SITE MATERIALS - When sufficient bedding material cannot be developed from on-site materials, and no provision is contained in the Contract Documents for importing bedding materials, the Engineer shall be notified as soon as possible. Alternative measures will be considered and a change can then be negotiated to provide additional materials in accordance with the General Conditions.

02200.3.13.3 BEDDING INSTALLATION - Pipe bedding shall be installed according to applicable sections of these Specifications for pipeline construction.

02200.3.14 BACKFILL

02200.3.14.1 BACKFILL MATERIALS AND PLACEMENT - Backfill shall be accomplished using acceptable materials as described in Section 02105 as follows:

- All backfill materials shall be at ± 2% of optimum moisture content when placed in the trench or other excavation.
- Unless provided otherwise on the Drawings, consolidated trench backfill shall be placed in lifts not greater than 8 inches.
- Unsuitable excavated material, or material with incorrect moisture content shall be removed and replaced.
- Soft spongy material that causes areas which "pump" when heavy loads pass over them, shall be removed and replaced with suitable material.
- Dry material that will not "ball" shall be removed and replaced.

  (The two foregoing conditions shall be considered sufficient evidence, without further testing, that the moisture content is incorrect and shall be grounds for removal and replacement of the material. Such replacement, if required, shall be at the sole expense of the Contractor.)

- Placement of backfill against cast-in-place concrete structures shall not be started until the concrete has been cured for the time required by the Contract Documents or prescribed by the Engineer.

02200.3.14.2 COMPACTION – Compaction procedures shall be as follows:

- The Contractor shall be responsible for obtaining construction water needed for compaction in accordance with Section 02204 of these Specifications.
- Bedding and consolidated backfill material shall be compacted with tamping, vibrating or conventional wheeled compaction equipment. Use care not to damage pipe while compacting bedding materials.
- The use of wheel rolling for compaction shall only be approved for compacting unconsolidated backfill materials.
- For work within state or federal highway rights-of-way, compaction shall meet the requirements of the respective applicable specifications.
- Backfill shall be thoroughly compacted to densities not less than those shown in the following table:

TABLE OF MINIMUM DENSITY REQUIREMENTS
(based on AASHTO-99 and T-91 and on ASTM D-2922 and E-3017)

Location	From Surface to 2-Feet Below Surface	From 2-Feet Below Surface to Top of Bedding	Bedding
Within 6 feet of, and/or under, any existing or proposed structure, pavement, curb, sidewalk or similar construction included in the Contract:	100% for granular and 95% for non-granular materials	95% for all materials	95% at all locations
Around any structure outside 6 feet:	90% for all materials	90% for all materials	90% at all locations
Cultivated and landscaped areas:	85% for all materials	85% for all materials	85% at all locations
Undeveloped Land:	Unconsolidated – see definition	Unconsolidated - see definition	85% at all locations

02200.3.15 SETTLING AND SUBSIDENCE

Dips or uneven surfaces caused by subsidence or post-construction settlement of fill or backfill in any trenches, excavations, fills, or embankments within the work, which become apparent within the warranty period, shall be repaired by the Contractor at no additional cost to the Owner.

02200.3.16 SAMPLING AND TESTING

02200.3.16.1 TESTING BY INDEPENDENT LABORATORY - As directed by the Engineer, the Contractor shall provide for all sampling and testing through a qualified, independent testing laboratory at the Contractor's own expense.

02200.3.16.2 SCHEDULE OF SAMPLING AND TESTING - The following schedule of sampling and testing provides minimum requirements, to assure compliance with all materials and compaction requirements described herein. The number of samples and tests shown shall be considered minimum, and field conditions may necessitate additional sampling and testing to be required by the Engineer.

GRADATION DETERMINATION (AASHTO T-27 and T-11)

Trench Location	Testing Required
Materials imported or manufactured at a site determined by this contract	One test per site or source
On-site excavated materials along trenches.	One test per geographical area where material composition and gradation visually appears consistent.

MOISTURE/DENSITY RELATIONSHIP (Proctor)
(AASHTO T-99 or T-180 Method D)

Trench Location	Testing Required
Materials imported or manufactured at a site determined by this Contract.	One test per site unless the material visually appears to change.
On-site excavated materials along trenches.	One test per geographical area where material composition visually appears consistent.

COMPACTION COMPLIANCE TESTING REQUIREMENTS
(AASHTO T-191 or Portable Nuclear Gauges)

Trench Location	Testing Required
Street crossing with gravel or bituminous surfacing.	One test per lift for each crossing.
Parallel to centerline of bituminous or gravel surfaced streets or roadways.	One test per lift for each 500-feet of trench length.
Along unsurfaced roads or in cultivated or landscaped areas.	One test per lift for each 1,000-feet of trench length with at least one test per area.
Under or adjacent to manholes, wetwells, enclosures, boxes, etc.	None, unless geological conditions are inconsistent and requested by the Engineer.

NOTE: The term "test" shall mean a single test with acceptable results, equal to or better than specified minimums. In the event compaction test results fall below the required minimum density; the Contractor shall re-compact and test the material until a test with acceptable results is obtained. Any test failure shall result in additional tests as required by the Engineer, at no cost to the Owner, to ensure that overall project quality objectives are met.

02200.4 METHOD OF MEASUREMENT

02200.4.1 NO MEASUREMENT

02200.4.1.1 SOLID ROCK EXCAVATION - Unless the Contract Documents contain provisions for "Solid Rock Excavation", no separate measurement or payment will be made for work requiring rock excavation.

02200.4.1.2 TRENCH EXCAVATION AND BACKFILL - Trench excavation and backfill will be considered incidental to other items shown in the Bid Schedule and separate measurement will not be made unless prescribed otherwise in the Contract Documents.

02200.4.2 SEPARATE MEASUREMENT

When listed as a separate item in the bid schedule, quantities of solid rock excavation shall be determined by the foot/foot unit, using a tape measure or other accurate measuring device to find the length of cut in lineal feet along the plane of cut and the average depth of cut in the rock and multiplying the two numbers together. This measurement shall include all labor, equipment, materials, and related work, including, but not limited to, ripping, sawing, boring, hammering, blasting, rock trenching, excavating, removing, hauling, and disposal, if required, of the existing bedrock deemed qualified by the Engineer for payment of completed rock excavation.

02200.5 BASIS OF PAYMENT

Separate payment will not be made for trench excavation unless prescribed otherwise in the Contract Documents.

PAYMENT ITEM	UNIT
Solid Rock Excavation	Foot/Foot

02201.1 DESCRIPTION

This section covers furnishing all equipment, labor, and other facilities to excavate, remove, backfill, compact, grade and shape earth materials required for construction of buildings, bridges, retaining walls, head walls, box culverts and other structures, in accordance with the Contract Documents.

02201.1.1 RELATED WORK

Section 01510 - Protection of Existing Properties
Section 02015 - Clearing and Grubbing
Section 02105 - Earthwork Materials
Section 02500 - Removal and Replacement of Surface Improvements
Section 02900 - Landscaping

02201.1.2 SUBMITTALS

Not used.

02201.1.3 DEFINITIONS

Consolidated Backfill - A condition of backfilling for which a specified compaction density is required. Maximum allowable lifts for consolidated backfill under this Section shall be 8 inches unless otherwise approved by the Engineer.

Unconsolidated Backfill - A condition of backfilling for which no compaction density is specified and the required compaction effort is layer placing and then compacting by wheel rolling or use of compacting equipment. Lifts of up to 24 inches are allowed for unconsolidated backfill.

Unclassified Excavation - A determination for excavating whereby no consideration will be given to different kinds of materials that are encountered.

Embankment Fill - The placement and compaction of suitable materials to raise the existing grade to the established elevations, and the placement and compaction of suitable materials within areas where unsuitable materials have been removed. Maximum lift for embankment fill under this Section shall be 6 inches unless otherwise approved by the Engineer.

02201.2 MATERIALS

Not used

02201.3 CONSTRUCTION REQUIREMENTS

02201.3.1 PERMITS

For work within state or federal highway rights-of-way, the Contractor shall be responsible for obtaining all required encroachment and construction permits prior to beginning any work within the rights-of-way.

02201.3.2 SITE PREPARATION

02201.3.2.1 CLEARING THE SURFACE - Before proceeding with any ground surface disturbances for work under this Section, the area to be disturbed by excavation, grading or embankments shall be cleared and grubbed in accordance with Section 02015.

02201.3.2.2 TOPSOIL - Unless otherwise indicated, the Contractor will not be required to separate, stockpile and replace topsoil on the Work site. When required in the Contract Documents, topsoil shall be removed and stockpiled for later distribution in accordance with Section 02015.

02201.3.2.3 REMOVAL OF SUBSURFACE MATERIALS - Following completion of clearing and grubbing, the Contractor shall locate and remove existing underground debris, posts, piping, cables and other underground obstructions. Unless indicated otherwise in the Contract Documents, no separate allowance for costs associated with removal of these materials will be allowed to the Contractor.

02201.3.2.4 RELOCATION OF UNDERGROUND UTILITIES - When required by the Contract Documents or determined necessary by the Engineer, existing underground utilities or other objects shall be relocated to provide clearance for required structural components prior to starting any structural excavation.

02201.3.3 EXCAVATION

02201.3.3.1 UNCLASSIFIED EXCAVATION - All excavation shall be unclassified, unless otherwise indicated in the Contract Documents. The Contractor shall perform all excavation to the elevations and dimensions shown on the Drawings and/or as required to accomplish the Work.

02201.3.3.2 CUT SLOPES - Unless otherwise shown on the Drawings, or directed by the Engineer, cut and fill slopes, or cut slopes in soil, shall be no steeper than two horizontal to one vertical. Cut slopes in rock shall be no steeper than 1.5 horizontal to one vertical.

02201.3.3.3 STOCKPILING AND DISPOSAL OF EXCAVATED MATERIALS - During the excavation operations, excavated materials which are suitable for use as backfill or embankments around structures, shall be piled separately at sufficient distance from the opening to be out of the way of equipment and to prevent slides or cave-ins.

All excavated materials not suitable, or not required, for fill or backfill shall be removed promptly from the site of the Work and disposed of in accordance with Section 01520.

Excavated materials, regardless of their disposition, shall be piled in such manner that will cause the minimum of inconvenience to public travel, and provisions shall be made for emergency travel as necessary.

02201.3.3.4 SHORING AND BRACING - Shoring or bracing shall be provided in accordance with OSHA safety requirements on all excavations, to protect workmen and the progression of the Work. In addition, excavation walls shall be braced and supported as required to prevent ground collapse or movement of ground surfaces and structures adjacent to the excavation. Slides or settlements, which occur in the excavation, shall be promptly removed and corrected by the Contractor. The arrangement of shoring and bracing components shall be made so as not to place any stress on portions of completed work.

02201.3.4 EXCAVATION IN ROCK

02201.3.4.1 SOLID ROCK EXCAVATION - Demonstration of the presence of "solid rock excavation" may constitute a changed condition, and the Contractor will be compensated for removal of such material in accordance with the General Conditions. Before excavation will be considered as "solid rock excavation", the Contractor shall demonstrate an inability to remove rock by making three attempts to rip the rock using equipment having not less than 235 fly wheel horsepower with a "Kelly" or similar type ripper. After such demonstration has indicated the presence of solid rock, and the Engineer determines its removal is necessary, authorization for removal of the solid rock may be granted in accordance with Section 00700.13 of the General Conditions.

02201.3.4.2 BLASTING - When blasting is deemed necessary for rock removal, the Contractor shall comply with all applicable State and Local laws, ordinances, and provisions for blasting safety and obtain written approval from the Engineer prior to starting of drilling and/or blasting operations.

In all cases, blasting shall be performed by experienced, qualified blasters. The Contractor is responsible for any and all damage caused by blasting, and blasting will not be allowed within 15 feet of any existing structures.

02201.3.5 OVER-EXCAVATION

02201.3.5.1 UNAUTHORIZED OVER-EXCAVATION - Care shall be taken not to excavate below the depth required by the Drawings. Any unauthorized over-excavation shall be refilled and compacted with material meeting the requirements of Section 02105 and approved for use by the Engineer at the expense of Contractor.

02201.3.5.2 UNSTABLE NATIVE FORMATIONS - The Contractor shall notify the Engineer if soft, spongy, or otherwise unstable native formations, unsuitable for structure foundations, are encountered during excavation. In the event the Engineer determines that such formations are inadequate, the Contractor will be directed to over-excavate and remove the unsuitable materials. The over-excavation shall be backfilled with approved select materials and compacted in accordance with the requirements described herein. Such situation will be considered as a changed condition and the Contractor will be compensated in accordance with the General Conditions.

02201.3.6 WATER

02201.3.6.1 DEWATERING - The Contractor shall control all ground or surface water during excavation, grading and subsequent construction activities. Dewatering systems shall be provided and operated by the Contractor so as to prevent the removal of the natural soils. Grading shall be performed as necessary to prevent surface water from flowing into excavations. Any water accumulated, therein during construction, shall be promptly removed by pumping or by other approved methods at the Contractor's expense.

Dewatering efforts shall be sufficient to ensure that softening of the bottom of excavations or formation of "quick" conditions or "boils" shall be prevented. Natural or compacted materials within the excavated areas, softened by saturation with ground water or standing surface water, shall be removed and replaced as instructed by the Engineer, at no additional cost to the Owner.

02201.3.6.2 INSTALLATION IN WATER - No backfill, subgrade materials, concrete or masonry footings, foundations, floors, equipment, or pipe shall be placed or laid in water. Water shall not be allowed to rise over such work for at least 24 hours following the pour or placement of any concrete or mortar used in the Work. Water shall not be allowed to rise unequally against structure walls for a period of 14 days following concrete placement or masonry erection.

02201.3.6.3 DISPOSAL - Any water to be removed from the Work site shall be disposed of by the Contractor in a suitable manner without damage to adjacent property.

02201.3.6.4 REFERENCE - See also Section 02200.3.12.

02201.3.7 SCARIFICATION

After excavating to the lowest subgrade elevation shown on the Drawings, and prior to placement of the structure footings or foundation components, unless otherwise directed by the Engineer, the top 6 inches of the subgrade shall be scarified, brought to the proper moisture content, and compacted in accordance with the Table of Minimum Density Requirements below.

02201.3.8 EMBANKMENT FILL AND BACKFILL

02201.3.8.1 ON-SITE BACKFILL MATERIALS - Unless directed otherwise by the Engineer or the Contract Documents, on-site materials complying with Section 02105 shall be used for all embankment, fill and backfill materials. Before on-site material becomes unavailable, and when provisions are not included in the Contract Documents for importing suitable materials, the Contractor shall notify the Engineer so that a change can be negotiated in accordance with the General Conditions.

02201.3.8.2 PLACEMENT IN LIFTS - Unless provided otherwise on the Drawings, suitable embankment fill, backfill, and bedding materials shall be placed in lifts which will be not greater than 6 inches thick after compaction. Bedding materials shall be moisture conditioned (by wetting or drying), before being placed in layers for compaction in accordance with the requirements of the Table of Minimum Density Requirements below.

02201.3.8.3 UNSUITABLE FILL AND BACKFILL MATERIALS - Any unsuitable fill and/or backfill material found within excavated materials, or material with incorrect moisture content shall be removed and replaced. Soft spongy material, causing areas that "pump" when heavy loads are passed over them, shall be removed and replaced with suitable material. Dry material that will not "ball" shall be removed and replaced. The two foregoing conditions shall be considered sufficient evidence, without further testing, that the moisture content is incorrect and shall be grounds for removal and replacement of the material. Such replacement if required shall be at the sole expense of the Contractor, and shall be accomplished prior to placement of any further material.

02201.3.9 COMPACTION

02201.3.9.1 MININUM DENSITY REQUIREMENTS - After placement, all materials shall be thoroughly compacted to not less than the densities indicated in the table below. Compaction shall be achieved and verified in accordance with AASHTO T-99, ASTM D-1556, ASTM D-1557, ASTM D-2922 and/or ASTM D-3017 as applicable.

TABLE OF MINIMUM DENSITY REQUIREMENTS
(based on AASHTO-99 and T-91 and on ASTM D-2922 and E-3017)

Location	From Surface to 2-Feet Below Surface	From 2-Feet Below Surface to Top of Bedding	Bedding
Within 6 feet of, and/or under, any existing or proposed structure, pavement, curb, sidewalk or similar construction included in the Contract:	100% for granular and 95% for non-granular materials	95% for all materials	95% at all locations
Around any structure outside 6 feet:	90% for all materials	90% for all materials	90% at all locations
Cultivated and landscaped areas:	85% for all materials	85% for all materials	85% at all locations
Undeveloped land:	Unconsolidated - see 02201.1.3	Unconsolidated - see 02201.1.3	85% at all locations

02201.3.9.2 OTHER SPECIFICATIONS - For work within state or federal highway rights-of-way, compaction shall meet the requirements of the respective applicable specifications.

02201.3.9.3 COMPACTION EQUIPMENT - Embankment fill and consolidated backfill material shall be compacted with conventional tamping or vibrating compaction equipment of such capacity and weight to achieve the required compaction density. The use of wheel rolling for compaction shall only be approved for compacting unconsolidated backfill materials.

02201.3.9.4 PLACEMENT AGAINST STRUCTURES - Embankment fill or backfilling against cast-in-place concrete structures shall not be started until the concrete has been cured for the time required by these Specifications or prescribed by the Engineer. Compaction within 3 feet of any new or existing structure shall be by hand operated vibratory or tamping equipment.

02201.3.9.5 CONSTRUCTION WATER - The Contractor shall be responsible for obtaining construction water needed for compaction in accordance with Section 02204.

02201.3.10 SETTLING AND SUBSIDENCE

Dips or settlement of fill or backfill in any excavation or embankment within the Work, which occur within the warranty period, shall be repaired by the Contractor at no additional cost to the Owner.

02201.3.11 SAMPLING AND TESTING

02201.3.11.1 INDEPENDENT LABORATORY - The Contractor shall provide all required sampling and testing by an independent qualified testing laboratory as directed by the Engineer.

02201.3.11.2 SCHEDULE OF SAMPLING AND TESTING - The following schedule of sampling and testing provides minimum requirements, to assure compliance with all materials and compaction requirements described herein. The number of samples and tests shown shall be considered minimum, and field conditions may necessitate additional sampling and testing to be required by the Engineer.

GRADATION DETERMINATION (AASHTO T-27 and T-11)

Location	Testing Required
Materials imported or manufactured at a site determined by this contract	One test per site or source
On-site excavated materials along trenches	One test per geographical area where material composition and gradation visually appears consistent.

MOISTURE/DENSITY RELATIONSHIP (Proctor)
(AASHTO T-99 or T-180 Method D)

Location	Testing Required
Materials imported or manufactured at a site determined by this Contract.	One test per site unless the material visually appears to change.
On-site excavated materials along trenches.	One test per geographical area where material composition visually appears consistent.

COMPACTION COMPLIANCE TESTING REQUIREMENTS
(AASHTO T-191 or Portable Nuclear Gauges)

Location	Testing Required
Under Structure footing or foundation	One test per lift for each 100 linear feet.
Within an embankment erected to support a structure under structure floor slabs	One test per lift for each 1,000 square feet.
Within embankments for cultivated or landscaped areas.	One test per lift for each 5,000 square feet.

NOTE: The term "test" shall mean a single test with acceptable results, equal to or better than specified minimums. In the event compaction test results fall below the required minimum density; the Contractor shall re-compact and test the material until a test with acceptable results is obtained.

02201.3.12 GRADING

Upon completion of excavation, the site shall be accurately graded to the spot elevations and slopes shown on the Drawings, to allow proper installation of the structure in accordance with applicable Sections of these Specifications.

02201.4 METHOD OF MEASUREMENT

02201.4.1 NO MEASUREMENT

Separate measurement will not be made for earthwork for structures. Unless the Contract Documents contain provisions for "Solid Rock Excavation", no separate measurement or payment will be made for work requiring rock excavation.

02201.4.2 SEPARATE MEASUREMENT

When listed as a separate item in the Bid Schedule, quantities of solid rock excavation shall be determined by the foot/foot unit, using a tape measure or other accurate measuring device to find the length of cut in lineal feet along the plane of cut and the average depth of cut in the rock and multiplying the two numbers together. This measurement shall include all labor, equipment, materials, and related work, including, but not limited to, ripping, sawing, boring, hammering, blasting, rock trenching, excavating, removing, hauling, and disposal, if required, of the existing bedrock deemed qualified by the Engineer for payment of completed rock excavation.

02201.5 BASIS OF PAYMENT

Payment for earthwork for structures shall be included in the unit prices provided for the respective structure elements listed in the Bid Schedule. When listed as a separate item on the Bid Schedule, payment for "Solid Rock Excavation" will be made as follows:

PAYMENT ITEM	UNIT
Solid Rock Excavation	Foot/Foot

02222.1 DESCRIPTION

This section covers furnishing and installation of pipe and fittings of the type, class and size designated for the water system defined on the Drawings, in these Specifications, and elsewhere in the Contract Documents.

02222.1.1 RELATED WORK

Section 02105 - Earthwork Materials
Section 02200 - Trench Excavation and Backfill
Section 15110 - Pipe and Piping Systems
Section 15230 - Waterline Valves and Hydrants
Section 15232 - Water System Control Valves
Section 15234 - Water Service Connections
Section 15236 - Water Main Flow Meters

02222.1.2 SUBMITTALS

02222.1.2.1 MATERIALS AND EQUIPMENT - The Contractor shall submit for review complete information, showing all pipe, materials, fittings, gaskets, couplings, coatings, linings, supports, mechanical restraints, thrust blocks and configuration prior to the delivery of any components to the project. All information shall be provided in accordance with Section 01300 and written evidence of compliance from the manufacturer shall be provided with each delivery of material.

02222.1.2.2 TESTING - As construction proceeds, the Contractor shall submit test documentation in accordance with this section of these Specifications.

02222.1.3 DEFINITIONS

Fitting - Any component of a pipeline, excluding the pipe itself and valves and meters, which is used for connecting pipe sections; changing line direction or size; connecting meters, valves, tanks, etc.; or starting or terminating pipelines.

Mains - Water distribution pipes, located in streets or rights-of-ways, to which water service connections are made for users of the system.

Run - Any identified section of a pipeline.

Saddle - A fitting placed on a pipe to reinforce the pipe wall, through which a tapping hole is drilled.

Service Lateral – The line which connects to the water meter or to the service stub at the property line extending from there, on private property, to the plumbing at the foundation of a house or business.

Service Stub – The line running from the tap on a main to the meter or to the property line as appropriate.

Tap - The actual connection made to water mains which includes drilling an opening into the main, threading, installing a tapping saddle when appropriate, and installing a valve into the opening.

02222.2 MATERIALS

02222.2.1 PIPE AND FITTINGS

See Section 15110

02222.2.2 PIPELINE LOCATION IDENTIFIERS

Pipeline location identifiers generally take the form of marker posts, warning tape, and tracer wire.

02222.2.2.1 TRACER WIRE - Unless otherwise described on the plans or herein, the tracer wire shall be an insulated, #12, direct bury copper wire designed and manufactured for this purpose.

02222.2.2.2 WARNING TAPE - The warning tape shall be an inert, plastic, direct bury type with a 2-inch minimum width, of the appropriate safety color, and specifically manufactured for underground utility identification. The tape shall have wording imprinted on it identifying the type of utility it is protecting.

02222.2.2.3 MARKING POSTS - Shall be fiberglass compound, aluminum, or other corrosion resistant metal of 5 foot length and 4 inches wide, or otherwise as shown on the Drawings. They shall be fitted with a deterioration resistant warning notice or label appropriate to the application.

02222.2.3 MISCELLANEOUS FITTINGS AND MATERIALS

02222.2.3.1 POLYETHYLENE ENCASEMENT - Where soil conditions are determined to be severely corrosive and when shown on the Drawings or required in the Contract Documents, tubular polyethylene encasement shall be installed around buried ductile iron piping and fittings in accordance with ANSI/AWWA C-105.

02222.2.3.2 CASING PIPE - Where casing pipe is called for on the Drawings or is required by the Engineer, the Contractor shall furnish and install the casing in accordance with Sections 02315 and 02320 of these specifications.

02222.2.3.3 PIPE PENETRATION OR CASING SEALS - Where required on the Drawings or in these Specifications, the Contractor shall furnish and install pipe-to-wall linked rubber seals in core drilled structures, walls, pipe sleeves, or casings in accordance with the manufacturer's instructions. Seals shall be link seals by Thunderline Corporation, or an approved equal.

02222.2.3.4 PIPE RESTRAINTS – Pipe restraints shall be as follows:

- Concrete thrust blocking shall be formed, sized, and placed as described herein and shown on the Drawings. Reinforcing bars used in thrust block construction shall be preformed and fusion bonded epoxy coated.

- Mechanical restraint of piping shall be accomplished with one of the following restraining systems or an approved equal:

  ⇒ Grooved Ductile Iron AWWA Couplings by Victaulic Company of America (use only with exposed piping systems).

  ⇒ MEGALUG thrust restraints by EBAA Iron Sales, Inc.

⇒ FIELDLOK restraint gaskets by U.S. Pipe Company. Without the written approval of the Engineer, use of this restraint device is limited to joints in carrier pipe installed in a casing pipe.

All joints of pipe installed under streambeds or canal crossings, or installed in casing pipes, shall be protected with mechanical restraint.

Restraint protection of above ground or exposed piping in buildings or enclosures shall be accomplished only with mechanical restraints.

02222.3 CONSTRUCTION REQUIREMENTS

02222.3.1 HANDLING AND APPROVAL OR REJECTION OF MATERIALS

All materials delivered to and used at the job site are subject to approval of the Engineer or the Owner. Care shall be taken during handling of pipe, to avoid any impact which might cause damage. Dropping pipe during unloading will not be permitted. Pipe will be carefully inspected in the field before and after laying. If any cause for rejection is discovered in a pipe before or after laying, it shall be removed and replaced by the Contractor, at no additional cost to the Owner. Any pipe found to be unfit or rejected due to cracks, broken bells or spigots, irreparable chipped lining, etc., shall be removed from the job site.

02222.3.2 DIAGRAMMATIC LAYOUT

Piping layout on the Drawings shall be considered diagrammatic for all piping not shown with detailed dimensions. When this is the case, pipe size and location are provided, but the Drawings are not intended to show every offset, fitting, or structural difficulty that will be encountered during project construction.

02222.3.3 ALTERATION OF ALIGNMENT

At no additional cost to the Owner, and with written permission from the Engineer, piping alignment may be varied from that shown on the Drawings, to avoid structural or mechanical difficulties, or to avoid the work of other trades. The Contractor still will be liable to provide all materials and labor required to complete all work in accordance with the best practice of the trade, and to the satisfaction of the Engineer.

02222.3.4 INSTALLATION

02222.3.4.1 DEWATERING - Prior to pipe laying and jointing, sufficient dewatering effort shall be provided to maintain the ground water level at or below the surface of the trench bottom or base of the bedding course. The dewatering operation; however accomplished, shall be carried out in such a manner as to not permanently disturb natural underground water conditions.

02222.3.4.2 CONNECTION TO EXISTING FACILITIES - When connections are to be made to any existing pipe or appurtenances, for which the actual elevation or position cannot be determined without excavation, the Contractor shall excavate for, and expose the existing pipe or appurtenances before laying any new pipe. The Engineer shall be allowed to inspect the existing pipe or appurtenances before any connection is made. The Contractor shall make any adjustments in line or grade which may be necessary to accomplish the intent shown on the Drawings.

Where new fittings, valves, meters, restraints etc., are required to be installed in, or attached to, existing piping, or where connections are to be made to existing piping, the Contractor shall furnish and install the necessary components needed to accomplish the work, whether or not specifically indicated on the Drawings.

02222.3.4.3 CAPPING PIPE END - At the close of each workday, or whenever the work ceases for any reason, the end of the pipe shall be securely closed, unless otherwise permitted by the Engineer.

02222.3.4.4 JOINING – Joining of pipe shall be as follows:

- When making connections, pipe shall be cut and beveled in a neat and workmanlike manner, so as to provide a smooth, beveled end at right angles to the axis of the pipe. Pipe and fittings shall be assembled so there will be no distortion or springing of the pipelines. Flanges, unions, flexible couplings and other connections shall come together at the proper orientation. The fit shall not be made by springing any piping, nor shall orientation or alignment be corrected by taking up on any flange bolts. Flange bolts, union halves, flexible connectors, etc., shall slip freely into place. If the proper fit is not obtained, the piping shall be altered to fit.

- PVC pipe, 2 inches and smaller in diameter, shall be joined by solvent welding. No disturbance of joints, including from trench backfill operations, will be allowed until solvent welded joints are cured.

- PVC pipe, larger than 2 inches in diameter, shall be joined by means of gasketed joints.

- With bell and spigot joints, care should be taken to properly align the pipe before joints are forced home. Gaskets shall be lubricated in accordance with manufacturer's instructions. During insertion of the spigot end, the pipe shall be partially supported by hand, sling, or crane to minimize unequal lateral pressure on the gasket and to maintain concentricity until the gasket is properly positioned. Since the most flexible gasketed joints tend to creep apart when the end pipe is deflected and straightened, such movement shall be held to a minimum once the joint is home.

- Where fusion of polyethylene pipe joints is required, sections of pipe shall be joined in a continuous length on the job site above ground. Joining shall be by the butt fusion method and shall be performed in strict accordance with the pipe manufacturer's recommendations. Equipment used for butt fusion joining shall be capable of meeting all conditions recommended by the pipe manufacturer, including, but not limited to, temperature requirements, alignment, and fusion pressures.

02222.3.4.5 LAYING - All pipe laid shall be retained in position, using mechanical means if necessary, so as to maintain alignment and joint closure until sufficient pipe bedding and backfill have been completed to adequately hold the pipe in place. All pipe shall be laid to conform to the prescribed line and grade shown on the plans, within specified limits. No blocking of any kind shall be used to adjust the pipe to grade, except when used with concrete embedment. Bedding materials shall be placed so the bottom surface of the pipe will have full bearing for the entire barrel length. The pipe shall rest on not less than 1/4 of its outside perimeter. Bell holes shall be dug as required to assure uniform support along the barrel but shall be no larger than necessary.

Unless otherwise approved by the Engineer, pipe shall be laid upgrade from the point of connection on the existing pipeline or from a designated starting point. Pipe shall be installed with the bell end forward or upgrade, unless approved otherwise. When pipe laying is not in progress, the forward end of the pipe shall be kept closed with an approved temporary plug.

02222.3.4.6 PIPE RESTRAINT – Pipe restraint work shall be as follows:

- The Contractor shall provide and install either concrete thrust blocks or mechanical pipe restraints on all pressure piping not connected with bolted flanges or welded joints.
- For projects involving pipeline construction covered under this section of the Specifications, a pipe restraint schedule is included in the Drawings. Pipe restraints (thrust blocks and/or mechanical restraints) shall be furnished and/or constructed and installed as shown on the Drawings and described in the schedule.
- Pressure pipe shall be properly blocked or restrained at all fittings, wherever the pipeline makes a change in direction of 11.25 degrees or more, wherever it changes sizes, or wherever it ends.
- Placement of concrete thrust blocking shall provide bearing against undisturbed vertical earth banks or approved compacted backfill, sufficient to absorb thrust from line pressure, and in a configuration so that pipe joints and fittings will be accessible.
- All restraints shall be in place before any hydrostatic testing and flushing are performed on the system.
- The Contractor shall allow visual inspection of every thrust block or mechanical restraint before it is buried.

02222.3.4.7 FINISH BEDDING - After the pipe is laid, additional bedding material shall be placed in 6-inch lifts to a level even with the spring line of the pipe and compacted. The portion of the trench from the spring line to 12 inches above the top of the pipe shall then be filled and compacted in the same way.

02222.3.4.8 REQUIREMENTS FOR INSTALLATION NEAR SEWER LINES - Locate potable water piping at least 10 feet horizontally (measured edge to edge) from any existing or proposed parallel sewer or wastewater leach line. Should conditions prevent the 10-foot separation, the water line may be laid closer than 10 feet to sewer lines (but not leach lines) provided:

- The water line is laid 18 inches above the top of the sewer line, but deep enough to prevent freezing, and
- The water line is laid in a separate trench, or
- The water line is laid on an undisturbed earth shelf on one side of the sewer line trench, or
- The water line is laid in a sewer or drain line trench, which has been backfilled and compacted to not less than 95% of maximum density, as determined by ASTM D-690.

Where potable water lines cross sewer lines, the bottom of the water line shall be at least 18 inches above the top of the sewer line for ten feet on each side of the sewer line, measuring perpendicularly from the water line to the sewer line. When such vertical separation is impossible to achieve, a vertical separation of less than 18 inches may be allowed provided:

- In new construction for both water line and sewer line they shall be constructed of ductile iron pipe or thermoplastic pipe joined by either mechanical or bolted flange joints. Thermoplastic pipe may also use solvent welded joints. In situations with an existing sewer line, the new water line shall be constructed as previously described.

- And, when making such crossing, install the water line in such manner that the center of a full length of pipe is on the centerline of the sewer line to isolate the water line joints as far as possible from the sewer line.

02222.3.4.9 EXPOSED PIPING - No exposed piping shall be installed until all equipment to which the pipe is to be attached has been installed and it can be determined where piping and fittings shall be located to make a neat, efficient arrangement. Piping shall be aligned with equipment connections such that no external load or stress will be transferred to any equipment from the piping. Piping shall be installed with a sufficient number of unions, flexible couplings, or flanged joints, in addition to those shown on the Drawings, to allow for convenient inspection and maintenance.

Exposed pipe work shall be suspended or supported, to prevent sagging or over-stressing of the pipe and connections. Assembly of pipe and fittings shall be accomplished so there will be no distortion or springing of the pipe. The fit shall not be made nor the alignment corrected by taking up on any flange bolts. Joints shall come together in proper orientation, and Flange bolts, union halves, flexible couplings, and etc. shall slip freely into place. If the proper fit is not obtained, the piping shall be altered to make the fit meeting the above requirements.

Exposed pipe shall be installed in straight runs parallel to the axis of the structures. Pipe runs shall be horizontal and vertical; except that gravity drain lines shall be pitched down in the direction of flow at a slope not less than 1/8 inch per foot.

All exposed pipe shall be painted in accordance with Section 09910 of these Specifications. Factory finished items are not required to be field painted except touch-up. The color and type of paint used shall be submitted to the Engineer for his approval.

02222.3.4.10 DRAINS AND OTHER SYSTEMS - In addition to other requirements in this Section, all irrigation and other lines fitted with drains shall be installed such that continuous slope is maintained to designated drain locations. In areas where there are both culinary water pipelines and irrigation pipelines, exposed portions of irrigation water piping shall be identified by distinctive coloring or other marking. Culinary and irrigation lines and extensions shall be completely separated, installed in separate trenches, and there shall be no cross-connection between the systems under any circumstances.

02222.3.5 SPECIAL CONSIDERATIONS FOR HDPE PIPE

02222.3.5.1 HANDLING AND STORAGE – Polyethylene pipe is able to withstand normal installation handling. However, unusually rough handling of polyethylene pipe can result in damage to the pipe wall. Care shall be taken to avoid pushing or pulling polyethylene pipe over or around sharp projections. Polyethylene pipe is subject to impact damage when dropped from excessive heights or when heavy objects are dropped upon it, particularly during cold weather. Kinking or buckling shall be avoided and any section of pipe which has been damaged in this manner shall be cut out and replaced. If a scratch depth is greater than 10% of the pipe wall thickness, then the section shall be removed and replaced.

02222.3.5.2 FUSION JOINT INSPECTION – The field technique for evaluating a butt fusion joint is bead appearance. The recommended procedures should result in the desired appearance. The Contractor shall inspect the entire circumference of the fused joint for uniform non-porous bead alignment. Improper fusion shall be redone. The Contractor shall comply with the Butt Fusion Joint Appearance Guide recommended by the manufacturer.

02222.3.5.3 PIPE PLACEMENT – Polyethylene pipe can be joined either above ground or in the ditch as the situation dictates. Though most joining can be accomplished above ground, joining which must be done in the ditch shall be well planned to ensure that enough space is available and that proper

alignment is achieved. Care shall be taken to avoid buckling, gouging, and other mechanical damage when lowering polyethylene pipe into the ditch. The pipe should be laid so that there are no bends with a radius less than 20 times the pipe diameter and no joints within 3 feet of any bends. (90 times the pipe diameter at fusions.)

- Align all pipe and fitting joints true to line and grade. Extremely cold weather makes polyethylene pipe stiffer and increases the likelihood of impact damage.

- Because plastic pipe contracts as it cools, it is desirable in hot weather to snake the pipe in the bottom of the trench. This provides for "slack" in the pipeline to be taken up as the pipe cools and contracts in the ditch prior to backfilling. It is recommended that backfilling be accomplished after the pipe has cooled in the shade of the trench.

02222.3.5.4 HYDROSTATIC LEAK TESTING – Hydrostatic testing of the HDPE pipeline shall be performed on as complete of sections of the installed pipeline as possible and in the presence of the Engineer. Hydrostatic testing procedures shall be as described by "DriscoPlex" Bulletin: PP 802-TN, Test Phase Alternate #1 (www.driscoplex.com). Under no conditions except with the written consent of the Engineer shall pneumatic testing be allowed. Pressure recordings and other testing data shall be kept by the Contractor and supplied to the Engineer upon successful completion of the testing procedures.

02222.3.6 FLUSHING AND CLEANING

02222.3.6.1 FLUSHING WITH WATER - Prior to proceeding with pressure testing (and/or disinfection if required) of completed lines, the Contractor shall fill the test section with clean, potable water and flush the lines. The Contractor shall furnish all equipment and labor to complete the flushing as required by this section. Water for flushing shall be provided by the Owner.

02222.3.6.2 DIFFICULT CONTAMINANTS - Certain contaminants, especially in caked deposits, resist flushing at any velocity. If, in the opinion of the Engineer, such contaminants have entered the line during construction, the interior of the pipe shall be swabbed, as necessary, to remove the debris prior to proceeding with flushing.

02222.3.6.3 MINIMUM FLUSHING FLOW AND VELOCITY - The Contractor shall make all arrangements, to establish a minimum 2.5 feet per second (fps) flow velocity in the line during the flush. Flushing shall proceed until the installed pipe is free of debris. The flows needed to produce the required flushing velocity indicated above are provided in the table below.

FLUSHING FLOW AND VELOCITY

Pipe Diameter (inches)	Flow (gpm) to Produce 2.5 fps
4	100
6	200
8	400
10	600
12	900
16	1600

NOTE: With 40 psi residual pressure, 2 1/2 inch and 4-1/2 inch hydrant outlet nozzles will have the ability to discharge approximately 1,000 GPM and 2,500 GPM respectively.

02222.3.7 TESTING

The Contractor shall perform all testing, and shall furnish all materials, equipment, and labor necessary to complete this work as required. Any work that fails to meet the acceptance criteria of prescribed testing shall be repaired and/or replaced at no additional cost to the owner. All repaired work shall be re-tested. This sequence shall be repeated until the work meets the acceptance criteria.

02222.3.7.1 PRESSURE TESTING - All pipelines constructed for carrying potable, non-potable, and water-borne products shall be pressure tested for leakage when they are completely assembled, unless directed otherwise in these Specifications or in writing by the Engineer.

WARNING - The hydrostatic test procedures described herein are not applicable to air pressure testing.

Prior to pressurization all required flushing shall have been completed. Pipeline sections to be tested shall be isolated from any connecting lines. Air release taps shall be provided at points of highest elevation, the test section shall be filled with clean potable water, and all air shall be removed from the line. Pressure on the test section shall then be brought to full test pressure and maintained at that level for a period of not less than 4 hours. Pipelines shall be tested at 50 psi over normal static pressures shown on the Drawings or to the manufacturer's class rating, which ever is lower. Permanent plugs shall be inserted into the air release tap holes after the test has been completed.

02222.3.7.2 LEAKAGE TESTING - The leakage test shall be conducted concurrent with the pressure test. Amount of leakage, if any, will be determined by measuring the quantity of additional water required to maintain the prescribed hydrostatic pressure test during the test period. Accurate means shall be provided to measure the quantity of water required to maintain full pressure on the line for the 4 hour test period, the measured leak rate shall not exceed the rate "L" computed as follows:

$$L = SD(P^{0.5})/133{,}200$$

where:
L = Leakage rate (gal/hour)
S = Length of tested pipe (feet)
D = Nominal diameter of pipe (inches)
P = Average test pressure (psi)

When the allowed amount of leakage is exceeded, leaks shall be located and repaired and the system shall then be re-tested by the Contractor until compliance is achieved.

All visible leaks in exposed pipe shall be repaired.

02222.3.7.3 OPERATIONAL TESTING (*pressurized irrigation only*) - Pressurized irrigation systems shall be tested for proper system operation after backfill is in place and sprinkler heads have been adjusted to final position. This test shall demonstrate that the system meets coverage requirements (based on operation of one circuit at a time) and that all automatic controls function properly.

02222.3.7.4 NON-RIGID PIPE DEFLECTION TESTING - At the Engineer's request, the Contractor shall test requested portions of all non-rigid pipe after being installed and backfilled to ensure that circumferential deflection does not exceed 5% of the diameter. Such test will consist of passing a mandrel through an open section of pipe, sized appropriately to detect non-compliance. The mandrel shall be sized in accordance with the requirements provided in Section 02224 for checking sewer pipe. In the event deflection non-compliance is found, the Contractor shall make

repairs as outlined in Section 02224 and additional testing of other sections of pipe will be requested.

02222.3.7.5 TESTING DOCUMENTATION - The Contractor shall maintain a record of all testing performed, together with the test results obtained, for each line installed under this Contract. Minimum information to be included in these records shall be as follows:

- All Documents:
  - Date of issuance of the record
  - Name of Contract
  - Contractor's name and address

- Disinfection Report:
  - Name and address of treatment supervisor
  - Disinfection method used
  - Location and boundary description of section to be disinfected
  - Time and date of disinfectant introduction
  - Time and date of disinfectant release
  - Initial disinfectant residual (PPM) for each outlet tested
  - Time and date of flushing after disinfection
  - Signature of treatment supervisor (signifies completion of disinfection activities)

- Bacteriological Report:
  - Date issued
  - Project name and location
  - Laboratory's name, certification number, address and phone number
  - Test location
  - Time and date of sample collection
  - Name of person collecting sample
  - Time and date of laboratory test start
  - Coliform bacteria test results for each sample
  - Certification that water conforms (or fails to conform) to bacterial standards of the appropriate state public drinking water regulations
  - Bacteriologist's signature

- Test Report:
  - Type of test
  - Location of test
  - Sizes, types, and lengths of pipe in test section, and test boundary description
  - Date and Time test started
  - Date and Time test completed
  - Test pressure (*Pressure Test only*)
  - Amount of leakage/allowable leakage (*Pressure Test only*)
  - Mandrel dimensions(*Obstruction and Non-Rigid Pipe Deflection Tests only*)
  - Test result (*pass/fail*) (*All Tests*)
  - Printed Name/Signature and Date of Test Supervisor (Contractor's representative) (*All Tests*)
  - Printed Name/Signature of Inspector (Engineer's representative) witnessing and approving the test (*All Tests*)

02222.3.8 DISINFECTION

02222.3.8.1 REGULATORY COMPLIANCE - All pipelines to be used for culinary water service shall be disinfected in accordance with the requirements of state and local public drinking water regulations.

02222.3.8.2 METHODS - The Contractor may use any method which complies with the above referenced standards; however, the "slug method", prescribed in ANSI/AWWA C-651, is preferred. This method basically consists of filling the line with potable water and then injecting a "slug" of concentrated chlorine solution (100 mg/L) at the upstream end of the line. The "slug" is then moved through the line by slowly draining the low end. When properly conducted, this procedure provides contact to the interior pipe surfaces with a heavily concentrated dose of chlorine to achieve disinfection.

02222.3.8.3 FLUSHING - After disinfection, the lines shall be flushed until residual chlorine is reduced to the levels safe for consumption. Samples for bacteriological testing can then be taken. The Contractor shall safely and legally dispose of contaminated water used for disinfection after consultation with the local authorities. Under no circumstances shall heavily chlorinated water be allowed to mix with "live" waters, meaning waters in lakes, rivers, streams or wetlands.

02222.3.9 PIPELINE LOCATION IDENTIFIERS

The Contractor shall furnish and install such identifiers as shown on the Drawings and/or prescribed in these Specifications.

02222.3.9.1 TRACER WIRE – Tracer wire shall always be installed in the trench with non-metallic pipelines, during or immediately following their installation and may be required in the installation of metallic pipelines where electric conductance is necessary and is not provided through the pipeline because of its type of construction. Tracer wire placement shall be as shown on the Plans but shall generally be immediately beneath (preferred), to the side, or above the pipeline with approximately 4 inches of separation. Tracer wire shall be brought to the surface of the ground at all valves and risers and where otherwise shown on the plans.

Tracer wire shall be installed as shown in the Plan details. Where splices in the wire are required, the Contractor shall solder the wire connections. Tee splices shall be made with a minimum of 4 turns wrapped tightly around the bared portion of the main tracer. Do not cut main tracer wire. Line splices shall be made by crossing the two bare sections of wire with a minimum of 4 turns in opposite directions as shown in splice detail. Solder and finish connection using a no. 1 welding tip with a soft non-carbonizing flame or a propane torch, using rosin flux and 60/40 rosin core solder. Do not use acid core solder under any circumstances. Use only enough heat to insure a smooth solder joint. Heat should be applied to the wire, not to the solder. Heat the connection for a few seconds and touch the end of the solder to the joint; when the proper temperature is achieved, the solder will melt and flow freely around the connection. Allow the wire to cool and do not move while cooling. Insulate by applying several turns of 3 m 88 or approved equal electrical tape around the soldered joint. Extend the tape well over the wire insulation in all directions.

Some soil conditions and/or installation circumstances may require the additional installation of cathodic protection for the tracer wire. When this is the case, cathodic protection will appear as a separate bid item and details for its installation will appear on the Plans and elsewhere in these Specifications.

02222.3.9.2 WARNING TAPE – A continuous ribbon of warning tape shall be installed during the backfill operation. Tape shall be placed 12-inches above the top of the pipeline or otherwise as shown on

the drawings. At roll ends and at places where the tape has been broken, the loose ends shall be tied together to prevent separation during the rest of backfill.

02222.3.9.3 MARKING POSTS – Marking posts shall be installed at the placement intervals shown on the Plans. Posts shall not be deformed or damaged during installation. The Contractor shall use a post hole digger to install markers when there is danger of damage to posts from pounding or hammering

02222.3.10 CLEANUP

Following acceptance of testing and completion of backfilling and surface restoration, the Contractor shall prepare the work for contract closeout in accordance with Section 01200 of these Specifications.

02222.4 METHOD OF MEASUREMENT

02222.4.1 BURIED WATER LINES

The amount of buried water line pipe shall be determined by measuring the lineal feet of pipe in place and accepted, including the lengths of fittings, valves, couplings, and portions of pipe within casings, unless called out otherwise in the Contract Documents.

Measurement of lines passing through, or connecting to control valves or other operating devices enclosed in vaults or manholes, shall be made only up to the pay limit of the enclosure or vault as shown on the Drawings. If no pay limit is shown, measurement will be made to a point five (5) feet outside of the enclosure.

Measurement of ductile iron pipe shall include polyethylene encasement where that material is required.

02222.4.2 PIPELINE LOCATION IDENTIFIERS

Measurement of tracer wire and location markers installed with non-metallic pipe shall be included in the measurement of the waterline pipe unless they are separate bid items in which case measurement for tracer wire shall be the same as the length of waterline installed and location markers shall be measured by counting the number of markers installed.

02222.4.3 EXPOSED PIPELINES

Exposed water pipe shall not be measured in connection with the installation of water lines but shall be included in the measurement of the structure or facility where the exposed pipe is located, and payment for such pipe shall be included in the payment for those bid items.

02222.4.4 FITTINGS

Unless specifically called out for separate payment on the Bid Schedule, fittings for pipelines and piping systems will be considered appurtenant to the line or system being installed, and measurement for such fittings will be included in the measurement for that pipeline or piping system.

02222.4.5 MISCELLANEOUS

Separate measurement for valves and vaults and enclosures and their contents will be as described in other sections of these Specifications.

02222.5 BASIS OF PAYMENT

The accepted quantities will be paid for at the contract unit price for:

PAY ITEM	UNIT
PVC Pipe (*Class*) [AWWA C-900] or [*Pressure rated*] (*size*)	Lineal Foot
DI Pipe (*Class*) (*size*)	Lineal Foot
HDPE Pipe [IPS] or [DIPS] C906 SDR (#) (size)	Lineal Foot
Galvanized Iron Pipe (*Schedule*) (*size*)	Lineal Foot
Pipeline Location Markers	Each

No separate payment will be made for fittings unless called for on the Bid Schedule.

WATERLINE PIPE INSTALLATION

SECTION 02222SP

The following shall be added to Standard Specification 02222.2

02222.2.4 STEEL PIPE

The pipe shall be ASTM A53, Grade B, which conforms to ANSI/AWWA C200. The pipe diameter and wall thickness shall be as shown on the Drawings.

The following shall be added to Standard Specification 02222.3

02222.3.11 WELDERS' QUALIFICATIONS - All welding shall be done by welders qualified under the provisions of ANSI/AWS D1.1. Qualification shall have been performed by an approved, independent, testing agency not more than 6 months prior to commencing work. Welding machines and electrodes similar to those to be used on the Project shall have been used in the qualification test. The Contractor shall furnish all material and bear the expense of qualifying welders.

The following shall be added to Standard Specification 02222.4

2222.4.6 TEMPORARY BYPASS PIPING
Measurement of temporary site piping required to ensure that full flow of water be delivered to the fish at all times during construction shall be lump sum. Measurement shall include all piping, shoring, bracing, connections and labor required to install temporary piping and removing the piping after construction.

2222.4.7 MISC. PIPE CONNECTIONS
Measurement of misc. pipe connections required to tie all new piping to existing features shall be lump sum and shall include all piping, supports, labor and any incidental materials or equipment required to make all connections as shown on the Drawings.

2222.4.8 WELDED STEEL SPRING LINE (12" & 14" Diameter)
Measurement for welded spring line shall be made by measuring the lineal foot of pipe in place and accepted, including the lengths of fittings, couplings, and supports as shown on the drawings.

The following shall be added to Standard Specification 02222.5

The accepted quantity will be paid for at the contract unit price for:

PAY ITEM	UNIT
Temporary Site Piping	Lump Sum
Misc. Pipe Connections	Lump Sum
(size) Welded Steel Spring Line	Lineal Foot

02226.1 DESCRIPTION

Includes furnishing all labor, equipment and materials required to install pipe, dispose of unsuitable materials, perform trench backfilling and compaction in conformance with Section 02200 and provide pavement restorations in conformance with Section 02500.

02226.1.1 RELATED WORK

Section 02105 - Earthwork Materials
Section 02200 - Trench Excavation and Backfill
Section 02500 - Removal and Replacement of Surface Improvements

02226.1.2 SUBMITTALS

Submit manufacturer's certification that all material furnished is in compliance with specifications, standard references, and contract requirements in accordance with Section 01300.

02226.1.3 DEFINITIONS

Pipe Zone - The area around the pipe in the trench width and up to 12-inches over the pipe.

Drainage Pipe - Perforated and non-perforated pipe used for collection and transmission of subsurface drainage.

Culvert - Pipe used for transmission of surface water under and around roadways.

02226.2 MATERIALS

The Contractor shall not change pipe size, material or class without written approval from the Engineer. Provide the type, class and size of pipe shown on the Drawings and conforming to the following:

02226.2.1 REINFORCED CONCRETE PIPE

Use Class A or B with Type II cement, which conforms to AASHTO M-170. Elliptical pipe shall be Class A or B, which conforms to AASHTO M-207 with tongue and grove joints.

02226.2.2 CORRUGATED POLYETHYLENE CULVERT PIPE

Corrugated polyethylene culvert pipe shall be Class A or B conforming to the requirements of AASHTO M-294.

02226.2.3 CORRUGATED GALVANIZED STEEL PIPE AND PIPE-ARCH

Corrugated galvanized steel pipe and pipe-arch shall be Class A, B or C, which conforms to the requirements of AASHTO M-36.

02226.2.4 CORRUGATED ALUMINUM PIPE AND PIPE-ARCH

Corrugated aluminum pipe and pipe-arch shall be Class A, B or C, which conforms to the requirements of AASHTO M-196 and M-197.

02226.2.5 PVC DRAIN PIPE

Solid wall and perforated drain pipe with rubber gasketed joints, which conforms to the requirements of ASTM D2729. Perforation shall follow the ASTM D2729 perforation pattern of 2, one-half inch holes 120° apart with 5-inch spacing.

02226.2.6 PE DRAIN PIPE

Corrugated solid wall and perforated drainpipe with rubber gasketed joints, which shall conform to ASTM F405.

02226.2.7 DRAIN GRAVEL

Drain Gravel shall comply with the requirements provided in Section 02105.

02226.2.8 GEOTEXTILE FABRIC

Geotextile Fabric shall be as called for on the Drawings and specified in Section 02950.

02226.3 CONSTRUCTION REQUIREMENTS

02226.3.1 HANDLING AND STORAGE OF PIPE

The Contractor shall handle and store pipe to prevent damage by crushing or piercing and in such a way as to prevent contamination. Any pipe delivered to the Work site, which does not conform to specifications or is scratched, bent, cracked, chipped or otherwise damaged, shall be rejected. The Contractor shall protect pipe and components against dirt and damage during shipment and storage and shall store pipe in strict conformance with the manufacturer's recommendations. The Contractor shall not store PE or PVC plastic pipe in direct sunlight for more than 30 days.

02226.3.2 PREPARATION

The Contractor shall verify location of existing utilities and structures ahead of pipe laying operation. If pipe adjustment is necessary due to location of other utilities, secure approval from Engineer prior to proceeding.

02226.3.3 TRENCHWORK

The Contractor shall excavate trenches in accordance with Section 02200. The Contractor shall repair unstable subgrade for pipe installation by over-excavating to stable soils or a minimum 8-inches depth and replace with approved stabilization material.

02226.3.4 DEWATERING

The Contractor shall keep the pipe trenches free from water during pipe installation by a method acceptable to the Engineer.

The Contractor shall be responsible for damages of any nature resulting from the dewatering operations, notwithstanding approval of the method by the Engineer.

02226.3.5 SHORING

The Contractor shall provide trench shoring and protection in accordance with applicable OSHA standards and Section 01510.

02226.3.6 INSTALLATION

02226.3.6.1 PLACEMENT – Pipe placement shall be as follows:

- The Contractor shall handle and install pipe as per manufacturer's specific instructions.
- The Contractor shall make bellholes and depressions only of such length, depth and width as required for properly accommodating the particular type of pipe joint being installed.
- The Contractor shall join pipe in accordance with manufacturer's recommendation or as specified in piping specification section.
- Pipelines shall be laid on uniform grades.
- Do not install pipe at a grade less than 0.5%.
- Lay gravity flow pipe upgrade beginning at lower end.
- Pipe shall not be installed without continuous support under the barrel.
- The Contractor shall obtain written approval from the Engineer to deflect pipe from true line and grade. Do not exceed deflection allowed by pipe manufacturer's recommendation.
- The Contractor shall not lay pipe in water or when trench conditions or weather are unsuitable for such work.
- The Contractor shall place circular concrete pipe which contains elliptical reinforcing so that the reference lines designating the top of the pipes will not be more than 5° from the vertical plane through the longitudinal axis of the pipe.
- Not more than 300 feet of continuous pipe placement will be allowed without the installation of an inlet box, catch basin, combination box, clean-out box, manhole or other such structure.

02226.3.6.2 CUTTING TOOL - The Contractor shall use an approved machine or cutting tool recommended by the pipe manufacturer to cut pipe.

02226.3.6.3 DAMAGED PIPE - The Contractor shall remove and relay any section of pipe already placed which is found to be out of alignment, defective or damaged.

02226.3.6.4 PLUGS - The Contractor shall provide plugs for pipeline branches, stubs or other open ends, which are not to be immediately connected. The Contractor shall use a joint comparable to the main line joints and thrust block as required to secure plugs.

02226.3.6.5 GALVANIZED PIPE - The Contractor shall provide protection to galvanized pipe to prevent scratches or abrasion and assure that the coating is not damaged. Remove and replace damaged pipe sections when directed by the Engineer. Provide proper facilities for lowering sections of pipe into trenches.

02226.3.6.6 CONNECTION TO CONCRETE - The Contractor shall form, size and finish structures connecting piping in accordance with the details of the Drawings and Section 03100. The Contractor shall install mortar in joints at catch basins, clean-outs, manholes, etc. Remove all loose material and soil from the surface on which concrete will be placed. Non-metallic pipe shall be thoroughly wetted prior to pouring the collars.

02226.3.6.7 PIPE BEDDING - Unless otherwise shown on these Contract Documents, culverts shall be bedded with on site bedding materials or imported bedding, which conforms to Section 02105. Drainage piping shall be bedded in accordance with the details shown on the Drawings with material which also conforms to Section 02105.

02226.3.6.8 BACKFILL - The Contractor shall compact trench backfill in accordance with the requirements of Section 02200 and 02222.

02226.3.7 INSPECTION

Prior to starting backfill of trenches, the Contractor shall notify the Engineer of completion of pipe laying and allow the Engineer to check all installed drain piping and culverts. When access to installed pipe is determined necessary for checking by the Engineer, the Contractor shall open any covering as requested. If defects are found, the Contractor shall make the necessary corrections at no cost to the Owner. If no defects are found, the cost of uncovering and recovering shall be an additional expense covered by the Owner in accordance with the General Conditions (Section 00700).

02226.4 METHOD OF MEASUREMENT

02226.4.1 PIPE AND CULVERTS

Measurement of drainage piping and culverts shall be made by using a tape measure or other accurate measuring device to determine the number of lineal feet of pipe or culvert, along the centerline of the pipe, installed and accepted. This measurement shall include the lengths of all in-line fittings and shall stand as the measurement of all other work involved with the pipe installation such as trenching, backfilling, and site restoration as required.

02226.4.2 ENTRANCE AND EXIT STRUCTURES

Measurement of culvert or drainage pipe entrance and exit structures and measurement of culvert end sections shall be separate from the lineal measurement of the pipe and shall be made by counting the number of such structures built and accepted.

02226.4.3 OTHER WORK AND MATERIALS

The method of measurement for other work and materials such as drain rock, geotextile fabric, and import bedding and backfill will be described separately when called for on the Drawings, in these Specifications, or required by the Engineer.

02226.4.4 DEWATERING

Dewatering of trenches is considered incidental to the construction. The Contractor shall include all associated costs for trench dewatering in the lump sum contract price.

02226.5 BASIS OF PAYMENT

The accepted quantities will be paid for at the contract unit price for:

PAY ITEM	UNIT
(Diameter, Type) Culvert Pipe	Lineal Foot
(Diameter, Type) Drain Pipe	Lineal Foot
Entrance/Exit Structures	Each
Culvert End Section	Each

Payment for other materials, (i.e., drain rock, imported bedding and backfill, geotextile fabrics, etc.) will be made in accordance with their respective specification requirement.

02500.1 DESCRIPTION

This work includes removal and restoration of existing features, public or private, including but not limited to asphalt or concrete pavement, concrete structures, curb and gutter, sidewalk, gravel surfacing, driveways, crosswalks, landscaping, field crops, irrigation ditches, fences, culverts, buried or exposed utilities, abandoned utilities, small utility buildings and the disposal of resulting waste materials and debris.

02500.1.1 RELATED WORK

Section 01510 - Protection of Existing Properties
Section 02015 - Clearing and Grubbing
Section 02200 - Trench Excavation and Backfill
Section 02511 - Hot Plant Mix Bituminous Surfacing
Section 02520 - Pavement Cutting
Section 02900 - Landscaping

02500.1.2 SUBMITTALS

When any improvement not owned by the Owner is designated for restoration work, then, upon completion of such restoration, the Contractor shall obtain a written statement of acceptance or release from the responsible owner of the feature. This statement, in turn, will be submitted to the Engineer for his review and approval prior to acceptance of the work for payment.

02500.1.3 DEFINITIONS

Not used.

02500.2 MATERIALS

02500.2.1 GENERAL

When restoration of a feature is indicated in the Contract Documents, such work shall be accomplished so as to restore the feature to its original, or better, condition and/or function as it existed prior to removal.

It is recognized that exact duplication of materials cannot always be achieved, but reasonable effort is expected from the Contractor to restore the feature with materials which will provide the same or better service and appearance as observed prior to removal.

All materials shall be new.

02500.2.2 BITUMINOUS SURFACE

02500.2.2.1 PRIMER OR TACK COAT – Shall be an approved bituminous material such as type MC-70-250, SS1, or CS-1.

02500.2.2.2 PATCHING AND REPAIR - Plant mix material that meets or exceeds the requirements of Section 02511 herein, or of the local State Department of Transportation for asphalt surface road repair, shall be used for patching and repair.

02500.2.2.3 SURFACING – Shall be hot or cold mix bituminous surfacing, meeting or exceeding the requirements of Sections 02511 or 02512 herein, or of the local State Department of Transportation for asphalt surface road repair.

02500.3 CONSTRUCTION REQUIREMENTS

02500.3.1 UNCLASSIFIED REMOVAL AND RESTORATION

02500.3.1.1 EXISTING IMPROVEMENTS - All existing facilities disturbed by the Contractor in prosecution of the Work, including but not limited to asphalt or concrete pavement, concrete structures, curb and gutter, sidewalk, gravel surfacing, driveways, crosswalks, landscaping, field crops, irrigation ditches, fences, culverts, buried or exposed utilities, abandoned utilities, small utility buildings or any other structures or obstructions designated to be removed on the Drawings, by the Engineer, or these Specifications, shall be removed, cleaned up, and then restored or replaced in kind by the Contractor in new condition.

02500.3.1.2 ADJACENT IMPROVEMENTS - Care shall be exercised in such removal to assure that adjacent facilities or structures, which are to remain, are not disturbed. Any damage to such existing facilities or structures resulting from carelessness or negligence on the Contractor's part shall be satisfactorily restored to new condition at the Contractor's expense.

02500.3.1.3 VEGETATION - Trees, shrubs, and other landscape plants designated to be saved for replanting shall be carefully removed, bundled, set aside and protected for replanting by the Contractor. Turf Sod to be saved for replanting shall be removed by machine cutting. In lieu of removal and replacement of turf sod or field crops, the Contractor may, upon approval of the property owner, remove and replant the same. Such agreements shall be documented on the final property release to be signed by the property owner.

Replanting of landscape items shall be performed in accordance with Section 2900.

02500.3.2 TOPSOIL

02500.3.2.1 REMOVAL AND PROTECTION - In all construction areas where re-growth of vegetation is desired, and when called for by the Contract Documents, the Contractor shall remove, segregate, stockpile, store, and protect topsoil during excavation in accordance with Section 02900. Topsoil shall be kept free from contamination from foreign materials and other soils. The Contractor shall arrange construction activities to avoid damage or disturbance to the stockpiled soil.

02500.3.2.2 REPLACEMENT - When backfill operations have been completed, the topsoil shall be replaced and restored to the original contours or as called for on the Drawings, in accordance with Section 2900 of these Specifications.

02500.3.3 GRAVEL SURFACE

02500.3.3.1 REMOVAL - When restoration of graveled driveways, roadways, or parking areas is required, the existing gravel surfacing shall be graded off and stockpiled safely away from ongoing work activities, to prevent contamination with subsurface materials. It may then be reapplied and compacted during restoration activities.

02500.3.3.2 RESTORATION - Areas to be restored shall be backfilled and graded to uniform lines and compacted to the density prescribed for trenching in Section 02200. Existing gravel surfacing materials shall then be replaced in uniform 3 inch layers compacted to 95% of maximum density. After compaction, the affected area shall be graded smooth. Sufficient new material of equal or better quality shall be applied and mixed in, to replace materials lost during prosecution of the Work, to ensure a 3-inch minimum gravel cover after compaction and grading.

02500.3.4 BITUMINOUS SURFACE

02500.3.4.1 REMOVAL - Bituminous pavement surface shall be removed and restored in accordance with this paragraph unless provisions for restoration are made in other Sections of these Specifications. The pavement surface, public or private, designated for removal shall be removed to neat lines, which shall be cut in accordance with Section 02520. No ripping or rooting will be permitted outside of the limits of the cut lines.

Existing driveways, sidewalks, etc., which do not match the new finish grade as shown on the Drawings, also shall be removed preparatory to restoration work.

02500.3.4.2 DISPOSAL - Surfacing materials removed shall be disposed of in accordance with Section 1520 of these Specifications, and will not be permitted in the backfill, except as specifically authorized by the Engineer and in accordance with local requirements.

02500.3.4.3 RESTORATION – Restoration of bituminous surface shall proceed according to the following steps:

- First, the sub-grade shall be graded to a uniform surface, and 6 inches of Untreated Base Coarse (UBC) gravel shall be placed over the area in lifts not thicker than 3 inches, compacted to 95% of its maximum density.

- Then, the exposed edges of existing pavement shall be primed with a material approved for this purpose.

- Unless shown otherwise on the drawings or required otherwise by the Engineer, hot or cold mix bituminous surfacing shall be spread and compacted in individual, 3-inch maximum lifts over the base course. Minimum thickness of the new bituminous surfacing layer shall be equal to the adjacent surface thickness, but shall be not less than 3 inches thick when compacted to 95% of its maximum density.

- Rolling operations shall be conducted in such a manner that shoving or distortion will not develop beneath the roller. The surface shall be finished to a smooth, uniform line and grade with surface deviations not exceeding plus or minus 1/4 inch in 10 feet, unless the surface is subject to more stringent State, County, or Municipal requirements. The determination of smoothness compliance may be made with a straight edge or string line at the option of the Engineer. Any irregularities shall be satisfactorily corrected at the sole expense of the Contractor.

- Existing driveways, sidewalks, etc., which were removed because they did not match the new finish grade, shall be replaced and restored to their original or better condition to match the new finish grade shown on the Drawings, or as directed by the Engineer.

02500.3.5 REMOVAL AND RESTORATION OF CONCRETE IMPROVEMENTS.

02500.3.5.1 REMOVAL - Existing concrete pavement in streets, alleys, driveways, sidewalks, etc., public or private, shall be cut in accordance with Section 02520, and removed to the lines indicated on the Drawings, or as directed by the Engineer. No ripping or rooting will be permitted outside of the limits of saw cut lines.

Existing driveways, sidewalks, etc., which do not match the new finish grade as shown on the Drawings, also shall be removed preparatory to restoration work.

02500.3.5.3 DISPOSAL - All materials removed shall be disposed of in accordance with Section 1520 of these Specifications, and will not be permitted in the backfill, except as specifically authorized by the Engineer and in accordance with local codes.

02500.3.5.4 RESTORATION - Sub surface preparations shall be the same as those in paragraph 02500.3.4.3 above.

- Concrete pavement including sidewalks, driveways, roadways, and parking area surfacing shall be replaced by the Contractor in accordance with Division 3 of these Specifications, unless otherwise directed by the Engineer

- Those existing driveways, sidewalks, etc., which were removed because they did not match the new finish grade, shall be replaced and restored to their original or better condition to match the new finish grade shown on the Drawings, or as directed by the Engineer.

- All other concrete improvements shall be restored in accordance with details shown on the Drawings, or as directed by the Engineer, and as required by the provisions of Division 3 of these Specifications.

02500.3.6 REMOVAL AND RESTORATION OF FENCES

When necessary to remove any fence to facilitate its operation, the Contractor shall obtain prior agreement with the owner of the fence for its removal. Temporary containment measures shall be provided, if needed, at no additional expense to the Owner. As soon as practical, the permanent fence shall be restored to its original condition or better.

02500.3.7 RESTORATION OF IRRIGATION DITCHES

Restoration of irrigation ditches shall be made in such a manner that the ditch configuration and size will be equivalent to its original condition and the ditch will be located on its original alignment. Any embankment required to restore the original slope of the ditch will be layer compacted with mechanical compaction equipment to 90% of maximum dry density determined by AASHTO T-99.

02500.3.8 CLEANUP

Areas of construction activity shall be left in a condition of uniform grade, blending into pre-existing contours and concealing, as much as possible, evidence of construction activity by back dragging or raking to conceal tire marks. Cleanup and disposal of surplus materials shall be performed in accordance with Section 1520.

02500.4 METHOD OF MEASUREMENT

02500.4.1 NO BID SCHEDULE LINE ITEM

When the Bid Schedule in the Contract does not contain a line item for "Removal and/or Restoration of Surface Improvements", then this work will be considered incidental to other items included in the Bid Schedule, and no separate measurement shall be made for this work.

02500.4.2 "DESIGNATED AREA" LINE ITEM

Measurement for removal and/or of surface improvements in a designated area shall be the "lump sum" of the work required to remove and properly dispose of materials resulting from removal.

02500.4.3 "DESIGNATED FEATURE" LINE ITEM

Measurement for removal and/or restoration of designated features shall be per unit as described in the Bid Schedule.

02500.4.4 BITUMINOUS SURFACE PAY LIMIT

Measurement for bituminous surface removal and replacement shall be made by multiplying the pay limit by the actual length of removal and replacement in lineal feet as determined using a tape measure or other accurate measuring device.

In general, for pipe trench excavation, the pay limit shall be determined by the formula W = OD + 18 inches (pay limit width equals pipe outside diameter plus 18 inches), rounded up to the nearest standard bucket width. Actual measurement may be modified according to information indicated on the Drawings or as directed by the Engineer.

The pay limit for removal of bituminous surface for other purposes shall be as shown on the Drawings or directed by the Engineer.

02500.4.5 DAMAGED ITEMS

Measurement of items damaged or removed as a result of the Contractor's negligence shall not be allowed and no payment will be made under this contract.

02500.5 BASIS OF PAYMENT

The accepted quantities will be paid for at the contract unit prices as follows:

PAY ITEM	UNIT
Removal of Site Surface Improvements	Lump Sum
Removal of (*Name of Structures*)	Each
Removal of Sidewalk	Square Yard
Removal of Fences	Lineal Foot
Removal of Driveway Slabs	Square Yard
Removal of Curb and Gutter	Lineal Foot
Replace (*Name of Structure*)	Each
Replace (*Thickness*) Sidewalks	Square Yard
Replace (*Thickness*) Driveway Slabs	Square Yard
Replace (*Description*) Fence	Lineal Foot
Replace (*Description*	Lineal Foot or Lump sum
Restore (*Description*)	Lineal Foot or Lump Sum

02510.1 DESCRIPTION

This special provision covers all sampling and testing of subgrade and pavement materials. The materials sampling and testing shall be done by an independent certified testing company and all testing reports shall be submitted to the Engineer within a reasonable time period.

02510.1.1 RELATED WORK AND REFERENCED SECTIONS

Section 02200 – Trench Excavation and Backfill
Section 03050 – Portland Cement Concrete

02510.1.2 SUBMITTALS

All sampling and test reports shall be submitted in accordance with Section 01300.

02510.1.3 DEFINITIONS

Not used.

02510.2 MATERIALS

Not used.

02510.3 CONSTRUCTION REQUIREMENTS

02510.3.1 TESTING

The minimum testing requirements are as follows:

02510.3.1.1 EMBANKMENT

• Maximum Laboratory Density	1 test in each soil type
• Field Density and Moisture	1 test per 2000 square yards

02510.3.1.2 BACKFILL

• Field Density and Moisture	2 tests per culvert or structure (Refer to Section 02200 for Trench Excavation and Backfill Testing)

02510.3.1.3 UNTREATED BASE COURSE

• Sieve Analysis	1 test per production day
• Maximum Laboratory Density	1 test per 10,000 tons
• Field Density and Moisture	1 test per 2000 square yards

02510.3.1.4 ASPHALT CONCRETE PAVEMENT

• Mix design (ASTM 1559 and AASHTO T-283)	1 mix design for the project
• Asphalt temperature	As necessary to assure compliance
• Gradation and Asphalt Content	2 tests per production day
• Field Density	1 test per 1600 square yards
• Mix and Laydown Temperature	As necessary to assure compliance
• Thickness	1 test per 1600 square yards

02510.3.1.5 PORTLAND CEMENT CONCRETE

- Slump Test — 1 test per 50 cubic yards
- Air Test — 1 test per 50 cubic yards
- Strength Test — 1 compressive strength per 50 cubic yards

02510.4 METHOD OF MEASURMENT

Measurement for this pay item will be by the lump sum.

02510.5 BASIS OF PAYMENT

The accepted quantities will be paid for at the contract unit price:

PAY ITEM	UNIT
Materials Sampling and Testing	Lump Sum

DIVISION 3

CONCRETE

03050.1 DESCRIPTION

This section contains requirements for Portland cement concrete materials and concrete mix designs.

03050.1.1 RELATED MATERIALS AND WORK

Section 03100 - Concrete Forming, Finishing and Curing
Section 03200 - Concrete Reinforcement
Section 03300 - Concrete Structures and Slabwork
Section 03500 - Pre-Cast Concrete Components
Section 03600 - Grout and Mortar

03050.1.2 SUBMITTALS

03050.1.2.1 PROPOSED MIX DESIGN - Each proposed mix design shall be submitted at least 14 days prior to its use in the Work. Indicate whether mix has been designed for pumping. Mix design submittals shall include the following information:

- Water-cement ratio.
- Proportion of materials in the mix.
- Source and type of cement.
- Analysis of water to be used, unless potable.
- Type and name of admixtures applied. Indicate when accelerating or retarding admixtures are to be used and the resulting change in placement times.
- Slump, air content, and temperature of samples.
- Unit weights of fresh and dry light weight concrete.
- Any applicable and verifiable test documentation available if the submitted mix design has been used by the Contractor in prior projects.

03050.1.2.2 AGGREGATE TEST REPORT - Aggregate Test Report (submit for each aggregate source):

- Data of test analysis.
- Sieve analysis.
- Organic impurities.
- Sodium sulfate soundness test.
- Reactivity of aggregate.
- Complete identification of source of aggregate.

03050.1.2.3 CHANGES IN MIX DESIGN - After the design of the mix or mixes has been approved by the Engineer, neither the source, character, or grading of the aggregate, nor the brand or type of cement shall be changed, without 48 hours written notice to the Engineer. Should such changes become necessary, no concrete containing such new or altered materials shall be placed until the revised mix design has been submitted to the Engineer for review and approval.

03050.1.3 DEFINITIONS

Workability - The ease of placing, consolidating and finishing freshly mixed concrete.

Consolidation - Hand rodding or mechanically vibrating actions which give freshly mixed concrete the characteristics of a thick fluid so as to minimize voids when set.

Hydration - The chemical reaction between water and calcined limestone resulting in the excellent bonding properties of the cement particles with one another and with the aggregates in the mix.

Curing – Synonymous with the hydration reaction. May be enhanced by procedures which assure the retention of sufficient moisture to allow the reaction to go as far to completion as possible.

Strength - The maximum resistance of a mortar or concrete specimen to axial compressive loading expressed in psi.

Admixtures - Chemical additives to concrete mixes intended to adjust setting time, reduce water demands, increase workability and entrain air.

Air Entrainment - Introduction of chemicals to concrete mixtures which produce microscopic air bubbles which improve the workability and ability to resist deterioration due to freezing.

Reinforcement - Materials formed or mixed in concrete mixtures, to increase the ability of the concrete to withstand loading when set (hardened).

Water-Cement Ratio - The weight of the water divided by the weight of the cement in a concrete mixture.

Tempering - The addition of water to mixed concrete after arrival on site.

03050.2 MATERIALS

03050.2.1 CEMENT

03050.2.1.1 SITE-PLACED CONCRETE - For site-placed concrete, cement shall be Type II (low alkali) cement, meeting requirements of ASTM C-150, unless otherwise directed by the Engineer or these Specifications. Do not use cement containing lumps, or cement which has partially set. Do not mix cements originating from different sources or manufacturers.

03050.2.1.2 PRE-CAST CONCRETE - For pre-cast concrete, cement shall be Class 5000 (minimum) in accordance with ACI 318 for units to be installed above ground. For units installed below ground, concrete shall be Class 4000 in accordance with ASTM C 478 and ASTM C 858.

03050.2.2 WATER

Shall be potable or water which meets the requirements of AASHTO T-26.

03050.2.3 REINFORCEMENT

Shall be in accordance with Section 03200 of these Specifications.

03050.2.4 ADMIXTURES

03050.2.4.1 AIR ENTRAINMENT - Air entrainment of concrete shall meet the requirements of AASHTO M-154 (ASTM C-260).

03050.2.4.2 PLASTICIZERS - Water reducing agents (plasticizers) and set retarding agents shall meet the requirements of AASHTO M-194 (ASTM C-494). Only types A or F will be approved as water reducing agents and only types D or G will be approved as set retarding agents. Water reducing agents and set retarding agents shall be pre-measured and added in strict accordance with manufacturer's instructions. Calcium chloride will not be approved.

03050.2.4.3 FLY ASH - Pozzolan (fly ash) may be used to replace a percentage of cement in the mix design in accordance with ASTM C-618, under the following conditions:

- The minimum required cement content shall be expressed in the design formula before replacement calculations are made.
- The amount of Portland cement replaced by pozzolan shall not exceed 15% for exterior concrete (concrete exposed to weather) and 20% for interior concrete.
- The ratio of replacement by weight of pozzolan to cement shall be 1.25 to 1.0.
- Loss of ignition of pozzolan shall be less than 3 percent, and the water requirement shall not exceed 100 percent.
- All other requirements of this Section still apply.
- Mix designs including trial batches are required for each aggregate source and for each concrete class.
- See also Subsection 03050.2.7.4 below.

03050.2.5 AGGREGATE

03050.2.5.1 AGGREGATE RATIO - The combined weight of coarse and fine aggregate material passing the No. 200 sieve shall not exceed 1.75 percent of the total weight of aggregate. The ratio of coarse to fine aggregate shall not be less than one (1) nor more than two (2), nor shall the amount of coarse aggregate be great enough to cause difficulty in concrete placement or honeycombing in the structure.

03050.2.5.2 COARSE AGGREGATE - Coarse aggregate shall comply with AASHTO M-80, using gradations from the following table:

COARSE AGGREGATE GRADATIONS

	Percent Passing (by weight)							
	Sieve Size							
Aggregate Size	2½"	2"	1½"	1"	3/4"	½"	3/8"	No. 4
2" to No. 4	100	95-100		35-70		10-30		0-5
1½" to No. 4		100	95-100		35-70		10-30	0-5
1" to No. 4			100	95-100		25-60		0-10
3/4" to No. 4				100	90-100		20-55	0-10

Maximum coarse aggregate gradation shall not be larger than 1/5 of the narrowest dimension between sides of forms; shall not be larger than 1/3 the depth of slabs; shall not be larger than 3/4 of the minimum clear distance between reinforcing bars or between bars and forms, whichever is less; and shall not be larger than 2 inches.

The maximum percentage by weight of deleterious substances allowed in coarse aggregate materials shall be:

DELETERIOUS SUBSTANCES ALLOWED IN COARSE AGGREGATE

Substance	Percent
Soft fragments	2.0
Coal and lignite	0.3
Clay lumps	0.3
Other deleterious substances	2.0

03050.2.5.3 FINE AGGREGATE - Fine aggregate shall comply with AASHTO M-6 using gradations from the following table:

FINE AGGREGATE GRADATIONS

Sieve Size	Percent Passing (by weight)
3/8-inch	100
No. 4	95 to 100
No. 16	45 to 80
No. 50	10 to 30
No. 100	2 to 10

The maximum percentage by weight of deleterious substances allowed in fine aggregate shall be:

DELETERIOUS SUBSTANCES ALLOWED IN FINE AGGREGATE

Substance	Percent
Coal and lignite	0.3
Clay lumps	0.5
Other deleterious substances	2.0

03050.2.5.4 AGGREGATE SOUNDNESS AND REACTIVITY - As determined in accordance with ASTM C-88, potentially deleterious aggregates shall not be used unless service records have shown the aggregates to be innocuous, and the Engineer subsequently approves them in writing.

03050.2.6 MIXING REQUIREMENTS

03050.2.6.1 CONCRETE CLASSIFICATIONS - Mixing requirements for the specific concrete classes indicated on the Drawings and/or within these Specifications shall be as follows:

CONCRETE CLASSIFICATIONS

Concrete Properties	Concrete Classifications		
	5000	3500	2000
Coarse Aggregates (see requirements shown below)			
Maximum Water/Cement Ratio (gal/sack)	5.0	6.5	8.0
Minimum Cement Content (sacks/CY)	***	6.0	4.5
Slump (inches)**	2 to 4	2 to 4	2 to 5
Air Content (percent)	5.0 to 7.5	5.0 to 7.0	3.0 to 5.0
Required Average 28 Day Compression Strength Test (psi)****	5200	3700	2200
Required Minimum 28 Day Compression Strength Test (psi)****	4800	3300	1800

Notes:
- * All concrete installed shall be Class 3500 unless otherwise required in the Contract Documents.
- ** When water reducing agents are not used.
- *** Cement content shall be appropriate to produce a mixture meeting the requirements for water/cement ratio and workability for the specific job conditions.
- **** One compressive strength test shall consist of the average strength of two cylinders in the test sample.

03050.2.6.2 REQUIRED AVERAGE DAY COMPRESSIVE STRENGTH - The Contractor shall furnish and install concrete that will produce a Required Average (28) Day Compressive Strength as shown on the table above. The average of any three consecutive (28) day strength tests shall not fall below the required Minimum (28) Day Compressive Strength Test shown. If the average of any three consecutive tests falls below the Required Minimum, the average strength of the concrete shall be increased at the contractor's expense by increasing the cement content.

03050.2.6.3 WATER REDUCING AGENTS - When water reducing agents (plasticizers) are used in the concrete mixtures shown above, maximum slump requirements may be increased to 5 inches with low range water reducers and to 8 inches with high-range water reducers.

03050.2.6.4 FLY ASH - When fly ash is used in the mix, the cement in the water/cement ratio denotes the cement and fly ash combined. Cement shall be introduced into the batcher before the fly ash.

03050.2.6.5 CONCRETE PLACED IN WATER - For concrete deposited in water, add one additional bag of cement per cubic yard more than the design requires for concrete placed above water.

03050.3 CONSTRUCTION REQUIREMENTS

03050.3.1 STORING CEMENT

Bagged and bulk cement shall be stored in weatherproof enclosures to exclude moisture and contaminants.

03050.3.2 STOCKPILING AND HANDLING AGGREGATE

03050.3.2.1 CLEAN SITE - The site provided for stockpiling aggregates shall be clean with adequate space to provide separate stockpiles for coarse and fine aggregates.

03050.3.2.2 WASHING AGGREGATE - Washed aggregates shall be allowed to drain to a uniform moisture content, and stockpiles shall be built at least 48 hours before use.

03050.3.2.3 HEIGHT - Aggregate shall not be dropped more than 10 feet from the conveyor, nor shall cone shaped piles more than 10 feet high be built.

03050.3.2.4 STOCKPILE LAYERING - Stockpiles shall be built in thin layers (5 feet maximum) in such manner, to prevent spillage of aggregate over the sides of the stockpile.

03050.3.2.5 FROZEN MATERIALS - Stockpiles containing snow, ice, or frozen materials shall not be used.

03050.3.3 BATCHING MATERIALS

03050.3.3.1 SCALES - The Contractor shall provide scales or arrange for usage of scales that have been certified by State agencies within the past 12 months.

03050.3.3.2 BATCH MIXERS - Batch mixers shall be operated at the manufacturer's recommended drum speed. Drums and blades shall be kept free from excessive cement and mortar build up. Cement shall be introduced into the batcher before fly ash, and all admixtures shall be introduced to the mixer separately.

03050.3.3.3 CENTRAL MIXING PLANT - At central mix plants, all materials shall be mixed for at least 80 seconds at recommended drum speed. When more water is added to the cement mixture, the materials shall be mixed for an additional 30 seconds.

03050.3.3.4 MIXING PERIOD - The mixing period for truck mixers shall be maintained between 70 and 100 revolutions at mixing speed. Maintain a minimum of 90 revolutions for front end discharge trucks. Concrete mixing shall be completed before the truck leaves the batch plant yard.

03050.3.3.5 WATER REDUCING AGENTS - If water reducing agents are added at the site, they shall be added using injection equipment capable of rapidly and uniformly distributing the admixture. Prior to discharge, the concrete shall be mixed for a minimum of 5 minutes at a drum rate not less than 12 rpm or more than 15 rpm discharge.

03050.3.4 HEATING AGGREGATE AND WATER

03050.3.4.1 HEATING EQUIPMENT - When approved by the Engineer, the Contractor, at its own expense, may provide and operate heating equipment to heat aggregate and water because of cold weather conditions. All heating operations shall meet temperature limitations provided in these Specifications and shall conform to Standard ACI 306. The Contractor shall ensure that excessive heat does not cause "flash set" when the cement is added.

03050.3.4.2 UNIFORM HEATING - Aggregates shall be heated uniformly with steam or dry heat. Water shall be heated to between 70°F and 150°F when introduced into the mixer. Measures shall be taken to prevent overheating and hot spot development. No combustion products (ash, smoke, gas and etc.) shall contact the aggregate.

03050.3.5 COOLING CONCRETE MIXTURE

03050.3.5.1 COOLING EQUIPMENT - When approved by the Engineer, the Contractor, at its own expense, may provide and operate equipment to refrigerate water, provide ice or cool aggregate, to mix concrete due to hot weather conditions. All methods of cooling shall meet the requirements of ACI 305.

03050.3.5.2 USE OF ICE - When ice is introduced into the mixer, it shall be in such form as to be completely melted and dispersed throughout the mix at the completion of the mixing time. The mixing time

shall be held to the minimum practicable, consistent with producing concrete meeting the specified requirements.

03050.3.6 CONCRETE TRANSPORT

3050.3.6.1 TRUCKS - Concrete mixtures shall be transported only in conventional transit mixers or agitator trucks with rating plates that are readable. Trucks shall be equipped with visible water meters and revolution counters and shall be capable of measuring all water introduced into the mixing drum.

03050.3.6.2 LOADING - Trucks shall not be loaded:

- In excess of their rated mixing capacity, or
- In excess of 63 percent of the drum gross volume, or
- In quantities less than 2 cubic yards

03050.3.7 CONCRETE TEMPERING

03050.3.7.1 ADDING WATER – Concrete may be tempered through the addition of water under the following conditions:

- Water shall be added within specified time limits. At no time shall water be added after testing has taken place.
- Wherever possible, water shall be added after the truck leaves the batch plant.
- Water shall not be added in excess of the water/cement ratio or in excess of that specified on the batch tickets.
- The mixing drum shall be rotated at least 30 revolutions at the manufacturer's recommended mixing speed when water is added, OR, addition of water for tempering shall be followed by 3 minutes of mixing at mixing speed prior to discharge.
- Water shall not be added after 1/2 cubic yard or more of concrete has been discharged from the drum.

03050.3.7.2 LOW SLUMP - When concrete arrives at the site with a slump below specification, the Contractor may temper the mix up to the maximum approved water/cement ratio, provided:

- The mix design allows for on-site water addition;
- The amount of water added is accurately measured to the nearest gallon;
- The maximum slump is not exceeded; and
- The person adding water is approved to do so by the Engineer and the concrete supplier.

03050.3.7.3 TEMPERING WITH PLASTICIZER - Do not deliver concrete containing plasticizer to the site unless the batch delivery ticket displays water/cement ratio prior to plasticizer addition. Tempering with plasticizer after delivery time window expiration shall not be allowed.

03050.3.8 CONCRETE PLACEMENT

Shall be in accordance with Section 03300.

03050.3.9 CONCRETE SAMPLING AND TESTING

03050.3.9.1 PROCEDURE - Tests for slump, air entrainment, strength and temperature by an independent certified testing facility shall be provided by the Contractor. Independent test facility can be changed by Engineer at any time. Sampling and testing will be performed at the expense of the Contractor and as directed by the Engineer.

03050.3.9.1 SAMPLING FREQUENCY - Concrete sampling frequency shall be as noted below:

- A minimum of one air test (ASTM C-231) and one slump test (ASTM C 143) shall be performed for each placement over 5 cubic yards. At least one air and one slump test shall be performed for each additional load of concrete placed.
- For each test, the concrete temperature and the time shall be verified and recorded. Air and slump test results shall be recorded on batch delivery tickets.
- If an air test fails, immediately retest the same load. The concrete shall be rejected if the second air test fails to meet specified requirements. If the second air test meets specified requirements, a third test will be performed to establish concrete acceptance or rejection.
- If the slump for an individual load cannot be corrected by tempering within the mix design requirements and within the requirements of these Specifications, the load shall be rejected.
- The testing facility shall prepare test cylinders for strength testing in accordance with ASTM C-31 & ASTM C-39.
- At least one strength test shall be performed for each placement over 5 cu. yd., and one additional test for every 50 cu. yards of concrete placed or more frequently at the Engineer's discretion. Three cylinders shall be prepared for each test. One cylinder from each test may be set aside at the Contractor's request for strength verification prior to form removal. The average compressive strength of two cylinders constitutes one compressive strength test.
- The Contractor shall provide space in the work area and protect sample cylinders from disturbance for 24 hours after they are cast or until they are moved from the work area by testing laboratory personnel or under the direction of the Engineer.
- The average compressive strength shall meet the requirements shown in the table in Section 03050.3.1 for the class of concrete placed.

03050.4 METHOD OF MEASUREMENT

Measurement for concrete placed in accordance with these Specifications shall be as described in Section 03300.

03050.5 BASIS OF PAYMENT

Acceptable quantities of concrete, when measured separately, shall be paid for at the contract unit prices described in Section 03300.

03100.1 DESCRIPTION

Includes furnishing materials, accessories and labor required to form, finish and cure interior and exterior cast-in-place concrete.

03100.1.1 RELATED WORK

Section 03050 - Portland Cement Concrete
Section 03200 - Concrete Reinforcement
Section 03300 - Concrete Structures and Slabwork
Section 03500 - Precast Concrete Components
Section 03600 - Grout and Mortar

03100.1.2 SUBMITTALS

03100.1.2.1 SHOP DRAWINGS - When called for in these Specifications, the Contractor shall furnish shop drawings of forms for specific concrete items. Such drawings shall show general construction of forms, jointing, location of ties and other items affecting visibility.

03100.1.2.2 FORM RELEASE AGENT - Where concrete surfaces are scheduled to receive special finishes or applied coverings, which may be affected by the form release agent, submit manufacturer's instruction for use of agent.

03100.1.2.3 CHEMICAL HARDENER - Submit name, type, chemical analysis and manufacturer's recommended rate of application for chemical hardener, when specified.

03100.1.2.4 CURING COMPOUNDS - Submit manufacturer's specifications, test information, ingredients, certification, and installation recommendations for curing compounds. This information may become the basis of acceptance or rejection of the work cured by the material used. See also the submittal requirement under Membrane Curing Compounds in 03100.3.6.2 herein

03100.1.3 DEFINITIONS

Shoring - The framework installed to support formwork.

Re-Shoring - Framework installed or not removed which serves as support for form-work after concrete sets and there is less need for the support.

Form Coatings - Compound coated on forms, preventing concrete surface bonding to the forms.

Curing Compound - Liquid medium sprayed or coated on concrete to retain moisture.

03100.2 MATERIALS

03100.2.1 FORM TIES AND SPREADERS

Shall be removable or snap-off metal, designed to prevent form deflection and to prevent spalling concrete surfaces upon removal. Form ties shall be factory fabricated. Field fabricated ties will not be acceptable. The portion of the tie remaining within concrete after removal of exterior parts should be 1 inch below the outer concrete surface, and the remaining hole in the concrete surface shall not be larger than 1 inch diameter, unless approved otherwise by the Engineer. Ties for water tanks, diversion structure, etc., should have waterstops.

03100.2.2 JOINT FILLER

Shall be furnished and installed in accordance with Section 03310 herein.

03100.2.3 FORM RELEASE AGENTS

Commercial formulation form release agent compounds shall be used. Form release agents shall not bond with, stain or adversely affect concrete surfaces requiring later bond or adhesion. They shall not impede the wetting of surfaces to be cured with water or curing compounds. Surplus oil on forms and form oil on reinforcing steel and construction joints shall be removed before concrete is placed. Diesel fuel shall not be used as a releasing agent.

03100.2.4 FILLETS FOR CHAMFERED CORNERS

Shall be wood strips 3/4 inch by 3/4-inch size and of maximum possible length.

03100.2.5 MORTAR AND GROUT

Shall be furnished in accordance with Section 03600 herein.

03100.2.6 LIQUID CHEMICAL HARDENER

Shall be a colorless aqueous solution, containing a blend of magnesium fluosilicate, zinc fluosilicate and a wetting agent. The mixture shall contain not less than 2 pounds fluosilicate per gallon and shall not interfere with adhesives and the bonding of finishes where such is indicated.

03100.2.7 WATER

Water for curing shall meet the requirements of Section 03050 herein.

03100.2.8 MOISTURE RETAINING SHEETING

Shall be white, waterproof paper, polyethylene film or burlap-polyethylene sheet which meets the requirements of ASTM C-171.

03100.2.9 MOISTURE ABSORPTIVE COVER MAT

Shall be clean cotton or burlap fabric roll goods.

03100.2.10 CURING COMPOUND

Shall be a clear type with fugitive dye conforming to ASTM C-309, Type 1, unless otherwise approved by the Engineer. **CAUTION!!** The method of application of curing compound specified herein requires more product than is normally suggested by the manufacturer and that is customary in the trade. The amounts specified herein shall be applied, regardless of manufacturer's recommendation or customary practice.

03100.3 CONSTRUCTION REQUIREMENTS

03100.3.1 SITE CONDITIONS

The Contractor shall examine the condition of the area on which forms are to be installed and conditions under which the work of this Section is to be performed, and shall correct unsatisfactory

conditions which would prevent proper and timely completion of the work. Do not proceed until unsatisfactory conditions have been corrected.

03100.3.2 DESIGN OF FORM-WORK

03100.3.2.1 LOADING - Form-work shall be designed to safely support all vertical and lateral loads that may be induced by wet concrete both during the placement and afterward, until such loads can be supported by the structure itself as the concrete sets and begins to cure. Forms and falsework shall be designed to include assumed values of live load, dead load, weight of moving equipment to be operated on form-work, concrete mix, height of concrete drop, vibrator frequency, ambient temperatures, foundation pressures, stresses, lateral stability and other factors pertinent to the safety of the structure during construction.

In form-work design, provide for all openings, offsets, keyways, recesses, moldings, reglets, chamfers, blocking, screed, bulkheads, anchorage, inserts and other features as required on the Drawings.

03100.3.2.2 TOLERANCES – Form-work design shall call out material and components of sufficient strength, thickness, number of ties, amount of bracing, etc., to withstand the pressure of newly placed concrete without bow or deflection.

03100.3.3 FORM-WORK CONSTRUCTION

03100.3.3.1 COMPLIANCE – Form-work shall be constructed in compliance with ACI 347, to the exact sizes, shapes, lines and dimensions shown, and as required to obtain accurate alignment, location, grade, and level and plumb work in finished structures.

03100.3.3.2 MATERIALS – Form-work shall be constructed from steel, steel reinforced panels, smooth grade plywood, or other materials which may be approved by the Engineer or shown on the Contract Documents for special purposes. Plywood material with raised grain, patches, or other defects that will mar the finished surface of the concrete surface shall not be used.

03100.3.3.3 ERECTION - Form facing materials shall be erected, supported, braced and maintained by structural members spaced to prevent deflection. Form-work shall be tight, to prevent leakage of cement paste during concrete placement. Joints shall be solidly butted together and backed up as required to prevent leakage and fins. Forms placed in successive units for continuous surfaces shall be fitted to provide accurate alignment, free from irregularities, and within allowable tolerances. Use selected materials to obtain required finishes.

Provide for all openings, offsets, keyways, recesses, moldings, reglets, chamfers, blocking, screed, bulkheads, anchorage, inserts and other features required. Accurately place and securely support items to be built into forms. Provide formed openings for elements to be embedded in or pass through the concrete. Install accessories in accordance with manufacturer's instructions and ensure items are not disturbed during concrete placement. Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in the finished slab surface. Provide and secure units to support types of screeds required.

Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Bevel wood inserts for forming keyways, reglets, recesses and the like, to prevent swelling and assure ease of removal

Form-work shall accommodate the work of all other trades where materials and products must be purchased and fabricated before the opportunity exists to verify the measurements of the adjacent

construction affecting their installations. Verify size and location of all openings, recesses and chases with the trade requiring such items, and ensure that forms for openings and construction which accommodate installation by other trades, be accurately sized and located as dimensioned on the Drawings.

03100.3.3.4 FORM RELEASE AGENT - Coat form/concrete contact surfaces with form coating compound before reinforcement is placed. Do not allow excess form coating material to accumulate in the forms or to come into contact with surfaces which will be bonded to fresh concrete. Apply in compliance with manufacturer's instructions.

03100.3.3.5 CLEANING - Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt and other debris just before concrete is placed.

03100.3.3.6 TOLERANCES – The Engineer recognizes that, given the realities of the physical world, there are times when formwork for concrete cannot be constructed closely enough to yield zero tolerances in the finished work. Therefore, the following tolerances are allowed but shall not be exceeded:

- In general, deviation in alignment of slabs and walls shall not exceed ¼ inch in the horizontal or vertical dimensions of a pour. All slabs which are indicated to be level shall have a maximum deviation of 1/8 inch in 10 feet without any apparent change in grade.

- The maximum tolerance from true level and plumb throughout the entire length and/or height of a structure shall be +/- ¼ inch and without any abrupt changes from one part of the pour to another.

- Form-work construction for circular structures shall be allowed a maximum deviation in the arc of ¼ inch in each 10 feet of radius; therefor, as an example, a tank with a 50 foot radius shall be allowed a maximum deviation of 1-1/4 inch from the center of the tank to the arc of the wall. In circular construction, the Contractor also is allowed to deviate from the finish line shown on the Drawings through the use of form panels, which will give chord lengths not to exceed 2 feet.

In the event that deviation from the Drawing dimensions results in problems in the field, the Contractor shall be responsible for resolution of the conditions, as approved by the Engineer, without additional expense to the Owner.

03100.3.4 REMOVAL OF FORMS

03100.3.4.1 CONSIDERATIONS ASSOCIATED WITH FORM REMOVAL - Forms shall be removed in a manner to insure complete safety of the structure. Forms shall not be removed until concrete has sufficient strength to carry its own weight and the loads upon it with safety. Do not pry against face of concrete; use only wooden wedges.

03100.3.4.2 MINIMUM ELAPSED TIME - Forms shall not be removed sooner than the minimum elapsed times given in the following schedule unless allowed otherwise in the Contract Documents or as directed by the Engineer.

When directed by the Engineer, because of weather conditions or for other reasons, the forms shall remain in place for longer periods than stated below. The periods of time for form removal set forth below are minimums with no allowances for external loading. The periods of time set forth below are permissive only and do not relieve the Contractor from responsibility for risks associated with form removal.

MINIMUM ELAPSED TIME

Structural Component	Over 50°F	Between 40° and 50°F
Walls and perimeter forms at slab on grade panels	2 days	3 days
Underside of slabs		
Side forms of beams	10 days	14 days
Underside of beams	2 days	3 days
Stairways	10 days	14 days
	10 days	14 days

The time periods shown above are based on concrete materials being mixed and placed in accordance with these Specifications. When high early strength inducing admixtures are used in concrete, the Engineer may permit form removal after shorter times than those shown in the table. Form removal time also may be reduced if test cylinders of concrete, field cured along with the concrete they represent, have reached the strength specified in Paragraph 03050.3.1 of Section 03050 – Portland Cement Concrete.

03100.3.4.3 RE-SHORING - Where no re-shoring is planned, leave forms and shoring used to support weight of concrete in beams, slabs and other concrete members in place until concrete has attained its specified strength. Where re-shoring is planned, supporting form-work may be removed when concrete has reached 70 percent of specified strength, provided re-shoring is installed immediately.

Place re-shores as soon as practical after stripping operations are complete, but in no case later than the end of the working day on which stripping occurs. During re-shoring, do not subject concrete in beam, slab, column or any other structural member to combined dead, construction, and live loads in excess of loads permitted for developed concrete strength at time of re-shoring. Tighten re-shores to carry required loads without over stressing.

Re-shores shall remain in place until the supported concrete has reached its specified strength.

03100.3.5 CONCRETE FINISHING

03100.3.5.1 FINISHING FORMED SURFACES - Within 72 hours after forms are removed, the Contractor shall finish exposed surfaces in accordance with one of the procedures described below. Where no finish requirement is provided on the Drawings, formed concrete surfaces exposed to view and surfaces designated to receive paint shall be given a "Smooth" finish and slabs shall be given a "Trowel" finish. When workmanship is less than the acceptable standard, provide one of the rubbed finishes at no additional cost to Owner.

- F1 - As Cast Form Finish - No finish.
- F2 - Rough Finish - Patch defects and chip or rub off fins exceeding 0.33 inch height.
- F3 - Smooth Finish - In addition to the rough finish requirements, patch tie holes and defects and remove fins completely. When surface texture is impaired and form joints misaligned, grind, bush-hammer or correct such areas. Slurry grout areas evidencing minor mortar leakage to match adjacent concrete. Repair major mortar leakage as a defective area.
- F4 - Smooth Rubbed Finish - Remove forms and perform necessary patching as soon after placement as possible. Finish newly hardened concrete no later than 24 hours following form removal. Perform a smooth finish, then wet surfaces and rub with carborundum brick or other abrasive until uniform color and texture are produced.

- F5 - Grout Cleaned Rubbed Finish - Undertake this operation after all contiguous surfaces are completed and accessible. Perform a smooth finish, then brush blast with abrasive basting to open surface pores. Wet surface of concrete sufficiently to prevent absorption of water from grout. Mix grout in accordance with Section 03600 and rub a uniform coat over surface to be finished. Immediately after grouting, scrub surface with cork float or stone to coat surface and fill voids. While grout is still plastic, remove excess grout by working surface with rubber float or sack. After surface whitens from drying, rub vigorously with clean burlap. Keep damp for at least 36 hours after final rubbing.

- F6 - Cork Floated Rubbed Finish - Remove forms within 2 to 3 days of placement where possible. Perform a smooth finish and then dampen wall surface. Mix mortar in accordance with Section 03600, and apply with firm rubber float or with trowel, filling all surface voids and compress mortar into voids. If mortar surface dries too rapidly to permit proper compaction and finishing, apply a small amount of water with fog sprayer. Produce a final texture with a cork float using a swirling motion.

- F7 - Unformed Finish - After concrete is placed, strike smooth, tops of walls or buttresses, horizontal offsets and similar unformed surface occurring adjacent to formed surfaces. Float to texture which is reasonably consistent with formed surface. Continue final treatment on formed surfaces uniformly across unformed surfaces.

- F8 - Blasted Finish - Complete a smooth finish then perform abrasive blasting within 24 to 72 hours after casting. Coordinate with form-work construction, concrete placement schedule and form-work removal to ensure that surfaces are blasted at the same age for uniform results. Reapply curing protection after blast finishing.

- F9 - Architectural Finish - Finish in accordance with ACI 303.

- F10 - Tooled Finish - Dress thoroughly cured concrete surface with electric, air or hand tools to uniform texture, and give a bush hammered surface texture. Remove sufficient mortar to exposed coarse aggregate in relief and to fracture coarse aggregate for tooled finish.

03100.3.5.2 REPAIRING FORMED CONCRETE SURFACES - When the Drawings indicate repairs are required or when the Engineer determines areas are defective and require repair, the following procedure shall be taken to make repairs:

- Remove defective concrete to sound concrete and make edges perpendicular to surface or slightly undercut. Feathered edges are not permitted.

- Dampen area to be patched and at least 6 inches surrounding it.

- Prepare bonding grout by mixing to consistency of thick cream and brush into surface.

- Tie holes shall be cleaned, thoroughly dampened, and filled solid with patching mortar.

- Make any patches in concrete to closely match color and texture of surrounding surfaces. Determine mix formula for patching mortar by trial to obtain a good color match with concrete when both patch and concrete are cured and dry.

- Mix white and gray Portland cement as required to match surrounding concrete to produce grout having consistency of thick paint. Use a minimum amount of mixing water.

- Mix patching mortar in advance and allow to stand, without addition of water, and without frequent manipulation, until it has reached a stiff consistency. After surface water has evaporated from patch area, brush bond coat into surface. When bond coat begins to lose water sheen, apply patching mortar. Thoroughly consolidate mortar into place and strike-off to leave patch slightly higher than surrounding surface. Leave undisturbed for at least 1 hour before final finish. Keep patched area damp for 72 hours or apply curing compound.

- Do not use metal tools in finishing an exposed patch.

- Where as cast finishes are indicated, total patched area may not exceed 1 in 500 of as cast surface. This is in addition to form tie patches, if ties are permitted to fall within as cast areas.

- In any finishing process which is intended to expose aggregate on surface, patched areas must show aggregate. Outer 1-inch of patch shall contain same aggregates as surrounding concrete. After curing, expose aggregates together with aggregates of adjoining surfaces by same process.

03100.3.5.3 FINISHING SLAB SURFACES - In no case shall water be added to the surface (i.e., by sprinkling) to finish. Slab surfaces shall receive one of the following finish treatments as indicated on the Drawings:

- S1 - Floated Finish - After concrete has been placed, consolidated, struck-off and leveled, do not work further until ready for floating. Begin floating when water sheen has disappeared and surface has stiffness sufficient to permit operation. During or after first floating, check plainness of entire surface with a 10 foot long straightedge applied at 2 or more different angles. Cut down high spots and fill low spots to the required tolerance. Re-float slab immediately to a uniform sandy texture.

- S2 - Trowel Finish - Float finish the surface. Power trowel or hand trowel as required to provide a uniform surface. Do not apply (i.e. sprinkle) water or dry cement to surface of concrete when finishing. First troweling after floating shall produce smooth surface relatively free of defects, but may still show some trowel marks. Second trowel by hand after surface has hardened. Leave finished surface essentially free of trowel marks, uniform in texture and appearance. On surfaces intended to support floor coverings, grind off defects which would show through floor coverings.

- S3 - Broom Finish – Trowel finish the surface. Power trowel or hand trowel as required to provide uniform surface. Lightly brush surface parallel to direction of drainage with a hair broom. Coarseness of broom bristle may be varied slightly, to achieve desired degree of surface roughness.

- S4 - Exposed Aggregate Finish - Immediately after surface of concrete has been leveled to tolerance and surface water has dissipated, spread aggregate uniformly over surface to provide complete coverage to the depth of a single stone. Embed aggregate into surface by light tamping. Float surface until embedded aggregate is fully coated with mortar and surface has been brought to tolerance. Start exposure of aggregate after matrix has hardened sufficiently to prevent dislodgement. Flow ample quantities of water, without force, over surface of concrete while matrix encasing aggregate is removed by brushing with a fine bristle brush. Continue until aggregate is uniformly exposed. An approved chemical retarder sprayed onto freshly floated surface may be used to extend working time.

- S5 - Chemical Hardener Finish - Apply liquid chemical hardener finish to interior concrete floors where indicated. Do not apply liquid chemical concrete hardener on floor areas

scheduled to receive synthetic matrice terrazzo, setting beds for tile, terrazzo, vinyl flooring or like items. Apply hardener after complete curing and drying of concrete surface in accordance with manufacturer's recommendations. Evenly apply each coat and allow 24 hours for drying between coats. After final coat of chemical-hardener solution is applied and dried, remove surplus hardener by scrubbing and mopping with water.

03100.3.6 CONCRETE CURING

03100.3.6.1 SURFACES WITH UNREMOVED FORMS - When forms are left in place (i.e., underside of beams, etc.) the Contractor shall proceed with curing adjacent surfaces without regard to the formed surfaces. When such forms are removed, curing shall then proceed over the entire surface.

03100.3.6.2 CURING CONDITIONS - Immediately after finishing of concrete surfaces (formed or slab) the Contractor shall verify concrete surfaces are ready for curing. The Contractor shall correct any conditions detrimental to timely and proper completion of the work. Do not proceed until unsatisfactory conditions are corrected. A minimum ambient temperature of not less than 40° shall be maintained for at least 7 days during concrete curing. Concrete shall then be cured by one of the following methods:

- Moisture Cover - Water or continuous water-fog spray shall be applied, or the concrete surface shall be covered with water saturated absorptive mat kept continuously soaked, for not less than 7 days and nights.

- Moisture Retaining Sheet - Place cover in widest practicable width with sides and ends lapped and sealed to prevent moisture loss for a period of not less than 7 days and nights. All holes or tears in the cover sheet shall be kept repaired during the curing period.

- Membrane Curing Compound – All required repairs, patching, and final finishing operations shall be completed prior to application. Curing compound shall be applied as soon as the concrete is firm enough to work on. Slab surfaces shall be coated with curing compound within one hour after form removal; if more than one hour has elapsed, the surface shall be water cured.

  The compound shall be thoroughly mixed and a minimum of two coats shall be applied, with each coat applied in a direction different from that used for the preceding coat. The surface shall be coated and re-coated in a continuous operation until the surface has a uniform appearance; is effectively and completely sealed; and until a coating film remains on the surface of the concrete that can be scraped from the surface at any and all points after drying for at least 24 hours. Continuity of the coating shall be maintained, and all damage to the curing compound membrane shall be repaired, during the specified cure period.

  Curing compound shall not be allowed within the silhouette of any construction joint. If any curing compound enters the construction joint, the joint shall be sandblasted prior to placing any new concrete.

  Curing compound shall not be used on surfaces to be painted or coated.
  Surfaces intended to contain potable water (tank interiors, etc.) shall not be cured with curing compounds.

  Curing compound shall not be removed in less than 7 days from the time of application without written approval from the Engineer. When approved and prior to such removal, the Contractor shall provide a detailed plan for adequately curing the concrete.

03100.4 METHOD OF MEASUREMENT

Unless otherwise noted in the Special Provisions, separate measurement will not be made for concrete included as components of items shown in the Bid Schedule. Separate measurement for formed concrete and slabs shall be in accordance with the requirements of Section 03300.

03100.5 BASIS OF PAYMENT

Unless otherwise noted in the Special Provisions, no separate payment will be made for concrete included as components of items shown in the Bid Schedule. Separate payment for formed concrete and slabs shall be in accordance with the requirements of Section 03300.

03200.1 DESCRIPTION

Includes steel bars, wire fabric and rod mats required for cast-in-place concrete, with the necessary support chairs, bolsters, bar support and spacers required for supporting the reinforcement.

03200.1.1 RELATED Work

Section 03050 - Portland Cement Concrete
Section 03300 - Concrete Structures and Slabwork

03200.1.2 SUBMITTALS

03200.1.2.1 MILL TEST CERTIFICATION - Manufacturer's mill test certificates of supplied concrete reinforcement, indicating physical and chemical analysis shall be submitted.

03200.1.2.2 WELDER CERTIFICATION - Each welder's certification data shall be submitted to and approved by the Engineer prior to performance of welding on the project.

03200.1.2.3 SHOP DRAWINGS - Shop Drawings shall be submitted and shall indicate the sizes, spacings, locations and quantities of reinforcing steel and wire fabric; bending and cutting schedules; any proposed splicing; and reinforcement support, spacing devices and stirrup spacing.

03200.1.2.4 BAR SUPPORT SAMPLES - The Contractor shall submit for the Engineer's approval, samples of all bar supports it proposes to use along with a written description of where each type of bar support would be used.

03200.1.3 DEFINITIONS

Not used.

03200.2 MATERIALS

03200.2.1 CONCRETE REINFORCEMENT MATERIALS

03200.2.1.1 STEEL REINFORCEMENT - Unless otherwise specified, reinforcing steel shall be grade 60 billet steel conforming with ASTM A-615, including supplementary requirements S1. All such reinforcing shall be deformed steel bars with deformations in accordance with ASTM A-615. Bars shall be either uncoated or coated as indicated. ASTM A-706 steel shall be used if welding is indicated or allowed. All reinforcement shall be supplied in the maximum lengths practical or as indicated, unless otherwise authorized by the Engineer.

03200.2.1.2 WIRE FABRIC - Welded steel wire fabric shall be in accordance with ASTM A-185 plain type. It shall be new stock and free of any rust when placed in the Work. Wire fabric may be supplied in flat sheets or coiled rolls, and may be either coated or uncoated as indicated.

03200.2.1.3 STIRRUPS - Stirrup steel shall be in accordance with ASTM A-82.

03200.2.1.4 SPIRAL REINFORCEMENT - Spiral reinforcement for columns or other components shall be cold drawn steel wire in accordance with ASTM A-82.

03200.2.1.5 DOWEL BARS - Plain dowel bars for expansion joints shall be in accordance with ASTM A-615, 60-ksi-yield grade steel. Dowel bars shall be epoxy coated in roadway pavements. Metal dowel cans shall be provided at one end of dowel to permit longitudinal movement of the dowel within the concrete section. The Contractor shall provide for movement equal to the joint width plus 0.5-

inch. Load transfer bars shall be painted with 1 coat of paint conforming to AASHTO M-254 and coated 1/2 with grease.

03200.2.2 ACCESSORY MATERIALS

03200.2.2.1 TIE WIRE - Tire wire shall be 16-gauge minimum cold drawn plain steel wire, and shall be in accordance with ASTM A-82.

03200.2.2.2 REINFORCEMENT SUPPORTS - Unless otherwise required in the Drawings or these Specifications, reinforcement supports bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcement in place shall be wire type bar supports complying with CRSI recommendations. Wood, brick, and other unacceptable materials will not be allowed.

03200.2.2.3 SUPPORTS EXPOSED TO VIEW - Where support legs are in contact with forms on concrete surfaces exposed to view, supports shall be stainless steel or shall be provided with either hot-dip galvanized or plastic protected legs.

03200.2.3 FABRICATION

03200.2.3.1 STANDARDS - Steel reinforcement shall be cut, bent and fabricated in accordance with ACI 315 and with approved machine methods, in either the shop or the field.

03200.2.3.2 BENDING - Bars shall be accurately formed to the dimensions shown on the Drawings or applicable bending schedule. Bending or straightening in the shop or the field shall be accomplished so that the steel is not damaged. All bars shall be cold bent. Bends for hooks on bars shall be made around a pin having a diameter not less than 6 times the minimum thickness of the bar. Kinked bars shall not be used. Bars with bends not indicated on Drawings or final Shop Drawings shall not be placed in the Work. Reinforcement bars shall not be bent after they are embedded in concrete.

03200.2.3.3 SPLICES - Reinforcing splices not indicated on the Drawings shall be approved by the Engineer, and shall be located at points of minimum stress. The location of splices shall be indicated on Shop Drawings. Welding of reinforcing bars, when authorized by the Engineer, shall be performed in accordance with AWS D1.4. All rebar which is welded shall be grade 60 ASTM A706 material.

03200.3 CONSTRUCTION REQUIREMENTS

03200.3.1 DELIVERY AND STORAGE

03200.3.1.1 DELIVERY - Deliver reinforcement to the job site bundled, tagged and marked. Use metal tags indicating bar size, lengths and other information corresponding to markings shown on placement diagrams.

03200.3.1.2 STORAGE - Take all means necessary to protect reinforcement materials before, during and after installation and to protect the installed work of other trades. Store all reinforcement materials in a manner to prevent excessive rusting and fouling with grease, dirt and other bond breaking coatings. Take all necessary precautions to maintain identification after bundles are broken. In the event of damage or errors, immediately make all repairs or replacements necessary and at no additional cost to the Owner.

03200.3.2 REINFORCMENT ERECTION

03200.3.2.1 CLEAN AND SOUND MATERIALS - At the time of placement in the Work, reinforcement shall be free of loose mill scale, loose or excessive rust, paint, oil or grease, or other coating which may destroy its bond with the concrete. Bars with reduced cross-section due to rusting or other cause, even if all rust has been removed, shall not be allowed in the Work.

03200.3.2.2 CLEARANCE - Maintain the distance from vertical forms and between layers of reinforcement by means of prefabricated chairs, ties, hangers or other approved devices in accordance with "reinforcement support" paragraphs below. Placement and fastening of reinforcement in each section of the Work must be approved before concrete is placed.

03200.3.2.3 CLEAR DISTANCE - The clear distance between parallel bars shall not be less than one and one-half times the diameter of the bars, and shall in no case be less than 1 inch nor less than the maximum size of the coarse aggregate specified.

03200.3.2.4 MINIMUM COVER - Unless otherwise shown on the Drawings or approved by the Engineer, for all formed surfaces, the minimum concrete cover over the steel reinforcement shall be 1 1/2 inches for bars number 5 and smaller and 2 inches for bars number 6 through 18. The largest specified cover shall be used when different sized bars are encountered in the same face. No "bury" or "carrier" bars will be allowed unless specifically approved by the Engineer.

03200.3.2.5 CUTOUTS AND OPENINGS - Where reinforcing steel has to be cut to permit passage of pipe or to create openings with no detail available on the Drawings for extra reinforcement in such areas, the area of steel removed by the creation of the opening must be replaced by placement of at least double the area of the steel removed equally around the openings created. The steel shall be placed such that it extends 5 feet beyond the opening on each side, to provide for sufficient bond.

03200.3.2.6 METAL MESH - Sheets of metal mesh shall be bent as shown or required on the Drawings to fit the work. It shall be rolled or otherwise straightened to make a perfectly flat sheet before placement in the Work. Supports for metal mesh shall meet requirements for reinforcing bar supports.

Sheets of metal mesh shall be spliced in accordance with ACI 318 and shall be overlapped no less than 12 inches or one square plus 6 inches, whichever is greater, to maintain a uniform strength. The mesh shall be securely fastened at the ends, edges and at all supports to maintain clearances and overlaps.

03200.3.2.7 NOTICE TO OTHER TRADES - The Contractor shall ensure that all other crafts, sub-contractors, engineering support groups, and etc., whose work is related to concrete placement, are provided with ample notice and opportunity to introduce and finish required embedded items before concrete placement. All sleeves, inserts, anchors and any other embedded items shall be located and set in place prior to concrete placement. All voids in embedded items shall be temporarily filled to prevent entry of concrete.

03200.3.3 SPLICING

03200.3.3.1 ENGINEER APPROVAL - Except as shown on the Drawings, reinforcing steel shall not be spliced at any location without specific written approval of the Engineer. Splices in adjacent bars shall be staggered as directed by the Engineer.

03200.3.3.2 LAP SPLICES - Unless shown otherwise on the Drawings, or approved by the Engineer, bars up to and including number 11 shall be lap spliced in accordance with ACI 318 and shall be fastened together with steel wire.

Unless shown otherwise on the Drawings, or approved by the Engineer, bars at a lap splice shall be in contact with each other, and in no case shall the lap be less than 40 diameters of the spliced bars.

Unless shown otherwise on the Drawings, or approved by the Engineer, where bars are to be lap spliced at joints in the concrete, all bars shall project from the concrete first placed for a minimum length equal to the lap splice length as indicated on the Drawings. All concrete or other deleterious coating shall be removed from dowels and other projecting bars by wire brushing or sand blasting before the bars are embedded in a subsequent concrete placement.

03200.3.3.3 WELDING - Reinforcing steel shall be welded only if shown on the Drawings, or approved in writing by the Engineer. All welding of reinforcing steel shall comply with AWS D1.4.

03200.3.3.4 EXPANSION JOINTS - Reinforcement, or other embedded metal items bonded to the concrete, shall not be permitted to extend continuously through any expansion joint, with the exception of dowels in floors bonded on only one side of joint.

03200.3.4 REINFORCMENT SUPPORT

03200.3.4.1 PLACEMENT - All reinforcement shall be supported and retained in place, true to indicated lines and grades, by the use of approved bar supports, sized to position the steel in the exact location required on the Drawings. Supports shall be spaced at intervals of not more than 5 feet on center in any direction, to prevent movement of the steel during concrete placement. Deck steel shall be tied down to beams or forms at regular intervals not exceeding 5 feet on center in any direction.

03200.3.4.2 CONCEALMENT - Supports shall be completely concealed in the concrete and shall not discolor or otherwise mar the surface of the concrete.

03200.3.4.3 SAND PLATES - Supports with sand plates or horizontal runners shall be used for slabs on grade where the base material will not support chair legs.

03200.3.5 QUALITY COMPLIANCE

Reinforcing materials found to be damaged or at variance with the requirements of the Drawings or these Specifications for size, quantity, strength, position, arrangement, or other attribute, shall result in rejection of the concrete Work if they are not brought into compliance.

03200.4 METHOD OF MEASUREMENT

03200.4.1 NO MEASUREMENT

Unless shown otherwise, concrete reinforcement shall be included with the concrete item within which it is installed and no separate measurement shall be made.

03200.4.2 SEPARATE MEASUREMENT

When shown as a separate item on the Bid Schedule, measurement of reinforcing steel will be, based on the theoretical or calculated number of pounds placed and accepted according to the requirements of the Drawings and these Specifications. Measurement shall exclude splice bars used to replace test samples. No deductions will be made for any bends except for hooks. The length of the bar to be added to out-to-out dimensions of hooked bars will be shown on the plans. The weight calculations shall be based upon the following table:

WEIGHT CALCULATIONS FOR REINFORCING STEEL

Size	Lbs. per Lineal Foot	Size	Lbs. Per Lineal Foot
1/3 inch	0.167	#8	2.670
#3	0.376	#9	3.400
#4	0.668	#10	4.303
#5	1.043	#11	5.313
#6	1.502	#14	7.650
#7	2.044	#18	13.600

03200.5 BASIS OF PAYMENT

The accepted quantities of reinforcing steel will be paid for at the contract unit price. No allowance will be made for clips, wires or other material used for fastening reinforcement in place.

Payment will be made under:

PAY ITEM	UNIT
Reinforcing Steel	Lb.

03300.1 DESCRIPTION

Covers concrete placement operations for cast-in-place structural building frames, slabs and other components.

03300.1.1 RELATED WORK

Section 03050 - Portland Cement Concrete
Section 03100 - Concrete Forming, Finishing and Curing
Section 03200 - Concrete Reinforcement
Section 03310 - Concrete Joints for Slabwork
Section 03600 - Grout and Mortar

03300.1.2 SUBMITTALS

03300.1.2.1 RECORD OF PLACED CONCRETE - Contractor's record of placed concrete, which indicate the date, time, temperature, location, quantity, names/types of any additives used, and type of curing materials or procedures used.

03300.1.2.2 DELIVERY TICKETS - Copies of delivery tickets which indicate the date and time of delivery; the producer and the truck number; the volume of delivery; and the amounts (weights) of cement, aggregates and any additives, including all water added at plant and in the field.

03300.1.3 DEFINITIONS

Not used.

03300.2 MATERIALS

03300.2.1 CONCRETE

Shall meet Class and material requirements of Section 03050.

03300.2.2 BONDING COMPOUND

Shall be polyvinyl acetate or acrylic base, non-rewettable type.

03300.2.3 VAPOR BARRIER

Shall be minimum 6 mil thick, polyethylene sheet, and the Contractor shall allow for 6 inch overlap at all edges, unless shown otherwise on Drawings. Vapor Barrier required for below grade application shall be free from pin holes, tears, scars and other defects.

03300.2.4 FORMS

Shall meet requirements of Section 03100.

03300.2.5 REINFORCEMENT

Shall meet requirements of Section 03200.

03300.2.6 COVERINGS AND CURING COMPOUND

Shall meet requirements of Section 03100.

03300.2.7 GROUT

Shall meet requirements of Section 03600.

03300.2.8 WATERSTOP

Water stop shall be of the materials described and placed in the joints where shown on the Drawings and called for in these specifications. Precautions to insure proper support and location for the water stop during concrete placement shall be taken.

03300.3 CONSTRUCTION REQUIREMENTS

03300.3.1 PREPARATION

03300.3.1.1 ENGINEER NOTIFICATION - The Engineer shall be given not less than 24 hours notice of a pour before it starts.

03300.3.1.2 REINFORCEMENT AND OTHER MATERIALS - All anchors, seats, plates, reinforcement and other items, to be embedded or cast into concrete, shall be accurately placed, held securely, and not impede concrete placement.

03300.3.1.3 CONSTRUCTION LOADS - The Contractor shall ensure that construction loads shall not exceed member capacity.

03300.3.1.4 PREVIOUSLY PLACED CONCRETE - The Contractor shall prepare previously placed concrete by bush hammering or cleaning with steel brush, as required by the Drawings or these Specifications, and by application of the required bonding compound in accordance with manufacturer's instructions.

03300.3.1.5 DOWELING TO EXISTING WORK - At locations where new work is to be doweled to existing work, the Contractor shall drill 1 inch minimum oversize holes 20 bar diameters deep into the existing concrete. Holes shall be thoroughly cleaned with oil free air filled with epoxy grout from the bottom out, then insert the dowel full depth.

03300.3.1.6 TEMPERATURES - Temperature at the time of placement shall meet requirements provided in Section 03050 and Subsection 03300.3.4.1 below.

03300.3.1.7 DELIVERY - The Contractor shall ensure that concrete delivery meets all requirements of Section 03050.

03300.3.2 CONCRETE PLACEMENT

Concrete shall be conveyed, deposited and consolidated by methods that preclude separation or loss of ingredients.

03300.3.2.1 CONVEYING OF CONCRETE – Conveying of concrete shall be carried out as follows:

- Chutes for conveying concrete shall be sloped to permit concrete of the required consistency to flow without segregation.
- Where necessary, chutes shall be supplied with baffle boards or a reversed section at the outlet.

- Concrete shall not be allowed to drop more than 6 vertical feet without the assistance of pipes or tremies.

03300.3.2.2 DEPOSITION OF CONCRETE – Deposition of concrete shall adhere to the following requirements:

- Concrete shall not be placed if the subgrade is muddy, soft, or frozen.
- Concrete shall be deposited as near to its final position as practical.
- Use of vibrators for shifting concrete is not permitted.
- Concrete shall be placed in horizontal layers insofar as practical with placement starting at the low point and proceeding upgrade.
- Concrete slabs or footings shall be placed on compacted soil surfaces and the subgrade shall have a dampened condition. To achieve the dampened condition, the subgrade may be sprinkled with water in advance of placing concrete.
- Concrete placement shall be continuous between construction joints and shall be terminated with square ends and level tops unless otherwise shown on the plans.
- Concrete shall not be placed in horizontal sections until the concrete in the adjoining vertical members has been consolidated and 2 hours has elapsed to allow for shrinkage.
- Where concrete is to be deposited against hardened concrete joints, placement shall not begin until a grout mixture has been coated on the joint. This grout mixture shall consist of mixture prescribed in Section 03600.

03300.3.2.3 CONSOLIDATION OF CONCRETE - Consolidation of concrete, except for slope paving and concrete placed underwater, shall be accomplished through the use of vibrators as follows:

- A sufficient number of spare vibrators shall be kept available to preclude interruption of concrete placement due to vibrator failure and to have the capacity to consolidate the concrete mass within 15 minutes after placement in the forms.
- The location, manner and duration of the application of the vibrators shall be such as to secure maximum consolidation of the concrete without separation of the mortar and coarse aggregate, and without causing water or cement paste to flow to the surface.
- Vibrators shall be operated so as not to contact the subgrade, reinforcing steel or form work, and shall not be used to move the mass of concrete horizontally.
- External vibration, except for vibrating screeds, shall not be used, unless approved by the Engineer prior to the start of concrete placement.

03300.3.3 WATERSTOPS

Waterstops in the walls shall be carried into the slabs below and shall join the waterstops in the slabs with factory-made fittings or welded joints. All joints in water-bearing structures shall have waterstops, whether indicated on the plans or not. For other location requirements for waterstops, see the general notes of the plans.

03300.3.4 TIME LIMITATIONS

Mixed concrete shall be rejected if it is not placed within 90 minutes after water is introduced into the mixture and air temperature is 80°F or less, or if it is not placed within 60 minutes after water is introduced into the mixture and air temperature is above 80°F; or if the initial set has developed.

03300.3.5 HOT OR COLD WEATHER PLACEMENT REQUIREMENTS

03300.3.5.1 TEMPERATURE LIMITATIONS - Concrete temperature shall be between 50°F and 90°F at the time of placement in the forms.

03300.3.5.2 HOT WEATHER CONDITIONS - Hot weather conditions shall be considered to exist when ambient temperatures exceed 90^0 F, or when the ambient temperature is below 90^0 F but the temperature to humidity relationships shown in the following table for conditions below 90^0 F exist.

TEMPERATURE/HUMIDITY RELATIONSHIP

Relative Humidity Less Than (Percent)	Air Temperature Greater Than (°F)	Maximum Concrete Temperature (°F)
80	90	90
70	90	90
60	90	90
50	90	85
40	90	80
30	80	75
20	75	70

During hot weather conditions, the Contractor shall take the following steps to protect the concrete:

- The concrete ingredients shall be cooled before mixing to maintain concrete temperature at time of placement below the maximum acceptable values listed in the table below.

  Mixing water may be chilled, or chopped ice may be used to control the concrete temperature, provided the water equivalent of the ice is calculated into the total amount of mixing water. Ice shall be completely melted and dispersed throughout the mix at the completion of the mixing time.

  All methods and equipment for cooling of water and aggregate shall be subject to approval of the Engineer, and shall conform to ACI 305.

- Reinforcing steel shall be covered with water-soaked burlap as required, to prevent the steel temperature from exceeding the ambient air temperature immediately before concrete placement.

- Forms shall be thoroughly wet, but free of standing water, before concrete placement. Concrete should be placed in shallower layers than under normal weather conditions if necessary to assure coverage of the previous layer while it will respond readily to vibration.

- Fog spray shall be used during finishing whenever necessary to avoid surface plastic-shrinkage cracking. Fog spray shall also be used after finishing, before the specified curing is commenced, to avoid surface plastic-shrinkage cracking.

- Forms shall be kept covered and continuously moist. Once forms are loosened and during form removal, concrete surfaces shall be protected from drying, and shall be kept continuously wet by fog spraying or other approved means.

Additional costs due to concrete placement in hot weather conditions shall be the responsibility of the Contractor.

03300.3.5.3 COLD WEATHER CCONDITIONS - Cold weather limitations shall apply when air temperature falls below 40°F. Procedures for protecting concrete shall be in accordance with ACI Standard 306, "Recommended Practice for Cold Weather Concreting." If concrete placement is necessary during low temperature conditions, the Contractor shall take the following steps to protect the concrete:

- The Contractor shall heat all water and aggregates uniformly in accordance with Section 03050 before mixing, to obtain a concrete mixture temperature between 60°F and 90°F at the time of placement.

- The Contractor shall not use calcium chloride, salt or other material containing antifreeze agents or chemical accelerators unless approved otherwise in writing by the Engineer.

- If temperatures are expected to drop below 32°F the night before the concrete is placed, all reinforcement, the forms, and the ground shall be preheated at a minimum temperature of 50°F for a minimum of 12 hours prior to placement.

- The concrete shall be protected from freezing. The Contractor shall furnish all materials and equipment to insulate and to heat the work as necessary to maintain concrete temperatures above 50°F.

- Concrete temperature shall be maintained at not less than 50°F and not more than 70°F for the first 7 days after placement.

- Combustion type heaters, which produce carbon monoxide (CO), shall be adequately vented.

The Contractor shall assume all risk in connection with placing concrete in cold weather conditions. Permission given to place concrete in cold weather shall in no way relieve the Contractor of the responsibility for compliance with these Specifications. Any work not in compliance with these Specifications due to cold weather conditions shall be removed and replaced at the Contractor's expense.

03300.3.6 JOINTS

03300.3.6.1 COMPLIANCE - Construction joints shall be placed at the locations shown on the Drawings or as approved by the Engineer. Expansion and contraction joints and joint sealing shall be accomplished in accordance with Section 03310.

03300.3.6.2 CLEANING - Unless otherwise directed by the Engineer, all construction joints shall be cleaned prior to placement of concrete. All unsatisfactory concrete, latency material, stains, debris, and other foreign materials shall be removed. After cleaning, the surface shall be washed thoroughly to

remove all loose material. Excess water shall be disposed of in such manner that it will not stain, discolor, or otherwise affect adjacent surfaces of the structures.

03300.3.7 FINISHING

Finishing shall be accomplished as indicated on the Drawings and in accordance with the requirements of Section 03100. Water shall not be sprinkled on concrete surfaces during finishing.

03300.3.8 CURING

Curing shall meet the requirements of Section 03100.

03300.3.9 PROTECTION

The Contractor shall provide necessary barriers, walkways, etc. to protect freshly placed concrete from physical damage. Any damage sustained as a result of failure to provide such protection shall be corrected at the Contractor's expense.

03300.3.10 REPAIR OF DEFECTIVE CONCRETE

03300.3.10.1 REPAIR FOR NON-COMPLIANCE - All concrete that fails to conform to required material characteristics, dimensions, lines, finishes and elevations shown on the Drawings, or in accordance with these Specifications shall be replaced or corrected in accordance with these Specifications and as approved by the Engineer.

03300.3.10.2 ADDITIONAL TESTING - Any engineering analysis and additional testing required to determine the extent of repair will be provided by the Contractor at no additional cost to the Owner.

03300.3.10.3 REMOVAL OF SLABS WITH CRACKS - Removal of concrete sections with cracks in slabs which occur within 2 feet of expansion or construction joints may be deemed necessary by the Engineer.

03300.3.11 QUALITY COMPLIANCE

Concrete work may be rejected for failure to comply with the following requirements:

03300.3.11.1 SPECIFICATION NON-COMPLIANCE - Concrete work shall be rejected if the materials used in the work fail to comply with the requirements of Section 03050 and 03200.

03300.3.11.2 STRENGTH TEST FAILURE - Concrete work, for which the average of three 28-day compressive or flexural strength samples made from the same batch falls below the acceptance level, shall be rejected, unless otherwise directed by the Engineer.

03300.3.11.3 IMPROPER CURING - Concrete work for which the method of curing is not as specified, or that has been inadequately protected from extremes of temperature during the early stages of hardening and strength development, shall be rejected, unless otherwise directed by the Engineer.

03300.3.11.4 ACCIDENT AND INJURY - Concrete work that has been subjected to construction fires, accidents, mechanical injury or premature removal of formwork likely to result in deficient strength development, shall be rejected, unless otherwise directed by the Engineer.

03300.3.11.5 POOR WORKMANSHIP - Concrete work, subjected to poor workmanship that may result in deficient strength or load carrying capacity, including but not limited to honey combing, cold

joints, introduction of contaminants or embedded debris, improper placement location or dimensions, and etc., shall be rejected, unless otherwise directed by the Engineer.

03300.3.11.6 POOR FINISH - Concrete work that fails to meet the required finish in accordance with the requirements of Section 03100, or exposed concrete with defects adversely affecting the appearance of the specified finish shall be rejected, unless otherwise directed by the Engineer.

03300.4 METHOD OF MEASUREMENT

03300.4.1 NO MEASUREMENT

When concrete is not indicated as a separate item in the Bid Schedule, no measurement will be made and the concrete required for a structure shall be considered a component of another item or items shown in the Bid Schedule.

03300.4.1 SEPARATE MEASUREMENT

03300.4.1.1 CUBIC YARD - When concrete is indicated as a separate item on the Bid Schedule, measurement shall be made by counting the number of cubic yards placed and accepted as determined by calculating volumes using the dimensions shown on the Drawings. This measurement shall NOT include:

- Any allowance for reinforcing steel in concrete.
- Any allowance for concrete required for filling over-excavation for footings, walls or slabs.
- Any allowance for volume occupied by pipes (except culverts), reinforcing steel, anchors, conduits, or weep holes.

03300.4.1.2 SQUARE UNIT – Measurement for square feet or yards of concrete shall be made using an accurate measuring device to determine the length and width of concrete placed and accepted and then multiplying those values to find the amount of area covered.

03300.5 BASIS OF PAYMENT

The accepted quantities shall be paid for at the contract unit price:

PAY ITEM	UNIT
Concrete (*Class* _____)	Cubic Yard
Concrete (*Class* _____)	Square Yard
Concrete (*Class* _____)	Square Foot
Concrete Structure (*Name*)	Lump Sum

BUILDING FOUNDATION AND FLOOR

SECTION 03305SP

03305.1 DESCRIPTION

03305.1.1 Furnish materials and construct building concrete footings, foundation, pre cast manhole and floor slab as shown on the DRAWINGS and as required by these SPECIFICATIONS. The foundation shall consist of, but not necessarily be limited to, concrete, reinforcing steel, and all other miscellaneous items necessary to complete the footings, foundation, pre cast manhole and floor slab as shown on the DRAWINGS, or as required by these specifications.

03305.1.2 RELATED WORK

Section 02105 - Earthwork Materials
Section 02201 - Earthwork
Section 03050 - Portland Cement Concrete
Section 03100 - Concrete Forming, Finishing and Curing
Section 03200 - Concrete Reinforcement
Section 03500 - Concrete Structures and Slab Work

03305.2 MATERIALS

03305.2.1 Concrete as specified and in accordance with Section 03050.

03305.2.2 Reinforcing Steel as specified and in accordance with Section 03200.

03305.2.3 Pre cast Manhole as specified and in accordance with Section 03500.

03305.3 CONSTRUCTION REQUIREMENTS

03305.3.1 The CONTRACTOR shall complete construction of the steel building concrete footings, foundation, foundation walls and concrete floor, etc. in a manner that conforms with the requirements of the DRAWINGS and these SPECIFICATIONS, using good workmanship practices, and applicable building regulations.

03305.4 METHOD OF MEASUREMENT

03305.4.1 The method of measurement for the building concrete shall be "lump sum" and all incidental materials and construction needed to complete the building footings, foundation, pre cast manhole and floor slab as shown on the DRAWINGS.

03305.4.2 Pay limits for building concrete include all concrete inside the building and including the building exterior foundation walls/footings.

03305.5 BASIS OF PAYMENT

The accepted quantity will be paid for at the contract unit price for:

PAY ITEM	UNIT
Building Concrete	Lump Sum

03310.1 DESCRIPTION

Furnish materials and install appropriate longitudinal and transverse expansion joints, construction joints and crack control joints in slabs and pavement.

03310.1.1 RELATED WORK

Section 03050 - Portland Cement Concrete
Section 03100 - Concrete Forming, Finishing, and Curing
Section 03300 - Concrete Structures and Slabwork

03310.1.2 SUBMITTALS

The Contractor shall submit the following to the Engineer for review and approval:

03310.1.2.1 PRODUCT CERTIFICATION – The manufacturer's certification that product was manufactured, tested and supplied in accordance with source control requirements specified herein, together with a report of the test results and the date each test was completed.

03310.1.2.2 INSTRUCTIONS – The manufacturer's instructions for joint preparation, type of cleaning and installation.

03310.1.2.3 DATA SHEETS – The manufacturer's product and safety data for each joint sealant product required.

03310.1.2.4 SAMPLES – A manufacturer's sample of each joint sealant product required.

03310.1.3 DEFINITIONS

Not used.

03310.2 MATERIALS

03310.2.1 GENERAL

03310.2.1.1 COMPATIBILITY OF MATERIALS - Provide joint filler, sealant backings, sealants and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.

03310.2.1.2 DELIVERY OF MATERIALS - Deliver materials to site in original unopened containers or bundles with labels identifying manufacturer, product name and designation, color, expiration period for use, pot life, cure time and mixing instructions for multi-component materials.

03310.2.1.3 STORAGE AND HANDLING OF MATERIALS - Store and handle materials in compliance with manufacturer's recommendations to prevent deterioration; or damage due to moisture, high or low temperatures, contaminants or other causes.

03310.2.2 PRODUCTS

03310.2.2.1 JOINT VOID FORMER - Shall be of plastic with a waterstop and shall extend 1/3 of the depth of the concrete structural section.

03310.2.2.2 JOINT FILLER - J4 joint filler shall be the required standard and shall be used unless another filler from the list below is specified. Fillers shall be non-extruding, resilient, and meet the requirements of ASTM D-545:

- F1 Joint Filler – 13mm thick filler for expansion joints; bituminous (asphalt or tar) mastic in accordance with ASTM D-994; formed and encased between 3 layers of bituminous saturated felt or 2 layers of glass fiber felt.

- F2 Joint Filler - Cane or other cellulosic fiber in accordance with ASTM D-1751, saturated with asphalt.

- F3 Joint Filler - Granulated cork in accordance with ASTM D-1751; in an asphalt binder; encased between 2 layers of asphalt saturated felt or 2 layers of glass fiber felt.

- F4 Joint Filler - Sponge rubber fully compressible in accordance with ASTM C-1752, with resiliency recovery rate of 90 percent minimum.

- F5 Joint Filler - Cork in accordance with ASTM C-1752; impregnated and bound with asphalt; compressible with resiliency recovery rate of 90 percent if not compressed more than 50 percent of original thickness.

- F6 Joint Filler - Plastic foam (for cold-applied sealants only) pre-formed, compressible, resilient, non-waxing, non-extruding strips of flexible, non-gassing plastic foam; non-absorbent to water and gas; 20 lb/ft^3 density maximum; and of size and shape to control sealant depth and performance.

- Synthetic Sponge Rubber Filler - Synthetic sponge rubber filler shall be an expanded closed cell sponge rubber, manufactured from a synthetic polymer neoprene base. The material shall be No. 750.3 Ropax Rod Stock as manufactured by the Presstite Division of Interchemical Corporation; Bondtex as manufactured by Rubatex Corporation; or approved equal. The size of the material shall be 25 percent greater in diameter than the nominal joint width. The manufacturer's instructions for surface preparation and application shall be used as a guide for installation, except that the material shall not be installed by stretching beyond its normal length.

03310.2.2.3 SEALANT - Hot applied joint sealant shall be one of the following:

- HAS1 Sealant - Resilient and adhesive compound type in accordance with ASTM D-3405, for Portland cement concrete or asphalt concrete pavements.

- HAS2 Sealant - Thermoplastic type in accordance with ASTM D-3581, jet fuel resistant without rubber, unless indicated otherwise.

- HAS3 Sealant - Elastomeric type in accordance with ASTM D-1190.

- HAS4 Sealant - Elastomeric type in accordance with ASTM D-3406, one component, for Portland cement concrete pavements.

- HAS5 Sealant - Elastomeric type in accordance with ASTM D-3569, one component, jet-fuel resistant, for Portland cement concrete pavements.

Cold applied joint sealant shall be one of the following:

- CAS1 Sealant - Elastomeric type in accordance with ASTM C-920; chemically curing, for vehicular or pedestrian use and types of construction other than highway and airfield pavements and bridges and joint substrates indicated; Type S or M; Grade P or NS; Class 25; Use T, NT, M and O with the following characteristics:

  ⇒ Self leveling
  ⇒ 40 ± 5 ASTM D-2240 Shore A Hardness
  ⇒ 4 days minimum final cure
  ⇒ 10 to +150^0 F service range

- CAS2 Sealant - Mastic type in accordance with ASTM D-1850, single or multiple companion, for joints having a minimum width of 1/2 inch.

- CAS3 Sealant - Coal tar modified urethane type in accordance with FS SS-S-200; one part, jet fuel resistant; Type H.

- CAS4 Sealant – Elastomeric, pre-formed polychloroprene type with lubricant adhesive and indicated movement ratio which meets one of the following:

  ⇒ For concrete pavement seal; ASTM D-2628
  ⇒ For concrete bridge seal; ASTM D-3542

Synthetic rubber sealant shall be as follows:

- The sealant shall be a 3-part polyurethane compound.

- Sealant shall be designed to cure at room temperature to a firm, highly resilient rubber.

- Sealant shall have the following properties determined at conditions of 75° F and 50 percent relative humidity:

  ⇒ Base - polyurethane rubber
  ⇒ Solids - not less than 97 percent
  ⇒ Application time - not less than 3 hours
  ⇒ Cure time - not more than 5 days
  ⇒ Ultimate hardness - 35 ± 5 (Shore A Durometer)
  ⇒ Tensile strength (ASTM D412) - 300 pounds per square inch minimum
  ⇒ Ultimate elongation - not less than 300 percent
  ⇒ Color - gray to match concrete unless otherwise indicated

- All packages shall be code dated. No material shall be more than 6 months old when used. Material shall have been kept at temperatures lower than 80° F at all times.

03310.2.2.4 BACKER ROD – Backer rod shall be neoprene, butyl, EPDM, or silicone tubing complying with ASTM D-1056, water and gasoline non-absorbent, capable of remaining resilient at temperatures down to -26°F. Provide product with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and otherwise contribute to optimum sealant performance.

03310.2.2.5 BOND BREAKER TAPE – Bond breaker tape shall be self-adhesive polyethylene or other plastic tape as recommended by sealant manufacturer for preventing sealant from adhering to joint filler materials or joint surfaces at back or bottom of joint.

03310.2.2.6 WATERSTOPS - Waterstop shall be rubber waterstop or PVC waterstop as designated on the Plans or in the Special Provisions and shall meet the requirements described herein.

- Waterstops shall be as manufactured by Burke Concrete Accessories Inc., Kirkhill Rubber Company, Williams Products Inc., Greenstreak, or approved equal:

- Waterstop shall be of the width and cross-section configuration shown on the Drawings or required in the Special Provisions.

- At expansion joints, only hollow centerbulb type waterstop shall be used.

Rubber waterstop shall meet the following requirements and conditions:

- Waterstop shall be manufactured to ensure an integral cross section which will be dense, homogeneous, and free from porosity and other imperfections.

- Minor surface defects, such as surface peel, covering less than 1 square inch and surface cavities or bumps less than ¼" in longest lateral dimension and less than 1/16" deep, will be acceptable.

- The rubber waterstop shall meet the following Specifications:

  ⇒ Hardness-Shore A Durometer – 60 to 70, ASTM D 2240
  ⇒ Elongation - not less than 450%
  ⇒ Tensile Strength - not less than 3,000 psi
  ⇒ Tensile Strength after aging 48 hours in oxygen at 70°C and 300 psi - not less than 80% of original
  ⇒ 300% Modulus - not less than 900 psi
  ⇒ Water absorption after 2 days at 158°F – not more than 5%
  ⇒ Compression set after 22 hours at 158°F - not more than 30%
  ⇒ Specific Gravity - 1.17 ± .03

Polyvinylchloride (PVC) waterstop shall be as manufactured by Greenstreak, or approved equal, and shall meet the following requirements and standards:

Property	ASTM Test	Nominal Value
⇒ Water absorption	D 570	0.15
⇒ Tear resistance	D 624	350/lb.in.
⇒ Ultimate elongation	D 638	390%
⇒ Tensile strength	D 638	2250 psi min.
⇒ Low temperature brittleness	D 746	$+35^0$F/$+37^0$C (passed at)
⇒ Stiffness in flexure	D 747	1190 psi
⇒ Specific gravity	D 792	1.37
⇒ Ozone resistance	D 1149	No failure
⇒ Volatile loss	D 1203	0.30%
⇒ Hardness (Shore A15)	D 2240	76+/3
⇒ Accelerated Extraction		
Tensile strength		2130 psi
Elongation		370%

PVC waterstop shall be heat weldable, have great inherent elasticity, be impervious to many waterborne chemicals, be suitable for above or below grade installation, not produce electrolytic reactions, and not discolor concrete or mortar.

See Subsection 03310.3.4 for waterstop installation specifications.

03310.3 CONSTRUCTION REQUIREMENTS

03310.3.1 WEATHER CONDITIONS

Do not proceed with installation of joint sealant under unfavorable weather conditions. Install elastomeric sealant only when temperature is stable within the temperature range recommended by manufacturer for installation.

03310.3.2 PREPARATION

03310.3.2.1 JOINT CLEANING - Clean, prepare and size joints in accordance with manufacturer's instructions. Remove any loose materials and other foreign matter. Do not proceed with installation of joint sealant until contaminants capable of interfering with sealant adhesive properties are removed from joint substrates. Remove any moisture on the substrate.

Remove protective coating and any oil from metals with solvent recommended by the sealant manufacturer.

03310.3.2.2 JOINT DIMENSIONS - Examine joint dimensions and size materials to achieve required width to depth ratio. Adjust joint depths to allow sealant to perform properly.

03310.3.2.3 MATERIAL COMPATIBILITY - Verify that joint shaping materials and release tapes are compatible with sealant.

03310.3.3 CONSTRUCTION

03310.3.3.1 FEATURES AND PURPOSES OF JOINT CONSTRUCTION - Construct all joints as follows:

- At right angles to top surface of placement.
- Straight unless indicated otherwise.
- Before uncontrolled shrinkage cracking takes place.
- To prevent concrete edge slump.

03310.3.3.2 BOND BREAKER TAPE - Install where needed or required by manufacturer's recommendations to ensure that elastomeric sealant will perform properly.

03310.3.3.3 EXPANSION JOINTS - Expansion joints shall be constructed as follows:

- They shall be placed in locations as shown on the Drawings or as approved by the Engineer.
- Joints in exterior concrete slab work shall be placed where shown on Drawings or as recommended by Portland Cement Association's "Design and Control of Concrete Mixture Manual".
- Pre-molded filler strips shall extend full depth in slab.

- Unless otherwise noted on the Drawings or directed by the Engineer, isolation joints shall be used in all areas where slabs abut vertical surfaces. Joint material shall be placed as called for and in good alignment.

- In no case shall the reinforcing or other fixed metal items embedded in or bonded to concrete be made to run continuously through an expansion joint.

- Concrete edges at joints shall be neatly finished with an edging tool providing a slightly rounded edge on each side of the joint filler material.

03310.3.3.4 CONSTRUCTION JOINTS - Other references to construction joints are located in Subsection 03300.3.6.

03310.3.3.5 CONTROL JOINTS – Control joints shall be constructed as follows:

- Tooled Joints. Tooled joints shall be formed by scoring the slab full depth with a steel trowel along a straight edge in locations as shown on the Drawings or, if not shown, not to exceed 625 square feet in area. The joint shall be finished using a joint tool guided by a straight edge leaving a slightly rounded edge on each side of the joint.

- Sawn Joints. Sawn joints shall be sawn into interior concrete floors as indicated on the Drawings and at Contractor's option in place of pre-formed metal keys. Joints shall be sawn with a power saw designed to saw depth and width as shown on Drawings. Hand held saws will not be accepted. Saw cutting shall occur within 12 hours after placement of concrete. The line of the saw shall be straight, true to line and square. Pourable joint sealant shall be poured into all sawn joints. Installation shall be in strict accordance with manufacturer's specifications which shall include preparation, priming, etc.

03310.3.3.6 JOINT SEALING - Installation of joint sealant shall adhere to the following procedures:

- Manufacturer's Instructions. Application shall be in strict accordance with the manufacturer's published instructions.

- Surface Preparation. All surfaces to which synthetic rubber sealant must bond shall be dry and free of dust, dirt, and other foreign residue and shall be primed with the manufacturer's recommended primer for the particular surface. Remove all oil, grease, wax, form release agents, curing compounds, bitumen, old caulking, and other latent material by sand blast or water blast, as recommended by the sealant manufacturer. Maximum angle for sand blasting is 25 degrees $\pm$ 5. Clean and dry with air blast. Do not contaminate air blast with oils or lubricants. Remove frost and moisture in concrete joint substrates before commencing sealing.

- Installation. If necessary, joints shall be saw cut, to provide the required sealant thickness and depth. Application shall be by means of a pneumatic caulking tool or other approved method. Ensure that sealant is installed in uniform, continuous ribbons without gaps or air pockets, with complete bonding of joint surfaces on opposite sides. Except as otherwise indicated, fill sealant rabbet flush with surface. Where horizontal joints are between a horizontal surface and vertical surface, fill joint to form a slight cove so that joint will not trap moisture and dirt.

  Install sealant to depths indicated or, if not indicated, as recommended by sealant manufacturer, but within the following general limitations measured at center (thin) section of bead:

⇒ For sidewalks, pavements and similar joints sealed with elastomeric sealants and subject to traffic and other abrasion and indentation exposures, fill joints to a depth equal to 75 percent of joint width, but neither more than 5/8 inch deep nor less than 3/8 inch deep.

⇒ For normal moving joints sealed with elastomeric sealants but not subject to traffic, fill joints to a depth equal to 50 percent of joint width, but not more than 1/2 inch deep nor less than 1/3 inch deep.

⇒ For joints sealed with non-elastomeric sealants and caulking compounds, fill joints to a depth in the range of 75 percent to 125 percent of joint width.

- Overflow and Spillage. Do not allow poured sealant compound to overflow or spill onto adjoining surfaces or to migrate into voids of adjoining surfaces. Clean adjoining surfaces to eliminate evidence of spillage.

- Overheating. Do not overheat hot applied sealants.

- Exposed Edges. Unless indicated otherwise, recess exposed edges of gasket and exposed joint filler slightly behind adjoining surface so compressed units will not protrude from joints.

03310.3.3.7 CURING AND PROTECTION – The Contractor shall follow the steps listed below regarding curing and protection of sealant:

- Cure sealant and caulking compounds in accordance with manufacturer's instructions and recommendations to obtain high early bond strength, internal cohesive strength and surface durability.

- Follow procedures required for cure and protection of joint sealants during construction period so they will be without deterioration or damage (other than normal wear and weathering) at time of Substantial Completion.

- Protect joint sealant during and after curing period from contact with contaminating substances, or from damage resulting from deterioration through the time of Substantial Completion.

- If damage or deterioration occurs, immediately cut out and remove damaged or deteriorated joint sealant and reseal joint with new materials. Repaired area shall be indistinguishable from un-repaired area.

03310.3.3.8 CLEANUP - Clean off all excess sealant or sealant smears adjacent to joints as the work progresses. Use methods and cleaning materials approved by manufacturers of joint sealant and of the products in which joints occur.

03310.3.4 WATERSTOPS

03310.3.4.1 INSTALLATION - Waterstops shall be installed in concrete joints where and as indicated on the Plans. Waterstops shall be set accurately to the position and line indicated on the Plans. Where required at expansion joints, the hollow, centerbulb type waterstop shall be installed centered on the joint.

03310.3.4.2 CONTINUITY - All waterstops shall be continuous. Waterstops in walls shall be carried into lower slabs and shall join the waterstops in the slabs with appropriate types of fittings. Waterstops shall be terminated 3 inches from the top of finished surfaces of walls and edges of slabs unless otherwise specified or indicated on the Plans.

03310.3.4.3 FASTENING IN PLACE - Edges shall be held and securely fixed in position at intervals of not more than 24 inches to prevent movement during the placing of the concrete. Wires placed near the outer bulb and/or special clips may be used for this purpose, at the Contractor's option. No nails shall be driven through a waterstop in the vicinity of any construction joint.

03310.3.4.4 JOINTS – Waterstop joints shall meet the following requirements

- All waterstop joints shall be watertight.
- All joints shall be made by the use of factory-made fittings and unions, some of which will be special.
- Fittings and unions shall be cemented in place using clamps over the entire area of splice until the cement is bonded permanently.
- Welding of the waterstop without the use of factory-made unions and fittings will not be permitted.
- Split type waterstop may be used, at the option of the Contractor, provided that all junctions between standard solid type waterstop and split type waterstop shall be made with solidly welded and cemented unions between the two waterstops. This union may be split and re-cemented in accordance with the manufacturer's recommended method.
- Cement shall be as recommended by the manufacturer of the waterstop, and field cementing or solvent welding shall be in accordance with the manufacturer's directions.

03310.4 METHOD OF MEASUREMENT

Unless otherwise indicated in these Specifications, no separate measurement will be made for the materials and work covered by this section.

03310.5 BASIS OF PAYMENT

Unless otherwise noted in these Specifications, no separate payment will be made for items under this section. Compensation shall be included in the prices paid for the various contract items and no separate compensation will be allowed.

03500.1 DESCRIPTION

This is a generic specification covering furnishing and installing of pre-cast concrete units, complete with required accessories as shown on the Drawings and called out in these Specifications.

03500.1.1 RELATED WORK

Section 01300 - Submittals
Section 02224 – Sewer Pipe and Manholes
Section 03050 - Portland Cement Concrete

03500.1.2 SUBMITTALS

03500.1.2.1 SHOP DRAWINGS - Submit shop drawings showing unit design, signed and sealed by a Professional Engineer, in accordance with Section 01300. The Contractor shall not proceed with fabrication until shop drawings have been approved.

03500.1.2.2 UNIT DESIGN – Unit design shall incorporate the following:

- Pre-cast units shall be designed in accordance with ACI 318 and PCA design handbooks under the direction of a Professional Engineer experienced in the design of such units.
- Indicate unit locations, unit identification marks, fabrication details, reinforcement, connection details, pertinent dimensions, and erection support points.
- Units shall be designed to support the required shipping and handling loads, and the live, dead and construction loads.
- Component connections shall be designed to provide adjustment to accommodate misalignment of structure during installation.
- The Engineer may approve design deviations provided that equivalent units serving the same basic function and intent are furnished at no additional cost to the Owner. Such deviations shall only be approved upon written request and when accompanied with complete design calculations and drawings.

03500.1.3 DEFINITIONS

Not used.

03500.2 MATERIALS

03500.2.1 ACCESSORIES

Connecting and supporting devices shall be carbon steel in accordance with ASTM A 36. Bolts, nuts and washers shall be carbon steel or stainless steel as required on the Drawings. Grade 60 reinforcement shall be provided for all units.

03500.2.2 IDENTIFICATION MARKS

Unit identification marks shall appear on all manufactured units.

03500.2.3 FINISHES

Shall be in accordance with one of the following paragraphs. If no finish is prescribed on the Drawings, the Standard Finish will be provided.

03500.2.3.1 STANDARD FINISH - Produced in plastic or metal lined forms which impart a smooth finish. Small surface holes, normal form joint marks, minor chips and spalls may be approved. Major or unsightly imperfections, honeycomb or structural defects are not acceptable.

03500.2.3.2 COMMERCIAL FINISH - Produced in plastic or metal lined forms which impart a smooth finish. Remove fins and large projections and fill holes over 1/2 inch with sand-cement paste. Faces shall be true and well defined. Exposed ragged edges shall be corrected by rubbing or grinding.

03500.2.3.3 ARCHITECTURAL GRADE FINISH - Produced in plastic or metal lined forms which impart a smooth finish. Fill holes over 1/4 inch in diameter with sand-cement paste. Grind smooth form offsets or fins over 1/8 inch. Coat with neat cement paste using a float and after paste has dried, rub with burlap to remove loose particles.

03500.2.3.4 SPECIAL FINISHES - Finishes produced by sandblasting, acid washing, or form liners shall be specifically defined on the Drawings or in these Specifications and samples showing texture and color will be required for approval.

03500.2.3.5 PAINTABLE FINISHES - Where unit surfaces will be painted, only form release agents compatible with paints shall be used during fabrication.

03500.3 CONSTRUCTION REQUIREMENTS

03500.3.1 FABRICATION

Fabrication of pre-cast units shall proceed as follows:

03500.3.1.1 RECORDS - Maintain plant records and quality control program during production of structural pre-cast concrete. Make records available to Engineer.

03500.3.1.2 MOLDS - Use molds which are rigid and constructed of material that will result in uniform finished products.

03500.3.1.3 PLACEMENT AND VIBRATION - Place and vibrate concrete to ensure: proper consolidation, elimination of cold joints, and minimize entrapped air marks on finished surfaces.

03500.3.1.4 REINFORCEMENT AND FITTINGS - Provide required connecting devices, plates, angles, and connectors to steel framing members, bolts and accessories. Ensure reinforcing steel, anchors, inserts, plates, angles and other cast-in items are sufficiently embedded, anchored and properly located.

03500.3.1.5 LIFTING DEVICES - Embedded lifting or handling devices shall be capable of supporting units in positions anticipated during manufacture, storage, transportation and erection.

03500.3.1.6 FINISHED SURFACE - Ensure finished surfaces of pre-cast structural units are uniform.

03500.3.1.7 CURING - Cure units under identical conditions to develop specified concrete quality and minimize appearance of blemishes such as non-uniformity, staining or surface cracking.

03500.3.2 DELIVERY, STORAGE AND HANDLING

03500.3.2.1 DELIVERY - Unless otherwise approved in writing, do not deliver units to job site until required for installation.

03500.3.2.2 EDGE PROTECTION - Provide edges of units with adequate protection to prevent staining, chipping or spalling of concrete.

03500.3.2.3 HANDLING - Handle pre-cast units in positions consistent with their shape and design. Lift and support only from support points indicated on Shop Drawings.

03500.3.2.4 BLOCKING AND BRACING - Block and laterally brace units while in storage. Provide lateral bracing that is sufficient to prevent bowing and warping. Bracing shall be clean, non-staining and of a type that will not inhibit uniform curing of exposed surfaces.

03500.3.3 INSTALLATION

Do not install pre-cast units until concrete has attained its design compression strength. Install members plumb, level and in alignment. Clean weld marks or other marks, debris or dirt from exposed surfaces of units.

03500.3.4 REPAIR

Repair of damaged units may be acceptable if structural integrity or appearance is not impaired.

03500.4 METHOD OF MEASUREMENT

03500.4.1 NO MEASUREMENT

Separate measurement for pre-cast concrete units will not be made when the unit is a component of a building, assembly or enclosure for which identification is made in the Bid Schedule.

03500.4.2 SEPARATE MEASUREMENT

When pre-cast concrete units appear as a separate item on the Bid Schedule, they will be measured either by counting the number of units installed and accepted or by using a measuring tape or other accurate measuring device to determine the total number of lineal feet of units installed and accepted.

03500.5 BASIS OF PAYMENT

Separate payment for pre-cast concrete units will not be made when they are a component of building, assembly or enclosure identified in the Bid Schedule.

The accepted quantities will be paid for at the contract unit price for:

PAY ITEM	UNIT
Pre-Cast Concrete (*Describe*)	Each
Pre-Cast Concrete (*Describe*)	Lineal Foot

DIVISION 5

METALS

05010.1 GENERAL

This section of the Specifications covers metals and metal work required to furnish, fabricate, and to install the following nonexclusive list of items:

- Aluminum and miscellaneous nonferrous metals
- Anchors and anchor bolts
- Bolts
- Cast-iron frames and covers
- Grating and frames
- Ladders
- Louvers
- Manhole frames and covers
- Metal roof decking
- Miscellaneous metal items shown on the Plans or specified
- Miscellaneous structural steel
- Pipe handrails, pipe sleeves, inserts, and chains
- Platforms
- Sheet metalwork
- Special supports, hangers, and anchors
- Stairs and treads
- Steel lintels
- Supports for mechanical equipment
- Tread plates and frames

05010.1.2 RELATED WORK

Not used.

05010.1.3 SUBMITTALS

Certified copies, in duplicate, of mill tests or reports from a recognized commercial laboratory shall be furnished when requested as to the chemical, tensile, and bending properties of each shipment of structural metal or part thereof having common properties. All tests and analyses shall be made in accordance with the applicable ASTM Specification.

05010.1.3 DEFINITIONS

Not used.

05010.2 MATERIALS

05010.2.1 ALUMINUM

05010.2.1.1 SHEET ALUMINUM - Except as otherwise specified or indicated on the Plans, sheet aluminum shall be alloy 50050H14 conforming to the requirements of ASTM B 209 and shall be not less than 0.025 inch in thickness.

05010.2.1.2 STRUCTURAL ALUMINUM - Structural aluminum shall be 6061-T6, and extruded aluminum shall be 6063-T42.

Aluminum shapes and appurtenant materials shall conform to the requirements of ASTM B 221 and ASTM B 308 and shall be of aluminum alloy known commercially as 6061-T6. Materials not otherwise specified shall conform to the latest applicable Specifications of ASTM.

05010.2.1.3 BOLTS - All bolts for bolting aluminum shall be Type 304 or 316 stainless steel of sizes indicated on the Plans.

05010.2.2 STEEL

05010.2.2.1 SHEET STEEL - Galvanized sheet iron or steel shall conform to ASTM A 525, 1.25-ounce coating; black steel to ASTM A 569.

05010.2.2.2 STRUCTURAL STEEL – Structural steel shall be as follows:

- Unless otherwise specified, structural steel shall conform to ASTM A 36.
- Cast iron shall conform to ASTM A 48, Class 40B.
- Galvanized structural steel or iron shall be "hot dipped" galvanized after fabrication. Electro-galvanizing shall not be used unless specified otherwise.
- All structural steel shall be delivered free from mill scale, rust, or pitting.
- Items not galvanized or protected by a shop coat of paint shall be protected from the weather until erection and painting.

05010.2.2.3 STAINLESS STEEL - Stainless steel, unless specifically specified or indicated on the Plans otherwise, shall be Type 316 or Type 304, nonmagnetic.

05010.2.2.4 STEEL PIPE - Steel pipe shall conform to ANSI B 36.10, Table I.

05010.2.2.5 BOLTS - High tensile bolts shall conform to ASTM A 325.

05010.2.2.6 OTHER ITEMS

Other structural and miscellaneous metal items shall be as indicated on the Plans or as specified elsewhere.

05010.3 CONSTRUCTION (FABRICATION) REQUIREMENTS

05010.3.1 GENERAL

All structural or foundry items shall be carefully fabricated to true dimensions without warp or twist. Welded closures shall be neatly made; and where weld material interferes with fit or is unsightly in appearance, it shall be ground off smooth.

05010.3.1.1 INSTALLATION - Each structural item shall be installed true to level, plumb, alignment, and grade with all parts bearing or fitting the structure or equipment for which it is intended accurately and securely. It shall not be permitted to cock out of alignment, re-drill, reshape, or force to fit any fabricated item. It is the Contractor's responsibility to place anchor bolts or other anchoring devices accurately and to make any surfaces, which bear against structural items smooth and true to level to preclude the necessity of any springing, re-drilling, or reshaping.

05010.3.1.2 SPECIAL ALIGNMENT - Pipe railings, posts, and structural items needing a special alignment to preserve straight, level, even, smooth lines shall be rigidly supported and braced and kept braced until concrete, grout, or dry pack cement mortar has hardened for a period of not less than 48 hours.

05010.3.1.3 FIT - The Contractor shall be responsible for the correct fitting of all metalwork in the field. The Contractor shall take all measurements necessary to properly fit its work in the field, and it shall be governed by and be responsible for these measurements and the proper working out of all details.

05010.3.1.4 WELDING – General welding procedures are as follows (see also Subsections below):

- The Contractor shall notify the Engineer at least 24 hours before starting shop or field welding.
- A welding inspector may check the materials, the equipment, and the qualifications of the welders.
- The inspector may use gamma ray, magnetic particle, dye penetrant, trepanning, or any other aid to visual inspection which it may deem necessary to be assured of the adequacy of the welding.
- The costs of any tests and all re-tests on defective welds shall be borne by the Contractor. Cost in connection with qualifying welders shall also be borne by the Contractor.
- The cost of tests on sound welds will be borne by the Owner.
- Welders doing unsatisfactory work shall be removed or may be required to pass qualification tests again.

05010.3.1.5 MISCELLANEOUS METALWORK - Where anchors, connections, or other details of miscellaneous metalwork are not definitely shown or specified, its material, size, form, attachment, and location shall conform to best practice.

05010.3.1.6 HAZARDOUS PROJECTIONS - Sharp or hazardous projections shall be rounded off and ground smooth.

05010.3.1.7 CHIPS AND DEBRIS - All chips and other debris lodged between contacting surfaces shall be removed before assembly.

05010.3.2 ALUMINUM

05010.3.2.1 STRUCTURAL ALUMINUM

The Contractor shall furnish and install all structural aluminum items in accordance with the Plans and as specified. It shall provide all supplementary parts necessary to complete each item even though such work is not definitely covered by the Plans and Specifications. Its size, form, attachment, and location shall be such as to conform to the best of current practice.

05010.3.2.2 LAYOUT ON ALUMINUM - Hole centers may be center punched and cutoff lines may be punched or scribed. Center punching and scribing shall not be used where such marks would remain visible on the surface of the fabricated material.

When critical dimensions exist, a temperature correction shall be applied in the layout as necessary. The coefficient of expansion shall be taken as 0.000013 per degree F.

05010.3.2.3 CUTTING AND DRILLING ALUMINUM – Aluminum may be cut and drilled as follows:

- Material 1/2 inch thick or less may be sheared, sawed, or cut with a router. Material more than 1/2 inch thick shall be sawed or routed.
- Cut edges shall be true, smooth, and free from excessive burrs or ragged breaks.
- Edges of plates carrying calculated stresses shall be planed to a depth of 1/4 inch. Sawn or routed edges will be acceptable when the finish is of equal quality to a planed edge.
- Re-entrant cuts shall be avoided wherever possible. If used, they shall be filleted by drilling prior to cutting.
- Rivet or bolt holes may be punched or drilled to finished size before assembly.
- The finished diameter of holes for unfinished bolts shall be not more than 1/16 inch larger than the nominal bolt diameter.
- All holes shall be cylindrical and perpendicular to the principal surface. Holes shall not be drifted in such a manner as to distort the metal.
- Flame cutting of aluminum alloys is not permitted.

05010.3.2.4 ALUMINUM FORMING AND ASSEMBLY - Structural aluminum material may not be heated except in forming operations where material may be heated to a temperature not exceeding 400 degrees F for a period not exceeding 30 minutes to facilitate bending. Such heating shall be done only when proper temperature controls and supervision are provided to insure that the limitations on temperature and time are carefully observed.

05010.3.2.5 WELDING ALUMINUM - This Specification shall apply to both field and shop welding operations. The general recommendations and regulations shown in the American Welding Society Specifications D1.1, "Structural Welding Code," apply to 6061-T6 structures. Detail requirements for welding aluminum alloy 6061-T6 are given as follows:

- Filler metal for welding shall be aluminum alloy welding rods conforming to the requirements of AWS A 5.10 and shall be AWS classification ER 4043, ER 5154, ER 5254, ER 5183, ER 5356, or ER 5556.
- The welding process and welding operators shall both meet a qualification tests. The method of qualification shall conform to the method described in the ASME Boiler and Pressure Vessel Code, Section IX, "Welding Qualifications," Part B. Aluminum alloy 6061-T6 shall be used for the qualification test plates. Operators shall be qualified on the basis on bend tests and a fillet weld soundness test.
- Dirt, grease, forming or machining lubricants, or any organic materials shall be removed from the areas to be welded by cleaning with a suitable solvent or by vapor degreasing. Additional operations to remove the oxide coating just prior to welding are required when the inert gas tungsten arc welding method is used. This may be done by etching or by scratch brushing. The oxide coating may not need to be removed if the welding is done with the automatic or semi-automatic inert gas shielded metal arc.

- Suitable edge preparation to assure 100 percent penetration in butt welds shall be used. Oxygen cutting shall not be used. Sawing, chipping, machining or shearing may be used.

- Any welding of aluminum shall be done using a nonconsumable tungsten electrode with filler metal in an inert gas atmosphere (TIG) or using a consumable filler metal electrode in an inert gas atmosphere (MIG). No welding process that requires the use of a welding flux shall be used unless prior approval has been obtained from the Engineer. Preheating for welding is permissible provided the temperature does not exceed 400° F for a total time of 30 minutes.

- Welding of any structure which is to be anodized shall be done using filler alloy rods that will not discolor when anodized. ER 5154, ER 5254, ER 5183, ER 5356, or ER 5556 filler alloy rods shall be used.

05010.3.2.6 PROTECTION OF ALUMINUM SURFACES - Aluminum surfaces to be placed in contact with wood, concrete, masonry, or dissimilar metals other than stainless steel shall be protected as specified in the appropriate sections of Division 9 – Finishes.

05010.3.2.7 BOLTING - Where aluminum comes in contact with steel it shall be bolted with stainless steel bolts and separated or isolated from the steel with neoprene gaskets or washers or as specified in Division 9.

05010.3.3 STEEL

05010.3.3.1 STRUCTURAL STEEL – The following shall apply:

- The Contractor shall furnish and install all structural steel items in accordance with the plans and as specified herein.

- The Contractor also shall provide all supplementary parts necessary to complete each item even though such work may not be specifically covered by the Plans and Specifications.

- Wherever applicable, all fabrication and erection of steel items shall conform to AISC "Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings" except as the same may be modified by applicable building codes, the General Conditions, and these Specifications.

05010.3.3.2 WELDING OF STEEL – Both the general recommendations and regulations shown in the American Welding Society Specifications D1.1, "Structural Welding Code," as well as the detail requirements in those specifications apply to welding of steel structures. Welding of steel shall adhere to the following:

- All welding of steel under this section shall be done by welders who have a current AWS certificate for the type of welding to be done by the welder.

- All welding of structural steel type ASTM A 36 shall be done using mild steel covered Arc Welding Electrodes conforming to ASTM A 233, Series E70, or shall be done using Electrodes and Fluxes for Submerged Arc Welding conforming to ASTM A 558, Classification F70-XXXXX, where XXXXX refers to any electrode referred to in ASTM A 558.

- Welding of stainless steels shall be done with electrodes and techniques as recommended in Welded Austenitic Chromium - Nickel Stainless Steels - Techniques and Properties as

published by the International Nickel Company, Inc., New York, New York. All welds shall be full penetration welds, unless specified otherwise.

05010.3.3.3 PROTECTION OF STEELWORK - The Contractor shall paint steel and miscellaneous ferrous metal items as specified in the appropriate sections of Division 9-Finishes.

05010.3.4 DUCTWORK

05010.3.4.1 DESIGN AND FABRICATION - Ducts shall be fabricated of aluminum or galvanized steel sheets with gauges of sheet metal, joint types, reinforcing, bracing, supporting, fabricating, installing, and other requirements in accordance with Duct Manual and Sheet Metal Construction for Ventilating and Air Conditioning Systems of the Sheet Metal and Air Conditioning Contractors National Association, Inc. Ducts shall be designed for the appropriate pressure type as shown in the above mentioned Duct Manual. Details on the Plans in some cases call for sheet metal thicknesses greater than called for in the Duct manual. Sheet metal shall conform to whichever requirement calls for the greater thickness. Aluminum ducting shall be not less than 0.063 inches thick.

05010.3.4.2 HANGERS - Ducts shall be supported on both sides at all changes in direction and at not greater than eight foot intervals by suitable hangers as specified herein or as detailed on the Plans. For galvanized ducting, hangers for ducts 12-inch by 24-inch or smaller shall be galvanized sheet metal straps not lighter than 18-gauge by one inch secured to the structure by one 5/16-inch bolt and to the duct by not less than two No. 10 sheet metal screws or 3/16-inch stove bolts. Hangers for ducts larger than 12-inch by 24-inch shall be galvanized steel straps or rods not less than 0.13 square inches in net cross section, secured to the structure by a Grinnell Figure 152, Size 2, concrete insert, or approved equal, and to a duct pocket or reinforcing angle by two 1/4-inch stove bolts. For aluminum ducting, supports shall be equivalent to supports for galvanized ducting except that all fasteners, fittings, and shafting shall be stainless steel.

05010.3.4.3 FLEXIBLE CONNECTIONS - Where blowers or equipment containing blowers or other machine elements, which may cause vibration, are connected to ducts or housing, such connections shall be by means of flexible connections. These flexible connections shall be airtight at the pressures encountered and be flame proof and water proof. The flexible material shall be equivalent to 14 ounce canvas.

05010.4 METHOD OF MEASUREMENT

Not used.

05010.5 BASIS OF PAYMENT

Not used.

05050.1 DESCRIPTION

This section covers a generic list of miscellaneous metals specifications.

05050.1.1 RELATED WORK

Not used.

05050.1.2 SUBMITTALS

Not used.

05050.1.3 DEFINITIONS

Not used.

05050.2 MATERIALS

05050.2.1 LADDERS AND METAL STAIRS

All ladders shall be safety ladders conforming to OSHA standards. All ladders and stairways supplied to the project shall be of one manufacturer. All stair and ladder wells shall be adequately guarded, and all stairs shall have handrails as specified or shown on the Plans.

Ladders shall be secured to the supporting surface by bent plate chips providing not less than 7 inches between the supporting surface and center of rungs. If exit from the ladder is forward, over the top rung, side rails shall be extended not less than 3-feet-3 inches above, and returned to the landing. If exit from the ladder is to the side, the ladder shall extend not less than 5-feet 6-inches above the landing and be rigidly secured at the top.

05050.2.2 ALUMINUM LADDERS

Aluminum ladders shall be made of 6063-T5-aluminum alloy, of welding construction. Rungs shall be not less than 1-inch square bar with 1/8-inch grooves in the top and redivided edges. Side rails shall be no lighter than 3 inches by 3/8 inches. Ladders shall be of the size, shape, location, and details indicated on the Plans. Ladders greater than 20 feet in height shall have standard ladder cages designed in accordance with State and OSHA requirements. All aluminum surfaces, which will be in contact with concrete, shall be coated as specified in Division 9.

05050.2.3 ALUMINUM STAIRWAYS

Aluminum stairways shall be fabricated and installed as shown on the Plans. Stairway stringers shall be fabricated of aluminum alloy 6061-T6. Treads shall be aluminum as specified below. Handrail shall be fabricated of aluminum pipe as specified under aluminum handrail.

Stair treads shall be aluminum of the sizes called for on the Plans, and shall be of the same type and make as called for under GATING. All fasteners shall be of Type 304 or 316 stainless steel.

Stair treads shall be furnished with cast abrasive type safety nosing.

05050.2.4 ARCHITECTURAL AND MISCELLANEOUS SHEET METAL

Sheet metal flashing and counterflashing shall be installed as indicated on the Plans. Galvanized steel or anodized aluminum flashing shall be used when indicated and specified on the Plans.

Unless otherwise indicated flashing shall be 0.025-inches thick. The aluminum flashing shall receive a 215-R1 anodic finish after fabrication as indicated on the Plans. Exposed edges shall be folded back 1/2-inch to provide stiffness. Except as otherwise indicated and specified on the Plans, counterflash shall be provided over all base flashings.

Unless specifically noted, galvanized steel flashing shall be used in contact with structural steel and anodized aluminum flashing shall be used in contact with structural aluminum. This shall be done to protect against dissimilar metal action.

Surfaces to which sheet metal is to be applied shall be even, smooth, round, thoroughly clean and dry, and free from all defects that might affect the application. All cutting, fitting, drilling, and other operations in connection with sheet metal required to accommodate the work of other trades shall be performed under this section. All accessories or other items essential to the completeness of this sheet metal installation, though not specifically shown or specified, shall also be provided under this section. Nails, screws, and bolts shall be of the types best suited for the intended purpose and shall be of a composition that will not support galvanic action in the installation. Where sheet metal abuts into adjacent materials, the juncture shall be executed in a manner satisfactory to the Engineer.

Sheet metal items not covered elsewhere shall be as indicated on the Drawings and as required to provide a watertight installation. Formed sheet metal for metal covered work shall accurately reproduce the detail and design shown and profiles, bends, and intersections shall be sharp, even, and true.

05050.2.5 ALUMINUM SHEET METAL WORK

Except as otherwise specified or indicated on the Plans, sheet aluminum shall be alloy 5005-H14 conforming to the requirements of ASTM B 209 and shall be not less than 0.025 inch in thickness and extruded aluminum shall be 6063-T42.

05050.2.6 MISCELLANEOUS STRUCTURAL STEEL

Miscellaneous steel items not specified herein shall be as shown on the Plans or specified elsewhere and shall be fabricated and installed in accordance with the best practices of the trade.

05050.2.7 LINTELS

Lintels for masonry construction shall be structural steel beams or angles, fabricated as indicated on the Plans.

05050.2.8 SUBMERGED ASSEMBLY BOLTS

Assembly bolts for wood baffles, collectors, and other assemblies in areas where stainless steel anchor bolts would be required shall be stainless steel bolts Type 304 or 316.

05050.2.9 ANCHOR BOLTS AND INSERTS

Wherever feasible, anchor bolts shall be cast in place when concrete is placed.

All anchor bolts and concrete anchors embedded in concrete shall be accurately spaced with bolts truly normal to the surfaces from which they project. Type 304 or Type 316 stainless steel anchor bolts and nuts shall be used under these circumstances:

- Any time they are submerged in water.

- In the case of structures customarily containing water, placed in walls, ceilings, or overheads, even if above water level.
- In the dry side of water bearing walls.
- Where securing aluminum to steel or concrete.

Anchor bolts not required by above conditions to be of stainless steel, may be of carbon steel conforming to ASTM A 307 or ASTM A 36. Carbon steel anchor bolts in the following locations shall be hot-dip galvanized.

- Anchor bolts exposed to the weather
- In electrical manholes or pull boxes.
- In tunnels, passageways, galleries, vaults, or rooms below grade or enclosed in part by water bearing walls.

In anchoring machinery bases subject to heavy vibration, two nuts shall be used, one serving as a locknut. In all cases where steel anchor bolts are used, a liberal coating of nonoxidizing wax shall be applied to the threads before screwing on nuts.

All bolts, when indicated for future use, shall be first coated thoroughly with nonoxidizing wax, followed by turning nuts down to the full depth of thread. Exposed thread shall then be neatly wrapped with a waterproof polyvinyl tape.

05050.2.10 INSTALLATION

Anchor bolts shall be embedded not less than 12 diameters. Where shown on the Plans, anchor bolts shall be set in metal sleeves having an inside diameter approximately 3 times the bolt diameter and not less than 12-bolt diameters in length. Sleeves shall be filled with grout when the machine or other equipment is grouted.

05050.2.11 CONCRETE ANCHORS

Concrete anchors, where indicated on the Plans or specified, shall mean drilled in place anchors with integral anchor bolts. Concrete anchors shall be Phillips "Wedge Anchors" with integral anchor bolts, or Expansion Products Company "Wej-It" concrete anchors with integral anchor bolts, or approved equal.

The material of each concrete anchor, including its integral anchor bolt, shall be the same material as would be required, under these Specifications, for anchor bolts in the same location that the concrete anchor is to be used.

Concrete anchors shall have the following minimum embedment lengths:

EMBEDMENT OF CONCRETE ANCHORS

Size	Embedment Length
3/8"	1-1/2"
½"	2-1/4"
5/8"	2-3/4"
¾"	3-1/4"

If Wej-It expansion anchors are used they shall have the following minimum embedment length:

WEJ-IT ANCHORS

Size	Embedment Length
¼"	1-1/2"
½"	5"
5/8"	5"
¾"	5"

Anchor bolts, of the same material and size as required for the specified concrete anchors, may be cast in the concrete in lieu of using concrete anchors. Embedment of bolts in concrete shall be not less than 12-bolt diameter plus a standard hook.

No cast iron, lead cinch, or slug-in anchors will be permitted for use.

05050.2.12 MISCELLANEOUS CAST IRON

All castings shall be tough, gray iron, free from cracks, holes, swells, and cold shuts, and be of workmanlike finish, and shall conform to the Standard Details and with the ASTM Specification Designation A 48, Class 40 B. The quality shall be such that a blow from a hammer will produce an indentation on a rectangular edge of the casting without flaking the metal. Before leaving the foundry, all castings shall be thoroughly cleaned and subjected to a hammer inspection, after which they shall receive a coating of coal-tar pitch varnish in such a manner as to form a firm, tenacious coating.

05050.2.13 MANHOLE FRAMES AND COVERS

Manhole frames and covers shall be made from a superior quality gray iron, conforming to the requirements of ASTM A 159, Class G3000, or ASTM A 48, Class 30-B. Frames and covers shall have horizontal and vertical bearing surfaces machined to fit neatly, and the cover shall bear firmly in the frame without rocking and shall be easily removable. Frames and covers shall be heavy-duty traffic type designed for H-20 loading and shall have a combined set weight of at least 360 pounds.

Frames shall have a clear inside opening of 24 inches diameter and shall be of the bottom flange type. Frame height shall be approximately 4½" and bottom flange outside diameter shall be approximately 32 inches.

Covers shall have a skid resistant grid pattern design as recommended ASTM publication STP326.

The elevations at which manhole frames and covers are to be set shall conform to the requirements set forth on the Plans, but in all cases shall be governed by the Engineer in the field. Where the cover is in existing pavement or in the traveled way of the existing road shoulder, it is to be placed flush with the existing surface. Where the structure is outside the limits of the traveled shoulder but not in the roadside ditch, it should be placed 1/10 foot or more above the existing ground surface. Where the manhole cover falls in the existing roadside ditch or right of way, it is to be placed approximately 1½ feet above the existing ground surface or as directed by the Engineer. Manhole frames shall be set at the required grade and shall be securely attached to the top precase manhole shaft unit. After the frames are securely set in the place provided herein, covers shall be installed and all necessary cleaning and scraping of foreign materials from the frames and covers shall be accomplished to ensure a fine satisfactory fit. All costs of setting and securing manhole frame and cover sets in place as herein provided, including all necessary concrete work shall be considered as included in applicable contract unit prices and no additional allowance will be made therefor.

Cast lettering on manhole covers shall be as shown on the Plans. Shop drawings of all manhole rings and covers shall be submitted to the Engineer.

05050.2.14 CAST IRON PRESSURE MANHOLE FRAME AND COVER

The Contractor shall furnish and install, ready for use as indicated on the Plans and as specified herein, rectangular pressure manholes and covers. Each pressure manhole shall have a clear opening of 18" X 30". The pressure plate shall be flat on top and shall not be less than 1/2 inch thick steel and fastened with 316 stainless steel studs and stainless steel nuts. A 1/8-inch thick neoprene gasket shall be supplied between the frame and pressure plate. Lifting shall be provided with a watertight pickhole. The frame shall be a seal-type with flanges at the base and at the top.

05050.2.15 MISCELLANEOUS ALUMINUM

Structural and other metal items fabricated from aluminum, not covered separately herein shall be fabricated in accordance with the best practices of the trade and shall be field assembled by riveting or bolting with no welding or flame cutting permitted except as approved by the Engineer.

05050.2.16 ALUMINUM STAIR NOSING

Stair nosings shall be installed on all treads of all concrete stairs including the top tread of the upper slab. Stair nosings shall be aluminum abrasive cast nosings with aluminum oxide granules integrally cast into the metal forming a permanent nonslip long wearing surface. The nosings shall be Type 101 Stair Tread by Wooster Products, Inc., Spruce Street, Wooster, Ohio 44691, Type A stair treads by American Abrasive Metals Company, or approved equal. The treads shall have integrally cast anchors. Stair nosings shall be cast in fresh concrete and shall be flush with the tread and riser faces. Stair nosing shall be coated with zinc chromate primer in accordance with the provisions of Division 9. Screws shall be 304 or 316 stainless steel.

05050.2.17 MANHOLE STEPS

Manhole steps shall consist of 3/4-inch diameter stainless steel or polyethylene rungs. Rungs shall extend 7-inches from the face of the wall to which they are anchored and shall have a minimum clear width of 16-inches. Rungs shall be designed such that the foot cannot slide off the end. Distance between rungs shall be 12-inches. Rungs shall be hook anchored into walls a minimum of 6-inches.

05050.3 CONSTRUCTION REQUIREMENTS

Not used.

05050.4 METHOD OF MEASUREMENT

Not used.

05050.5 BASIS OF PAYMENT

Not used

05100.1 DESCRIPTION

05100.1.1 Includes furnishing and installing galvanized steel, extruded aluminum, or fiberglass bar grating for commercial or industrial floors and walkways as shown on the Drawings and in accordance with the requirements described herein.

05100.1.2 RELATED WORK

Section 05050 Miscellaneous Metals.

05100.1.3 SUBMITTALS

The Contractor shall provide complete information, which includes shop drawings for fabrication and erection of all work, parts lists, fabrication details, loading tables, anchor details, and manufacturer's installation instructions and details in accordance with the requirements of Section 01300.

With regard to 05100.2.6 – Slip Resistant Surfaces, below, evidence of compliance with the requirements stated there shall be furnished from the grating manufacturer to the Engineer at the time of delivery of the gratings to the Project site.

05100.1.4 DEFINITIONS

Not used.

05100.2 MATERIALS

05100.2.1 GENERAL GRATING REQUIREMENTS

Grating shall be of such bar size and spacing that, as determined by the manufacturer, the grating will support a uniform loading of 180 pounds per square foot on the entire area of the grating, using an extreme fiber stress of not more than 10,000 pounds per square inch. The maximum deflection under this loading will not be more than 1/240 of the clear span of the grating. The spacing of the main grating bars shall not be more than 1-1/8 inches clear between bars. Crossbars shall be at right angles to the main bearing bars, and center to center spacing shall not exceed 4¼ inches. Ends of grating and cutouts shall be banded. Grating shall be of the thickness shown on Drawings or as required by these Specifications. All grating supplied to the project shall be by one manufacturer.

05100.2.2 STEEL BAR GRATING

Shall be machine-welded, galvanized carbon steel bearing bars and cross bars. Bearing bars for steel grating shall be not less than 1-1/2 inches in depth, unless directed otherwise by the Engineer. Spacing of bearing bars and cross bars shall not be less than those required in 05100.1.1.1 above. Span length of the bearing bars shall be in accordance with the information shown on the Drawings. The grating shall in all cases, meet the load and deflection requirements of 05100.1.1.1.

05100.2.3 ALUMINUM GRATING

Shall be I-bar or rectangular bar type grating with bearing bars and cross bars locked together by a swaging process. Bearing bars for aluminum grating shall be not less than 2 inches in depth, unless shown otherwise on the Drawings, or unless directed otherwise by the Engineer. Spacing of bearing bars and crossbars shall be as required in 05100.1.1.1 above. Span length of the

bearing bars shall be in accordance with the information shown on the Drawings. The grating shall in all cases, meet the load and deflection requirements of 05100.1.1.1.

Aluminum grating shall be supported on aluminum shelf angles cast in the concrete as indicated on the Drawings. Gratings, shelf angles, anchors, etc. shall be of 6061-T6 or 6063-T6 aluminum alloy, except that cross bars may be of 6063-T5 aluminum alloy. All surfaces of shelf angles, anchors, etc. to be in contract with concrete shall be coated as specified under Division 9.

05100.2.4 FIBERGLASS GRATING

Shall be constructed of fiberglass strands set in thermoset plastic in a one-piece mold. Glass content shall not exceed more than 35 per-cent by weight. The resin shall be an opaque, fire retardant polyester or vinyl material with a UL classification. The color and mesh pattern shall be indicted on the Drawings. Bearing bars for fiberglass grating shall be not less than 3 inches in depth, unless directed otherwise by the Engineer. Spacing of bearing bars and cross bars shall be the manufacturer's standards, but load capacity and deflection shall meet all requirements of 05100.1.1.1 above. Span length of the bearing bars shall be in accordance with the information shown on the Drawings.

05100.2.5 FLOOR PLATE

Shall be a commercial grade of hot-dipped, galvanized carbon steel or aluminum plating with a raised pattern of surface projections to resist slippage of foot traffic. The size, thickness, span length and pattern configuration shall be as shown on the Drawings but, in no case shall the thickness be less than ¼-inch.

05100.2.6 CAST IRON GRATING

Shall be cast gray iron meeting the requirements of ASTM 48-93, Class 35B of the type and configuration shown on the Drawings. Castings shall be of uniform quality and free from blow holes, smooth and cleaned by shot-blasting. The size, minimum weight, spacing and span length of the grating sections shall be in accordance with the requirements indicated on the Drawings. Gratings located in areas subject to vehicular traffic shall be capable of sustaining standard highway H-20 loads. Bearing surfaces between grating and supporting cast iron frames shall be machined to allow full contact between the grating and fence.

05100.2.7 SLIP RESISTANT SURFACES

When slip resistant surfaces are required by the Drawings or these Specifications, such surfaces shall conform to all applicable OSHA standards and to USDA/FDA requirements for the food and drug industry, when applicable.

05100.3 CONSTRUCTION REQUIREMENTS

05100.3.1 PREPARATION

The Contractor shall carefully prepare the supporting structure to provide a neat fit and unobstructed walking surface in accordance with the Drawings. A clearance of 1/4-inch shall be provided for grating sections to provide easy removal and minimal movement when tread on. Openings for piping or other obtrusions shall be reinforced to support bearing components of the grating.

05100.3.2 Gratings shall be furnished and installed with appropriate clips and/or fasteners as recommended by the grating manufacturer. Supporting frames for grating shall be fabricated from materials which will not contribute to the corrosion or deterioration of the grating and which will provide

uniform support to the grating sections. Grating frames shall be designed to be removable and/or replaceable unless shown otherwise on the Drawings.

05100.3.4 Grating located in areas subject to foot and vehicular traffic shall have opening spaces sufficiently small as to not allow entrapment of bicycle or wheelchair wheels.

05100.3.5 Support for grating sections shall be constructed in full compliance with the recommendations of the grating manufacturer. Openings for piping or other obtrusions shall be properly reinforced to provide support of the bearing components of the grating section.

Except as otherwise specified or shown on the plans, grating shall be supported on shelf angles cast in the concrete as indicated on the plans. All surfaces of shelf angles, rebates, anchors, etc. to be in contact with concrete shall be coated as specified under Division 9.

05100.3.6 The clear opening space for grating section shall provide sufficient space for easy removal of sections; however, it shall not be oversized to allow excessive movement of the sections. Unless otherwise indicated, this clearance space shall be ¼-inch between grating sections and supporting frames. The top surfaces of grating sections adjacent to each other shall be in the same plane.

05100.4 METHOD OF MEASUREMENT

Separate measurement of the floor will not be made when the material is installed as a component of a building or structure listed in the Bid Schedule.

05100.5 BASIS OF PAYMENT

Separate payment will not be made for floor grating included in the measurement of a building or structure in which it is installed.

05570.1 DESCRIPTION

This section covers furnishing and installing galvanized iron or welded steel pipe posts filled and set in concrete at designated locations shown on the Drawings and in accordance with the requirements described herein.

05570.1.1 RELATED WORK

Not used.

05570.1.2 SUBMITTALS

Not used.

05570.1.3 DEFINITIONS

Not used.

05570.2 MATERIALS

05570.2.1 POSTS

Posts shall consist of Schedule 40, galvanized pipe or welded carbon steel pipe with 3/16-inch (min.) wall thickness. Pipes shall extend 48-inches above the driving surface in which they are set and 36-inches below the driving surface. Diameter shall be as shown on the drawings.

05570.2.2 CONCRETE

Concrete installed in the post interior and surrounding the post shall be Class 2000 Portland cement concrete meeting the requirements of Section 03050 of these Specifications. Concrete shall be premixed before placing.

05570.3 CONSTRUCTION REQUIREMENTS

The Contractor shall carefully locate the position of the bumper post from information provided on the Drawings and excavate a hole of sufficient diameter and depth to provide at least 4-inches of coverage when filled with concrete.

The posts shall be set plumb and in a position that will not obstruct entry into any doorway to be protected by the post. Following the setting and filling of the post with concrete, a galvanized iron cap will be screwed on the galvanized pipe and/or a steel cap will be welded tightly to the welded steel post and the post will then be cleaned and painted in accordance with Section 09910 of these Specifications with red enamel.

05570.4 METHOD OF MEASUREMENT

Separate measurement of the bumper posts will not be made when they are installed as a component of a building or structure listed in the Bid Schedule. Measurement of the posts will be included with the building or structure which it serves.

05570.5 BASIS OF PAYMENT

Separate payment will not be made for bumper posts included in the measurement of a building or structure in which it is installed.

DIVISION 6

WOOD AND PLASTICS

06100.1 DESCRIPTION

Carpentry shall include furnishing and installing wood, metal, and other materials typically used for wood framed buildings or building components.

06100.1.1 RELATED WORK

Section 08110 – Doors, Frames, and Hardware
Section 08210 - Metal Windows
Section 09910 - Painting

06100.1.2 SUBMITTALS

The Contractor shall submit information which indicates size, grade and source of lumber materials for review and approval by the Engineer. Information which describes materials, thickness, size, model number, manufacturer's name, etc. shall be submitted for review for all other materials, including its fasteners, required to complete the building or its component as shown on the Drawings and described herein. All such information and/or materials shall be submitted in accordance with Section 01300 of these Specifications.

06100.1.3 DEFINITIONS

Not used.

06100.2 MATERIALS

06100.2.1 LUMBER

Lumber materials shall be graded No. 2 or better, Douglas Fir, Pine, or Hemlock and shall be free of warping which will affect the alignment of the structural component in which it is installed. Lumber materials which contain signs of rot, fungus, or termite damage will be rejected. Wood materials installed in direct contact with soils, earth materials or concrete floors or footings shall be pressure treated or foundation grade Redwood.

06100.2.2 LAMINATED STRUCTURES

Laminated structural joists, beams and girders shall be of the size and strength capacity shown on the Drawings and shall be manufactured in accordance with the standards of the American Institute of Timber Construction.

06100.2.3 PLYWOOD

Plywood shall be not less than three ply and of the grade and thickness shown on the Drawings, and manufactured in accordance with the standards of the American Plywood Association.

06100.2.4 EXTERIOR FINISH

Wood materials used for exterior finishing shall be solid wood or exterior plywood or plywood siding of the type and grades shown on the Drawings.

06100.2.5 INTERIOR FINISH

Wood materials used for painted interior finishing shall be finger jointed grade ("Paint Grade") pine. Materials used for interior finishing when coated to show a natural wood grain shall be clear grade solid wood or veneered plywood of the species, type and grade shown on the Drawings. Pressed wood or simulated wood materials will not be acceptable for wood cabinets or naturally finished wood trim.

06100.2.6 METAL FRAMING

Metal framing shall consist of galvanized steel sheet of the gage and dimensions shown on the Drawings and manufactured in accordance with the standards prescribed in the Uniform Building Code. Wood may be substituted for metal, or metal may be substituted for wood framing. However, all framing installed within a building must be either wood or metal, unless shown otherwise on the Drawings.

06100.2.7 WALLBOARD

All wallboard shall be of the size and configuration indicated on the Drawings and of a type consistent with good building practice. Wallboard shall conform to the applicable requirements of the most recent edition of the Uniform Building Code (UBC), Sections 2511, 2512, and 2513, as appropriate, together with associated tables therein.

06100.2.8 HARDWARE

All fasteners, hardware and fittings shall be of the size and configuration indicated on the Drawings and consistent with good building practice. Metal hardware and fittings shall be of a good quality, industrial grade, manufactured for heavy-duty service.

Fasteners shall be as required by the UBC as mentioned in 06100.2.7, above. All metal fasteners (nails, clips, etc.) used on members exposed to wet or exterior conditions shall be galvanized steel, stainless steel or aluminum. Screws for fastening gypsum wallboard shall be corrosion resistant steel.

06100.3 CONSTRUCTION REQUIREMENTS

06100.3.1 CARPENTRY STANDARDS

All carpentry work provided in this Contract shall be performed in accordance with the applicable requirements of the UBC, its current amendments, and any building requirement enforced by any local building authority.

In general, all carpentry shall be performed in a manner that exhibits good quality. All joints shall be cut to fit tight. All load bearing member joints shall cut and fit to provide full bearing and load distributing capability.

06100.3.2 WALLBOARD

Installation of wallboard shall comply with the applicable requirements of UBC Sections 2511, 2512, and 2513. Fastener placement shall conform to Table 25G of the UBC as applicable.

Unless indicated otherwise in these Specifications, in addition to fastening with steel screws, all gypsum wallboard shall be glued at all contacts with framing.

06100.3.3 WOOD PLATES

Wood plates on concrete or masonry walls shall be installed to form a level plane. When necessary, cement grouting will be used to ensure full bedding of the plates.

06100.3.4 CABINETS

Cabinets shall be furnished and installed in conformity to the requirements for "custom" grade as defined by the Architectural Woodwork Institute standards. Shelving in cabinets shall be shall be manufactured so as to be adjustable.

06100.3.5 EXPOSED PLYWOOD EDGES

Exposed edges of plywood paneling around door or vent openings, or at corners, shall be concealed with wood casing. Concealing shall be accomplished with 1/4-inch (minimum thickness) moldings unless shown otherwise on the Drawings.

06100.3.6 VINYL BASE

When not shown otherwise, 2-inch (minimum) width vinyl base shall be installed to close the joint between the floor and wall. Such base material shall be installed by securing with a waterproof adhesive to the wall.

06100.4 METHOD OF MEASUREMENT

Separate measurement will not be made for carpentry. When carpentry is required, its measurement shall be included with the measurement for the building or structure shown in the Bid Schedule.

06100.5 BASIS OF PAYMENT

Payment for carpentry shall be included in the payment for the building or structure as shown in the Bid Schedule.

DIVISION 7

THERMAL AND MOISTURE PROTECTION

07210.1 GENERAL

07210.1.1 RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

07210.1.2 SUMMARY

A. This Section includes the following:

1. Foundation wall insulation (supporting backfill).
2. Cavity wall insulation.
3. Concealed building insulation.
4. Metal building insulation system and vapor barrier exposed to plenum areas.
5. Perimeter fire-containment systems - fire safing
6. Vapor retarders.

B. Related Sections include the following:

1. Division 3 Section "Cast-in-Place Concrete."
2. Division 4 Section "Unit Masonry Assemblies" for insulation installed in cavity walls.

07210.1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for Verification: Full-size units for each type of exposed insulation indicated.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for insulation products.

D. Research/Evaluation Reports: For foam-plastic insulation.

07210.1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of building insulation through one source.

B. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.

1. Surface-Burning Characteristics: ASTM E 84.

2. Fire-Resistance Ratings: ASTM E 119.

3. Combustion Characteristics: ASTM E 136.

07210.1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Protect plastic insulation as follows:

1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.

2. Protect against ignition at all times. Do not deliver plastic insulating materials to Project site before installation time.

3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

07210.2 PRODUCTS

07210.2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Extruded-Polystyrene Board Insulation:

a. DiversiFoam Products.
b. Dow Chemical Company.
c. Owens Coming.
d. Tenneco Building Products.
e. Engineer approved equal.

2. Glass-Fiber Insulation:

a. CertainTeed Corporation.
b. Johns Manville Corporation.
c. Knauf Fiber Glass.
d. Owens Coming.

3. Metal Building Roof and Sidewall Systems:

a. Thermal Design, Inc.
b. "Simple Saver Systems" 1-800-255-0776.
c. Engineer approved equal.

4. Perimeter Fire-Containment Systems:

a. United States Gypsum Co.
b. Architect approved equal.

07210.2.2 INSULATING MATERIALS

A. General: Provide insulating materials that comply with requirements and with referenced standards.

1. Preformed Units: Sizes to fit applications indicated; selected from manufacturer's standard thicknesses, widths, and lengths.

B. Extruded-Polystyrene Board Insulation: ASTM C 578, of type and density indicated below, with maximum flame-spread and smoke-developed indices of 75 and 450, respectively:

1. Type IV, 1.60 lb/cu. ft. (26 kg/cu. m), unless otherwise indicated.

C. Unfaced Mineral-Fiber Blanket Insulation (for concealed wall applications): ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indices of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

D. Unfaced Mineral-Fiber Blanket for application at metal purlin/roofing and sidewall girt systems: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from glass, slag wood or rock wool with maximum flame-spread and smoke-developed indices of 25 and 50 respectively, passing ASTM E 136 for combustion characteristics.

1. Nominal 3-1/2" batt for application directly under metal roofing and siding system.

2. Nominal 6" batt or thicker for application within the roof purlin spacing concealed by proprietary system vapor barrier.

3. Completed system R-value based on 4'-9" member and wall girt spacing of R-30.

07210.2.3 PERIMETER FIRE-CONTAINMENT SYSTEMS

Where indicated for gaps between the perimeter edge of fire-resistance-rated floor and roof/ceiling assemblies, provide a perimeter fire-containment system with the fire-test-response characteristics indicated, as determined by testing identical systems per UBC Standard 26-9 and UL 20709 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Materials shall be identified with appropriate markings of applicable testing and inspecting agency.

1. Products: Subject to compliance with requirements provide

a. USG Thermafiber SAFB
b. Architect approved equal.

07210.2.4 VAPOR RETARDERS

A. Products: Subject to compliance with requirements, provide one of the following:

B. Polyethylene Vapor Retarder: ASTM D 4397, 6 mils (0.15 mm) thick, with maximum permeance rating of 0.13 perm (7.5 ngfPa x s x sq. m).

1. Application: concealed by gypsum wallboard

C. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

D. Heavy Duty Fire Retardent, Reinforced Polyethylene Vapor Retarder (nominal 8 mil thickness): 2 outer layers of colored polyethylene film laminated to a woven HDPE 900 denier Skrim and weighing not less than 31 lb./1000 sf (14.1 kg/i 00 sq m) with a maximum permeance rating of 0.02 US perms (11.44 ng/Pa x s x sq m), and a flame-spread and smoke developed indices of not more than 25 and 50 respectively.

1. Application: at interior side of all metal building roofs and sidewalls.

2. Custom sizes: match structural bay widths up to 5000 sf per piece.

3. Color: Super White

07210.2.5 AUXILIARY INSULATING MATERIALS

Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates.

07210.2.6 INSULATION FASTENERS

Products: Subject to compliance with requirements, provide one of the following:

1. Insulation-Retaining Strapping: Continuous painted steel strapping formed from 0.0 16-inch (0.41-mm) thick galvanized steel sheet, sized as required to hold metal building insulation and vapor retarded securely in place, but not less than 1 inch (25.3 mm) in width.

2. Strap Anchors: Metal roof insulation system manufacturer approved painted self-drilling steel fasteners.

07210.3 EXECUTION

07210.3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for
Sections in which substrates and related work are specified and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

07210.3.2 PREPARATION

A. Clean substrates of substances harmful to insulations or vapor retarders, including removing projections capable of puncturing vapor retarders or of interfering with insulation attachment.

B. Close off openings in cavities receiving poured-in-place insulation to prevent escape of insulation. Provide bronze or stainless-steel screens (inside) where openings must be maintained for drainage or ventilation.

07210.3.3 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and application indicated.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice and snow.

C. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. At metal roof systems and sidewall systems apply multiple layers of insulation to provide complete fill of purlin/girt depth under slight compression.

E. At walls apply multiple layers of insulation to produce thickness indicated, and as required to make up total thickness.

07210.3.4 INSTALLATION OF PERIMETER INSULATION

A. On vertical surfaces, set units in adhesive applied according to manufacturer's written instructions. Use adhesive recommended by insulation manufacturer.

1. If not indicated, extend insulation a minimum of 24 inches (610 mm) below exterior grade line; 36 inches (915 mm) total piece size.

B. Protect below-grade insulation on vertical surfaces from damage during backfilling by applying protection board. Set in adhesive according to insulation manufacturer's written instructions.

C. Protect top surface of horizontal insulation from damage during concrete work by applying protection board.

07210.3.5 INSTALLATION OF CAVITY WALL INSULATION

On units of plastic insulation, install small pads of adhesive spaced approximately 24 inches (610 mm) o.c. both ways on inside face, as recommended by manufacturer. Fit courses of insulation between wall ties and other confining obstructions in cavity, with edges butted tightly both ways. Press units firmly against inside wythe of masonry or other construction as shown.

1. Supplement adhesive attachment of insulation by securing boards with two-piece wall ties designed for this purpose and specified in Division 4 Section "Unit Masonry Assemblies."

2. At wall assemblies indicating metal zee framing, adhesive can be deleted.

07210.3.6 INSTALLATION OF GENERAL BUILDING INSULATION

A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

B. Seal joints between closed-cell (nonbreathing) insulation units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.

C. Install mineral-fiber blankets in cavities formed by framing members according to the following requirements:

1. Use blanket widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill cavity, provide lengths that will produce a snug fit between ends.

2. Place blankets in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.

3. For metal-framed wall cavities where cavity heights exceed 96 inches (2438 mm), support unfaced blankets mechanically.

D. Place loose-fill insulation into spaces and onto surfaces as shown, either by pouring or by machine blowing to comply with ASTM C 1015. Level horizontal applications to uniform thickness as indicated, lightly settle to uniform density, but do not compact excessively.

1. For cellulosic loose-fill insulation, comply with the Cellulose Insulation Manufacturers Association's Special Report #3, "Standard Practice for Installing Cellulose Insulation."

E. Stuff glass-fiber, loose-fill insulation into miscellaneous voids and cavity spaces where shown. Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft. (40 kg/cu. m).

07210.3.7 INSTALLATION OF PERIMETER FIRE CONTAINMENT SYSTEMS

A. Install perimeter fire-containment blanket systems to completely fill voids in fire rated construction. Cut and piece material as required to comply with manufacturer's recommended installation procedures.

07210.3.8 INSTALLATION OF VAPOR RETARDERS

A. General: Extend vapor retarder to extremities of areas to be protected from vapor transmission. Secure in place with adhesives or other anchorage system as indicated and metal strap systems at roof purlins. Extend vapor retarder to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.

B. Seal vertical joints in vapor retarders over framing by lapping not less than two wall studs or one roof purlin bay spacing. Fasten vapor retarders to framing at top, end, and bottom edges; at perimeter of wall openings; and at lap joints. Space fasteners 16 inches (406 mm) o.c.

C. Seal overlapping joints in vapor retarders with adhesives or vapor-retarder tape according to vapor-retarder manufacturer's instructions. Seal butt joints and fastener penetrations with vapor-retarder tape. Locate all joints over framing members or other solid substrates.

D. Firmly attach vapor retarders to substrates with mechanical fasteners or adhesives as recommended by vapor-retarder manufacturer.

E. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarder.

F. Repair any tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarder.

07210.3.9 PROTECTION

Protect installed insulation and vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

07210.4 METHOD OF MEASUREMENT

Unless a separate bid item for furnishing and installing the work outlined in this Section is provided in the Bid Schedule, this work shall not be measured for separate payment, but shall be considered incidental to other items in the Bid Schedule.

07210.5 BASIS OF PAYMENT

Complete compensation for the accepted work outlined in this Section shall be included in other bid items when no separate bid item is provided in the Bid Schedule for this work.

07500.1 DESCRIPTION

Includes furnishing and installing lightweight fiberglass or foam insulation in buildings or enclosures as shown on the Drawings and in accordance with the requirements described herein.

07500.1.1 RELATED WORK

Not used.

07500.1.2 SUBMITTALS

The Contractor shall provide complete information which includes complete product description and manufacturer's installation instructions in accordance with the requirements of Section 01300.

07500.1.3 DEFINITIONS

Not used.

07500.2 MATERIALS

07500.2.1 FOAM

Foam insulation materials shall be Styrofoam brand insulation board, or approved equal, with a thermal resistance rating (R-Value) per inch of five (5) and a capability of being submerged in water and not absorbing more than 0.1% water by volume.

07500.2.2 FIBER

Fiber insulation materials shall consist of long, resilient glass fibers bonded with a thermosetting resin in batts faced with foil and kraft paper facing which enables the product to carry a fire hazard classification rating of 25/50 or less per ASTM E 84. Unless called for otherwise, the thermal resistance and material shall be Corning, 6", R-19.

07500.3 CONSTRUCTION REQUIREMENTS

The type, application and installation of either insulation material will be as shown on the Drawings.

07500.3.1 PREPARATION AND INSTALLATION

The Contractor shall carefully prepare the supporting structure to provide a neat fit for the insulation material in accordance with its manufacturer's recommendations. Appropriate anchor devices or procedures shall be provided to retain the insulation in proper position as recommended by the manufacturer.

07500.3.2 DUCT INSTALLATION

New supply ductwork shall be insulated with 1-pound density, 1-inch thick, fiberglass blanket insulation having aluminum foil reinforced facing complete with vapor barrier. Insulation shall be secured to the sheet metal with clips and adhesive as recommended by the insulation manufacturer. Insulation shall be fitted to the duct surfaces with all joints tightly butted together and against standing seams. All joints and/or holes shall be vapor sealed using an adhesive compound as recommended by the insulation manufacturer.

07500.4 METHOD OF MEASUREMENT

Separate measurement of thermal insulation will not be made when the material is installed as a component of a building or structure listed in the Bid Schedule. Measurement will be included with the building or structure which it serves.

07500.5 BASIS OF PAYMENT

Separate payment will not be made for thermal insulation included in the measurement of a building or structure in which it is installed.

DIVISION 9

FINISHES

09205.1 GENERAL

The interior finish of the building shall be painted concrete and Fiberglass Reinforced Panels (FRP)

09205.1.1 RELATED WORK

Section 06100 – Carpentry
Section 09910 – Painting
Section 03100 – Concrete Forming, Finishing and Curing

09205.2 REQUIREMENTS

Concrete - All interior concrete surfaces shall be smooth finished. Formed surfaces shall be ground or grouted as necessary in accordance with Section 03100 of the specifications.

After a smooth finish is achieved, the concrete shall be prepped in accordance with the paint manufacture's recommendations and painted with a minimum of two coats. The paint requirements shall be that of Severe Service as defined in Section 09910 of the Standard Specifications

Framed Walls – All framed walls shall be insulated and sheeted with ¾" OSB in accordance with Section 06100 of the Standard Specifications. After the OSB is installed, it shall be covered with FRP in accordance with the Drawings and the manufactures recommendations.

09205.3 METHOD OF MEASUREMENT

The method of measurement for the interior building finishes shall be "lump sum" and shall include but not limited to all labor and materials required to provide the building with a clean finish as specified herein or shown on the drawings.

09205.4 BASIS OF PAYMENT

The accepted quantity will be paid for at the contract unit price for:

PAY ITEM	UNIT
Building Interior Finish	Lump Sum

09910.1 DESCRIPTION

The Contractor shall furnish all labor, materials and equipment necessary to paint all designated components of buildings, piping and equipment in accordance with these Specifications.

09910.1.1 RELATED WORK

Not used.

09910.1.2 SUBMITTALS

09910.1.2.1 DESCRIPTIVE LITERATURE - Descriptive literature identifying manufacturer, type, content, application recommendations, and color samples, shall be provided in accordance with Section 01300 of these Specifications.

09910.1.2.2 DATA FOR PAINT APPROVAL - Complete data on each type and kind of paint and primer shall be submitted to the Engineer for approval. Approval shall be received from the Engineer before the paint is delivered to the jobsite. This procedure must be followed whether or not the paint that the Contractor proposes to use is named in the Specifications. Approval data shall show where and for what uses each paint product is proposed. Information submitted on each proposed type and kind of paint shall include data to show that the paint meets the detailed requirements of these Specifications.

09910.1.2.3 SAMPLES - The Contractor shall prepare and submit sample colors for all items which require color selection by the Engineer. No color selection will be made until all samples of all paints have been submitted. After all samples of all paints have been submitted, the Engineer will prepare a color scheme using the submitted colors. Colors will not necessarily be standard colors with all suppliers. The manufacturer shall mix colors, to secure the desired color when it is not one of his standard colors.

09910.1.2.4 SAND BLAST PANELS - The Contractor, at the beginning of the Project, shall furnish one square foot steel panels sandblasted in accordance with the sandblasting specifications and coated with non-yellowing shellac or clear non-yellowing plastic coating. Panels shall be used as the standards for preparation of steel surfaces for the duration of the project.

09910.1.2.5 PAINT REMNANT - At the end of the project, the Contractor shall turn over to the Engineer a gallon can of each type and color of paint, primer, thinner, or other coating used in the field painting. If the manufacturer packages the material concerned in gallon cans, then it shall be delivered in unopened labeled cans as it comes from the factory. If the manufacturer does not package the material in gallon cans, and in the case of special colors, the materials shall be delivered in new gallon containers, properly closed with typed labels indicating brand, type, color, etc. The manufacturers' literature describing the materials and giving directions for their use shall be furnished in three bound copies. A typewritten inventory list shall be furnished at the time of delivery.

09910.1.3 DEFINITIONS

Submerged Surfaces - In general, items shall be treated as submerged if they are to be at any time under water or are in structures that normally contain water. Unless specified otherwise, anything below the tops of the walls of such structures shall be considered as submerged.

09910.2 MATERIALS

09910.2.1 QUALITY CONTROL

This specification is not intended to be exclusive or limit competition, but rather to set forth the minimum standards for quality and performance. The Owner reserves the right to reject substitutions if in his opinion, the proposed substitutions will not achieve comparable equipment installation and performance standards.

09910.2.2 COLOR

The Engineer will make color selection from color samples provided by the Contractor.

09910.2.3 PAINT SELECTION

All paint and coating systems shall include high quality materials, resistant to temperatures up to 130°F, and sunlight exposure. Paints selected shall meet the manufacturer's recommendations and suitability standards for the specific application where it will be used.

09910.2.3.1 MINIMUM REQUIREMENTS - Minimum requirements for paint materials and their application shall be as shown in the tables below:

EXTERIOR PAINT APPLICATION TABLE

Application Substrata	No. of Coats	Paint Materials and Manufacturer*	Coating Thickness (Mils Per Coat)
Wood Siding, Trim, Doors	1	A-100 Exterior Alkyd Wood Primer	2.3
	2	A-100 Exterior Latex Flat House & Trim by Sherwin Williams - OR -	1.3
	1	SUPRIME 8 Exterior	1.3
	2	Pro-Hide Plus Latex Satin House by Pratt & Lambert- OR -	1.3
		System 2H-4 Alkyd by Tnemic	
	1	Tnemic 36-603 Undercoater	2.5
	2	2H-Color Hi-Build Tnemie Gloss	2.5
Porous Masonry (Block)		System 52-2 Modified Epoxy Sand Texture Finish by Tnemic	
	1	52-Color Tnemie-Crete	60-80
	1	52-Color Tnemie-Crete	8-10
Concrete Walls, Above Grade	1	Loxon Ext. Masonry Acrylic Primer	3.1
	2	A-100 Exterior Latex Satin House & Trim by Sherwin Williams -OR -	1.3
	2	Pro-Hide Plus Latex Satin House by Pratt & Lambert – OR –	1.3
		System 6-1 Acrylic Latex Low Sheen by Tnemic	
	2	6-Color Tnemie-Cryl	2.5
Metal (Aluminum)	2	A-100 Exterior Latex Satin House & Trim by Sherwin Williams - OR -	1.3
	1	SUPRIME 3 Latex Metal Primer	1.3
	2	Pro-Hide Plus Latex Satin House by Pratt & Lambert – OR –	1.3

Application Substrata	No. of Coats	Paint Materials and Manufacturer*	Coating Thickness (Mils Per Coat)
Metal (Aluminum) Con't.	1 1	DEFLEX 4020 Primer DEFLEX 4206 S/G Waterborne Acrylic Enamel by DeVoe	3 1.5
Metal, New Steel, (Mild Service)	1 2 1 2 1 1 2	Kem Kromik Universal Metal Primer Direct to Metal Enamel by Sherwin Williams - OR - SUPRIME 3 Latex Metal Primer Pro-Hide Plus Latex Satin House by Pratt & Lambert – OR – Devguard 4160 Primer followed by Devguard 4308 Alkyd Enamel or DEFLEX 4218 DTM Enamel by DeVoe	2.5 3.0 1.3 1.3 2 2 2
Metal, New Steel, (Severe Service)	 1 1	System 66-2 Aliphatic Polyurethane by Tnemic 66-Color Hi-Build Epoxoline 70-Color Endura-Shield	 4 2
Metal, Galvanized Steel, (Mild Service)	1 2 1 2 1 2	Galvite HS A-100 Exterior Latex Satin House & Trim by Sherwin Williams -OR - SUPRIME 2 Latex Metal Primer Pro-Hide Plus Latex Satin House by Pratt & Lambert – OR – Devguard 4020 Primer DEFLEX 4206 S/G Waterborne Acrylic Enamel by DeVoe	2.0 1.3 1.3 1.3 3 1.5
Metal, Galvanized Steel, (Severe Service)	 1 1	System 70-1 Aliphatic Polyurethane by Tnemic 66-Color Hi-Build Epoxoline 70-Color Endura-Shield	 4 2
PVC Pipe	 1	System 66-23 Epoxy Polyamide by Tnemic 66-Color Hi-Build Epoxoline	 4

INTERIOR PAINT APPLICATION TABLE

Application Substrata	No. of Coats	Paint Materials and Manufacturer*	Coating Thickness (Mils Per Coat)
Woodwork	1 2 1 2 1 2	ProMar 200 Alkyd Enamel Undercoater ProMar 200 Int Alkyd Semi-Gloss by Sherwin Williams-OR SUPRIME 11 Int Alkyd Wood Primer Pro-Hyde Plus Alkyd Satin by Pratt & Lambert – OR – System 2H-4 Alkyd by Tenemic Tnemic 36-603 Undercoater 2H-Color Hi-Build Tnemie Gloss	1.9 1.7 1.5 1.5 2.5 2
Drywall	1 2	ProMar 200 Latex Wall Primer ProMar 200 Int Alkyd Semi-Gloss by	2.5 1.8

Application Substrata	No. of Coats	Paint Materials and Manufacturer*	Coating Thickness (Mils Per Coat)
Drywall (cont.)		Sherwin Williams - OR -	
	1	SUPRIME 1 100% Acrylic MP Primer	1.1
	2	Pro-Hyde Plus Latex Satin by Pratt & Lambert – OR –	1.5
		System 6-1 Acrylic Latex Low Sheen by Tnemic	
	2	6-Color Tnemie-Cryl	2
Metal (Aluminum)	1	SUPRIME 9 Int/Ext Alkyd Metal Primer	1.1
	2	Pro-Hyde Plus Alkyd Satin by Pratt & Lambert – OR –	1.5
	1	DEFLEX 4020 Primer	3
	1	DEFLEX 4206 Semi-Gloss Waterborne Acrylic Enamel	1.5
Metal, New Steel, (Mild Service)	1	Kem Kromik Universal Metal Primer	2.5
	2	ProMar 200 Int Alkyd Semi-Gloss by Sherwin Williams - OR -	1.7
	1	SUPRIME 9 Int/Ext Alkyd Metal	1.1
	2	Primer Pro-Hyde Plus Alkyd Satin by Pratt & Lambert – OR –	1.5
	1	Devguard 4160 Primer followed by	2
	1	Devguard 4308 Alkyd Enamel or	2.5
	2	DEFLEX 4218 DTM Enamel by DeVoe	2
Metal, New Steel, (Severe Service)		System 66-2 Epoxy Polyamide by Tnemic	
	1	66-1211 Epoxoline Primer	3.5
	1	66-Color Hi-Build Epoxoline	4
Metal, Galvanized Steel, (Mild Service)	1	Galvite Paint	2.0
	2	ProMar 200 Int Alkyd Semi-Gloss by Sherwin Williams - OR -	1.8
	1	SUPRIME 9 Int/Ext Alkyd Metal	1.1
	2	Primer Pro-Hyde Plus Alkyd Satin by Pratt & Lambert – OR –	1.5
	1	Devguard 4020 Primer	3
	2	DEFLEX 4206 S/G Waterborne Acrylic Enamel by DeVoe	1.5
Metal, Galvanized Steel, (Severe Service)		System 66-2 Epoxy Polyamide by Tnemic	
	1	66-1211 Epoxoline Primer	3.5
	1	66-Color Hi-Build Epoxoline	4
Ductile Iron (DI) Pipe and fittings	1	SUPRIME 9 Int/Ext Alkyd Metal	1.1
	2	Primer Pro-Hyde Plus Alkyd Satin by Pratt & Lambert – OR –	1.5
	1	Devguard 4160 Primer followed by	2
	1	Devguard 4308 Alkyd Enamel or	2.5
	2	DEFLEX 4218 DTM Enamel by DeVoe	2

Application Substrata	No. of Coats	Paint Materials and Manufacturer*	Coating Thickness (Mils Per Coat)
PVC Pipe (Mild Service, Interior Only)	2	System 6-1 Acrylic Latex Low Sheen by Tnemic 6-Color Tnemie Cryl	2
PVC Pipe (Severe Service)	1	System 66-23 Epoxy Polyamide by Tnemic 66-Color Hi-Build Epoxoline	4
Concrete Walls and Ceilings (Mild Service)	1 2 1 2	ProMar 200 Latex Wall Primer ProMar 200 Int Alkyd Semi-Gloss by Sherwin Williams - OR - SUPRIME 4 Latex Wall Primer Pro-Hyde Plus Latex Satin by Pratt & Lambert	1.1 1.3 1.2 1.5
Concrete Walls and Ceilings (Severe Service)	2	System 66-4 Epoxy Polyamide by Tnemic 66-Color Hi-Build Epoxoline	4
Porous Masonry Walls (Mild Service)	1 2 1 2	Pre-Prime 167 by Devoe ProMar 200 Latex Wall Primer ProMar 200 Int Alkyd Semi-Gloss by Sherwin Williams - OR - SUPRIME 4 Latex Wall Primer Pro-Hyde Plus Latex Satin by Pratt & Lambert	1.5 1.1 1.3 1.2 1.5
Porous Masonry Walls (Severe Service)	1 2	System 66-15 Epoxy Polyamide by Tnemic 54-660 Masonry Filler 66-Color Hi-Build Epoxoline	75-100 4
Concrete Floors (Mild Service)	1 1 2 2 2	Pre-Prime 167 by Devoe Concrete and Terrazzo Sealer (ANCO Cure and Hard by Intermountain Concrete Specialties. Industrial Enamel by Sherwin Williams - OR - With STAND Alkyd Floor Enamel by Pratt & Lambert – OR – Devguard 4328 Alkyd Enamel by DeVoe	1.5 None 2 1 2
Concrete Floors (Severe or Mild Service)	2	System 67-1 Epoxy Polyamide Semi-Gloss by Tnemic 67-Color Tneme Tread	2.5

*Brand names of materials have been used to indicate the types and quantities of materials required. Approved equals will be accepted.

09910.2.3.2 PAINT FOR WASTEWATER SYSTEMS - All paint for concrete and metal surfaces in wastewater systems shall be especially adapted for such use.

- Fume Resistance. All paint for final coats shall be fume resistant, compounded with pigments suitable for exposure to sewage gases, especially to hydrogen sulfide and to carbon dioxide. Pigments shall be materials, which do not tend to darken, discolor, or fade due to the action of sewage gases. If a paint manufacturer proposes use of paint which is not designated "fume resistant" in its literature, it shall furnish full information concerning the pigments used in this paint.

- Lead Paint. No lead paints shall be used.

09910.2.3.4 PAINT FOR POTABLE WATER SYSTEMS - All paint systems to be used in potable water service shall meet NSF requirements. See also Subsection 09910.2.3.5 below.

09910.2.3.5 PAINT FOR SUBMERGED SURACES

- Coal Tar Epoxy. Coal tar epoxy shall meet and conform with Government Specification Mil P-23236 with further qualification that the coal tar epoxy manufacturer and product must be listed on the current U.S. Navy Qualified Products List. Coal tar epoxy shall be subject to the Engineer's approval.

- Alternate Systems. Alternate coating systems for submerged service, such as Epoxy Polyamide Epoxoline by Tnemic, Epoxy Bar Rust 233H, by DeVoe, or equal, may be required for some applications, or may be approved in lieu of coal tar by the Engineer, upon request. Some colors of Epoxy Polyamide Epoxoline, or equal may be acceptable for use in potable water systems, however the manufacturer must be consulted for verification of acceptability prior to use in potable water applications.

09910.2.3.6 HIGH TEMPERATURE SURFACE TO 400°F - Paint for high temperature surfaces shall be DeVoe Hi-Heat Aluminum HT-4, Glidden 592 Metallite Aluminum, or Sherwin-Williams Silver-Brite Heat resisting aluminum paint B59 S1, or approved equal.

09910.2.4 CLEANING MATERIALS

Cleaning materials shall be best quality solvents, chemicals or detergents, which are commercially prepared for preparing painted surfaces and delivered to the site in sealed containers bearing an identifying label and the manufacturer's name.

09910.3 APPLICATION REQUIREMENTS

ALL paint and coating systems shall be applied in strict accordance with the manufacturer's published instructions for use.

09910.3.1 SURFACE PREPARATION

09910.3.1.1 CLEANING - All surfaces to be painted shall be clean and dry except that in some cases the paint manufacturer's directions may require wetting the surface before painting. Grease and oil shall be removed by wiping with mineral spirits or naphtha per Specification SP-1. Rust, scale, welding slag, and spatter shall be removed and the surface prepared by hand tool cleaning, power tool cleaning, or blast cleaning in accordance with the appropriate Specification SP-2 through SP-10.

09910.3.1.2 METAL SURFACES - Except as otherwise provided, all preparation of metal surfaces shall be in accordance with Specifications SP-1 through SP-10 of the Steel Structures Painting Council (SSPC). Sandblasting procedures shall be as follows:

- No surface, which is to be sandblasted, shall be given a coat of primer or paint in the shop or in the field before sandblasting.

- Unless otherwise specified, all iron or steel surfaces which are to be painted as <u>submerged</u> metal shall be dry sandblasted on the site in accordance with Specification SP-10, near white blast cleaning.

- Except as otherwise specified, all metal surfaces, which are to be painted as non-submerged metal, shall be commercial blast cleaned per Specification SP-6. This sandblasting shall be done not more than 12 hours ahead of the painting, subject to humidity and weather conditions between the time of sandblasting and painting operations. If any rusting of sandblasted surfaces occurs before painting, such rusting shall be removed by additional sandblasting.

- Threaded portions of valve and gate stems, machined surfaces intended for sliding contact, surfaces to be assembled against gaskets, surfaces of shafts for sprockets or to fit into bearings, machined surfaces of bronze trim on slide gates, and similar surfaces shall be masked off to protect them from the sandblasting of adjacent surfaces.

- Cadmium-plated or galvanized items shall not be sandblasted except that cadmium plated, zinc-plated, or sheradized fasteners used in assembly of equipment to be sandblasted shall be sandblasted in the same manner as the other metal.

- Surfaces which cannot be sandblasted, or cannot be sandblasted and then painted after the assembly of which they are a part has been completed and placed in final position, shall be sandblasted, or sandblasted and painted, before the items are put into final position. In some cases, while the painting could be done after the items concerned were in place, the limitation on time between sandblasting and painting may make it necessary to paint the surfaces before installation of those items.

- Sand or other media residue from sandblasting operations shall be thoroughly removed, using any method necessary and consistent with the requirements of the painting system, including vacuum cleaners or other means.

09910.3.1.3 GALVANIZED SURFACES - Galvanized surfaces which are to be painted shall first be treated with Koppers No. 40 Metal Conditioner; Amercoat No. 59 as manufactured by Amercoat Corporation, Brea, California; Galvaprep No. 5 as manufactured by Amchem Products, Fremont, California; or approved equal.

09910.3.1.4 CONCRETE SURFACES - Concrete and masonry surfaces shall be free of dust, mortar droppings and spatter, fins, loose concrete particles, form release materials, oil, grease, and other deleterious materials. If required by the coating manufacturer, such surfaces shall be etched as specified below or brush off blast cleaned per Specification SP-7.

Concrete surfaces specified to be acid etched shall be etched with a 15 to 20 percent solution of muriatic or sulfamic acid until the surface has the texture of find sandpaper. The surface shall then be thoroughly scrubbed with clean water, rinsed, and allowed to dry.

09910.3.1.5 WOOD SURFACES - Wood shall be cleaned and dusted immediately prior to painting. Final dusting shall be accomplished using tack cloth. Shelves, drawers, benches, and associated woodwork shall be sanded before painting and lightly sanded between coats. Prior to application of each coat, the surfaces shall be again dusted with tack cloth to remove all dust.

09910.3.1.6 BITUMINOUS PAINTED SURFACES - Surfaces, which are to be painted with other than bituminous paint, and which have a bituminous coating (such as coal tar varnished pipe), shall be sealed with not less than 2 coats of Inertol Tar Stop; Sherwin-Williams Metalatex B42W100; Glidden Insulcap as manufactured by the Glidden Company; or approved equal. This seal coating shall be applied in sufficient quantity to permanently prevent bleeding of the bituminous coating.

09910.3.1.7 HIGH TEMPERATURE SURFACES - In general, high temperature paint shall be applied to exposed (un-insulated) steam line valves and traps, heat exchangers, and miscellaneous metal piping and equipment in piping and mechanical systems exposed to high temperatures. The

Contractor shall paint these surfaces with two coats of high temperature paint as specified herein or as otherwise shown or directed. No painting shall be done on surfaces with a temperature in excess of 125 degrees F at the time of application. Immediately before application of the first coat of paint, the surface shall be sandblasted according to SSPC-SP-5 (Blast Cleaning to "white" metal). See also Subsection 09910.3.1.2 above.

09910.3.1.8 THINNING - No thinning of paint other than as directed by the manufacturer's published directions shall be done without the approval of the Engineer. No painting shall be done under conditions, which, in the opinion of the Engineer, will jeopardize the appearance of quality of the painting in any way.

09910.3.1.9 TINTING OF FIRST COAT - When two coats of the same material are specified, the first coat applied shall be tinted with aluminum powder, lampblack, or other suitable pigment to distinguish it from the top coat.

I09910.3.1.10 BETWEEN-COATS TREATMENT - All painted surfaces shall be dusted between coats, and high gloss finish shall be lightly sanded and dusted between coats unless otherwise directed by the manufacturer.

09910.3.2 PAINT APPLICATION

09910.3.2.1 PAINTER QUALIFICATIONS - Contractor or subcontractor personnel applying the coating system shall have had past experience in application of the type or types of coatings and under similar conditions that it will be required to meet in this contract. The qualifications of personnel applying the coating system, whether Contractor or subcontractor shall be verified by the Contractor prior to allowing application to proceed. The Contractor shall not subcontract paint application to a subcontractor that is not qualified to apply the coating system.

09910.3.2.2 WEATHER CONDITONS - No painting shall be done under dusty conditions, during or immediately after a rain, during rainy weather, or when the temperature is less than 50°F.

09910.3.2.3 GENERAL REQUIREMENTS FOR LAYING-ON OF PAINT – These requirements shall be as follows:

- All work shall be done in a workmanlike manner, leaving the finished surfaces free from drops, ridges, waves, holidays, laps, or brush marks.
- Where possible, prime coats shall be applied by brush and well worked into the surface, unless directed otherwise by the paint manufacturer.
- Other paints may be applied by brush, roller, trowel, or spray, unless manufacturer's recommendations or these Specifications require a particular method of application.
- Primer and intermediate coats of paint shall be un-scarred and completely integral at the time of application of each succeeding coat.
- Each coat shall be subject to the inspection and approval of the Engineer before the next succeeding coat is applied, and defective work of any kind shall be deemed sufficient cause for re-coating the entire surface involved.
- Where spray application is used, each coat of paint shall be applied to a thickness equivalent to a brush coat application at a coverage rate not greater than that specified by the manufacturer for a brush coat application. All spray painting shall be done with airless type spray units.

- The time interval between paint coats shall meet the recommendations of the paint manufacturer, and these Specifications. The Contractor shall not allow excessive time or exposure between coats, where such excessive time or exposure will impair the bond between the coats.

- The number of coats specified in these Specifications is the minimum to be applied. Suction spots between coats shall be touched up, and additional coats shall be provided if required to produce a finished surface with a solid, even color free from defects.

- The total thickness of the coating shall be as specified. Additional coats of paint shall be added if necessary to bring the total thickness up to not less than that specified. For control, the Contractor shall determine the dry film thickness of the coatings on metal surfaces with a correctly calibrated thickness meter. The Contractor also shall check for holidays with a low voltage holiday detector. The Engineer may use the Contractor's meter and detector for additional inspection and checking deemed necessary.

- Particular care shall be used to assure that the specified coverage is secured on the edges and corners of all surfaces. Additional brush coats shall be applied if necessary to ensure coverage of the edges and corners.

- Damaged paint or scratched painted surfaces shall be sanded smooth before repainting. Sanding and repainting shall be done to such a degree and in such a manner that all evidence of the scratches or damages is obscured.

09910.3.2.4 COAL TAR EPOXY – Application of coal tar epoxy shall be as follows:

- Where called for in the Painting Schedule, shown on the Drawings, or required in these Specifications, concrete and some other submerged surfaces shall be coated with not less than two coats of coal tar epoxy.

- Only components from new, previously unopened containers shall be used to mix coal tar epoxy coatings. Coal tar epoxy shall be mixed and applied in accordance with the manufacturer's recommendations. All coating components shall be mixed with power mixers. The time during pouring or stirring will not be allowed as mixing time. The minimum mixing time as recommended by the manufacturer shall be met. Only unit quantities shall be mixed.

- Coal tar epoxy shall be applied to a total dry film thickness of not less than 16 mils.

- Some metal surfaces may require sandblasting prior to application of the coating system. See Subsection 09910.3.1.2 above.

- In some cases it may also be necessary to apply coatings to parts or subassembly surfaces before they are actually installed at their final Project or system location. All support brackets, stem guides, pipe clips, fasteners, etc., that are bolted to concrete shall be painted on all sides.

- Application of coal tar epoxy shall be performed only at the job site unless specific approval is granted for offsite application. Offsite application will not be allowed unless by an applicator with acceptable proven and documented experience in the application of coal tar epoxy systems.

- Each succeeding coat shall be applied over the previous coat as soon as possible in accordance with the manufacturer's instructions, without causing sagging. Succeeding coats shall not be

delayed longer than allowed by the manufacturer's instructions. In no case shall the application of subsequent coats be made after the previous coat has set or oxidized. All coats, and the full thickness on all parts, shall be applied before the previous coat has cured. The Contractor shall check the film thickness after application, and before the coating has cured, to ensure that sufficient coating thickness has been applied. If additional coating is necessary, it shall be applied the same day. Checking and control of thickness at this stage shall be the Contractor's obligation and responsibility and not the Engineer's.

- If the surface coating has been applied for a longer period of time than the limits in the Table below, and if it is found that bituminous paint has not been applied to the specified thickness, the areas that are too thin shall be sandblasted to remove the surface film from the coating. These sandblasted areas shall then be washed and cleaned with the solvent recommended by the manufacturer and shall be re-coated within the time limits specified for coating over fresh bituminous paint. Washing or cleaning the surface of the paint with solvents or other solutions will not be a satisfactory substitute for the specified sandblasting if the painted surface is older than the time limits indicated in the table. This applies even if the paint manufacturer approves the solvent method as adequate for preparing the old surface.

TEMPERATURES AND COATING TIMES

Average Temperature	Maximum Time Between Coats
50 - 60° F	36 hours
60 - 70° F	24 hours
70 - 80° F	12 hours
80 - 120° F	4 hours

Coal tar epoxy shall not be applied when the ambient temperature is less than 50 degrees.

09910.3.2.5 EDGES AND CORNERS - The Contractor is hereby CAUTIONED that the edges and corners of members are difficult places upon which to build the required thickness of paint. The required thickness must be applied to all surfaces, including the corners and edges, by applying as many spray coats as necessary or by additional brush coats on the corners and edges, if necessary, in order to build up the required thickness.

09910.3.3 FINISH SCHEDULE

The Contractor shall finish all work as follows unless indicated otherwise on the drawings or within these Specifications:

TABLE OF FINISH SCHEDULES

NO FINISH	FACTORY FINISH	SITE FINISH
Stainless Steel Surfaces	Heating Units	Interior Concrete Building Floors and Walls
Polished Aluminum Surfaces	Electric Control Panel Cabinets	Interior Building Walls & Ceiling
Chain Link or Stock Fencing	Cranes & Hoists	All Interior and Exterior Exposed
Name Plates	Gauges and Meters	Piping Valves & Pipe Supports
Exterior Concrete	Instruments	Exposed Electrical Conduit & Junction Boxes
Exterior Masonry Surfaces	Light Fixtures and Cover Plates	Entry Doors and Frames
Exposed Plastic Pipe & Fittings	Electrical Wiring & Transformers	Wood Moldings and Trim
Warning Labels	Ventilating Fans	Other Exterior Surfaces
Operating Instructions	Dampers	Indicated on drawings
Gratings	Air Conditioning Units	Motors, Pumps, Equipment
Buried or Encased Pipe	Metal Soffit & Fascia Covering	
	Roofing and Siding	
	Roll-Up Overhead Doors	

09910.3.4 CLEANUP

Upon completion of painting, the Contractor shall remove all masking and protective covers and properly dispose of all rubbish, debris and unused paint materials. The Contractor shall remove and cleanup all paint overspray, drips, spatters and etc. from any and all surfaces where it does not belong.

09910.4 METHOD OF MEASUREMENT

09910.4.1 NO MEASUREMENT

Separate measurement for Painting will not be made when painting is included as part of an item, building or structure listed in the Bid Schedule.

09910.4.2 SEPARATE MEASUREMENT

Separate measurement for Painting will be made as a Lump Sum when painting is listed as a separate item in the Bid Schedule.

09910.5 BASIS OF PAYMENT

When Painting is included as part of the measurement of another item, structure or building listed in the Bid Schedule, separate payment will not be made.

When Painting is required for a specific item, the accepted quantity will be paid for at the contract unit price for:

PAY ITEM	UNIT
Paint (*Item Description*	Lump Sum

DIVISION 10

BUILDING SPECIALTIES

10175.1 DESCRIPTION

Includes furnishing and installing gas operated unit space heaters and their controls in designated buildings and equipment enclosures in accordance with the Drawings and these Specifications.

10175.1.1 RELATED WORK

Section 16010 - General Electrical Requirements

10175.1.2 SUBMITTALS

The Contractor shall provide complete information which includes cutaway drawings, parts lists, power requirements, heating capacity and manufacturer's installation instructions in accordance with the requirements of Section 01300.

10175.1.3 DEFINITIONS

Not used.

10175.2 MATERIALS

10175.2.1 FORCED AIR HEATER

Shall be a new unit with an enclosed motor, heat exchanger and fan fabricated from heavy gauge metals which are moisture and corrosion resistant as described on the Drawings. Gas heaters shall be AGA gas certified units and approved by the local gas supplier. Heat exchangers shall have all electric welded construction with 18 gauge (min.) tubes and 16 gauge (min.) header plates of aluminized steel.

All unit heaters shall have adjustable louvers for proper air diffusion and shall be fitted with the following:

- Low voltage combination gas valve containing main and pilot gas cocks,
- Main and pilot gas pressure regulators,
- Redundant solenoid gas valves,
- Pilot solenoid gas valve and 100% safety shut-off, and
- Fan control.

10175.2.2 BURNERS

Shall be made of 18 gauge aluminized steel with type 430 stainless steel ribbon inserts and shall fire directly into the heat exchanger tubes.

10175.2.3 CABINET SIDE PANELS

Shall be of 20 gauge cold rolled steel (minimum) and drain pans of 20 gauge-aluminized steel (minimum).

10175.2.4 MOUNTING BRACKETS

Heaters shall be provided with either wall or ceiling mounting brackets as required.

10175.2.5 FAN MOTORS

Shall be equipped with thermal overheat protection.

10175.2.6 CONTROL OF FORCED AIR HEATERS

Shall be provided thermostatically with the thermostat located on the heater or wall mounted in an efficient location that can be easily operated in the building. Thermostats shall be low voltage, mercury types. All heater units shall be UL listed and shall be manufactured in compliance with NEC and OSHA standards.

10175.3 CONSTRUCTION REQUIREMENTS

Gas heaters shall be furnished and installed in accordance with NEC, OSHA, applicable local requirements and the manufacturer's instructions.

10175.4 METHOD OF MEASUREMENT

10175.4.1 Separate measurement for heaters will not be made when they are furnished and installed as components in a building or enclosure separately identified in the Bid Schedule.

10175.4.2 Separate measurement will be made for heaters furnished and installed only when they are installed as replacement or additional items identified in the Bid Schedule.

10175.5 BASIS OF PAYMENT

10175.5.1 Separate payment for heaters will not be made for heaters furnished and installed as equipment in a building or enclosure identified in the Bid Schedule.

10175.5.2 When furnished and installed separately and shown in the Bid Schedule, the accepted quantity for Gas Space Heaters will be paid for at the contract unit price shown in the Bid Schedule for:

PAY ITEM	UNIT
Install *(Size) (Type)* Space Heater	Each
Replace *(Size) (Type)* Space Heater	Each

10210.1 DESCRIPTION

The Contractor shall furnish and install fans, louvers, dampers, and ventilators in designated buildings and equipment enclosures in accordance with the Drawings and these Specifications.

10210.1.1 RELATED WORK

Section 10210 - Fan Operated Ventilators
Section 10125 - Electric Space Heaters
Section 16010 - Electrical System Requirements

10210.1.2 SUBMITTALS

The Contractor shall provide complete information, which includes cutaway drawings, parts lists, and capacity and manufacturer's installation instructions in accordance with the requirements of Section 01300.

10210.1.3 DEFINITIONS

Not used.

10210.2 MATERIALS

10210.2.1 QUALITY CONTROL

This specification is not intended to be exclusive or limit competition, but rather to set forth the minimum standards for quality and performance. The Owner reserves the right to reject substitutions if in his opinion, the proposed substitutions will not achieve comparable equipment installation and performance standards.

10210.2.2 FANS

10210.2.2.1 WALL FANS - Wall fans shall be new, wall mounted, direct drive fans, mounted in a screened aluminum or steel frame suitable for mounting in an exterior opening. The fan propeller shall be statically and dynamically balanced cast aluminum, rated in accordance with the Air Movement and Control Association (AMCA), Certified Ratings Program, and fitted with ball type bearings. The fan shall have a spun steel venturi/wall base, and a heavy-duty steel power assembly. The fan shall also include an all aluminum motor operated backdraft damper and a ¼ inch by ¼ inch mesh 16 gauge aluminum screen on the inlet, and corrosion resistant fasteners.

The screening shall be removable for maintenance of the motor, and the unit shall be fitted with flanges around the exterior perimeter, which can provide a weather tight fit without additional moldings. The fan motor shall be capable of operating at standard power supply voltages from 110 through 480 volt, single phase or three phase as specified. All wall fans shall be UL listed and shall be manufactured in compliance with NEC and OSHA standards. Noise levels shall not exceed the maximum limits of Section 11010 of these Specifications.

When the Drawings call for wall fans and louvers to be mounted in wall openings, the louvers will typically be installed on the wall exterior to protect the fan. Both the louvers and the fan units should be removable or coordinated for convenient maintenance. Power actuated louvers shall be connected such that they open automatically when the fan is energized.

10210.2.2.2 TUBE FANS - Tube fans shall be new, direct drive, tube type fan units capable of being mounted directly in a circular pipe duct. The fan motor and housing shall be fabricated from corrosion

resistant steel, aluminum, or plastic and shall be capable of operating in both a vertical or horizontal orientation. The fan propeller shall be rated in accordance with the AMCA Certified Ratings Program. The fan shall have straightening vanes, which are heliarc welded at the discharge side of the unit to eliminate turbulence. The fan shall have a pre-wired twist lock disconnect, and the motor shall be out of the air-stream. The fan wheel shall incorporate true airfoil blades, which are heliarc welded to the hub with non-overloading characteristics. The fan support bracket shall include an extruded rubber isolator. The fan motor shall use ball bearings and shall be capable of operating on a 110 through 480 volt, single phase or three phase standard power supply, as specified. All tube fans shall be UL listed and shall be manufactured in compliance with NEC and OSHA standards. Noise levels shall not exceed the maximum limits of Section 11010 of these Specifications.

10210.2.3 LOUVERS AND DAMPERS

10210.2.3.1 MECHANICALLY OPERATED LOUVERS - Mechanically operated louvers shall be the type and size shown on the Drawings, and shall be as manufactured by the Airolite Company, Penn Ventilator Company, Vent Products Company, Inc., or approved equal. The frame and blades shall be 0.080 6063T5 extruded aluminum, with a standard mill finish, and the frames shall be formed to fit the openings. Blades shall be accurately fitted and firmly secured to the frames. The edges of all louver blades shall be folded or beaded for rigidity. The louvers shall include blade edge seals, and a flange mounting system, unless otherwise shown on the Drawings. Axles shall be ½-inch minimum diameter x 2-inch long plated steel rods. Bearings shall be ½-inch minimum diameter nylon. All louvers and dampers shall be furnished with ¼-inch by ¼-inch mesh 16-gauge aluminum bird screens in a standard folded frame, installed on the inside face of fixed louvers, on outside face for adjustable or automatic louvers, unless shown otherwise on the Drawings. Unless specified otherwise, mechanically operated louvers shall close automatically when the fan is not operating. Louvers shall receive a Class I anodized coating.

10210.2.3.2 POWERED LOUVERS - Where powered operators are required, the louvers shall be fully equipped and set up with the powered operators installed. Powered operators shall be sized as shown on the drawings and shall be as manufactured by Barber Coleman, or approved equal.

10210.2.3.3 FIXED LOUVERS - Galvanized steel fixed louvers shall be a complete factory assembled unit with stationary blades welded securely to the frame and of the size and configuration shown on the Drawings. Louvers shall be fabricated from 10 gauge galvanized steel sheet and fit with a #10 copper alloy insect screen soldered to the inside surface of the louvered opening. Unless shown otherwise in the CONTRACT DOCUMENTS, painting of galvanized louvers will not be required.

10210.2.3.4 DOOR LOUVERS - Door louvers shall be complete factory assembled, adjustable steel (19 gauge min.) door louvers with manually operated shutters, which can be closed tight. The louvers shall be fit with mounting brackets, which form a tight fit around the opening in the door. The louver shall incorporate a factory installed coating system. The color shall be as selected and approved by the OWNER. The louver shall be the model, size and configuration shown on the Drawings. When no size is shown on the Drawings, door louvers shall be 12 inches by 24 inches.

10210.2.4 ROOF VENTILATORS

10210.2.4.1 POWERED ROOF VENTILATORS - Powered roof ventilators for attic ventilation shall operate automatically on a thermostat that can be adjusted between 60°F and 120°F. The ventilators shall be sized as shown on the Drawings. The units shall include built-in safety firestats in the thermostat housings that will automatically shut off power to the units if the temperature reaches or exceeds 170°F, to prevent the vent from drawing in more air in the event of a fire. The units shall be of all metal construction of either galvanized steel, aluminum, or both. No plastic domes or flashing plates shall be used. The units shall incorporate an integral screen of 1/8-inch mesh

maximum, to keep out birds and large insects. Appropriate flashing and lap cement shall be installed to ensure that the vents are fully weatherproof.

10210.2.4.2 WIND DRIVEN TURBINES - Wind driven turbine roof ventilators installed to remove hot attic air and to prevent condensation under winter conditions, shall be 12-inch internally braced turbine ventilators, as shown on the Drawings. Ventilators shall be constructed of 24-gauge galvanized steel with an aluminum painted finish, and shall have ribbed blades for added strength. Turbine ventilators shall use hard chrome plated DuPont Delrin bearing systems, or approved equal. The ventilator shall be supplied with an integral automatic damper, designed to fit inside the 12-inch turbine base and turbine with base units. The damper shall be fully open at 90°F and shall be fully closed at 50°F. When installed on pitched roofs the ventilator shall employ an angle adjustable base, which will allow the ventilator to be installed with the axis of ventilator rotation plumb. Appropriate flashing and lap cement shall be installed to ensure that the vents are fully weatherproof.

10210.2.5 TURBINE VENTILATORS FOR ROOM VENTILATION

Wind driven turbine roof ventilators installed to circulate and vent warm air out of building spaces shall be 12-inch internally braced turbine ventilators, as shown on the Drawings. Ventilators shall be constructed of 24-gauge galvanized steel with an aluminum painted finish, and shall have ribbed blades for added strength. Turbine ventilators shall use hard chrome plated DuPont Delrin bearing systems, or approved equal. The ventilator shall be supplied with an integral thermally actuated automatic damper, designed to fit inside the 12-inch turbine base and turbine with base units. The damper shall be fully open at 90°F and shall be fully closed at 50°F. When installed on pitched roofs the ventilator shall employ an angle adjustable base, which will allow the ventilator to be installed with the axis of ventilator rotation plumb. Turbine roof ventilators used for room ventilation shall incorporate ductwork through the roof, attic spaces and ceiling. A factory painted aluminum or vinyl louvered grille shall be fastened to the ceiling to cover the duct opening in the ceiling. The louver shall closely match the interior ceiling colors. The ductwork shall be 24 gauge galvanized steel, minimum. Appropriate flashing and lap cement shall be installed to ensure that the vents are fully weatherproof.

10210.3 CONSTRUCTION REQUIREMENTS

Fans, louvers, dampers and ventilators shall be installed at the locations shown on the Drawings. Installations shall be in strict accordance with the manufacturer's installation instructions, NEC, OSHA, applicable local codes and requirements, the Drawings, and these Specifications. Wall openings shall be as shown on the Drawings.

Equipment installed in a concrete or masonry opening shall be mounted with expansion anchors through the frame or flange, or as otherwise detailed on the Drawings. Equipment installed in a wood framed opening shall be installed using lag screws or bolts, or as otherwise detailed on the Drawings. Where a caulked seal is required, ventilation equipment shall be provided with caulking stops. After installation, all joints between the equipment and the opening shall be caulked.

10210.4 METHOD OF MEASUREMENT

10210.4.1 NO MEASUREMENT

Unless a separate bid item for furnishing and installing the work outlined in this Section is provided in the Bid Schedule, this work shall not be measured for separate payment, but shall be considered incidental to other items in the Bid Schedule.

10210.4.2 SEPARATE MEASUREMENT

Where items installed under this section are listed separately in the Bid Schedule, the items shall be measured by counting the completed and accepted units.

10210.5 BASIS OF PAYMENT

Complete compensation for the accepted work outlined in this Section shall be included in other bid items when no separate bid item is provided in the Bid Schedule for this work.

When a separate bid item is provided in the Bid Schedule, complete compensation for this accepted work shall be included in the contract unit price on the Bid Schedule.

PAY ITEM	UNIT
Install (*Size*) (*Type*) Louvers	Each
Replace (*Size*) (*Type*) Louvers	Each
Install (*Size*) (*Type*) Fan	Each
Replace (*Size*) (*Type*) Fan	Each
Install (*Size*) (*Type*) Damper	Each
Replace (*Size*) (*Type*) Damper	Each
Install (*Size*) (*Type*) Roof Ventilator	Each
Replace (*Size*) (*Type*) Roof Ventilator	Each
Install (*Size*) (*Type*) Room Ventilator	Each
Replace (*Size*) (*Type*) Room Ventilator	Each

10400.1 DESCRIPTION

This section covers furnishing and installing safety and hand railings and their supporting fixtures, frames, and/or hardware in buildings or on other structures. Materials and locations of installation are to be as shown on the Drawings or required in these Specifications.

10400.1.1 RELATED WORK

Not used.

10400.1.1 SUBMITTALS

10400.1.1.1 DESCRIPTIVE INFORMATION - The Contractor shall provide descriptive information which shows detailed dimensions of rails and posts, material composition, details of fittings or anchors required for fastening, finishing, manufacturer's name, loading bearing capacity and manufacturer's installation instructions in accordance with the requirements of Section 01300.

10400.1.1.2 COMPLIANCE WITH STANDARDS - Evidence of these materials complying with applicable industrial safety standards shall be provided. In cases where a potential exists for the railing to serve public access, compliance with the Uniform Federal Accessibility Standards shall be required.

10400.1.3 DEFINITIONS

Not used.

10400.2 MATERIALS

10400.2.1 ALUMINUM RAILING

Shall be extruded aluminum pipe with posts and fittings specifically manufactured for installation as handrails. Aluminum pipe materials shall have a minimum outside diameter of 2.0-inches. Spans between posts or mounting brackets shall not exceed 6-feet. Mounting screws and fasteners shall be stainless steel. Aluminum components of the railings shall be anodized and the railing shall be given a Class I architectural finish.

10400.2.2 FIBERGLASS RAILING

Shall be composite fiberglass with continuous glass fibers along the axial span and may be round or square tubing manufactured specifically for handrails. The resin used for the composition shall be fire retardant polyester. The color of the railings shall be yellow unless indicated otherwise by the Engineer. Railing installed where exposure to sunlight is possible, shall be provided with an ultraviolet (UV) light protection coating. Maintenance and repair instructions shall be provided to the Engineer with the submittal information indicated above. Metal hardware and materials furnished for mounting fiberglass handrails shall be stainless steel.

10400.2.3 STEEL PIPE RAILING

Shall be welded carbon steel pipe with posts and support fittings specifically manufactured for installation as handrails. Railing materials shall have a minimum outside diameter of 1.90-inches and a minimum wall thickness of 0.145-inches. Spans between posts or mounting brackets shall not exceed 6-feet. Mounting screws and fasteners shall be stainless steel. Following installation, all railings, posts and fittings shall be given two coats of gloss enamel epoxy paint of the color and as approved by the Engineer.

10400.2.4 TOP RAILINGS

Shall be continuous in sections up to 12-feet in length. When joints in the railings become necessary, they will be assembled tight and free from any sharp edges or burrs or nicks. All posts shall be single unspliced pipe lengths. Welds shall be ground smooth and finished to provide an uninterrupted surface.

10400.3 CONSTRUCTION REQUIREMENTS

Railing components shall be furnished from the same manufacturer and shall be installed in careful accordance with the manufacturer's instructions. All screwed or bolted fasteners shall be drawn up tight so that the completed railing is rigid and free of movements at joints and attachments.

10400.4 METHOD OF MEASUREMENT

10400.4.1 NO MEASUREMENT

No separate measurement shall be made for furnishing and installing railings when they are components of a structure or building shown on the Bid Schedule.

10400.4.2 SEPARATE MEASUREMENT

When shown as an item on the Bid Schedule, measurement shall be made for each linear foot of each type and configuration of railing furnished and installed. Such measurement shall include the posts and the supporting frame when normally furnished as a unit.

10400.5 BASIS OF PAYMENT

Separate payment for railings will not be made when they are furnished and installed as components in a building or enclosure identified in the Bid Schedule.

The accepted quantity of railings measured separately will be paid for at the contract unit price shown in the Bid Schedule for:

PAY ITEM	UNIT
(*Name*) Railings (*Size*) (*Type*)	Lineal Foot

10410.1 DESCRIPTION

The Contractor shall furnish and install aluminum handrails as shown on the Drawings and required by these Specifications. One manufacturer shall supply all aluminum railings used on the project.

10410.1.1 RELATED WORK

Not used.

10410.1.2 SUBMITTALS

10410.1.2.1 DESCRIPTIVE LITERATURE - Descriptive literature which identifies the manufacturer, load capacity, and materials of fabrication for all items furnished under this section shall be provided by the Contractor in accordance with Section 01300 of these Specifications.

10410.1.2.2 CERTIFICATION OF COMPLIANCE - Certification of compliance to the standards and Specifications contained herein shall be obtained from the manufacturer and provided by the Contractor at the time of delivery of these materials to the project site.

10410.1.3 DEFINITIONS

Not used.

10410.2 MATERIALS

10410.2.1 QUALITY CONTROL

This specification is not intended to be exclusive or limit competition, but rather to set forth the minimum standards for quality and performance. The Owner reserves the right to reject substitutions if in his opinion, the proposed substitutions will not achieve comparable equipment installation and performance standards.

10410.2.2 FEDERAL SAFETY STANDARDS

The handrail system shall comply with minimum Federal safety standards

10410.2.3 HANDRAIL SYSTEMS

10401.2.3.1 MANUFACTURE - Handrail systems shall be the ReynoRail Aluminum Railing System, Connectorail Aluminum Railing system, or approved equal. All fastenings and fasteners shall be as recommended or furnished by the manufacturer.

10410.2.3.2 COMPOSITION - All rails, posts, and fitting-assembly spacers shall be formed from 6063-T5 or T6 extruded aluminum pipe of 1.9-inch OD and 0.145-inch wall thickness. Kick plates shall be fabricated of aluminum alloy 6061-T6. All other aluminum parts shall be 6063 extruded aluminum or F514.0 aluminum castings. Unexposed parts shall be Type 300 series stainless steel. All components shall be completely fabricated and assembled without welding. Plug screws or blind rivets shall be Type 305 stainless steel.

10410.2.3.3 FINISH - Aluminum railing components shall be given a Class I architectural anodized finish on all exposed surfaces after cutting, 4 mils on castings, and 0.7 mils on pipe. Aluminum shall be pretreated before anodizing for cleaning and removing all markings. Anodizing finish shall be clear.

10410.2.3.4 TOE BOARDS - The handrail system shall include toe boards where indicated on the Drawings and on all open sides of walkways or platforms where a person can pass beneath the walkway or platform, where there is moving machinery or where there is equipment with which falling material could create a hazard.

Toe boards shall be 4-inches nominal in vertical height from top edge to level of the floor or walkway. They shall be securely fastened in place with not more than 1/4-inch clearance above floor level.

10410.2.4 GATE MATERIALS

Aluminum gate materials, quality, design and workmanship shall be similar to the aluminum railing, and shall be designed as part of the railing system. Hinges shall be installed so that each gate can swing 180 degrees from the closed position to the fully open position. Gates shall swing to the walkway side of the handrail only. Gate stops shall be installed on the stationary railing posts to prohibit gates from swinging the wrong direction. Latch assemblies shall be of a durable self-locking type. Construction and installation of each gate frame, hinges, gate stops and latch shall conform to OSHA minimum strength requirements. Gate closing springs shall be stainless steel.

10410.3 CONSTRUCTION REQUIREMENTS

The Contractor install handrails where shown on the Drawings in accordance with the manufacturer's recommendations.

10410.3.1 WORKMANSHIP AND PROTECTION OF FINISH

The Contractor shall be responsible for the workmanship, rigidity, and protection of the system finish. He shall use all precautions necessary to protect the finish from scratches, nicks, gouges, dents, etc. during assembly and installation.

10410.3.2 ASSEMBLY AND INSTALLATION

10410.3.2.1 HANDRAIL SYSTEMS – Procedure shall be as follows:

- All pipe cuts shall be square and accurate for minimum joint-gap. Cuts shall be clean and straight, free of burrs and nicks. All holes shall be drilled and countersunk the proper size, as required for a tight, flush fit of assembly screws and all other component parts.

- All fastenings and fasteners shall be as recommended or furnished by the manufacturer, except that pipe rails shall be fastened to fittings with series 300 stainless steel pop rivets or flush set screws.

- Rail shall be erected straight, level, plumb, and true to the positions as indicated on the Drawings. Any deviation from the true line or grade, which is visible to the eye, shall be corrected.

- Posts shall be installed as single un-spliced pipe lengths. Post spacing shall not exceed 6 feet on center. All other attachment brackets shall be spaced as specified on the manufacturer's installation Drawings.
- Top rails shall be continuous whenever possible. Single, un-spliced lengths shall be attached to a minimum of 3 posts in all cases. Lower rails shall be single, un-spliced lengths between posts.

- Where protection is applied for prevention of dissimilar materials electrolysis, care shall be taken that none of the protective material is visible when assembly is completed.

- Fasteners shall be appropriately installed and drawn up tight with a hand wrench or screw driver so that completed railing is rigid and completely free of play at all joints and attachments. All hook bolts shall be tightened to torque recommended by the manufacturer.

10410.3.2.2 ALUMINUM GATES - Aluminum gates shall be installed at openings in the handrails where shown on the Drawings. Each gate shall consist of a gate frame, hinges, gate stops, and a latch. Each gate, in the closed position, shall be in a vertical plane with the handrail.

10410.4 METHOD OF MEASUREMENT

10410.4.1 NO MEASUREMENT

Unless a separate bid item for furnishing and installing the work outlined in this Section is provided in the Bid Schedule, this work shall not be measured for separate payment, but shall be considered incidental to other items in the Bid Schedule.

10410.4.2 SEPARATE MEASUREMENT

Where items to be furnished and installed under this section are listed separately in the Bid Schedule, quantities shall be established by using a tape measure or other accurate measuring device to determine the total number of lineal feet of handrail system installed and accepted. This measurement shall include all gates, components, and fittings.

10410.5 BASIS OF PAYMENT

Complete compensation for the accepted work outlined in this Section shall be included in other bid items when no separate bid item is provided in the Bid Schedule for this work.

When a separate bid item is provided in the Bid Schedule, complete compensation for this accepted work shall be included in the contract unit price on the Bid Schedule.

PAY ITEM	UNIT
Aluminum Handrail System	Lineal Foot

DIVISION 13

SPECIAL CONSTRUCTION

13150.1 GENERAL

Specifications for the materials and construction of a steel building as outlined herein and as shown on the drawings.

13150.1.1 RELATED WORK

Section 02105 - Earthwork Materials
Section 02201 - Earthwork
Section 03050 - Portland Cement Concrete
Section 03100 - Concrete Forming, Finishing and Curing
Section 03200 - Concrete Reinforcement
Section 03300 - Concrete Structures and Slab Work

13150.1.2 REFERENCES

A. American Institute of Steel Construction (AISC):
   1. AISC- Code of Standard Practice – Manual of Steel construction -Allowable Stress Design (ASD).

B. American Iron and Steel Institute (AISI):
   1. AISI – Cold-Formed Steel Design Manual.

C. Metal Building Manufacturers Association (MBMA):
   1. MBMA – Design Practices Manual.

D. American Society for Testing and Materials (ASTM):
   1. ASTM A36/A36M – Structural Steel.
   2. ASTM A53 – Hot Dipped, Zinc-coated Welded and Seamless Steel Pipe
   3. ASTM A307- Carbon Steel Externally Threaded Standard Fasteners.
   4. ASTM A325 – High Strength Bolts for Structural Steel Joints
   5. ASTM A500 – Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Round and Shapes.
   5. ASTM A529/A529M – Structural Steel with 42 KSI (290 Mpa) Minimum Yield Point (½ in. (12.7 mm Maximum Thickness)
   6. ASTM A572/A572M – High-Strength Low-Alloy Columbium-Vanadium Steels of Structural Quality

E. American Welding Society (AWS):
   1. AWS D1.1 – Structural Welding Code.

F. International Building Code 2003 (IBC 03)

13150.2 DESIGN REQUIREMENTS

A. Structures shall be designed in accordance with the requirements of the "International Building Code", "American Institute of Steel Construction" specifications, "American Iron and Steel Institute" specifications, and "Metal Building Manufacturers Association - Design Practices Manual". The latest edition of each of these publications shall apply.

B. Standard design loads shall be as follows:

Roof Snow Load	Wind Load	Seismic
81.6 Psf (IBC 2003)	90 MPH Exposure C	Per IBC2003, Zone D
20 Psf Live Load		
Building Category 4		

C. Standard Load Combinations are:
Dead Load + Live Load.
Dead Load + Wind Load.
Dead Load + Live Load + ½ Wind Load.
Dead Load + Wind Load + ½ Live Load.

D. Design building with vertical concentrated foundation design load not to exceed a 45,000 pounds.

E. Provide Engineered Certified shop drawings stamped by a Utah State Registered Professional Engineer.

13150.3 PRIMARY FRAMING

A. Rigid Frames – shall be either tapered or constant-depth "I" beam sections, fabricated by automatic or hand welding. . Frames shall be spaced nominal per need. Roof slope shall be 1 inch in 12 inches (low profile). Rigid frames shall be bolted together where required with A-325 or 1-490 bolts.

B. Post and Beam End Frames: Shall be fabricated of either cold-formed sections 8" or 10" inches deep or built-up sections. Standard end-post spacing is 20 feet maximum center to center.

C. Anchorage: Building shall be anchored to concrete foundations at the base of frame columns with cast in place anchor bolts furnished and engineered by the manufacture to resist the design loads produced by the building frame. Column base reactions in the structural calculations as well as the anchor bolt drawings for use in preparing foundation design by others.

13150.4 SECONDARY FRAMING

Purlins and Girts: Purlins and girts shall be fabricated of cold-formed steel 8" or 10" inches deep, with LGSI shape. Minimum thickness is 16 US gage; built-up sections are acceptable where required. Purlins and girts shall be a "Z" or "C" shape. Spacing and gage of these members shall be as determined by design and shown on the plans. Purlins and girts shall be attached to the primary framing members with ½" diameter A-307 bolts.

13150.5 PRIMARY AND SECONDARY FRAMING PAINT

All frames, purlins and girts shall receive one (1) shop coat of rust inhibitive primer after being thoroughly cleaned of loose mill and scale rust or other materials deleterious to paint bonding.

13150.6 PRIMARY AND SECONDARY FRAMING MATERIAL SPECIFICATIONS

A. Plates and bars used in fabricating automatically continuous welded beams and columns: Materials all conform to the chemistry requirements of ASTM A-36 modified minimum YP 50 ksi.

B. Structural Pipes: Materials all conform to the chemistry requirements of ASTM A-36 minimums.

C. Cold Formed Steel: Steel used to form purlins and girts shall be hot rolled steel. Materials all conform to the chemistry requirements of ASTM A607grade 50 or ASTM A570 grade.

13150.7 WIND BRACING

A. Diaphragm strength of wall panel is used for wind bracing in endwalls, if sufficient wall panel is available. Where necessary, cable or rod bracing will be used to resist forces, sized to withstand required loading.

B. Galvanized Cable: meeting ASTM A475, sized to withstand required loading.

C. Adjustable Rod: meeting ASTM A36/A36M; ASTM A572/A572M Grade D; or ASTM A529/A529M, sized to withstand required loading.

D. Wind Columns: fabricated from shop welded, built-up steel plates, meeting ASTM A36/A36M, sized to withstand required loading, where seismic forces will allow.

E. Portal Frames: fabricated from shop welded, built-up steel plates, meeting ASTM A36/A36M, sized to withstand required loading.

13150.8 ROOF AND WALL COVERING

A. Exterior Roof and wall covering shall be "PBR" panels formed from galvanized steel of minimum 26 U.S. gage with not less than 1.250 oz. per sq. ft. of zinc coating.

B. Material specification: Materials all conform to the chemistry requirements of ASTM A446.

C. Exterior Roof and wall panels shall be fastened to framing members with #12 hex head mechanical zinc plated self-tapping, self-drilling screws.

D. Factory coated silicon modified polyester colored roof and wall sheets will be provided optionally with color to be selected by customer from available standard colors.

E. High ribs of the panel shall be spaced at 12 inches on center. These ribs shall be 1-1/4 inches in depth.

F. Two secondary ribs shall be located between the major ribs. Roof and wall panels shall be made to overlap one rib. The panels shall provide a net coverage of 3'-0". All wall panels shall be continuous from base to eave except where length becomes prohibitive.

G. Fiberglass Reinforced Translucent Panels: Where translucent roof or sidewall panels are indicated they shall have a profile matching the adjacent steel panels. Nominal weight of panels shall be 8 oz. per sq. ft. and a nominal thickness of .060 inches.

H. Roof and Wall Insulation: WMP-VR; white polypropylene film fiberglass & polyester scrim. R19 value in wall ; Full cavity or basket system in roof meeting R19 value.

13150.9 WALKDOORS, WINDOWS AND OVERHEAD DOORS

A. Walk-in Doors: Standard walk-in door shall be 3'0 x 7'0 , 4'0x 7'0 , 6'0 x 7'0, with a 1 ¾ inch thick single swing flush type steel construction with commercial grade lever lockset meeting ANSI #A156.2, Series 4000, Grade 2. 6'0x 7'0 will be double swing type.

B. All walk-in doors and frames shall be galvanized and bonderized for maximum rust protection and paint adherence. In addition, they shall receive one shop coat of high grade oven baked paint. Frames shall be 16ga. Door face sheets 20ga. and meet R15 insulation value.

C. Provide 8" x 16 gauge C channel windows frames with commercial grade double pane vinyl windows furnished installed complete with sealants, flashing and trim.

D. Overhead Doors shall be commercial grade overhead sectional and insulated.

E. Overhead door support framing shall be designed t resist applicable wind loads and shall consist of channel jambs with a structural header at the top of the opening with required flashing and trim.

13150.10 GRAVITY RIDGE VENTILATORS

A. Where specified, ventilators shall be either continuous or circular, ridge mounted.

B. The base of the ventilators shall be provided to match the roof slope.

13150.11 GUTTER, TRIM AND DOWNSPOUTS

A. Gable, corner, eave and window and door trim shall be of 26 U. S. gage.

13150.12 RIDGE CAP

The standard formed ridge cap shall be formed to match the roof slope and shall be of the same material, color and configuration as the roof panels up to and including 3:12 slopes. Slopes over 3: 12 require universal ridge cap.

13150.13 SEALANTS

A. Closure Strips: Strips shall be constructed of semi-rigid polyethylene foam and shall match the standard. panel.

B. Tape Sealant: Ribbon mastic 3/32" x 3/8" shall be provided for side and end laps of panels where indicated.

13150.14 CONSTRUCTION REQUIREMENTS

13150.14.1 The CONTRACTOR shall complete construction of the erection of the building in a manner that conforms with the requirements of the DRAWINGS and these SPECIFICATIONS, using good workmanship practices, and applicable building regulations.

13150.14.2 Ensure and verify that the steel building layout matches the concrete foundation layout for proper connection to foundation.

13150.14.2 Assemble building materials and all specified components as per manufacturer's recommendations and to the specified code.

13150.15 METHOD OF MEASUREMENT

13150.15.1 The method of measurement for the steel building shall be "lump sum" and shall include but not limited to all windows and doors, insulation, anchor bolts, rain gutters, down spouts, and all incidental materials and construction needed to complete and finish the building as specified.

13150.16 BASIS OF PAYMENT

The accepted quantity will be paid for at the contract unit price for:

PAY ITEM	UNIT
Steel Building	Lump Sum

INSTALL OWNER FURNISHED EQUIPMENT

SECTION 13300SP

13300.1 DESCRIPTION

A. A significant amount of key and critical treatment processing equipment has been selected and purchased by The Division of Wildlife Resources for the treatment plant. The pre-selected treatment equipment consists of:

Qty	Item
2	Drum filters w/ control panels
1	Level Control Box
2	Backwash Booster Pumps
2	UV Reactor w/ controls
2	12" Electric Actuated Butterfly Valves
4	12" Manual Butterfly Valves
2	UPS
1	Alarm Panel
1	Phone Dialer
1	Flow Meter
3	14" TEE (SCH 40 PVC, FAB'D)
5	14" 90 DEGREE ELBOW (SCH 40 PVC, FAB'D)
4	14" PIPE (PVC SCH 40, 10' LONG)
2	14" VANSTONE FLANGE (PVC)
2	14" GASKET
2	14" BOLT SET (316 SS, PVC FL, DIP FL)
1	14" VANSTONE FLANGE (PVC)
1	14" GASKET
1	14" BOLT SET (316 SS, PVC FL, 3/8" THK ALUM FL)
6	14" TO 12" REDUCER BUSHING (PVC SCH 40)
2	14" TO 1 1/2" SADDLE (FOR PVC OR DIP)
4	12" BUTTERFLY VALVE (GEAR OP.)
2	12" BUTTERFLY VALVE (ACTUATED)
2	12" 90 DEGREE ELBOW (PVC SCH 40, FAB'D)
2	12" PIPE (PVC SCH 40, 10' LONG)
2	12" VANSTONE FLANGE (PVC)
4	12" GASKET
2	12" BOLT SET (316 SS, PVC FL, B-F VALVE, PVC FL)
4	12" VANSTONE FLANGE (PVC)
4	12" GASKET
2	12" BOLT SET (316 SS, PVC FL, B-F VALVE, PVC FL)
2	12" VANSTONE FLANGE (PVC)
2	12" GASKET
2	12" BOLT SET (316 SS, PVC FL, 1/2" THK SS FL)
2	12" VANSTONE FLANGE (PVC)
4	12" GASKET
2	12" BOLT SET (316 SS, PVC FL, B-F VALVE, 1/2" SS FL)

2	4" TEE (PVC SCH 40)
2	4" MALE ADAPTER (PVC SCH 40)
2	4" THREADED CAP (PVC SCH 40)
1	4" PIPE (PVC SCH 40, 10' LONG)
1	1-1/2" CLOSE NIPPLE (PVC SCH 80)
1	1-1/2" PVC BALL VALVE TRUNION
2	1-1/2" 90 DEGREE ELBOW (PVC SCH 80, FIPxFIP)
1	1-1/2" x 12" NIPPLE (PVC SCH 80)
1	1-1/2" x 6" NIPPLE (PVC SCH 80)
6	GALLON 719
6	GALLON 711
6	GALLON P-70
4	EMPTY CANS
4	6" ROLLERS
4	3" ROLLERS

All of the equipment has been Provided by PRAqua Technologies Ltd.

Contact Info:
Project Manager: Kevin Graham
PRAqua Technologies Ltd.
1635 Harold Road
Nanaimo, BC, Canada
V9X 1T4
Phone (250) 714-0141
Fax (250) 714-0171

B. The design of the treatment plant has been made around the selected and procured equipment. The CONTRACTOR will be required to build the treatment plant, including installation of the treatment equipment previously procured by the OWNER, plus furnishing and installing all other equipment and materials (not previously procured) which will be necessary to make a fully operational treatment facility. The detailed drawings include equipment schedules which show which materials will be supplied by OWNER and which materials will be supplied by Contractor.

C. The CONTRACTOR is responsible to insure coordination and compatibility of all equipment (OWNER furnished and CONTRACTOR furnished) in a complete working system. The intent here is to remove the OWNER as middle man between the CONTRACTOR and various manufacturers. The CONTRACTOR accepts the responsibility to look after, furnish and install, all materials and items supplied and not supplied by OWNER that are necessary for a fully operational wastewater treatment plant.

D. PRAqua accepts the responsibility to cooperate fully with the CONTRACTOR by providing necessary information and assistance, answer questions, provide complete material lists of equipment to be furnished, support the CONTRACTOR's efforts in identifying miscellaneous materials that are needed to be furnished by the CONTRACTOR in order to complete the Work, thereby transferring from the OWNER

to the CONTRACTOR the loose ends that would ordinarily be the responsibility of the purchaser of the equipment.

E. The CONTRACTOR's responsibilities shall be as follows: coordinate and receive delivery, unload equipment, suitably store equipment on site, install equipment, start-up equipment, work with OWNER and Supplier/Manufacturer to test equipment, furnish and install all necessary items not furnished by Supplier/Manufactures, and other miscellaneous tasks necessary for the Supplier/Manufactures and CONTRACTOR to complete their contract responsibilities.

F. The Supplier/Manufacturers are under contract to provide installation supervision and start-up calibration, initial operation, performance test, and maintenance instruction to the OWNER, ENGINEER, and CONTRACTOR during installation and start-up operations.

G. The CONTRACTOR shall coordinate its construction schedule with the actual delivery date of the equipment from the various manufactures or make arrangements for storage which will be in accordance with the Supplier/Manufacturers contract with the OWNER.

H. Upon request, the Suppliers/Manufacturers and the ENGINEER will make available to the CONTRACTOR all shop drawings and submittals. At the CONTRACTOR's request, additional information that is required for installation of the equipment will be provided. The Suppliers/Manufacturers shall furnish required O&M Manuals for the furnished equipment.

I. The CONTRACTOR shall receive delivery of the OWNER furnished equipment at the site, inspect the equipment against packing lists, unload equipment, and suitably store equipment per the manufacturer's instruction. Any damage to the equipment after delivery shall be repaired by the CONTRACTOR at the CONTRACTOR's expense. The equipment will arrive with final paint coating in place. The CONTRACTOR shall perform all touch-up painting, regardless of the cause.

J. The CONTRACTOR shall provide in its bid all compensation to furnish and install all material not furnished by Suppliers/Manufacturers (as identified herein) in order to construct a complete operating treatment plant as specified and shown.

13300.2 METHOD OF MEASUREMENT

13300.2.1 The method of measurement for the installation of the owner furnished equipment shall be lump sum and shall include all labor to unload, install, and assist the supplier with start-up of the facility.

13300.3 BASIS OF PAYMENT

The accepted quantity will be paid for at the contract unit price for:

PAY ITEM	UNIT
Install Owner Furnished Equipment	Lump Sum

DIVISION 15

MECHANICAL

15110.1 DESCRIPTION

This section is a materials specification and is included for guidance in selecting materials for pipe and related fittings and appurtenances used in the construction of water and sewer systems.

15110.1.1 RELATED WORK

Section 02222 - Waterline Pipe Installation
Section 02224 - Sewer Line Pipe Installation
Section 15230 - Waterline Valves and Hydrants
Section 15232 - Water System Control Valves

15110.1.2 SUBMITTALS

The Contractor shall submit for review complete information, showing all pipe, materials, fittings, gaskets, couplings, coatings, linings, supports, mechanical restraints, thrust blocks and configuration prior to the delivery of any components to the project. All information shall be provided in accordance with Section 01300 and written evidence of compliance from the manufacturer shall accompany each delivery of material.

15110.1.3 DEFINITIONS

Not used.

15110.2 MATERIALS

15110.2.1 NSF COMPLIANCE

All pipe and materials furnished and installed for culinary use shall comply with National Sanitary Foundation (NSF) Standard 61. Also, all plastic pipe must be approved by the NSF for potable water use and shall carry the factory "NSF " stamped label on the pipe indicating such approval.

15110.2.2 POLYVINYL CHLORIDE PIPE (PVC)

15110.2.2.1 PIPE – Shall be as follows:

- For sizes less than 4 inches OD, PVC pipe shall be Schedule Rated pressure pipe meeting the requirements of ASTM D1785 of the schedule and size shown on the Drawings.
- PVC pipe 4 inches and larger, shall be rigid, thermoplastic Class Rated pressure pipe meeting the requirements of ANSI/AWWA Standard C900 or C905 (latest revision). The pressure class or the dimensional ratio and the size shall be as shown on the Drawings.
- While Class Rated and Pressure Rated pipe materials are not interchangeable, when specifically allowed in the Contract Documents, for size 4" and larger, rigid thermoplastic Pressure Rated pressure pipe, meeting the requirements of ASTM D2241, may be furnished and installed. Operating pressure for this pipe shall be as shown on the Drawings

15110.2.2.2 FITTINGS FOR PVC PIPE – Unless specifically authorized otherwise, fittings for 4 inch and larger size PVC pipe in underground service shall be ductile iron (DI) and shall meet the requirements of NSF 61 and ANSI/AWWA C-153. They shall have a standard coating of cement mortar on the interior surfaces in compliance with AWWA C-104. DI fittings meeting these requirements may be used with smaller PVC piping. PVC fittings meeting the requirements of

ANSI/AWWA C-907 may be used with PVC pipe smaller than 4 inches, and, in some instances, where specifically authorized, with PVC pipe sizes 4 inches through 8-inches.

15110.2.3 DUCTILE IRON PIPE

15110.2.3.1 INTERIOR COATING - The interior surface of all DI pipe shall be coated with a standard coating of cement-mortar in accordance with ANSI/AWWA Standard C-104 unless required otherwise in the Contract Documents. Field coating of DI pipe will not be acceptable.

15110.2.3.2 BURIED PIPE – Unless shown otherwise on the Drawings, shall be as follows:

- Buried ductile iron pipe shall be Thickness Class 51.
- Shall meet requirements of ANSI/AWWA C-151.
- Joints shall be bell and spigot or mechanical, which meet the requirements of ANSI/AWWA C-111.

15110.2.3.3 EXPOSED PIPE – Shall meet these requirements, unless shown otherwise on the Drawings:

- Exposed ductile iron pipe shall be Thickness Class 53.
- Pipe shall comply with ANSI/AWWA Standard C-151.
- Pipe joints shall be flanged, meeting the requirements of ANSI/AWWA C-115, or mechanical type couplings (MTC), meeting the requirements of ANSI/AWWA C-606. MTC shall be Victaulic grooved couplings, as manufactured by Victaulic Company of America or approved equal), unless shown otherwise on the drawings.
- 3" to 12" compact flanged fittings shall be ductile iron and shall be produced in accordance with laying lengths specified in ANSI/AWWA C10/A21.10. Flange surface shall be faced and drilled in accordance with ANSI Class 125 B16.1. Nominal body thickness shall be Manufacturer's Standard, but shall not be less than those specified in ANSI/AWWA C153/A21.53 "Standards for Ductile Iron Compact Fittings". Flange thickness shall be in accordance with the Manufacturer's Standards. Working pressure rating shall be 250 psi for water. Fittings shall be made in the United States of America and shall not have been refurbished or reworked by anyone other than the manufacturer. When greater than 250 psi is called for on the plans, then the Supplier shall furnish higher class rated flanges. Standard Class 125 template for drilling shall be used for all flanges. Drilling templates shall be in multiples of four, so that fittings may be made to face in any quarter. Boltholes shall straddle the centerline and shall be equally spaced. Misalignment of boltholes of two opposing flanges shall not exceed 0.12 inches. Blind flanges 12 inches and over shall be provided with lifting eyes. Insulated flanges shall be provided where required.
- Gaskets shall be full faced, 1/16-inch thick compressed sheets of Aramid fiber base, with nitrile binder and non stick coating, suitable for temperatures to 700°, pressures to 1000 psig and a pH range of 1 to 11. Blind flange gaskets shall cover the entire inside face of the flange and shall be cemented in place. Gaskets shall be as manufactured by John Crane, style 2160; Garlock, style 3000; or approved equal.

15110.2.4 GALVANIZED IRON PIPE AND FITTINGS

Shall be of the schedule rating shown on the Drawings and shall be used only in exposed, non-corrosive atmospheres where piping diameters are less than 4 inches.

15110.2.5 PIPE AND FITTINGS FOR WATER SERVICE LINES

Shall meet the requirements provided in Section 15234 for water service connections.

15110.2.6 PIPE FOR GRAVITY SEWER SYSTEMS

Gravity sewer pipelines may be constructed with PVC or polyethylene (PE) plastic sewer pipe and fittings. Such materials shall be of the type, configuration and size shown on the Drawings and/or on the Bid Schedule.

15110.2.6.1 PVC PIPE - All PVC sewer pipe and fittings shall meet the standards of ASTM D3034 and F679. Such pipe shall be manufactured with a rubber gasketed joining system which meets ASTM D3212 and shall be furnished with a standard dimensional ratio of 35 (SDR 35) for wall thickness, unless shown otherwise on the Drawings.

15110.2.6.2 PE PIPE - All PE sewer pipe and shall be smooth, solid wall, high density polyethylene pipe manufactured from PE 3408 material conforming to ASTM D1248, Type III, Class C, Category 5, Grade P34 with a P3408 rating from the Plastic Pipe Institute. Fittings for this pipe shall be molded from a polyethylene compound equal to or exceeding the properties of the pipe being supplied.

15110.2.7 PIPE FOR PRESSURE SEWER SYSTEMS

Pressure sewer pipelines shall be constructed with DI, PVC, or PE plastic sewer pipe. Fittings and materials shall be of the type, SDR rating, (or pressure class) and size shown on the Drawings and/or on the Bid Schedule.

15110.2.7.1 PVC PIPE - All PVC pipe for pressure sewer lines shall be rigid, pressure rated, thermoplastic pipe which meets the standards of ASTM D2241. Fittings for PVC pipelines shall be Class 50, cement mortar lined, rubber gasketed, DI which meet the requirements of ANSI/AWWA C-153 and C-104.

15110.2.7.2 PE PIPE - PE pipe for pressure sewer lines shall be smooth, solid wall, high density polyethylene pipe manufactured from PE 3408 material conforming to ASTM D1248, Type III, Class C, Category 5, Grade P34 with a P3408 rating from the Plastic Pipe Institute. Fittings for this pipe shall be molded from a polyethylene compound equal to or exceeding the properties of the pipe being supplied.

15110.2.8 PIPE AND FITTINGS FOR IRRIGATION SYSTEMS

Shall be either DI or Pressure Rated PVC, of the type and class shown on the Drawings, for line diameters 4-inches and greater. Buried lines smaller than 4 inches in diameter shall be Schedule Rated PVC as shown on the Drawings.

15110.2.9 PIPE FOR DRAIN SYSTEMS

Piping for sub-drainage may be constructed with polyvinyl chloride (PVC) or polyethylene (PE) plastic non-pressure drainage or sewer pipe and fittings. Such materials shall be of the type, configuration and size shown on the Drawings and/or on the Bid Schedule.

15110.2.9.1 PVC PIPE - All PVC drainage pipe and fittings shall meet the standards of ASTM F794. Such pipe shall be manufactured with a rubber gasketed joining system which meets ASTM D3212 and may be furnished with ribbed, corrugated or smooth exterior walls with smooth interior wall surfaces, unless shown otherwise on the Drawings. Rubber gasketed joints will not be required for collection pipe applications with perforated or slotted pipe sections.

15110.2.9.2 PE PIPE - All PE drainage pipe shall be solid, corrugated or ribbed wall high-density polyethylene pipe with smooth interior wall surfaces. Material shall conform to ASTM D1248, Type III, Class C, Category 5, Grade P34 with a P3408 rating from the Plastic Pipe Institute. Fittings for this pipe shall be molded from a polyethylene compound and with equivalent properties and configurations specifically designed to fit the pipe being supplied.

15110.2.10 MISCELLANEOUS FITTINGS AND MATERIALS

15110.2.10.1 PIPE SUPPORTS - Floor mounted pipe supports for suspended, exposed piping systems shall be adjustable stanchion type supports designed to cradle the pipe diameter by 170 degrees. The support shall fit ductile iron or steel diameters snugly, without excessive gaps between the support and the pipe. Support saddle width shall be a minimum of 2 inches wide. The support must offer a minimum of 3 inches of final adjustment, after installation. Supports shall be supplied with independent base and adjustment collar designed to accept standard sized Schedule 40 galvanized steel pipe for coarse adjustment. Supports shall be fabricated from A36 mild steel, and shall have an electro-galvanized finish. Floor mounted pipe supports shall be the Standon Model S92 or C92 as manufactured by Material Resources, Inc., 22700 N. W. Quatama Street, Hillsboro Oregon 97124, or approved equal. The standard required model shall be the S92. Non standard materials or model numbers shall be as specified on the Drawings.

15110.2.10.2 "Y" STRAINERS - shall be constructed of high-tensile ASTM A126 Class B Cast Iron with blow-off connections and self-aligning cylindrical screens and shall be equal to Watts Regulator Series 77F or better quality.

15110.2.10.3 FASTENERS – Fastener requirements are as follows:

- Unless otherwise required in these Specifications or shown on the Drawings, all bolting hardware for <u>buried</u> pipe, fittings, valves, and components shall be of manufacturer's standard materials.

- Unless otherwise required in these Specifications or shown on the Drawings, all bolting materials for <u>exposed</u> pipe, fittings, valves, and components shall be Type 316 stainless steel. Where space restrictions preclude the use of regular bolts, stainless steel threaded studs may be used on all valve flange connections.

- In all instances where stainless steel threaded fasteners are used, a coating of an approved, permanent anti-seize compound shall be applied to the fastener to prevent galling and to assist in disassembly.

- All bolts and/or studs shall extend through the nuts at least 1/4 inch.

15110.2.10.4 COUPLINGS – Couplings shall meet the following requirements:

- Unless prescribed otherwise on the Drawings or in these Specifications, couplings shall meet the requirements of ANSI/AWWA C-219. All flexible couplings shall meet the minimum requirements of Smith Blair 400 series.

- Sleeves shall have a smooth inside taper and there shall be no surface irregularities on any sealing surface. Gaskets shall be suitable for the project application.

- Flexible couplings for buried DI and PVC pipe sizes 2 through 16 inches in diameter shall be fabricated of steel or ductile iron. For pipe sizes larger than 16 inches, flexible couplings shall be of steel. Coupling components for use in potable water systems shall be factory coated with an FDA approved, bonded epoxy coating, applied to an average 12 mil thickness.

- Flexible couplings for exposed pipe shall be manufactured of steel, unless shown otherwise on the Drawings, or approved by the Engineer. Coupling components for use in potable water systems shall be factory coated with an FDA approved, fusion-bonded epoxy coating, applied to an average 12 mil thickness.

15110.2.10.5 RESTRAINT HARNESS – Where required, restraint harness for bell and spigot pipe joints shall be as manufactured by EBAA Iron Co. or an approved equal. The restraint shall consist of a split bell ring to go behind the bell and a split, serrated ring to grip the pipe on the other side of the joint. The harness shall be held together with clamping bolts and tie bolts. The rings shall be fabricated of 60-42-10 DI conforming to ASTM A-536. Clamping bolts shall be grade 5 galvanized machine bolts. Tie bolts are of low alloy steel. The harness shall have a minimum working pressure of 150 psi. Harness size shall be as shown in the schedule on the Drawings or as specified in the Special Provisions.

15110.2.10.6 VALVES AND FITTINGS - Shall be as specified in their respective sections in these Specifications.

15110.2.10.7 BOXES AND ENCLOSURES – Shall be of the size, type, and configuration indicated on the Drawings and Contract Documents.

15110.3 CONSTRUCTION REQUIREMENTS

See Sections 02222 and 02224 for construction requirements for applicable piping systems.

15110.4 METHOD OF MEASUREMENT

Unless specifically called out for separate payment on the Bid Schedule, fittings for pipelines and piping systems will be considered appurtenant to the line or system being installed, and measurement for such fittings will be included in the measurement for that pipeline or piping system.

15110.5 BASIS OF PAYMENT

Not used.

15120.1 DESCRIPTION

15120.1.1 The CONTRACTOR shall furnish and install all pipe, fittings, closure pieces, supports, gaskets, joining materials, or other appurtenances as shown and specified for a complete and workable plant piping system.

15120.1.2 All pipe and fittings shall be of the type, class, and size designated on the DRAWINGS and as specified in these SPECIFICATIONS. All pipe, fittings, gaskets, solvent cements, and other items or materials installed in a pipeline containing water intended for culinary use shall comply with National Sanitary Foundation (NSF) Standard 61. Also, all plastic pipe must be approved by the NSF for potable water use and shall be stamped "NSF-PW" on the pipe indicating such approval.

15120.1.3 Piping shall be installed as indicated on the DRAWINGS. Pipe size and locations are provided, but the DRAWINGS are not intended to show every offset, fitting, or structural difficulty that may be encountered during project construction.

15120.1.4 Exposed piping shall not be erected until the all equipment to which the pipe is to be attached has been installed and it can be determined where the piping and fittings shall be located to make a neat, effective arrangement. Pipe runs shall be horizontal and vertical and installed in straight runs parallel the axis of the pipe chases.

15120.1.5 If the CONTRACTOR desires to change any of the piping layouts shown on the DRAWINGS, he shall submit to the ENGINEER, for approval, his detailed proposed layouts. Such approved changes shall come at no additional cost to the OWNER. The CONTRACTOR shall provide all materials and labor required to complete all WORK in accordance with the best practice of the trade, and to the satisfaction of the ENGINEER.

15120.1.6 RELATED WORK

Section 02200 - Trench Excavation & Backfill
Special Provision - Tubing Systems
Special Provision - Compressed Air Piping
Special Provision - Pipe Schedule
Special Provision - Sitework Piping
Special Provision - Drain Piping & Manhole Installation
Special Provision - Water Valves
Special Provision - Supports & Anchors

15120.1.7 REFERENCES

15120.1.7.1 Work covered by this Specification shall meet or exceed the provisions of the latest editions of the following Codes and Standards in effect at the time of award of the Contract:

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D1785 Polyvinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80, and 120

ASTM D2564 Solvent Cements for Polyvinyl Chloride (PVC) Plastic Pipe Fittings

ASTM D2466 Polyvinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 40

ASTM D2467 Polyvinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 80

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C 104	Standards for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
AWWA C 110	Standard for Ductile-Iron and Gray-Iron Fittings, 3 In. through 48 In. for Water and Other Liquids
AWWA C 111	Standard for Rubber Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings
AWWA C 150	Standard for the Thickness Design of Ductile-Iron Pipe
AWWA C 151	Standard for the Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids.
AWWA C 600	Standard for Installation of Ductile-Iron Water Mains and their Appurtenances
AWWA C 651	Standard for Disinfecting Water Mains
AWWA C 900	Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. through 12 In.
AWWA C 905	Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 14 In. through 20 In.
AWWA C 907	Standard for Polyvinyl Chloride (PVC) Pressure Fittings
AWWA M 23	Manual of Water Supply Practices - PVC Pipe-Design and Installation

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI B16	Bolt Hole Pattern for Pipe Flanges and Flanged Fittings

15120.1.8 SUBMITTALS

15120.1.8.1 The CONTRACTOR shall submit for review complete information, showing all pipe, fittings, gaskets, solvent cements, and other appurtenant materials were manufactured, tested and supplied in accordance with applicable references in this section together with a report of the test results and the date each test was completed. All information shall be provided in accordance with Section 01300 and written evidence of compliance from the manufacturer shall be provided with each delivery of material.

15120.1.8.2 As construction proceeds, the CONTRACTOR shall submit test documentation in accordance with Section 15120.3.5 of these SPECIFICATIONS.

15120.2 MATERIALS

15120.2.1 POLYVINYL CHLORIDE PIPE (PVC) - All exposed plant piping shall be rigid thermoplastic pressure pipe meeting the requirements of ASTM D1785, Schedule 40 (unless otherwise specified), and of the size shown on the DRAWINGS.

15120.2.2 PVC FITTINGS - Fittings for PVC piping shall meet the requirements of ASTM D2466 and ASTM 2467, of the schedule and size shown on the DRAWINGS.

15120.2.3 THERMOPLASTIC FLANGES - Flanges for PVC piping shall be Van Stone style and of the size and type shown on the DRAWINGS. Flanges shall meet the requirements of ASTM D2467 and ASTM D4024.

15120.2.4 PVC SOLVENT CEMENTS- Solvent cements for PVC piping shall meet the requirements of ASTM D2564 and the National Sanitary Foundation (NSF) Standard 61.

15120.2.5 DUCTILE IRON PIPE (DI) - All buried plant piping shall be DI Pressure Class 300, meeting the requirements of ANSI/AWWA Standards C-150 and C151 with push-on, mechanical, or flanged joints as shown on the DRAWINGS. Unless directed otherwise on the DRAWINGS or in these SPECIFICATIONS, the interior surface of all DI pipe shall be factory coated with a standard coating of cement-mortar, which shall be further covered with a bituminous seal coat, all in accordance with ANSI/AWWA Standard C-104. Field coating of DI pipe will not be acceptable or allowed.

15120.2.6 DUCTILE IRON FITTINGS - Fittings for DI piping shall be push-on, mechanical, or flanged as shown on the DRAWINGS and shall meet the requirements of ANSI/AWWA C-110 with a standard factory coating of cement-mortar on all interior surfaces, which shall be further covered with a bituminous seal coat, all in accordance with ANSI/AWWA Standard C-104 on the interior surfaces. Field coating of DI fittings will not be acceptable or allowed. Pressure rating for fittings shall be as required to meet or exceed the pressure rating of the piping.

15120.2.7 DUCTILE IRON FLANGES - Flanges shall be the size, class, and fitted with gaskets, in accordance with the requirements of ANSI/AWWA C-110. Mating surfaces of all flanges shall be protecting against rusting. Class D, 150 PSI flanges shall be provided when not otherwise shown on the DRAWINGS.

15120.2.8 GALVANIZED IRON PIPE AND FITTINGS - Galvanized pipe and fittings shall be schedule 80 unless otherwise shown on the DRAWINGS and used only in exposed, non-corrosive atmospheres where piping diameters are less than 4 inches.

15120.2.9 GASKETS - Gaskets shall be full faced, 1/8 inch thick EPDM. Blind flange gaskets shall cover the entire inside face of the flange and shall be cemented in place. Gaskets shall be as manufactured by ASAHI America, Inc., or approved equal.

15120.2.10 BOLTS - ALL bolts, nuts, hardware, and fasteners for fittings, valves, and piping components shall be Stainless Steel, Type 316 unless specifically approved otherwise by the ENGINEER in writing.

15120.2.11 THREAD COMPOUND - All nut and bolt threads shall be coated with an anti-seize thread compound, Product 767, as manufactured by Loctite Corporation (860/571-5100), or approved equal.

15120.3 CONSTRUCTION REQUIREMENTS

15120.3.1 HANDLING AND REJECTION OF MATERIALS

15120.3.1.1 Care shall be taken during handling of pipe, to avoid impact which might cause damage. Dropping pipe during unloading will not be permitted.

15120.3.1.2 Pipe will be carefully inspected in the field before installation. If any cause for rejection is discovered in a pipe before or after installation, it shall be removed and replaced by the CONTRACTOR, at no additional cost to the OWNER.

15120.3.1.3 Any pipe found to be unfit or rejected due to cracks, broken bells or spigots, irreparable chipped lining, etc., shall be removed from the job site.

15120.3.2 INSTALLATION

15120.3.2.1 When making connections, pipe shall be cut in a neat and workmanlike manner, so as to provide a smooth end at right angles to the axis of the pipe. Pipe and fittings shall be assembled so there will be no distortion or springing of the pipelines. Fittings, flanges, and any other connections shall come together at the proper orientation. The fit shall not be made by springing piping, nor shall orientation or alignment be corrected by taking up on any flange bolts. Flange bolts, mechanical joints, flexible connectors, etc., shall slip freely into place. If the proper fit is not obtained, the piping shall be altered to make the fit meeting the above requirements.

15120.3.2.2 At the close of each work day, or whenever the work ceases for any reason, the end of the pipe shall be securely closed, unless otherwise permitted by the ENGINEER.

15120.3.2.3 Exposed piping shall not be installed until all equipment to which the pipe is to be attached has been installed and it can be determined where piping and fittings shall be located to make a neat, efficient arrangement. Piping shall be aligned with equipment connections such that no external load or stress will be transferred to any equipment from the piping. Pipe runs shall be horizontal and vertical and installed in straight runs parallel to the axis of the pipe chases. Piping shall be installed to allow for convenient inspection and maintenance.

15120.3.2.4 All piping shall be painted in accordance with Section 9910 of these SPECIFICATIONS and color coded according the following table. Identification of the direction of flow and the contained liquid or piping system (i.e. "Raw Water", "House Water", "Finished Water", "Chlorine Gas", etc.) shall also be made on the pipe. The color and type of paint used shall be submitted to the ENGINEER for his approval.

<u>Color Scheme for Piping</u>

Raw	Olive Green
Potable	Dark Blue
Backwash Waste	Light Brown
Sludge	Dark Brown
Natural Gas	Red
Other Lines	Light Gray

15120.3.3 PIPE RESTRAINTS

Above ground or exposed piping shall be restrained as required in Section 15275 - Supports and Anchors.

The CONTRACTOR shall provide mechanical pipe restraints in accordance with the DRAWINGS and these SPECIFICATIONS. All restraints shall be in place before any hydrostatic testing is performed on the system. Pipe shall be properly blocked or restrained at all fittings wherever the pipeline makes a sudden change in direction of 11.25 degrees or more, wherever it changes sizes, or wherever it ends. Restraints shall be installed in accordance with the details shown on the DRAWINGS.

<u>The CONTRACTOR shall allow the ENGINEER to visually inspect every mechanical restraint before it is buried.</u>

15120.3.4 FLUSHING AND CLEANING - Prior to proceeding with pressure testing and disinfection of completed lines, the CONTRACTOR shall fill the test section with clean potable water and flush the lines. Certain contaminants, especially in caked deposits, resist flushing at any velocity. If, in the opinion of the ENGINEER, contaminants have entered the line during construction that will not be removed by flushing, the interior of the pipe shall be pigged or swabbed, as necessary, to remove the debris prior to proceeding with flushing.

15120.3.5 TESTING

15120.3.5.1 The CONTRACTOR shall perform all testing, and shall furnish all materials, equipment, and labor necessary to complete this WORK as required. Any WORK that fails to meet the acceptance criteria of prescribed testing, shall be repaired and/or replaced at no additional cost to the OWNER and then re-tested. This sequence shall be repeated until the WORK meets the acceptance criteria

15120.3.5.2 PRESSURE TESTING

15120.3.5.2.1 All pipelines for carrying potable, non-potable, and water-borne products shall be pressure tested for leakage when they are completed, unless directed otherwise in these SPECIFICATIONS or in writing by the ENGINEER.

15120.3.5.2.2 WARNING - The hydrostatic test procedures described herein are not applicable to air pressure testing.

15120.3.5.2.3 Prior to pressurization all required flushing shall have been completed. Pipeline sections to be tested shall be isolated. The test section shall be filled with clean potable water, and all air shall be removed from the line. Pressure on the test section shall then be brought to full test pressure and maintained at that level for a period of not less than 4 hours. Pipelines shall be tested at 50 PSI over normal static pressures or to the manufacturer's class rating, which ever is lower.

15120.3.5.2.4 No leakage will be allowed in the plant piping system. Should any leaks be discovered, the CONTRACTOR shall locate and repair the leak, and shall then be re-tested by the CONTRACTOR until compliance is achieved.

15120.3.6 DISINFECTION

15120.3.6.1 All pipelines to be used for culinary water shall be disinfected in accordance with the requirements of the latest revision of ANSI/AWWA C-651, the State of Utah Public Drinking Water Regulations and local requirements.

15120.3.6.2 The CONTRACTOR may use any method prescribed by the referenced standards; however, the "slug method" is preferred. This method basically consists of filling the line with potable water and then injecting a "slug" of concentrated chlorine solution (100 mg/L) at the upstream end of the line. The "slug" is then moved through the line by slowly draining the low end. When properly conducted, this procedure provides contact to the interior pipe surfaces with a heavily concentrated dose of chlorine to achieve disinfection.

15120.3.6.3 After disinfection, the lines are flushed until residual chlorine is reduced to the levels found in the rest of the OWNERS system, or until they reach levels safe for consumption. Samples for bacteriological testing can then be taken. The CONTRACTOR shall safely and legally dispose of contaminated water used for disinfection after consultation with the local authorities. Under no circumstances shall heavily chlorinated water be allowed to mix with "live" waters, meaning waters in lakes, rivers, streams or wetlands.

15120.3.7 TESTING DOCUMENTATION

The CONTRACTOR shall maintain a record of all testing performed, and the test results obtained for the lines installed under this CONTRACT. Minimum information contained on the record shall include the following:

1. All Documents:

   A. Date of issuance of the record
   B. Name of CONTRACT
   C. CONTRACTOR's name and address

2. Disinfection Report:

   A. Name and address of treatment supervisor
   B. Disinfection method used
   C. Location and boundary description of section to be disinfected
   D. Time and date of disinfectant introduction
   E. Time and date of disinfectant release
   F. Initial disinfectant residual (ppm) for each outlet tested
   G. Time and date of flushing after disinfection
   H. Signature of treatment supervisor (signifies completion of disinfection activities)

3. Bacteriological Report:

   A. Date issued
   B. Project name and location
   C. Laboratory's name, certification number, address and phone number
   D. Test location
   E. Time and date of sample collection
   F. Name of person collecting sample
   G. Time and date of laboratory test start
   H. Coliform bacteria test results for each sample
   I. Certification that water conforms (or fails to conform) to bacterial standards of State of Utah public drinking water regulations
   J. Bacteriologist's signature

4. Pressure Test Report:

   A. Type of test
   B. Location of test
   C. Sizes, types, and lengths of pipe in test section, and test boundary description
   D. Date and Time test started
   E. Date and Time test completed
   F. Test pressure
   G. Amount of leakage
   H. Test result
   I. Printed Name/Signature and Date of Test Supervisor (CONTRACTOR's representative)
   J. Printed Name/Signature of Inspector (ENGINEER's representative) witnessing and approving the test

15120.4 METHOD OF MEASUREMENT

Unless a separate bid item for furnishing and installing the work outlined in this section is provided in the Bid Schedule, this work shall not be measured for separate payment, but shall be considered incidental to other items in the Bid Schedule.

15120.5 BASIS OF PAYMENT

Not used.

Replace Section 15120.4 of the Standard Specifications with the following.

15120.4 METHOD OF MEASUREMENT

The method of measurement for payment of Install Plant Piping/Equipment will be lump sum. Measurement will included providing and installing all piping, fittings, closure pieces, supports, gaskets, joining materials, valves, air valves, sub grade plumbing inside the building shown on the drawings that are not provided by OWNER / PRAqua.

Replace Section 15120.5 of the Standard Specifications with the following.

15120.5 BASIS OF PAYMENT

PAY ITEM	UNIT
Treatment Plant Piping/Equipment	Lump Sum

15125.1 DESCRIPTION

15125.1.1 The Contractor shall furnish and install a piping system designated for fuel gases, such as natural gas, manufactured gas, undiluted liquefied petroleum gases, liquefied petroleum gas-air mixtures, or mixtures of any of these gases. Pipe and fittings shall be of the type, class, and size, shown on the Drawings and in these Specifications.

15125.1.2 Piping layout on the Drawings shall be considered diagrammatic for all piping not shown with detailed dimensions. Pipe size and location are provided, but the Drawings are not intended to show every offset, fitting, or structural difficulty that will be encountered during project construction.

15125.1.3 At no additional cost to the Owner, and with written permission from the Engineer, piping alignment may be varied from that shown on the Drawings, to avoid structural or mechanical difficulties, or to avoid the work of other trades. The Contractor shall provide all materials and labor required to complete all work in accordance with the best practice of the trade, and to the satisfaction of the Engineer.

15125.2 SUBMITTALS

The Contractor shall submit for review complete information, showing all pipe, materials, fittings, gaskets, couplings, coatings, supports, pipe supports, and configuration prior to the delivery of any components to the project. All information shall be provided in accordance with Section 01300 and written evidence of compliance from the manufacturer shall be provided with each delivery of material.

As construction proceeds, the Contractor shall submit test documentation in accordance with this section of these Specifications.

15125.3 MATERIALS

15125.3.1 PIPE AND FITTINGS

Piping shall be black-iron pipe (bare) schedule 40 or 80 as shown on the Drawings, (unless otherwise specified) and shall meet requirements of ASTM A-53, ASTM A-106, and API-5L grade B. Pipe joints shall be threaded, unless otherwise indicated on the Drawings. Galvanized iron, copper, brass, aluminum alloy or polyethylene pipe, (or tubing), is not acceptable.

Fittings shall be forged steel, conforming to ASTM A105, 2000 psi, threaded.

Threads for pipe and fitting shall comply with the American Standard for Pipe Threads B2.1 or ANSI(ASME) B1.20.1. Pipe with threads which are stripped, chipped, corroded, or otherwise damaged, shall not be used.

Pipe and fittings shall be clear and free from cutting burrs and defects in structure or threading. Defects in pipe shall not be repaired. When defective pipe or fittings are located in a system, the defective material shall be replaced.

15125.3.2 PIPE COATING

All buried piping, or piping otherwise in contact with a material exerting a corrosive action, shall be coated with a corrosion resisting material. Pipe coating systems shall be X-TRU Coat, TGF-3, YG-3, Scotch Coat, Fusion Bond Epoxy, or approved equal.

15125.3.4 FASTENERS

Unless otherwise required in these specifications or on the Drawings, all bolting materials for all pipe, fittings, valves, and components shall be Type 316 stainless steel unless otherwise required in the Contract Documents.

15125.4 CONSTRUCTION REQUIREMENTS

15125.4.1 HANDLING AND REJECTION OF MATERIALS

Care shall be taken during handling of pipe, to avoid impact, which might cause damage. Dropping pipe during unloading will not be permitted. If any cause for rejection is discovered in a pipe, it shall be removed and replaced by the Contractor, at no additional cost to the Owner. Any pipe found to be unfit or rejected shall be removed from the job site.

15125.4.2 INSTALLATION

No person, unless in the employ of or having permission from the serving gas supplier, shall open or make connections with a gas main. No person, unless in the employ of or having permission from the serving gas supplier, shall repair, alter, open or make connections to the service gas piping, or do any work on the parts of the gas supply system up to the meter set assembly.

In case any work done by a gas fitter or plumber discloses the need for repairs or alterations on any part of the gas supply system, the serving gas supplier shall be notified promptly of this fact.

If gas is leaking from any part of the gas supply system, a gas fitter or plumber no in the employ of the serving gas supplier may make necessary repairs and shall notify the serving gas supplier.

Pipe and fittings shall be assembled so there will be no distortion or springing of the pipelines. Flanges, unions, couplings and other connections shall come together at the proper orientation. The fit shall not be made by springing piping, nor shall orientation or alignment be corrected by taking up on any flange bolts. Threaded joints, flange bolts, union halves, etc., shall slip freely into place. If the proper fit is not obtained, the piping shall be altered to fit.

Gas pipe shall not be bent. Fittings shall be used when making turns in gas pipe.

No exposed piping shall be installed until all equipment to which the pipe is to be attached has been installed and it can be determined where piping and fittings shall be located to make a neat, efficient arrangement. Pipe shall be installed in straight runs parallel to the axis of the structures. Pipe runs shall be horizontal and vertical. Piping shall be installed with a sufficient number of unions or couplings, in addition to those shown on the Drawings, to allow for convenient inspection and maintenance.

Joint compound (pipe dope) shall be applied sparingly and only to the male threads of pipe joints. Such compounds shall be resistant to the action of liquefied petroleum gases.

Exposed pipe work shall be suspended or supported, to prevent sagging or over stressing of the pipe and connections. Gas piping shall not be supported by other piping. Gas piping shall not be run in or through an air duct, crawl space, chute, chimney or gas vent, ventilating duct, or elevator shaft.

Each outlet, including a valve or cock outlet , shall be securely closed gastight with a threaded plug or cap immediately after installation and shall be left closed until the equipment is connected

thereto. Likewise, when the equipment is disconnected from an outlet and the outlet is not to be used immediately, it shall be securely closed gastight.

The building structure shall not be weakened by the installation of the gas piping. Before any beams or joists are notched, special permission shall be obtained from the Engineer in writing.

No gas pipe smaller than ½" iron pipe size shall be used in any concealed location.

Underground gas piping shall buried at a sufficient depth, (18" minimum), or covered in a manner so as to protect the piping from physical damage.

15125.4.3 PRESSURE TESTING

The Contractor shall perform all testing, and shall furnish all materials, equipment, and labor necessary to complete this work as required. Any work that fails to meet the acceptance criteria as prescribed, shall be repaired and/or replaced at no additional cost to the Owner and then re-tested. This sequence shall be repeated until the work meets the acceptance criteria.

Before any system of gas piping is put into service, it shall be pressure tested to assure that it is gas tight. Where any part of the system is to be enclosed or concealed, testing should proceed the work of closing in. The test pressure used shall be capable of disclosing all leaks in the section being tested.

The test fluid shall be air, water or inert gas (e.g., nitrogen, carbon dioxide) provided means are used for removing all test fluid. Oxygen shall never be used.

Equipment shall not be included in the test and under no circumstances shall a valve in a line be used as a bulkhead between a section of the piping system being tested and adjacent section not being tested.

The test pressure used shall be no less than 1 ½ times the proposed working pressure, but not less than 3 psi. Test duration shall be long enough to determine if there are any leaks but not less than one-half hour for each 100 cubic feet of pipe volume, but not less than 10 minutes.

The piping system shall withstand the test pressure, without showing any evidence of leakage or other defects. While subject to test pressures the piping system shall be visually examined for signs of leakage or other defects. If air or inert gas is used, all exposed joints shall be checked by means of a soap bubble test. If leakage or other defects appear, the affected portion of the piping system shall be repaired or replaced and retested afterwards.

The Contractor shall maintain a record of all testing performed. Records shall be made for each piping section tested. A certification shall be made that all piping has been pressure tested by the standard.

All testing of piping systems shall be done with due regard for the safety of employees and the public during the test

15125.4.3.4 PURGING AND COMISSIONING

Suitable precautions shall be taken whenever a piping system, which is full of air, is cleared with a combustible gas. A slug of inert gas should be introduced to prevent the formation of an explosive mixture at the interface between gas and air, or the gas and air mixture shall be cleared to a safe location outside the building.

Before gas is turned into a system of new gas piping, or back into an existing system after being shut off, the entire system shall be to determine that there are no open fittings or ends and that all valves at outlets and equipment are closed.

After the piping system has been tested and determined to be free of leakage, the gas may be turned on and the service established.

15125.5 METHOD OF MEASUREMENT

Unless a separate bid item for furnishing and installing the work outlined in this Section is provided in the Bid Schedule, this work shall not be measured for separate payment, but shall be considered incidental to other items in the Bid Schedule.

Where items installed under this section are listed separately in the Bid Schedule, natural gas piping shall be measured by the linear foot of furnished, installed, and excepted pipe. Included in the linear measurement shall be all fittings, valves, and pipe, unless shown otherwise in the Contract Documents.

15125.6 BASIS OF PAYMENT

Complete compensation for the accepted work outlined in this Section shall be included in other bid items when no separate bid item is provided in the Bid Schedule for this work.

When a separate bid item is provided in the Bid Schedule, complete compensation for this accepted work shall be included in the contract at the unit price listed on the Bid Schedule.

PAY ITEM	UNIT
Black Iron Pipe (Schedule) (Size)	Lineal Foot

15230.1 DESCRIPTION

This section covers furnishing and installing valves and fire hydrants in water transmission and distribution lines, together with fittings, thrust blocking, and boxes and enclosures related to the operating equipment.

15230.1.1 RELATED WORK

Section 02222 - Waterline Pipe Installation
Section 15110 - Pipe and Piping Systems
Section 15232 - Water System Control Valves

15230.1.2 SUBMITTALS

All information shall be provided in accordance with Section 01300. Written evidence of compliance from the manufacturer shall accompany each delivery of material.

15230.1.2.1 VALVES 12 INCHES AND SMALLER, AND HYDRANTS - For valve sizes 12-inches and smaller, and fire hydrants, the Contractor shall furnish the manufacturer's standard data and catalogues for review and approval.

15230.1.2.2 VALVES LARGER THAN 12 INCHES - For all valves sized larger than 12-inches, the Contractor shall furnish shop drawings and technical data prepared by the manufacturer for review and approval.

15230.1.2.3 CONTENT - Submittals shall include complete details, dimensions, weights, diameter of stems, alloy for all valve parts and any information that may be required to assemble, install, operate and maintain the valve.

15230.1.2.4 BUTTERFLY VALVES - Certification of performance together with leakage and hydrostatic tests as described in Section 13 of ASTM/AWWA C-504 shall be furnished to the Engineer upon the Engineer's request.

15230.1.2.5 BALL VALVES - Certification of performance together with leakage and hydrostatic tests as described in Section 5 of ASTM/AWWA C-507, shall be furnished top the Engineer upon the Engineer's request.

15230.1.3 DEFINITIONS

Not used.

15230.2 MATERIALS

15230.2.1 GATE VALVES

15230.2.1.1 COMPLIANCE - All gate valves shall conform to AWWA C-500 or C-509 with the following characteristics:

15230.2.1.2 3-INCH AND SMALLER VALVES - Valves 3-inches and smaller shall be as follows:

- Valves shall be as manufactured by Ford, Hayes, Mueller, Red & White, or an approved equal.
- Valves shall be standard, double-disc, non-rising stem valves with wheel handles.
- Valve bodies shall be all bronze or brass.

- Valves shall be threaded, unless shown otherwise on the Drawings or required in these Specifications.

15230.2.1.3 GATE VALVES 4-INCH THROUGH 14-INCH - Gate valves 4-inches through 14-inches in size shall be as follows:

- Valves shall have a ductile iron body.
- Valves shall have a solid cast iron, rubber coated, wedge gate and a resilient seat.
- Gate shall be designed to work equally well with pressure on either side of it.
- Valves shall be of the non-rising stem type and shall be left hand opening (counter-clockwise) with a 2-inch square operating nut.
- All interior ferrous surfaces exposed to fluid flow shall have an NSF approved, fusion bonded, epoxy coating. Epoxy coatings shall be factory applied by an electrostatic or thermosetting process.

15230.2.1.4 GATE VALVES 16-INCHES AND LARGER - Gate valves 16-inches and larger shall be as follows:

- Valves shall be double-disc gate valves with flanged ends.
- Valves shall be manufactured in accordance with AWWA C-500. Bolts, nuts, studs, etc., used with the gear case also shall conform to the requirements for Bonnet Bolting in AWWA C-500.
- Valves shall have bevel gears and shall be actuated by 2-inch square operating nuts.
- The gears and stuffing box shall be enclosed in a watertight cast or ductile iron case for operation in buried location.
- The case shall be filled with grease at the factory.
- Valves shall be designed to operate in a horizontal orientation.
- Valves shall be equipped with bronze tracks, rollers and scrapers.
- By-pass valves shall be furnished with each valve mounted in position A as indicated in AWWA C-500.

15230.2.1.5 VALVES ON WATER MAINS - Valves on water mains shall have the following features:

- In-line valves shall have push-on or mechanical joints conforming to AWWA C-111.
- Valves attached to side outlets shall be flanged.
- By-pass valves shall be flanged.
- Valves in blow-off lines shall be flanged.
- Valves in fire hydrant lines shall have push-on or mechanical joints.
- Valves in air release and vacuum relief lines shall be flanged or threaded.

- Valves 12-inches and smaller shall be equipped with O-ring packing.

15230.2.2 BUTTERFLY VALVES

15230.2.2.1 MANUFACTURER - Butterfly valves shall be Dresser Industries "450", Allis-Chalmers "Streamseal", Henry Pratt "Groundhog", Mueller Lineseal III, or an approved equal.

15230.2.2.2 COMPLIANCE - Butterfly valves shall conform to AWWA C-504.

15230.2.2.3 CLASS - Valves shall be Class 150 seated, tight closing valves, furnished with mechanical or flanged joints

15230.2.2.4 SEATS - Rubber valve seats shall be replaceable without disassembling the valve and shall not be interrupted by the shafting. Rubber seats may be retained on the disc edge by stainless steel clamping in lieu of bonding to the valve body.

15230.2.2.5 SHAFT PACKING - Shaft packing shall be of the self-adjusting permanent type.

15230.2.2.6 OPERATION - Underground opening and closing shall be accomplished with permanently lubricated screw-type operators, totally enclosed and of watertight construction. Overload protection shall be incorporated into the operator allowing the application of 450 foot-pounds input torque at full-open and full-closed positions without damage to the operator or valve. A 2-inch square wrench nut and valve box shall be provided for operating the valve. Valves shall open counter clockwise unless indicated otherwise in the Special Provisions.

15230.2.3 BALL VALVES

15230.2.3.1 MANUFACTURER - Valves shall be produced by a manufacturer having at least five years experience in the manufacture of water works and valves.

15230.2.3.2 VALVES 4-INCHES AND LARGER - Ball valves, 4-inches and larger, shall be ductile iron or cast-steel body, double seated valves meeting the requirements of ANSI/AWWA C-507.

15230.2.3.3 SMALLER VALVES - Smaller valves shall be stainless steel, bronze, or iron bodied valves of the size, type and class shown on the Drawings.

15230.2.4 CHECK VALVES

15230.2.4.1 COMPLIANCE - Check valves shall be manufactured in accordance with ANSI/AWWA C-508.

15230.2.4.2 DESIGN - Check valves shall be of a clear waterway, swing-check type. They shall be designed to be mounted horizontally. They shall be fitted with flanged ends for easy servicing. They shall have an iron body and be bronze mounted.

15230.2.4.3 SEATING - Valves shall be provided with a metal to resilient material seating.

15230.2.5 HOSE BIBS

Hose bibs shall be 3/4-inch bronze or brass body, Watts Model SC-1, Red & White Model RW 301 or approved equal. All hose bibs shall have a tee handle.

15230.2.6 SAMPLE FAUCET

Sample faucet shall be a ½-inch chromed or brass body hose bib without hose connection threads.

15230.2.7 FIRE HYDRANTS

15230.2.7.1 COMPLIANCE - Fire hydrants shall conform to standard for dry barrel fire hydrants, AWWA C-502 and modifications herein specified.

15230.2.7.2 DESIGN - Hydrants shall be designed as follows:

- Hydrants shall be of the "compression" or "toggle joint" type with safety flange and safety stem coupling above the ground line so that they can be repaired without shutting off the water.
- Hydrants shall be of the dry top design with two or more "O" rings sealing the water from the operating mechanism.
- Hydrants shall be furnished with 5-inch minimum valve openings, one 4 1/2-inch NST pumper connection and two 2 1/2-inch hose connections.
- Hose nozzle threads, pump nozzle threads, operating nut and opening direction shall match existing hydrants in the system.
- Hydrants shall be designed for 4-feet of cover, unless shown otherwise on the Drawings.

15230.2.7.3 PAINTING - The portion of the hydrant above the ground line shall be painted in accordance with the Owner's standards.

15230.2.8 OPERATING WRENCHES

Unless notified otherwise by the Engineer, the Contractor shall furnish two, T-handle, operating wrenches for each project incorporating valves with 2-inch, square-head, operating nuts.

15230.2.9 VALVE BOXES

Valve boxes shall be cast iron, two piece, and adjustable valve boxes. Valve boxes shall be of the slip joint screw type and be of sufficient length for the pipe burial depth required. The cast iron cover of the valve box shall have the word "water" stamped thereon.

15230.2.10 CONCRETE ENCLOSURES

Concrete enclosures for valves shall be precast and of the type, size and configuration shown on the Drawings and shall be fabricated in accordance with the requirements for precast concrete construction provided in Section 03500.

15230.3 CONSTRUCTION REQUIREMENTS

15230.3.1 SETTING VALVES AND VALVE BOXES

All valves shall be set and jointed to the pipe in the manner described for pipe laying and jointing in Section 02222 of these Specifications. Valves shall be oriented with the operating nut vertical. Valve boxes shall be centered and plumb over the operating nut and shall be set so that no shock or stress will be transmitted to the valve. Tops of the valve boxes shall be set flush with the ground surface, concrete collars, or street surfacing, unless otherwise shown on the Drawings.

15230.3.2 VALVE RESTRAINT

Restraint shall be installed on all valves connected with slip-on, gasketed, or O-ring joints (i.e., bell & spigot, mechanical, etc.) in accordance with these Specifications and as shown on the Drawings.

15230.3.3 CONNECTING TO EXISTING MAINS

15230.3.3.1 CONNECTION TO EXISTING WORK - All connections to existing water mains shall be made by the Contractor, unless otherwise provided in these Specifications. The Contractor shall provide labor and materials, including special fittings and restraint devices, required to make the required connections between existing lines and new lines.

15230.3.3.2 INTERRUPTION OF SERVICES - Where the connection of new work to old requires interruption of service, the Owner, Engineer and Contractor shall mutually agree upon a date for such connection which will allow ample time to assemble labor and materials and to notify all customers in accordance with Section 01510.

15230.3.4 FIRE HYDRANT INSTALLATION

15230.3.4.1 SETTING - All hydrants shall stand plumb use hand level with the pumper nozzle facing the street. The hydrant shall be set with the ground line at the location indicated by the hydrant manufacturer.

15230.3.4.2 DRAINAGE - Drainage shall be provided at the base of the hydrant by placing clean gravel under and around the base of the hydrant as shown on the Drawings.

15230.3.4.3 RESTRAINT - All hydrants shall be restrained by setting thrust blocks or mechanical restraint assemblies in accordance with the Drawings.

15230.3.4.4 AUXILIARY GATE VALVES - All fire hydrant assemblies shall include auxiliary gate valves positioned as shown on the Drawings.

15230.3.5 THRUST BLOCKS

Thrust blocks or joint restraints (Mega Lug) shall be formed to prevent coverage of the pipe joints in accordance with the details shown on the Drawings and as described in Section 03100 and 03050. All thrust blocks shall be set against undisturbed earth.

15230.4 METHOD OF MEASUREMENT

15230.4.1 VALVES

Excavation, foundation preparation, restraint devices, valve boxes, backfill, and other miscellaneous devices, materials, or equipment required for installation shall be considered part of and included in the measurement of all valves and valve assemblies.

15230.4.1.1 NUMERICAL COUNT - When valves are installed as separate items or assemblies, the measurement shall be determined by counting the number of each size and type (including any associated valve box and concrete valve box collar) of valve installed and accepted.

15230.4.1.2 LUMP SUM - When valves are located in an enclosure, measurement shall be made as lump sum for the enclosure assembly and shall include the valve, any supplemental valves and fittings in the enclosure, and the enclosure.

15230.4.2 HYDRANTS

Measurement of hydrants shall be made by counting the number of hydrants set and accepted. For each hydrant, this measurement shall include the tee, shut-off gate valve, excavation and backfill, drain gravel, valve box and concrete collar, restraint, hydrant, and 5-feet of pipeline extending from the tee on the main line to the hydrant.

15230.4.3 NO SEPARATE MEASUREMENT

No separate measurement will be made for thrust blocks or other restraint provided with valves and fittings. Neither will separate measurement be approved for sample faucets and hose bibbs. Measurement for these items will be included with the quantity of the assembly whereon they are installed.

15230.5 BASIS OF PAYMENT

The accepted quantities will be paid for at the contract unit price.

PAY ITEM	UNIT
(Size) Gate Valve	Each
(Size) Ball Valve	Each
(Size) Butterfly Valve	Each
(Size) Check Valve	Each
Fire Hydrant Assembly	Each

15234.1 DESCRIPTION

Includes furnishing and installing materials which include excavation, water main tapping, stops, valves, service lines, meters, settings, boxes and other accessories required for installing water services to system users.

15234.1.1 RELATED WORK

Section 02200 - Trench Excavation and Backfill
Section 02222 - Waterline Pipe Installation
Section 15110 – Pipe and Piping Systems

15234.1.2 SUBMITTALS

15234.1.2.1 DESCRIPTIVE LITERATURE - Descriptive literature which identifies the manufacturer, model, size, material and parts lists from which the piping, fittings, valves and meters are manufactured, including installation instructions, shall be provided to the Engineer in accordance with Section 01300.

15234.1.2.2 CERTIFICATION OF COMPLIANCE - Written certification of compliance from the respective manufacturer shall be provided with each delivery of metal fittings, valves and meters.

15234.1.3 DEFINITIONS

Mains - Water distribution pipes, located in streets or rights-of-ways, to which water service connections are made for users of the system.

Tap - The actual connection made to water mains which includes drilling an opening into the main, threading, installing a tapping saddle when appropriate, and inserting (screwing) a valve into the opening.

Saddle - A fitting placed on a pipe to reinforce the pipe wall through which the tapping hole is drilled.

Key - Can mean either: the center piece of a corporation or curb valve which is turned to control flow through the valve; or, the "T-shaped" tool used by operators to reach and turn the key or closing piece of a valve.

Setter (also referred to as "yoke") - Is the prefabricated assembly of pipes and valves installed in a meter box and connected into the service line in which the water meter is mounted (or "set").

15234.2 MATERIALS

15234.2.1 SADDLES

Saddles shall be copper alloy body with copper alloy or stainless steel straps designed and sized specifically for tapping PVC water mains. Threading shall be tapered and the saddle shall conform to ANSI/AWWA C-800. Straps shall provide full support around the circumference of the pipe and have a bearing area of sufficient width along the pipe axis so that the pipe will not be distorted when tightened.

15234.2.2 CORPORATION STOPS

Corporation stops shall be copper alloy body ball-type or balanced pressure, o-ring sealed plug type valves with tapered threads and in conformance with the requirements of ANSI/AWWA C-800.

15234.2.3 CURB VALVES

Curb valves shall be copper alloy body ball-type valves; or balanced pressure, o-ring sealed, plug type valves. Curb valves shall be furnished with cast iron curb boxes and one piece lids fitted with copper alloy pentagon plug. The curb box shall be sized to properly fit the valve and adjust to the depth to which the valve is set.

15234.2.4 SERVICE LATERAL PIPE

Service lateral pipe shall be as called for on the Drawings and in accordance with the following:

15234.2.4.1 COPPER SERVICE PIPE - Copper service pipe shall be Type K soft, conforming to Federal specification WW-T-799 or ASTM B88-62.

15234.2.4.2 POLYETHYLENE PIPE - Polyethylene service pipe shall conform to the requirements of AWWA C-901, "Polyethylene (PE) Pressure Pipe, Tubing and Fittings, 2-inch through 3-inch for water." PE Pipe shall be pressure tubing conforming to Table 6 of said specification. Tubing shall be Class 160 with a DR of 9.0 or Class 200 with a DR of 7.3. If not specified, DR 7.3 shall be used.

15234.2.4.3 Ends of polyethylene tubing inserted in compression connections should be fitted with insert reinforcement.

15234.2.5 METER SETTER (YOKE)

Meter setter shall be fit with copper tubing (when required) and copper alloy and copper alloy fittings. Setters shall be furnished with copper alloy body, angle or straight, ball-type inlet valves with fittings appropriately sized to fit the meter. When required, a cast iron yoke ban shall be furnished to provide the setting.

15234.2.6 CHECK VALVE

Unless indicated otherwise on the Drawings, a check valve shall be provided with each meter setting. Check valves shall be copper alloy bodied, dual valves which meet the requirements of the State and local health authorities and conform to ASTM/AWWA C-510.

15234.2.7 WATER METERS

Water meters shall be cold water displacement type meters which complies with ANSI/AWWA C-700. The main case and bottom plate shall be of bronze and the meter shall be sized and equipped as shown on the Drawings. The meters shall be Model SR II by SENSUS Technologies, PMM Multi-Jet Series by Precision Meters, or an approved equal.

15234.2.8 METER BOX

Meter boxes shall be fabricated from rigid PVC or ABS plastic pipe. They shall have a minimum diameter of 18-inches, be sized to fit over the meter assembly while allowing reasonable interior access, and shall make an appropriate fit with the meter box ring and cover.

15234.2.9 METER BOX RING AND COVER

The meter box ring and cover shall be cast iron with a minimum diameter of 18-inches but shall be appropriately sized to fit larger meter boxes where required. The words "WATER METER" shall be cast into the cover. The cover shall be a locking type with a pentagonal head, corrosion resistant, screw down, locking device.

15234.2.10 METER BOX DRAINAGE

Meter box drainage shall be provided by placing 3-cubic yards of drain gravel at the base of new meter box drain.

15234.3 CONSTRUCTION REQUIREMENTS

15234.3.1 TRENCHING AND BACKFILL

Trenching and backfill for installation of service connections shall be completed in accordance with Section 02200. Service lines shall have a minimum of 3.5-feet of cover.

15234.3.2 INSTALLATION OF CONNECTIONS

Installation of water service connection components shall be as shown on the Drawings. All connections to PVC pipe shall be made by using a saddle rather than a direct tap. Service lines shall be slightly snaked in the trench near the connection to the water main to allow for some movement to avoid a rigid connection.

15234.3.3 REPLACEMENT OF EXISTING FACILITIES

When replacement of specified components of service connections is required, the Contractor shall: protect existing equipment, provide appropriate connecting fittings to accommodate the new component, use care in removal and salvaging of the existing component and deliver the existing components to the Owner's maintenance shop or headquarters.

15234.4 METHOD OF MEASUREMENT

15234.5.1 CONNECTIONS

Measurement for service connections shall be made by counting the number of "each" size of connection (consisting of furnishing and installing: (1) service saddle on the water main; (2) drilling and tapping; (3) corporation stop; and (4) the necessary excavation and backfilling) installed and accepted.

15234.5.2 SERVICE LATERALS

Service laterals shall be measured using an accurate measuring device to determine the number of linear feet of each size of service lateral pipe installed between the corporation stop and the meter setter. This measurement shall include furnishing and installing the pipe and appropriate connecting fittings and any necessary trench excavation and backfilling.

15234.5.3 SERVICE METER SETTER ASSEMBLY

Measurement of service meter setter assemblies shall be made by counting the number of each size of assembly furnished, installed, and accepted. This measurement shall include the curb stop meter

setter, connecting fittings, meter box, lid, drain gravel, and the necessary excavation and backfilling.

15234.5.4 WATER METERS

Measurement of water meters shall be made by counting the number of meters of each size furnished, installed, and accepted.

15234.5.5 STOCK WATERING TAPS

Measurement for stock watering taps shall be made by counting the number of each size of connection installed and accepted. This measurement shall include furnishing and installing: (1) service saddle on the water main; (2) drilling and tapping; (3) corporation stop; (4) 20-feet of service lateral; (5) curb stop and box; and (6) the necessary excavation and backfilling required to complete the connection.

15234.5.5 REPLACEMENT OF EXISTING FACILITIES

Where certain components of a total existing water service connection are to be replaced, measurement will be made by counting the number of each size and/or kind of the specifically identified component or components as shown in the Bid Schedule as installed and accepted. Such measurement shall include furnishing and installing the identified component, necessary excavation and backfill, and salvaging and delivery of any replaced component when designated.

15234.5 BASIS OF PAYMENT

The accepted quantities shall be paid for at the contract unit price for:

PAY ITEM	UNIT
(*Size*) Service Connection	Each
(*Size*) Service Lateral	Linear Foot
(*Size*) Service Meter Assembly	Each
(*Size*) Meter	Each
Replace (*Size*) (*Component Name*)	Each
Install (*Size*)(*Component Name*)	Each
(*Size*) Stock Watering Tap	Each
(*Size*) Stock Watering Tap	Each

15300.1 DESCRIPTION

The Contractor shall furnish and install floor drains in structures of the size and type, and at the locations shown on the Drawings.

15300.1.1 RELATED WORK

Section 02222 – Waterline Pipe Installation
Section 02105 - Earthwork Materials

15300.1.2 SUBMITTALS

Not used.

15300.1.3 DEFINITIONS

Not used.

15300.2 MATERIALS

15300.2.1 DRAIN

Floor Drains shall be cast iron body, 6-inch (minimum) diameter heavy-duty grated type with a removable cast iron or stainless steel cover.

15300.2.2 PIPING

Drain piping shall be drain waste and vent (DWV) schedule 40 PVC pipe and fittings sized to fit the floor drain in accordance with the Drawings.

15300.2.3 P-TRAPS

P-traps, when required on the Drawings, shall meet the requirements of Schedule 40 PVC pipefittings sized to fit the drainpipe.

15300.2.4 DRAIN GRAVEL

Drain gravel for floor drain sumps, where applicable, shall meet requirements of Section 02105 and shall be installed as shown on the Drawings.

15300.2.5 CHECK VALVES

Floor drain check valve, when required by the Drawings, shall be a rubber slip-on check valve capable of draining drainpipe under low flows and low pressures. The valves shall require no maintenance or repair. The check valves shall be attached to the drainpipe by stainless steel clamps.

15300.3 CONSTRUCTION REQUIREMENTS

15300.3.1 SETTING DRAINS

Where floor drains are required, the floor will have been designed with a slope to a low point where the drain is to be placed. Typically, the floor drain will be cast in the low point in the floor at the time of installation of the floor. The Contractor shall take care to coordinate the setting of

the drain and the pouring of the concrete so that the top surface of the drain cover is flush with the floor surface to allow complete drainage of any water which accumulates on the floor.

15300.3.2 PIPE WORK

Piping shall be connected and run on a 1% minimum slope away from the drain as shown on the Drawings. Where termination of the piping is in drain gravel, care shall be taken to locate the pipe end in the top one-third of the gravel sump. Where termination of the piping is at daylight, the Contractor shall provide a 5-foot section of cast iron or ductile iron pipe with protective screen, sized to match the drain pipe, at the daylight end of the pipeline so that the thermoplastic pipe will not be exposed to daylight.

15300.4 METHOD OF MEASUREMENT

15300.4.1 NO MEASUREMENT

Unless provided for as a separate bid item in the Bid Schedule, no separate measurement of the floor drain, its connecting piping, gravel sump, etc., will be made. Measurement of the drain will be included with the building or structure identified in the Bid Schedule.

15300.4.2 SEPARATE MEASUREMENT

When provided for in the Bid Schedule, the cost of all material and labor required of the floor drain assembly will be measured by counting the number of floor drain assemblies installed and accepted.

15300.5 BASIS OF PAYMENT

When a separate bid item is provided, complete compensation for this accepted work shall be included in the contract unit price on the Bid Schedule.

PAY ITEM	UNIT
Floor Drain Assembly	Lump Sum
Floor Drain Assembly	Each

ALUMINUM DOWNWARD-OPENING WEIR GATE

SECTION 15515SP

15515.1 DESCRIPTION

15515.1.1 The Contractor shall furnish and install an aluminum downward-opening weir gate as shown on the drawings and as specified herein. The equipment shall include weir gate, frame, and handwheel operator.

15515.1.2 The weir gate and operator shall be the product of a manufacturer having a minimum of five (5) years experience in the design and production of water control equipment of this type. At the request of the Engineer, the manufacturer shall submit evidence of performance on other projects with similar specialty fabrication requirements as specified herein.

15515.2 REQUIREMENTS

15515.2.1 The weir gate shall operate such that a full 1.5 ft. travel length (up and down) of the weir can be accomplished through the outlet of the splitter box. The gate shall be water tight at 4 ft of water depth over the weir gate. See drawings for mounting location details.

15515.2.2 The aluminum gate shall be ¼ inch minimum thickness extruded (ASTM B-221), cast (Alloy SR-319), or rolled aluminum (ASTM B-209) type 6061-T6. Guides for wall mounted frames shall be extruded.

15515.2.3 The wall mounted gate frame shall be of self contained design with integral welded yokes. Guides shall be extruded, one-piece, for the full height of the frame. Frames shall extend above the operating floor to the height shown on the plans. The yoke channels supporting the operator shall be welded to the guides to provide a one piece rigid frame. Yoke members shall be spaced such that the operator, stem and slide can be easily removed.

15515.2.4 Gate slide shall consist of a flat plate, reinforced with welded stiffeners. Stiffeners shall be of type, spacing and number such that, at the design head, bending stress is limited to 1/5 the ultimate strength of the materials and deflection is limited to 1/360 of the gate width. Stem connection will be by means of a threaded block, either directly welded to the slide or contained in a pocket designed to distribute operating forces to the upper region of the slide.

15515.2.5 The operating stem shall be sized to safely withstand without buckling or permanent distortion the stresses induced by normal operating forces. The stem shall have a minimum diameter of 1-1/2 inches. Stem threads shall be machine cut, acme type. Stems shall be stainless steel, ASTM A-276 type 304 and shall be one piece.

15515.2.6 Manually operated handwheel mechanism shall be provided as shown on the drawings. Handwheel shall have threaded bronze lift nut to match stem. An arrow on the handwheel shall indicate the direction of rotation to open the gate (downward movement of gate). A maximum effort of 40 pounds shall be required to operate the gate.

15515.2.7 All surfaces, in which contact between aluminum and concrete may occur, shall be coated with an epoxy paint in order to prevent aluminum-concrete contact.

15515.3 METHOD OF MEASUREMENT

15515.3.1 The downward-opening weir gate will be paid lump sum and shall include all the gate and all hardware to install and operate the gate.

15515.4 BASIS OF PAYMENT

The accepted quantity will be paid for at the contract unit price for:

PAY ITEM	UNIT
Aluminum Downward Opening Weir Gate	Lump Sum

DIVISION 16

ELECTRICAL

16010.1 DESCRIPTION

The General Conditions, Supplementary General Conditions, Alternates and Addenda, applicable drawings and the Technical Specifications herein shall apply to the providing and construction of a complete electrical system under the requirements of this Division 16.

16010.1.1 RELATED WORK AND REFERENCED SECTIONS

Section 01300 - Submittals
Section 02200 - Trench Excavation and Backfill
Section 16050 - Basic Materials and Methods
Section 16150 - Electrical Control Devices
Section 16210 - Lighting Fixtures
Section 16400 - Service and Distribution System

16010.1.2 SCOPE

A. The Work required under this Section consists of the Electrical General Requirements and related items necessary to complete the Work indicated within the Contract Documents.

B. This Section describes procedures and incidental items of Work relating to Electrical Division 16.

C. The drawings are diagrammatic, intended to indicate the general scope and location of the Work to be installed and are not to be considered as complete in every detail. The Contractor shall install all Work indicated and/or specified herein, complete in every way to perform the function (s) intended without additional cost.

D. Plans and Specifications are complementary, whatever is called for in either shall be as called for in both. In the event Work is called for in more than one place and is of conflicting requirements, the right shall be reserved to require the installation of the larger or the more expensive.

16010.1.3 CONTRACT DOCUMENTS

A. Contract documents consist of drawings, specifications, and other documents issued by the Engineer. Each is complementary and requirements shown, written or reasonably inferable therefrom on one is considered as written, shown and implied in all.

B. Electrical drawings are diagrammatic, but shall be followed as closely as actual construction and Work of other Contractors will permit. Runs to panels from outlets referred to as "home runs" are indicated, by pointing in the general direction of panels. Contractor shall continue such circuits to the panels as though the routes were completely indicated.

C. Deviations from the Drawings required to make Work of this Contract conform to Building as constructed, or as to Work of other contractors or subcontractors, shall be made by the Contractor at his expense. The Engineer reserves the right to make minor changes in the location of equipment and outlets without additional charges.

D. The Contractor shall familiarize himself with the architectural and mechanical plans. The Contractor shall perform all Work and provide all material required by the electrical Contractor shown under these and all other sections of the plans and specifications.

16010.1.4 SUBMITTALS

All submittals shall meet the requirements of Section 01300 of these Specifications.

16010.1.4.1 SHOP DRAWINGS – Submittal of shop drawings shall be as follows:

A. Submittal of shop drawings shall meet the requirements of Section 01300 of these Specifications.

B. Shop drawings shall be submitted within fifteen (15) days after the award of contract.

C. Shop drawing shall include functional and descriptive literature of the particular item furnished complete with dimensional drawings, rough-in and installation instructions, knock-out locations, hangers or mounting devices, etc., as required for the proper checking and installation of the equipment. Catalog sheets without any reference made to the particular item will not be acceptable. All special features called for in the Contract Documents shall be noted. Where performance test results of a product design are called for in the technical sections of these specifications, test data sheets shall be provided with the shop drawing submittal.

D. Shop drawings shall be submitted for all switch gear, motor control centers, motor starters, control panels, telemonitoring panels, alarms, electrical controls, electrical instrumentation, communication devices and circuitry, lighting fixtures, and equipment anchors and supports for seismically supported components.

E. In connection with seismic restraint requirements, shop drawings are required for all equipment anchors, supports, and seismic restraints. Submittals shall include weights, dimensions, load/deflection data, centers of gravity, standard connections, manufacturer's recommendations, and behavior problems (vibration, thermal, expansion, etc.) associated with equipment so that the final design can be properly reviewed.

F. Three preliminary sets shall be submitted to the Architect/Engineer for their review. Following review, two sets will be returned to the Contractor for correction. After corrections have been made, the formal six sets of the corrected shop drawings shall be submitted for final review and distribution.

G. Each shop drawing required under this or other sections of Division 16 shall be bound together in sets in one hard back three ring binder per set, properly indexed for the formal submittal. Binders shall be properly sized to adequately contain all of the materials to be placed therein and shall be labeled to identity the Owner, the name of the job, the name of the Contractor and/or any sub-contractor (s), and any other pertinent information.

16010.1.4.2 MATERIALS LIST - A materials list including manufacturer, type, size, model number and other properties shall be submitted for all raceway, conduit, fittings, support materials, wire, cable, junction boxes, and wiring devices, including boxes for weather proof devices.

16010.1.4.3 EQUIPMENT/INSTRUMENT LIST - Equipment/Instrument list(s) including manufacturer, type, size, model number and other properties shall be submitted for all equipment and instruments.

16010.1.4.4 OPERATION AND MAINTENANCE MANUAL – The Contractor, or electrical subcontractor, shall assemble and deliver to the Owner an operation and maintenance (O&M) manual for the electrical systems furnished and installed in connection with the Work. O&M manuals shall be as follows:

A. Number of copies shall be as specified in Section 01300 or as required in the Special Provisions or by the Engineer or the Owner. The O&M manual shall be reviewed and approved prior to the final inspection.

B. Each copy of the O&M manual shall be bound in a hard-backed binder. The front of each binder shall have the following information printed on it by silk screen process:

OPERATION AND MAINTENANCE MANUAL
FOR
(*PROJECT NAME*)
(*SPECIFIC SYSTEM NAME AND/OR LOCATION*, as appropriate)
(*OWNER'S NAME*)

A. Each copy shall contain a master index at the beginning of the manual showing all items included.

B. A separate section for each different type of item of equipment or information furnished shall be provided. Use plastic tab indexes for all sections of the book.

C. The first section of the manual shall consist of the names, addresses and telephone numbers of the Mechanical Engineer, Electrical Engineer, General Contractor, Electrical Contractor.

D. Descriptive literature (manufacturer's catalog cuts and other data) of each manufactured item shall be included. Literature shall show capacities and size of equipment used and shall be marked indicating each specific item with all applicable data underlined.

E. Operating instructions shall, at a minimum, include:

1. General description of the electrical system.
2. Where applicable, a step-by-step procedure to follow in putting each piece of electrical equipment in operation.
3. Provide diagram for the electrical control system showing the wiring of all related electrical control items, such as fuses, interlocks, electrical switches and relays.
4. Test results of all items requiring testing as called for in the technical section of specifications.

F. Maintenance instructions shall, at a minimum, include:

1. Manufacturer's maintenance instructions for each piece of electrical equipment installed in the project. Instructions should include installation instructions, parts numbers and lists, operation instructions of equipment, name of vendor, and maintenance and lubrication instructions.
2. A summary list of each piece of electrical equipment requiring lubrication, showing the name of the equipment, location, type and frequency of lubrication.
3. A complete list of all electrical equipment used indicating name, model, serial number and nameplate data of each item, together with number and name of each

system with which the item is associated.

I. An approved copy of the manual shall be used during final inspection and shall be left with the Owner for its use and disposition.

16010.1.4.5 OTHER INFORMATION - Other information shall be provided as required by the Engineer.

16010.2 MATERIALS

All equipment and materials shall be as specified, new, of the best quality and free from defects. Each type of equipment or material shall be the same make and quality.

16010.2.1 UNDERWRITERS LABORATORIES

All equipment, materials, and devices shall be approved by Underwriters Laboratories, Inc. (UL). Custom designed items shall be fabricated using UL approved materials. All custom panels shall bear the UL label certifying UL-508 standards.

16010.2.2 MATERIALS AND EQUIPMENT TO BE SUPPLIED

The Contractor or electrical Subcontractor shall provide all materials, equipment, and any other fittings or devices required for a complete and finished installation. Materials and equipment shall be as shown on the Drawings and/or as called for in these Specifications, including the Special Provisions if any, unless otherwise approved, in writing, by the Engineer.

16010.2.3 APPROVAL OF SUBSTITUTIONS

Equipment and materials are designated by one or more manufacturer's name brands or numbers. It is not the intent of the Specifications to exclude other equipment or materials that equal the standard of those specified. If the Bidder, in its bid, desires to use equipment or materials other than those specified, the Bidder must obtain written approval from the Engineer in this regard at least seven (7) calendar days prior to bidding. Submit complete data, including detailed specifications and drawings with written request in duplicate. Samples may be requested if deemed necessary. Certificates of compliance with specifications or a list of all exceptions to the specifications shall be included with request.

16010.2.4 STORAGE OF EQUIPMENT AND MATERIALS

A. The Contractor shall be responsible for the proper transportation, unloading, storage, and holding of all electrical systems, materials, and equipment until they are installed in the Work, and accepted by the Owner. This shall include responsibility for damage, loss, theft, and pilferage.

B. Materials and equipment shall be handled and stored in accordance with the manufacturer's and/or supplier's instructions. Packaged items shall be stored in original, undamaged condition with manufacturer's seals and labels intact. Materials and equipment shall be stored in a neat and orderly condition at all times and allowing for easy access for inspection.

16010.2.5 RACEWAYS AND FITTINGS

The manufacturer shall be Republic Steel, Triangle, National, Carlon, Allied or approved equal. All conduits shall be in accordance with the requirements of the National Electric Code (NEC) and applicable local codes. Steel conduit shall be in accordance with recommendations of the latest edition of American Iron and Steel Institute "Design Manual on Steel Electric Raceways."

A. RIGID GALVANIZED STEEL CONDUIT (RGS)

1. Shall be USAS C80.1, zinc-coated by hot-dip galvanizing or sheradizing with additional enamel or lacquer coating.
2. Fittings shall be threaded type and of the same material as the conduit.
3. Unless otherwise noted, rigid metallic conduit shall be used for underground runs, under slab runs, and where runs are placed in concrete. It shall also be used for exposed runs in mechanical rooms and for other exposed runs where the conduit is exposed to moisture, weather or mechanical injury.
4. Where rigid metallic conduit is used for underground installations, including elbows required to make sweeps in PVC conduit runs, the conduit shall be wrapped with 3m-50 10 mil pipe wrap or approved equal.

B. INTERMEDIATE METAL CONDUIT (IMC)

1. Shall be UL Standard 1242, hot-dip galvanized steel.
2. Fittings shall be threaded type and of the same material as the conduit.
3. It can be used for exposed runs in mechanical rooms and for other exposed runs where the conduit is exposed to moisture, weather or mechanical injury.
4. **This conduit shall not be used in hazardous areas.**

C. ELECTRICAL METALLIC TUBING (EMT)

1. Shall be in accordance with UL "Standard for Electrical Metallic Tubing" No. 797, galvanized mild steel with interior coat of enamel.
2. Fittings shall be steel compression type.
3. **Cast type, indenter, or set-screw type fittings shall not be used.**
4. EMT shall be used for exposed and concealed runs to lighting fixtures above 10 feet or above ceilings.
5. **Not approved for any exposed conduit runs or drops.**

D. NON-METALLIC CONDUIT (PVC)

1. Shall be PVC Schedule 40 heavy wall suitable for direct burial.
2. Fittings shall be threaded or solvent welded type of the same material as the conduit.
3. **Shall not be used above grade or embedded in concrete, except as noted specified for runs above 600 volts. PVC shall not be used where exposed or concealed in walls or floors.**
4. PVC may be used for all underground runs, except for bends exceeding 22 degrees where jacketed or wrapped rigid galvanized steel is required, and runs under concrete slabs. Runs under concrete slabs shall be embedded in earth a minimum of 4 inches below the bottom of the slab. Risers through concrete slabs shall be rigid steel or intermediate metal conduit.
5. Provide PVC to steel adapters as required.

E. FLEXIBLE LIQUID-TIGHT CONDUIT

1. Shall be galvanized steel, liquid-tight, with moisture and oil- proof extruded PVC cover.
2. Fittings shall be liquid-tight, compression type.
3. Approved for flexible connections to equipment, items or instruments subject to vibration such as motors, fans, pumps, dry transformers, etc.
4. **Flexible Liquid-tight conduit shall not be less than 18 inches in length and not more than 3 feet in length.**

F. FLEXIBLE STEEL CONDUIT

1. Shall be galvanized steel.
2. Fittings shall be compression type of the same material as the conduit.
3. Shall be used for lighting fixture runs above drop ceiling grid systems or other devices required or approved by NEC or as requested or approved by the Engineer. (Install ground conductor per NEC in runs over 6 feet in length.)

G. PVC COATED CONDUIT

1. Rigid Steel conduit coated with a minimum of 40 mil of PVC coating shall be used in all corrosive areas or where required by NEC or the Engineer.
2. **All fittings, boxes, support materials, clamps, etc., used with PVC coated conduit shall be PVC coated in a like manner.**
3. Wiring devices shall be corrosion resistant UL rated in corrosive areas requiring PVC coated conduit.

H. WALL AND FLOOR SLEEVES

1. Shall be galvanized sheet steel or pipe.

I. CLAMPS

1. Shall be galvanized malleable iron one-hole straps, beam clamps or other approved device with necessary bolts and expansion shields.
2. **Perforated metal straps shall not be used.**

J. CONDUIT SIZES

1. Shall be as indicated on the drawings.
2. **Shall not be smaller than ¾ inch exposed or 1 inch buried conduit unless otherwise specifically approved by the Engineer.**

K. CONDUIT BUSHINGS

1. For conduit 1-1/4 inch and larger use OZ type BLG or SBLG with Lay-in-Lug.
2. Use Lay-in-Lug bushings on multiple conduit entrances to enclosures or gutters.
3. Bonding bushings shall be used on conduits containing service entrance conductors.

A. ENTRANCE SEALS

1. Provide and install OZ entrance seals on all conduits entering building below grade.

B. RACKS AND SUPPORTS

1. Conduit support racks, Unistrut supports and fittings, etc., shall be hot-dipped galvanized, except in corrosive areas where the supports and fittings must be PVC coated.
2. **Painted metal supports are not allowed.**

C. PULL BOXES

1. Pull boxes, which are required for proper conduit installation, shall be sized according to the requirements of Article 370 of the NEC.
2. Shall be cast type condulets with threaded hubs

D. OUTLET/JUNCTION BOXES

1. Boxes shall be provided in the wiring or raceway systems wherever required for routing/pulling of wires, making connections and mounting of devices or fixtures.
2. Boxes in exposed conduit runs shall be cast metal condulets with threaded hubs installed exposed. **Non-metallic boxes are not allowed.**
3. Each box shall be metal and shall have the volume required by the National Electrical Code for the number of conductors enclosed in the box. Boxes for mounting lighting fixtures shall not be less that 4 inch octagonal or 4 inch square except that smaller boxes may be installed as required by fixture configuration, as approved. Boxes in the raceway system shall not be less than 1-1/2 inches deep, except where shallower boxes required by structural conditions are approved..
4. Boxes for other than lighting fixture outlets shall not be less than 4 inches square.
5. Boxes in concealed conduit runs shall be equipped with tile extension rings, device mounting straps and accessories required for the purpose of the outlet.

16010.2.6 A. CONDUCTORS

1. Shall be of the type, size, and locations as shown on the Drawings and meet the requirements of the latest addition of the National Electric Code (NEC).
2. Shall be soft-annealed coated copper in accordance with ASTM B33 or B189.
3. Conductors No. 10 and smaller shall be solid copper for lighting circuits only, all other circuits shall be stranded copper.
4. All conductors shall be THHN/THWN copper rated at 600 volts, unless otherwise noted.
5. **Aluminum conductors will not be allowed.**

B. GROUNDING CABLE

1. Shall be as called out on the drawings and per NEC. (Grounding lugs shall be the clamp type made of high conductivity copper alloy and shall be provided for all equipment to be grounded.)

16010.2.7 A. SPLICES, TAPS AND TERMINATIONS

1. Splices, taps and terminations made in interior damp or wet locations, corrosive atmosphere locations or exterior boxes above or below grade shall be covered with 3M heat shrinkable ITCSN series sleeves or end caps or Raychem equal as approved by the Engineer.
2. All splices shall require approval by the Engineer.

16010.3 CONSTRUCTION REQUIREMENTS

Unless notified otherwise, the Contractor responsible for the electrical Work shall perform all electrical work in accordance with the Drawings and with these Specifications.

16010.3.1 CODES, PERMITS, LICENSES AND STANDARDS

A. PERMITS AND LICENSES – The Contractor shall secure all permits and licenses required in connection with this work.

B. CODES AND STANDARDS - All work, labor, and equipment shall conform to applicable State and Local Codes and Standards and the applicable sections of the latest revisions of the following:

- American Society for Testing and Materials (ASTM)
- National Fire Protection Association, National Electrical Code (NEC)
- Insulated Power Cable Engineers Association (IPCEA)
- Underwriters Laboratories Inc. (UL)
- American Steel and Iron Institute, "Design Manual on Steel Electrical Raceways"
- National Electrical Manufacturer's Association (NEMA)
- American National Standards Institute (ANSI)
- Institute of Electrical and Electronic Engineers (IEEE)
- Uniform Building Code (UBC)
- Uniform Fire Code (UFC)
- Sheet Metal and Air Conditioning Contractors National Association (SMACNA)

Conflicts between any of the above referenced codes and standards and between any of them and these Specifications and/or the Project Drawings shall be resolved by complying with the more stringent requirements.

16010.3.2 SAFETY

A. REGULATIONS - The Contractor's work shall conform to the Associated General Contractors of America, Inc. *Manual of Accident Prevention in Construction* and shall comply with all current regulations of the Occupational Safety and Health Act (OSHA) as required for work identified on the Drawings or in these Specifications.

B. SAFETY GUARDS - All equipment, which the Contractor furnishes and installs, shall be provided with appropriate safety guards for prevention of accidents. The Contractor shall provide and maintain any other necessary construction required to secure safety of life or property, including the maintenance of sufficient lights to secure such protection.

16010.3.3 DIAGRAMMATIC DRAWINGS

A. The electrical drawings are diagrammatic, intended to indicate the general scope and locations of the work to be installed and are not to be considered as complete in every detail. The Contractor shall install all work indicated and/or specified herein, complete to perform the function intended without additional cost.

B. The electrical drawings are diagrammatic, however, they shall be followed as closely as actual construction and work of other contractors will permit. Runs to panels from outlets, referred to as "home runs", are indicated on the drawings by arrows pointing in the general direction of panels. Contractor shall continue such circuits to the panels as though the routes were completely indicated. Deviations from drawings required to make

the work of this Contract conform to building as constructed, or as to work of other contractors, shall be made at the Contractor's expense. The Engineer reserves the right to make minor changes in the location of equipment and outlets without additional charges.

16010.3.4 SITE EXAMINATION

Examination of the site shall be made by the Contractor, who shall compare it with the drawings and specifications and satisfy himself as to the conditions under which the work is to be performed. The Contractor shall, at such time, ascertain and check all conditions which may affect its work. No allowance shall subsequently be made in the Contractor's behalf for any extra expenses to which the Contractor may be put due to failure or neglect on its part to make such examination and determination of the condition.

16010.3.5 SUPERVISION

A. A competent foreman or superintendent, approved by the Owner's Representative, shall be at the site at all times to receive instructions and shall have the proper authority to act on behalf of the Contractor. The Contractor shall verify dimensions given on the electrical drawings and report any errors or inconsistencies to the Engineer before commencing the work. The Engineer or its representative will interpret the meaning of the Drawings and Specifications where questions arise.

B. Contractor shall assign persons to be in direct charge of work who are thoroughly experienced in the types of construction work specified herein. All labor shall be performed in a workmanlike manner by skilled workmen under the supervision of competent foremen.

16010.3.6 WORKMANSHIP

Workmanship shall be in accordance with the best present-day construction methods and shall be neat and orderly throughout the project.

16010.3.7 COORDINATION OF CONSTRUCTION

A. The Contractor shall coordinate work with other contractors, subcontractors, the Owner, and the Engineer to assure orderly and expeditious progress of work. The Contractor shall select order/sequence of work and establish schedule of working hours for construction, all subject to review and direction by the Owner.

B. This Contractor shall be held solely responsible for the proper installation of its work. The Contractor shall arrange with the proper contractors for the installation of anchors and other embedded devices, and for the leaving of required chases, openings, etc., and shall do all cutting and patching made necessary by its failure or neglect to make such arrangements with others. Any cutting or patching done by this Contractor shall be subject to the directions of the Engineer and shall not be started until approval has been obtained.

C. All cutting, welding or drilling of concrete or structural members shall be properly reinforced and patched to match as nearly as possible the surrounding work. Before cutting, welding or drilling any concrete or structural member, the Contractor shall secure the approval of the Engineer. Where deemed appropriate by the Engineer, in the case of gross negligence pertaining to this issue, the Engineer reserves the right to back-charge the Contractor for the Engineers associated costs.

16010.3.8 **INSTALLATION**

RACEWAY AND FITTINGS

A. STANDARDS

1. All conduit to be installed in accordance with the requirements of the National Electrical Code, latest addition.
2. Steel conduit to be installed in accordance with recommendations of American Iron and Steel Institute "Design Manual on Steel Electrical Raceways", latest addition.
3. PVC coated, "Plastic-Bond-Red", conduit installed in accordance with instructions in Robroy Plastic –Bond installation manual.

B. ELECTRICAL CONTINUITY

1. All metallic conduit systems shall be electrically continuous throughout.

C. MOISTURE

1. All conduit raceway systems shall be essentially moisture tight.
2. Conduit drainage shall be accomplished by sloping conduits towards manholes or boxes.
3. Where pockets cannot be avoided in exposed conduits, provide drainage fittings or weep holes. Weep holes drilled through the walls of any conduit or fitting shall not produce burrs on the inside or outside surface.

D. ALIGNMENT OF EXPOSED CONDUIT

1. Install conduit runs parallel or at right angles to lines of structure.

E. FIELD CUTS AND THREADS

1. Field cuts shall be made square, threads clean and sharp.
2. Remove burrs, sharp or rough edges by reaming.
3. Before couplings or fittings are attached, apply a coat of red lead or zinc chromate to male threads of RGS or IMC conduit, also apply these coatings or other special compound recommended by the manufacturer of the conduit where the conduit protective coating is damaged.
4. PVC coated conduit system requires male threads on conduit, elbows and nipples and all female threads on fittings or conduit couplings to be protected by application of a urethane coating.
5. **Care must be taken to assure that concrete surfaces are protected from cutting oil, any/all damage will be the responsibility of the Contractor.**

F. BENDS

1. Uniform, whether job-fabricated or made with standard fittings or boxes.
2. Do not dent or flatten conduit
3. Conduit installation should be installed symmetrically insofar as practicable.
4. Unless approved otherwise, bends larger than 1-1/4 inch shall be factory made.
5. Bends in exposed conduit shall be symmetrical insofar as practicable.
6. Do not expose bends at floor or ceiling.

G. LOCATION

1. Conduit routing is generally shown in schematic fashion, unless dimensioned or noted to the contrary.
2. Contractor is responsible to route conduits as required to connect equipment or devises.
3. Vertical risers, equipment and device locations are approximately as indicated on the drawings. Contractor shall coordinate installation of conduit with structure and equipment.
4. Contractor is responsible to coordinate conduit installation with other contractors installations, in the event of conflict, field routed conduit shall be moved at the Contractors expense.
5. Conduit shall be located a minimum 6 inches away from steam, hot water, or other hot surface. Protect from heat, as Engineer approved, if the 6 inch separation is impracticable.
6. Diagonal installation is not permitted.

H. BURIED/EMBEDDED CONDUIT

1. Buried conduit shall be a minimum of 30 inches below finished grade, sloped toward manholes or pull boxes.
2. RGS conduit installed underground, or used in PVC runs for sweeps larger than 22 degrees, must be wrapped with 3M-50 10 mil pipe wrap, approved asphalt compound or approved equal.
3. Mid-run weep holes and gravel drainage pockets will not be permitted.
4. Conduits embedded in concrete or masonry shall be securely held in place during concrete placement and construction operations.
5. In concrete floors, conduit shall be set before pouring of concrete begins. Conduit shall be routed in a direct line, with bends as long as possible, with 2 inches minimum from conduit to bottom of slab and maximum conduit size of 2 inch, unless otherwise approved.
6. Non-metallic conduits above 600 Volts shall be encased in red concrete covered by a minimum of 2 inches on all sides.

I. WALL PENETRATIONS

1. Penetrations through exterior building walls to be by core drilling and providing appropriate conduit entrance seals.
2. Openings through existing partitions shall be provided at Contractor's expense. Holes through masonry construction shall be drilled with suitable core drilling machine.
3. All work is to be performed neatly.
4. Patches shall match original material in composition and appearance.
5. Provide fire seals as detailed or required by NEC where a fire rated wall or partition is penetrated.
6. A template shall be provided by the Contractor to hold conduit groups terminating together or passing through fire walls or floors.
7. In walls and partitions, conduit shall be installed vertically. If vertical installation is impracticable, the Engineer shall approve horizontal installation for each location.

J. EXPANSION FITTINGS

1. Install expansion fittings in all conduit runs crossing structural expansion joints and in all straight conduit runs exceeding 75 feet in length.

K. CONDUIT ENDS

1. Insulating bushings shall be installed at open conduit ends, terminating in panels, control centers, consoles or other similar locations.
2. Plug space around cables with oakum and/or an approved sealing compound where conduits enter switchboards, cabinets or similar locations.
3. Cap or plug all spare conduit ends to prevent the entrance of foreign material.

L. CONDUIT CONNECTIONS

1. At cabinets and boxes use double locknuts and insulating bushings for rigid conduit.
2. At cable tray securely clamp conduit to tray and install insulating bushings.
3. Install insulated grounding bushings with lay-in ground lugs where metallic conduit terminates in non-metallic manholes or pullboxes.
4. Flexible conduit for connection to movable/vibrating equipment shall be liquid-tight, sealtite as manufactured by Anaconda Metal Hose Company, or approved equal, utilizing approved liquid-tight fittings.

M. SUPPORTS

1. Hangers and supports shall be galvanized or PVC coated.
2. Hangars generally are not detailed, but must be adequate to support combined weight of conduit. Rigid fastenings are to spaced at a maximum of 6 feet.
3. Clamps will be galvanized malleable iron one-hole straps, beam clamps or other approved device with necessary bolts, washers and expansion shields.
4. **Perforated metal straps shall not be used**.
5. Adjustable hangers shall be used to support horizontal runs only, use trapeze hangers for parallel runs of conduit. Install u-bolts or other approved clamping device at each end and at each elbow. Install clamp every third intermediate hanger for each conduit.

N. CONDUIT CLEANING

1. Contractor is to clean and swab the inside of conduits, by mechanical means, to remove foreign materials and moisture before conductors are installed.

O. SPARE CONDUITS

1. Spare conduits shall have a nylon pulling line installed for future installation of cables.
2. Recessed panels shall have three 1 inch spare conduits in the wall space stubbed-out above ceiling and three 1 inch spare conduits stubbed under the floor.
3. Spare conduits shall be capped.

CONDUCTOR INSTALLATION

A. BENDING RADII

1. Not to be less than permitted by ICEA and/or NEC.

B. SUPPORTS IN VERTICAL RUNS

1. To be in accordance with NEC requirements.

C. SPLICING

1. Will be permitted only with Engineers approval, and will be held to an absolute minimum..
2. Permitted only in junction boxes or similar accessible locations.
3. Cover with heat shrinkable sleeves to make moisture proof and corrosive resistant.
4. No splicing of instrument or control wiring shall be allowed without specific approval, by the Engineer.

D. CONNECTORS

1. Solderless compression or mechanical type will be utilized where screw does not bear directly on the wire.
2. Apparatus lugs, conductor, and coat shall be thoroughly cleaned with suitable oxidation inhibiting compound prior to connection.
3. Retaining cup washers shall be used where solid wire is used at terminal blocks.
4. Compression type connectors shall be installed using ratchet type crimping tools that will not release until full compression has been achieved.
5. Dies for the crimping tools shall be matched to the connector and approved for use by the Engineer and the connector manufacturer.
6. Twist on type, Scotch-lok or approved equal, connectors shall be restricted to the connection of lighting fixture wires only.

E. POWER CABLES

1. All power cables will be installed in strict accordance with the manufacturers instruction, and in conformance with NEC.

F. CONNECTIONS

1. All apparatus lugs shall be tandem single or multi-barrel lugs as detailed/required.

G. CONDUCTOR PULLING

1. Use pulling grips or eyes.
2. Firmly mount pulling reels on portable stand and secure against displacement
3. Use an approved by the Engineer commercial pulling compound for lubrication.
4. Monitor and do not exceed cable-pulling tension as specified by the cable manufacturer.

H. COLOR CODING

1. Single phase service – use white for neutral conductor, and black for ungrounded conductors.
2. Three phase service - feeder and branch conductors shall be color coded as follows

	120/208 Volt	277/480 Volt
a.	Phase A – Black	Brown
b.	Phase B – Red	Orange
c.	Phase C – Blue	Yellow
d.	Neutral – White	Grey
e.	Ground – Green or Bare	Green or Bare

3. Coding shall be by insulation color or minimum 1 inch band of colored tape.
4. Green covering of conductors shall be solely for grounding.

I. PHASING

1. Where common neutral is run for two or three circuits, phase conductors shall be connected to breakers in the panel, which are connected to different phase legs.
2. Home runs may be combined at the option of the Contractor, providing not more than three circuits are installed in one conduit, unless otherwise approved by the Engineer.

J. SERVICE SYSTEMS

1. Incoming service systems shall be grounded at two points with the main water service at the entrance point ground to the building and to driven ground rods as indicated on the Standard Detail Drawing.
2. Jumpers shall be provided around water meters and any dialectric sections of pipe.
3. Size shall be as indicated on the Drawings and/or as required by NEC.
4. Connections shall be accessible for inspection.
5. Neutral conductor connection to grounding electrode conductor shall be at the main service enclosure only.
6. Type of equipment and details of installation shall be verified with Power Company representatives.
7. Metering equipment shall be provided as indicated on the Drawings or as required by these Specifications.

16010.3.9 INSTALLATION OF POWER AND CONTROLS TO EQUIPMENT

A. Contractor shall provide all power and control wiring required for the work of other trades as described on the drawings and in the specifications, except where the furnishing and installing of such wiring is specified elsewhere. Connect cord sets to Owner furnished equipment and make connections to all electric power consuming equipment whether furnished under contract or by Owner.

16010.3.8 TEMPORARY ELECTRIC SERVICE DURING CONSTRUCTION

A. The Project Contractor is responsible for all project electrical work unless otherwise noted. The Contractor shall be aware, however, that some or all of the project electrical work may be performed by the Owner and/or an independent electrical contractor. The division of work to be performed by others may be indicated on the drawings, or may be as called for by the Engineer. But, the Contractor shall be responsible to review the Drawings and consult with the Engineer, to determine if its scope is less than one hundred percent of all project electrical work. The Contractor shall also be responsible to coordinate and schedule its work with that of the Owner or independent electrical contractor, and to leave its installations ready, with the connecting wires coiled, for the Owner or independent contractor to connect to or to terminate as necessary, thereby ensuring the most efficient completion of the project by all parties.

B. The Contractor or electrical subcontractor doing the work shall provide temporary power, complete with metering and wiring, for lighting and power outlets for construction tools and equipment. This contractor will make arrangements with the local power company for temporary electrical service connections for construction power.

C. No attempt shall be made herein to specify construction power requirements for equipment in detail. However, all temporary wiring shall meet NEC, Article 305,

requirements. The service shall be provided with a main disconnect, and all power receptacles shall be, or be protected by, appropriately rated GFI single-pole devices.

D. At completion of the Project, or sooner if directed, the temporary power supply shall be disconnected and removed from the construction site.

E. During construction, if it becomes necessary to shut down power to a critical item of equipment or process, the Contractor or electrical subcontractor shall provide the necessary wiring and a portable generator or other source of electric power to keep such critical equipment or process in operation.

16010.3.9 SEISMIC RESTRAINT

A. The appropriate Seismic Zone Classification will be provided on the Drawings or in the Special Provisions. All electrical equipment shall be securely anchored and seismically braced in accordance with the regulations contained in the most recently adopted edition of the UBC and with the SMACNA *Guidelines for Seismic Restraints of Electrical Systems* as they pertain to the Seismic Zone Classification given.

B. Units mounted and secured directly to structures shall be provided with connectors of sufficient strength to meet the restraining criteria.

C. All electrical equipment which is to be securely anchored (hard mounted) to the building or structure shall have supports designed to withstand lateral and vertical "G" loadings equal to or greater than UBC requirements and SMACNA guidelines for the given seismic zone.

16010.3.10 LABELING OF J-BOX COVERS

All J-Box covers shall be labeled with information showing the voltage and the circuit number in reference to each home run pulled through that J-Box and a particular run of conduit.. The Contractor shall continue such circuits to the panels as though the routes were completely indicated.

16010.3.11 REPAIR OF WORK

A. The work shall be carefully laid out in advance and where cutting, channeling, chasing, or drilling of floors, walls, partitions, ceilings or other surfaces is necessary for the proper installation, support, or anchorage of the conduit raceways or other electrical work, this work shall be carefully done. Any damage to building, piping or equipment shall be repaired by skilled mechanics of the trades involved, at no additional cost to the Owner.

B. Penetrations within fire rated wall assemblies shall be appropriately repaired and replaced to full integrity of the designed fire resistance of the wall.

16010.3.12 TESTING

On completion of the work, the installation shall be tested free from all grounds and short circuits. Normal feeders, circuits, and service entrance conductors with wire size #2 and larger shall be tested for leakage phase-to-ground and phase-to-phase prior to energizing the electrical system. The Contractor shall submit a written report to the Engineer showing methods used and readings taken. Voltage applied for testing shall not exceed two times normal operating voltage.

16010.3.13 GUARANTEE/WARRANTY

A. The following guarantee is a part of the specification and shall be binding on the part of the Contractor:

"The Contractor guarantees that this installation is free from defects. The Contractor agrees to replace or repair, to the satisfaction of the Owner's Representative, any part of this installation which may fail or be determined unacceptable within a period of one (1) year after final acceptance."

B. Electrical systems and equipment shall not be considered acceptable for substantial completion until they have performed in service continuously without malfunction for at least ten (10) days.

16010.3.14 DEFECTIVE EQUIPMENT

If equipment fails to conform to the Specifications or to operate satisfactorily, the Owner will have the right to operate said equipment until defects are corrected. The Owner will have the right to operate rejected equipment until it is replaced, without cost for depreciation use or wear. The Contractor shall remove defective equipment from operation for examination, adjustment, alteration, or change only at times approved by Owner.

16010.3.15 CLEAN-UP

A. As the work progresses, and on a daily basis, the Contractor shall remove from the premises and surrounding streets, alleys, etc., all rubbish and debris resulting from its operations and shall leave all equipment and material furnished by the Contractor absolutely clean and ready for use.

B. In addition, the Contractor shall periodically remove all debris and waste in order to maintain safe working and operating conditions, and shall dispose of the same in an approved manner. At the completion of work, The Contractor shall remove all its rubbish, tools, scaffolds and surplus materials from and about the site, leaving its work clean and the areas ready for occupancy.

16010.3.16 AS-BUILT DRAWINGS

Blue line white prints of drawings will be furnished by the Engineer, on which the Contractor shall accurately and neatly mark, in colored pencil, all changes or deviations from the drawings as such changes are made in the work. These drawings shall be reviewed with the Engineer on a timely basis, not to exceed at least once each month. Failure to keep as-built drawings up to date shall be cause for withholding monthly or final payment.

16010.3.17 FINAL INSPECTION AND ACCEPTANCE

The Contractor shall notify the Engineer when work is considered to be complete, in full operating condition, and ready for final inspection. The Engineer, after determining that the installation is ready for final inspection, will conduct the final inspection and tests as are deemed necessary to determine that the provisions of the specifications are satisfied. The Owner will not accept work nor make final payment to the Contractor until Engineer has certified that the work of the Contractor is complete and in conformance with the specifications and guarantees.

16010.4 METHOD OF MEASUREMENT

16010.4.1 NO SEPARATE MEASUREMENT

Separate measurement shall NOT be made for furnishing or installing electrical systems, components, materials required to be installed within the pay limits for a building or enclosure identified in the Bid schedule to be furnished by the Contractor.

16010.4.2 SEPARATE MEASUREMENT

A. NEW BUILDINGS - Separate measurement shall be made for installation of electrical systems, components, and materials, required for a building or enclosure shown on the Drawings and as called for in these Specifications and identified in the Bid Schedule, when such electrical systems, components, and materials are identified and listed in the Bid Schedule.

B. EXISTING BUILDINGS - Separate measurement will be made for installation of electrical systems, components, and materials, required to be installed or replaced in an existing building or enclosure, as shown on the Drawings and as called for in these Specifications, when such electrical systems, components, and materials are identified and listed in the Bid Schedule.

16010.5 BASIS OF PAYMENT

16010.5.1 No separate payment shall be made for furnishing or installing electrical systems, components, or materials required to be installed within the pay limits for a building or enclosure identified in the BID schedule to be furnished by the Contractor.

16010.5.2 When electrical systems, components, or materials are measured for a new building or enclosure as shown on the Bid Schedule, separate payment will be made as listed below.

16010.5.3 When initial installation or replacement of electrical systems, components, or materials is made in an existing building as shown on the Bid Schedule, the accepted quantity will be paid for at the contract price listed below:

PAY ITEM	UNIT
Electrical System *(Indicate Building)*	Lump Sum
Install Electrical *(Describe Component)*	Lump Sum
Install Electrical *(Describe Component)*	Each
Install Electrical *(Describe material)*	Lump Sum
Install Electrical *(Describe material)*	Lineal Foot
Replace Electrical *(Describe Component)*	Lump Sum
Replace Electrical *(Describe Component)*	Lump Sum
Replace Electrical *(Describe material)*	Lump Sum
Replace Electrical *(Describe material)*	Lineal Foot

16150. 1 GENERAL

16150.1.1 QUALITY ASSURANCE

A. Comply with NFPA 70 requirements for electrical materials and installation.

B. Provide products and components which have been UL listed and labeled, including UL marks indicating special type usage whenever applicable.

16150.2 PRODUCTS

16150.2.1 MOTOR STARTERS

A. Acceptable Manufacturers:

1. Allen-Bradley Co.
2. Eaton Corp/Power Distribution Div.
3. Furnas Electric Co.
4. General Electric Co. (GE Supply)
5. Square D Co.

B. Provide factory fabricated starters complying with NEMA Standards Publication ICS 2 with NEMA Type enclosures as specified in Section 16050.

C. Provide starters with thermal overload protection on each phase utilizing interchangeable melting alloy, Class 20 (trip in 20 seconds or less when carrying a current equal to 600 percent of its current rating) overload heaters, sized in field for full load current rating indicated on each motor nameplate.

D. Manual Motor Starter: Quick-make, quick-break trip free toggle or pushbutton operating mechanism; provisions for positive padlocking in OFF position.

E. Magnetic Motor Starter: Non-reversing or reversing, as indicated; manual reset overload relay with reset button on face of enclosure; full voltage starting; control transformer of sufficient capacity to handle operating coil and associated controls, integral with each starter; 120 volts control circuit, fuse protected; equipped with pilot light.

16150.2.2 CONTACTORS

A. Acceptable Manufacturers:

1. Allen-Bradley Co.
2. Eaton Corp/Power Distribution Div.
3. Furnas Electric Co.
4. General Electric Co. (GE Supply)
5. Square D Co.

B. Provide contactors complying with NEMA Standards Publication ICS 2 with NEMA Type enclosures as specified in Section 16050, unless otherwise indicated.

16150.2.3 RELAYS

A. Acceptable Manufacturers:

1. Control Relays:
2. Allen-Bradley Co.
3. IDEC Systems & Controls Corp.
4. Omron Electronics, Inc./Control Components Div.
5. Potter & Brumfield
6. Square D Co.

B. Provide relays complying with NEMA Standards Publication ICS 2 with NEMA Type enclosures as specified in Section 16050, unless otherwise indicated.

16150.2.4 CONTROL PANELS

A. Acceptable Manufacturers:

1. Allen-Bradley Co.
2. Eaton Corp/Power Distribution Div.
3. Furnas Electric Co.
4. Square D Co.

B. Provide factory fabricated oiltight pushbuttons, selector switches, pilot (indicating) lights, and pushbutton stations complying with NEMA Standards Publication ICS 2, heavy duty, with NEMA Type enclosures as specified in Section 16050.

1. Fabricate pushbutton stations for vertical or horizontal mounting, as indicated, and with button and light arrangements, as indicated on drawings.

C. Pushbuttons: Momentary or maintained contacts, as indicated; contacts rated 10 amps continuous carrying current, 600 volts AC; quick-make, quick-break, snap action operating mechanism.

D. Selector Switches: Rotary type; two or three position control, as indicated; legend plate with markings as indicated.

E. Pilot Lights: Transformer type, 120 volts AC; glass or acrylic plastic prismatic lens, color as indicated; legend plate with markings as indicated.

16150.2.5 CIRCUIT AND MOTOR DISCONNECTS

A. Acceptable Manufacturers:

1. Eaton Corp/Power Distribution Div.
2. Allen-Bradley Co.
3. Siemens Corp/Electrical Appartus Div.
4. Square D Co.
5. General Electric Co. (GE Supply)

B. Provide factory fabricated switches complying with NEMA Standards Publication KS 1 with NEMA Type enclosures as specified in Section 16050.

C. Safety Switches: 3 pole, heavy-duty, horsepower rated disconnect; rated at 600 volts; quick-make, quick-break operating mechanism; integral operating handle provided with means for positive padlocking in OFF position; current carrying parts constructed of high conductivity copper, with silver-tungsten type switch contacts; fusible or non-fusible as indicated; positive pressure type reinforced fuse clips for fusible switches.

D. Fuses: Dual element type, with time delay; non-renewable; current limiting where indicated.

16150.2.6 TRANSFER SWITCHES – MANUAL

A. Acceptable Manufacturers:

1. Eaton Corp/Power Distribution Div.
2. Square D Co.
3. General Electric Co. (GE Supply)

B. Provide manual transfer switches complying with NEMA Standards Publication KS 1, specifically designed to transfer power from one load to another load, with NEMA Type enclosures as specified in Section 16050.

C. Manual Transfer Switches: Double throw, 3 pole, heavy-duty, safety switch; rated at appropriate amperes, 600 volts; quick-make, quick-break operating mechanism; blades visible from front of unit for positive indication that switch is OFF; integral three position operating handle provided with means for positive padlocking in OFF position; current carrying parts constructed of high conductivity copper, with silver-tungsten type switch contacts; non-fusible.

16150.3 **METHOD OF MEASUREMENT**

16150.3.1 CONTROL PANELS – Measurement for this bid item shall include the conductor, conduit, and all pertinences needed for each control panel.

16150.4 **BASIS OF PAYMENT**

16150.4.1 Work completed under these bid items shall be paid for at the contract unit price as listed in the bidder's proposal and shall be considered complete compensation for furnishing and installing electrical components as shown on the plans, including but not limited to materials, labor, and equipment.

16150.4.2 The accepted quantity(s) shall be paid for at the contract unit price for:

PAYMENT ITEM	UNIT
Control Panel	Each

16210.1 DESCRIPTION

The Contractor shall provide and install all lighting systems for the Project, complete with lamps, brackets, hangers, mounting devices and all other miscellaneous components required to complete the lighting system as shown on the Drawings and in accordance with these Specifications.

16210.1.1 RELATED WORK

Section 16010 - Electrical General Requirements

16210.1.2 SUBMITTALS

Shop drawings shall be submitted for all light fixtures in accordance with Section 1300 of these Specifications.

16210.1.3 DEFINITIONS

Not used.

16210.2 MATERIALS

16210.2.1 LIGHTING FIXTURE TYPES AND SIZES

Shall be as designated on the Drawings or as otherwise required by the Special Provisions. All work, equipment, and materials shall be in accordance with UL "Standards for Electric Lighting Fixtures", No. 57, and the NEC (National Electric Code).

16210.2.2 INCANDESCENT FIXTURES

Shall be complete with medium base socket, all hardware required for installation, and lamps. Lamps shall be medium base, inside frosted, general purpose, or the project type as referenced in the electrical schedule.

16210.2.3 FLUORESCENT FIXTURES

Shall be provided complete with Class "P" high power factor, electronic type ballast with a -20°F temperature rating, together with all miscellaneous hardware and lamps. Ballast shall be CBM certified, ETL rated, with maximum sound level equivalent to General Electric Company Sound Rating "A". Lamps shall be cool white unless otherwise required on the Drawings.

16210.2.4 HIGH INTENSITY DISCHARGE FIXTURES

Shall be ballast type, complete with all miscellaneous hardware and lamps. Photocells shall be used as required on the Drawings. Ballast shall be constant wattage, high power factor type. Lamps shall be inside frosted and of the wattage indicated.

16210.2.5 HIGH PRESSURE SODIUM FIXTURES

High-pressure sodium and metal halide fixtures shall be suitable for all burning positions as specified for each type of luminaire.

16210.3 CONSTRUCTION REQUIREMENTS

16210.3.1 Fixtures and related materials shall be installed as nearly as possible in the locations shown on the Drawings. The Contractor shall coordinate the exact locations with structure, equipment, and other devices as approved by the Engineer and/or the Owner. Mounting heights shall be as indicated on the Drawings.

16210.3.2 Conductors serving grid ceiling fixtures shall be enclosed in 1/2 inch flex conduit from a junction box attached to the building structure. Fixture locations shall be coordinated with ceiling system. Fixtures shall be securely fastened to the ceiling framing members.

16210.4 METHOD OF MEASUREMENT

16210.4.1 FLUORESCENT FIXTURES – Measurement for this bid item shall include conductor, conduit, and all other pertinences needed for each fixture.

16210.4.2 HIGH PRESSURE SODIUM FIXTURES – Measurement for this bid item shall include conductor, conduit, and all other pertinences needed for each fixture.

16210.5 BASIS OF PAYMENT

Work completed under these bid items shall be paid for at the contract unit price as listed in the bidder's proposal and shall be considered complete compensation for furnishing and installing electrical components as shown on the plans, including but not limited to materials, labor, and equipment.

16210.5.1 The accepted quantity(s) shall be paid for at the contract unit price for:

PAYMENT ITEM	UNIT
Fluorescent Fixtures	Each
High Pressure Sodium Fixtures	Each

16400.1 GENERAL

16400.1.1 APPLICABLE SECTIONS

The General Conditions, Supplementary General Conditions, Special Conditions, Alternates and addenda, applicable drawings and the technical specifications herein shall apply to all work under this Division 16.

16400.1.2 SCOPE

Provide all operations, methods, labor and equipment and provide and install all materials and incidentals necessary for the completion of the work as specified herein or included on the drawings.

16400.1.3 WORK INCLUDED

A. Electrical work required for this work is shown on the drawings and includes, but is not necessarily limited to:

1. Complete new electrical distribution system for power and lighting as shown.

2. Complete system of raceways and outlets for Control and all other auxiliary systems of this Division 16. Unless noted otherwise, the equipment and wiring of these auxiliary systems will be furnished and installed under their respective sections; however, the conduit raceway systems will be furnished and installed under this Section 16400.

3. All excavating, backfilling, compacting, and grading required for the installation of all work covered under this Division 16.

B. Shall furnish and install all component parts of all the systems required for their safe and proper operation, whether or not specifically mentioned or noted on the drawings, except those items or articles which are specifically noted hereinafter as being supplied otherwise.

C. Perform all trenching and backfilling required in connection with the work of this section in strict accordance with the provisions of Division 02000 of these specifications.

D. Provide all required electrical connections and service to items described in all other sections of these specifications. Provide all those services outlined in other divisions of the specifications as being done by the electrical sub-contractor.

16400.1.4 RELATED WORK SPECIFIED ELSEWHERE:

Section 16010 - Electrical General Requirements
Section 16050 - Basic Materials and Methods
Section 16410 - Fuses
Section 16500 - Lighting

16400.2 PRODUCTS

16400.2.1 DISTRIBUTION PANEL BOARDS

A. Distribution panel boards shall be factory assembled dead front, wall mounted as

scheduled and braced for the indicated ampere rms symmetrical with equipment, bussing connections, circuit breakers and all similar components indicated on the drawings or required for proper completion. Each breaker shall have an etched micarta nameplate secured by two cadmium plated screws. Nameplates shall indicate equipment served as shown in schedule. Busses shall be copper of a maximum current density of 1000 amperes per inch and shall be equipped with uninsulated equipment ground bus. Three phase, 4-wire panels shall have full capacity neutral bus.

B. All floor mounted panels shall be mounted on a **4" housekeeping pad** and therefore to comply with NEC, the operating handles of switches and breakers shall be no more than 6'-2" above the bottom of the panel.

C. Distribution panel boards shall be wall mounted as indicated in schedules. For access to wiring gutters, panel shall be door within door construction. Shall be Square D, I-Line or equal of Siemens I.T.E., Cutler Hammer/Westinghouse or General Electric.

16400.2.2 BRANCH CIRCUIT PANEL BOARDS

A. Branch circuit panelboards shall be Square D for the scheduled voltage, 3 phase, 4 wire operation or equal of Siemens, or General Electric. Shall be equipped with bolt-on breakers. Minimum width shall be 20 inches. Minimum depth shall be 5.75 inches. Panel trims shall be of the door within door construction.

B. Busses shall be copper.

C. Branch circuit breakers shall be provided per schedules on drawings. All multi-pole breakers shall be common trip.

D. Doors shall be complete with corrected circuit schedule on inside. Panels shall be NEMA 3R type construction.

16400.2.3 DRY TYPE TRANSFORMERS

A. General Purpose Dry-Type Transformers: (Under 600 volts)

1) General: Furnish and install at locations shown on the drawings dry-type two winding power transformers for general power and lighting applications indicated. Transformers shall be UL listed and bear the required Listing Mark.

2) Electrical Rating: Shall be 60 hertz of sizes, phases, high voltage and low voltage as scheduled on the drawings. Each transformer, unless specifically noted otherwise, shall have six (6) 2-1/2% full capacity taps, two above and four below nominal voltage in the high voltage winding.Temperature Classification: Each transformer shall utilize an insulation system that has been properly temperature classified and approved by Underwriters' Laboratories. Unless specifically noted otherwise, the insulation classification shall be 220 C with 150 C winding temperature rise in accordance with Underwriters' Laboratories specification UL506.

3) Load Rating:

a. Each transformer supplied to this specification shall be capable of operating at 100% of nameplate rating (NPR) continuously while in an ambient temperature not exceeding 40°C and shall be capable of

meeting the daily overload requirements of ANSI Standard C57.96 as stated in the following chart:

PERMISSIBLE ONCE DAILY OVERLOADS WITH NORMAL LIFE MAINTAINED			
	Peak Load Following and Followed by a Constant Load of		
Peak Load Time (Hours)	90% NPR	70% NPR	50% NPR
1/2	162% NPR	185% NPR	200% NPR
1	138% NPR	148% NPR	152% NPR
2	123% NPR	128% NPR	133% NPR
4	113% NPR	115% NPR	118% NPR
8	106% NPR	107% NPR	108% NPR
NPR = Nameplate Rating			

b. Transformer loaded in accordance with this paragraph shall be capable of long service life under the thermal conditions specified. There shall be no need for derating.

4) Sound Rating: Each transformer shall have sound levels equal or lower than those established in the latest revision of ANSI Standard C89 as shown in the following chart:

Transformer Rating KVA	Maximum Sound Level Decibels
10-50	45
51-150	50
150-300	55

5) Other Requirements: The following requirements shall be in accordance with Underwriters' Laboratories specification UL506:

a. Enclosure:

(i) Ventilation openings
(ii) Corrosion resistance
(iii) Cable bending space
(iv) Grounding provisions
(v) Surface temperature rise
(vi) Wiring compartment temperature rise
(vii) Terminations

6) Test Requirements:

a. Each transformer furnished to this specification shall be subjected to the following production tests:

(i) Applied potential
(ii) Induced potential
(iii) No load losses
(iv) Voltage ratio
(v) Polarity
(vi) Continuity

b. The manufacturer shall have performed the following additional tests on units identical to the design type being furnished to this specification. Proof of performance of these lists in the form of test data sheets shall be provided as part of the shop drawing submittal.

(i) Sound levels
(ii) Temperature rise tests
(iii) Full-load losses
(iv) Regulation
(v) Impedance

7) Shop Drawings: Submit shop drawing for review prior to delivery to job site.

16400.3 EXECUTION

16400.3.1 INSTALLATION OF GROUNDING SYSTEM

A. The conduit system and neutral conductor of the wiring system shall be grounded to the cold water pipe having a continuous path to earth in compliance with grounding provisions as outlined in the NEC. Point of connection to the water system shall be as near as practicable to the service entrance. Provide bonding jumper same size as system ground to provide ground continuity from customer's side of metallic lines service entrance and street side of metallic mains. The neutral and ground shall be connected together at the main service switch only.

B. Where the water main is not metallic, delete water pipe ground requirements and provide a concrete encased electrode consisting of a 20-foot length of #3/0 bare copper conductor tied to the steel reinforcing bars and encased within a concrete footing. This footing shall be in direct contact with earth and located near the main panel.

C. The Contractor shall also install a made electrode ground system consisting of copperclad rods spaced not closer than six feet apart. Grounding conductors and connections to ground rods shall be protected from damage and shall be placed to avoid disconnect by unauthorized personnel. Interconnect with water pipe ground system.

D. The equipment grounding system shall be such that all metallic structures, enclosures, raceways, junction boxes, outlet boxes, cabinets, machine frames, portable equipment and other conductive items in close proximity with the electrical circuits operate continuously at ground potential and provide a low impedance path for the possible ground fault currents. The system shall comply with the National Electrical Code, modified as indicated on the drawings or specifications and as hereinafter specified to incorporate a maximum 25 ohms ground resistance. Grounding connections shall be accessible for inspection.

E. The distributions system shall be provided with a separate equipment grounding

conductor for each single or three-phase feeder, each branch circuit with a multi-pole protective device and each single phase receptacle and motor circuit as indicated. The required grounding conductor shall be installed in the common raceway with the related phase and/or neutral conductors. Single-phase branch circuits required for lighting, shall consist of phase and neutral conductors installed in common metallic conduit which shall serve as the grounding conductor. Conduit equipment connections utilized in conjunction with the above single-phase branch circuits shall be provided with suitable bonding jumpers connected to approved grounding type bushings. Single-phase branch circuits and all branch circuits installed in flexible conduits shall be provided with a separate grounding conductors as hereinbefore specified for the multi-pole branch circuits.

16400.3.2 INSTALLATION OF PANELS

A. Installation: Unless otherwise indicated on the drawings, install wall panels with the top of the trim 6'-0" above the finished floor. Panels located in equipment rooms and wire closets shall be surface mounted. Floor mounted panels shall be provided with a 4" concrete housekeeping pad. Floor mounted panels shall be anchored to floor at all four corners and to wall or structural member at top for seismic restraint.

B. Directories: Mount a typewritten directory behind glass or plastic on the inside of each panel door. On the directory, show the circuit number and complete description of all outlets with specific locations on each circuit. In addition, provide a typewritten label inside door showing source of power to panel both as to feeder switch, panel designation and location within buildings.

16400.3.3 GENERAL PURPOSE DRY TYPE TRANSFORMERS

A. General purpose dry transformers shall be mounted on floor at locations shown on drawings. Each shall be anchored to floor by means of a minimum of four 1/2" x 6" anchor bolts grouted in existing concrete floor.

16400.3.4 TESTING

A. General: Upon completion of this portion of the work, test all parts of the electrical system in the presence of the Engineer Owner's Representative.

B. Test Requirements: All systems shall test free from short circuits and grounds, shall be free from mechanical and electrical defects, and shall show an insulation resistance between phase conductors and ground of not less than that required by the National Electrical Code.

16400.3.5 FINAL INSPECTION

A. This Division 16 contractor's job foreman shall be present at the final inspection of the work by the Owner.

B. Electrical job foreman shall have pad and pencil to list all deficient items noted. Corrections and adjustments of deficient items shall be done after the inspection, not during.

C. See Section 16050 for other requirements for final inspection.

16400.4 METHOD OF MEASUREMENT

16400.4.1 DISTRIBUTION PANEL BOARDS – Measurement for this bid item shall include conductor, conduit and all other pertinences needed for each distribution panel board.

16400.5 BASIS OF PAYMENT

16400.5.1 Work completed under these bid items shall be paid for at the contract unit price as listed in the bidder's proposal and shall be considered complete compensation for furnishing and installing electrical components as shown on the plans, including but not limited to materials, labor, and equipment.

16400.5.2 The accepted quantity(s) shall be paid for at the contract unit price for:

PAYMENT ITEM	UNIT
Distribution Panel Boards	Each

16811.1 DESCRIPTION

16811.1.1 The CONTRACTOR shall furnish and install an emergency generator system that has been prototype tested, factory built, production tested, site tested, of the latest commercial design, together with all accessories necessary for a complete installation as shown on the plans and drawings, and specifications herein. The equipment supplied and installed shall meet the requirements of the national Electrical Code, along with all applicable local codes and regulations. All equipment shall be new, of current production of a national firm that manufactures the generator and controls, transfer switch, and assembles the standby generator sets as a matched unit so that there is one-source responsibility for warranty, parts, and service through a local representative with factory-trained servicemen.

16811.1.2 RELATED WORK

Section 16010-General Electrical work

16811.1.3 SUBMITTALS

16811.1.3.1 Submittals shall include prototype test certification and specification sheets showing all standard and optional accessories to be supplied, schematic wiring diagrams, dimension drawings, and interconnection diagrams identifying by terminal number, each required interconnection between the generator set, the transfer switch, and the remote annunciator panel if it is included elsewhere in these specifications.

16811.1.3.2 The CONTRACTOR shall furnish to the OWNER four (4) copies of all operation and maintenance manuals prior to the time of final acceptance for payment.

16811.2 MATERIALS

16711.2.1 The following manufacturers of generator sets have been PRE-APPROVED: Kohler, Onan, and Caterpillar.

16811.2.2 TESTING

To assure that the equipment has been designed and built to the highest reliability and quality standards, the manufacturer and local representative shall be responsible for three separate tests: design prototype tests, final production tests, and site tests.

16811.2.2.1 Design Prototype Tests: Components of the emergency system such as the engine/generator set, transfer switch, and accessories shall not be subjected to prototype tests since the tests are potentially damaging. Rather, similar design prototypes and pre-production models, which will not be sold, shall have been used for the tests. Prototype test programs shall include the requirements of NFPA 110 and the following:

1. Maximum power (kW)

2. Maximum motor starting (kVA) at 35% instantaneous voltage dip.

3. Alternator temperature rise by embedded thermocouple and by resistance method per NEMA MG1-22.40 and 16.40.

4. Governor speed regulation under steady state and transient conditions.

5. Voltage regulation and generator transient response.

6. Fuel consumption at ¼, ½, ¾, and full load.

7. Harmonic analysis, voltage waveform deviation, and telephone influence factor.

8. Three-phase short circuit tests.

9. Alternator cooling air flow.

10. Torsional analysis testing to verify that the generator set is free of harmful torsional stresses.

11. Endurance testing.

16811.2.2.2 Final Production Tests: Each generator set shall be tested under varying loads with guards and exhaust system in place. Tests shall include:

1. Single-step load pickup.

2. Transient and steady—governing.

3. Safety shutdown device testing.

4. Voltage regulation.

5. Rate Power

6. Maximum Power

16811.2.2.3 Site Tests: An installation check, start-up, and building load test shall be performed by the manufacturer's local representative. The engineer, regular operators, and the maintenance staff shall be notified of the time and date of the site test. The tests shall include:

1. Fuel, lubricating oil, and antifreeze shall be checked for conformity to the manufacturer's recommendations, under the environmental conditions present and expected.

2. Accessories that normally function while the set is standing by shall be checked prior to cranking the engine. These shall include: block heaters, battery charger, generator strip heaters, remote annunciator, etc.

3. Start up under test mode to check for exhaust leaks, path of exhaust gases outside the building, cooling air flow, movement during starting and stopping, vibration during running, normal and emergency line-to-line voltage, and phase rotation.

4. Automatic start-up by means of simulated power outage to test remote-automatic starting, transfer of the load, and automatic shutdown. Prior to this test, all transfer switch timers shall be adjusted for proper system coordination. Engine coolant temperature, oil pressure, and battery charge level along with generator voltage, amperes, and frequency shall be monitored throughout the test. An external load bank shall be connected to the system for a period of 2 hours to the nameplate kW rating.

16811.2.3 WARRANTY & MAINTENANCE

16811.2.3.1 The emergency generator system shall be warranted by the manufacturer for 1 year or 2,000 hours, whichever occurs first, from the date of the site start-up. Optional 2-year and 5-year warranties shall be available upon request.

16811.2.3.2 Service Contract: The engine-generator distributor shall furnish factory trained personnel and maintain a 24-hour parts and service capability, and show, at time of submittal, that they are regularly engaged in a maintenance contract program to semi-annually inspect and test run the engine to perform manufacturers recommended preventative maintenance service on the equipment furnished. At the Owner's option, a service contract shall be renewable on a year-to-year basis, thereafter, with costs being paid by the Owner.

16811.2.4 EQUIPMENT

16811.2.4.1 Generator

1. The generator set shall be a Cummins model GGFD 60HZ engine generator set or equal. It shall provide 35 kW stand by rating operating at 120/240 volts, single phase, .8 power factor. The generator set shall be capable of 35 kW rating while operating in an ambient condition of 104°F and 7,100 feet above sea level.

2. The generator set shall be capable of starting motor loads of 72 kVA inrush, with a maximum voltage dip of 35%.

3. Vibration isolators shall be provided between the engine-generator and heavy-duty steel base

16811.2.4.2 Engine

1. The 256 cubic-inch-displacement engine shall deliver a minimum of 74 hp at a governed speed of 2250 rpm. The engine shall be equipped with the following:

   A. An electronic isochronous governor capable of +.25% steady-state frequency regulation.

   B. 12 Volt positive engagement solenoid shift-starting motor.

   C. 70-Ampere minimum automatic battery charging alternator with solid-state voltage regulation.

   D. Positive displacement, full pressure lubrication oil pump, cartridge oil filters, dipstick, and oil drain.

   E. Dry-type replaceable air cleaner elements for normal applications.

2. The naturally aspirated engine shall be fueled with **natural gas** and be supplied with a unit-mounted electric solenoid fuel shut-off valve, flexible fuel line, and secondary fuel pressure regulator. A fuel strainer shall be provided, shipped loose, and for installation by the contractor prior to the hook up at the generator.

3. The engine shall have a minimum of 8 cylinders, and be liquid-cooled by a unit-mounted radiator, blower fan, water pump, and thermostats. This system shall properly cool the engine with up to 0.5 inches H20 static pressure on the fan in an ambient temperature up to 122°F/50°C.

16811.2.4.3 Generator

1. The alternator shall be salient-pole, brush-less, 12-lead re-connectable, self-ventilated of drip-proof construction with amortisseur rotor windings and skewed stator for smooth voltage waveform. The insulation shall meet the NEMA standard (MG1-22.40 and 16.40) for Class H and be insulated with epoxy varnish to be fungus resistant per MIL 1-24092. Temperature rise of the rotor and stator shall be limited to 130 Deg. C. The excitation system shall be of brush-less construction controlled by a solid-state voltage regulator capable of maintaining voltage within +/- 2% at any constant load from 0% to 100% of rating. The regulator must be isolated to prevent tracking when connected to SCR loads, and provide individual adjustments for voltage range, stability and volts-per-hertz operations: and be protected from the environment by conformal coating.

2. The generator set shall meet the transient performance requirements of ISO 8528-5, level G-2.

3. The alternator excitation shall be of a permanent magnet exciter design.

4. The generator shall be inherently capable of sustaining at least 250% of rated current for at least 10 seconds under a 3-phase symmetrical short circuit without the addition of separate current support devices.

5. The generator, having a single maintenance-free bearing, shall be directly connected to the flywheel housing with a semi-flexible coupling between the rotor and the flywheel.

16811.2.4.4 Controller

1. Controller

   A. Control The generator must meet NFPA-110 Level 1 requirements (1996 version) and must have an integral alarm horn as required by NFPA.

   B. NFPA-99 and NEC must also be accommodated.

   C. Set control must be listed under UL 508.

2. Applicability

   A. For standardization purposes, the control described herein must be available on generator sets 20 kW and larger.

   B. The control must be usable on 12- or 24-volt starting systems.

   C. Environment
      i) -40°C to +70°C operating temperature range
      ii) 5-95% humidity, non condensing

D. It shall be possible to mount the control on the generator set or remotely within 40 feet of the generator set. If mounted on the generator, the control must be able to be mounted in any of 4 orientations for ease of viewing.

3. Hardware Requirements

A. The control shall have a run-off/reset-auto three-position selector switch. If required, in the plans and specs, a version of the control shall have a key operated selector switch.

B. A controller mounted latch type emergency stop push button must be supplied.

C. It shall be possible to adjust alternator output voltage at the control.

D. Five indicating lights:

1) system ready - green
2) not in auto - yellow
3) programming mode - yellow
4) system warning - yellow
5) system shutdown - red

E. Lighted display with two lines of 20 alphanumeric characters for messages. Panel lights must be supplied as standard.

F. Sixteen position snap action sealed keypad for menu selection and data entry.

G. For ease of use, an operating guide must be on the controller faceplate.

H. An audible alarm must be supplied in the control.

4. Control Functional Requirements

A. Field programmable time delay for engine start. Adjustment range, 0-5 minutes in 1 second increments.

B. Field programmable time delay engine cool-down. Adjustment range, 0-10 minutes in 1 second increments.

C. It shall be possible to start the generator and run it at an idle speed during warm-up. The idle time must be user adjustable. Engine cool-down at idle must also be available. Required for ECM equipped engines only.

D. Real time clock and calendar for time stamping of events.

E. Output with adjustable timer for an ether injection starting system. Adjustment range, 0-10 seconds.

F. Output for shedding of loads if the generator reaches a user programmable percentage of its kW rating. Load shed must also be enabled if the generator output frequency falls below 59 Hz (60 Hz system) or 49 Hz (50 Hz system).

G. Programmable cyclic cranking that allows up to six crank cycles and up to 45 seconds of crank time per crank cycle.

H. The capability to reduce controller current battery draw, for applications where no continuous battery charging is available, must be provided. The controller vacuum fluorescent display should automatically be turned off after 5 minutes of no controller activity.

I. The controller firmware must provide alternator protection for overload and short circuit matched to each individual alternator and duty cycle.

J. A ± 0.25% digital voltage regulator must be incorporated into the controller software. No separate voltage regulator is acceptable. The digital voltage regulator must be applicable on single or three phase systems.

K. It must be possible to exercise the generator by programming a running time into the controller. This feature must also be enabled through the PC software.

5. Generator System Monitoring Requirements

A. All monitored functions must be viewable on the digital display.

B. The following generator functions must be monitored:
1) all output voltages - single phase, three phase, line to line, and line to neutral, 0.25% accuracy.
2) all single phase and three phase currents, 0.25% accuracy
3) output frequency, 0.25% accuracy
4) power factor by phase with leading/lagging indication
5) total instantaneous kilowatt loading and kilowatts per phase, 0.5% accuracy
6) kVARS total and per phase, 0.5% accuracy
7) kVA total and per phase, 0.5% accuracy
8) kW hours
9) a display of percent generator duty level - actual kW loading divided by the kW rating.

C. Engine parameters listed below shall be monitored: *(required for ECM equipped engines only).
1) coolant temperature both in English and metric units
2) oil pressure in English and metric units
3) battery voltage
4) rpm
5) lube oil temperature*
6) lube oil level*
7) crankcase pressure*
8) coolant level*
9) coolant pressure*
10) fuel pressure*
11) fuel temperature*
12) fuel rate*
13) fuel used during the last run*
14) ambient temperature*

D. Operational records since system start up must be stored in the controller.
   1) run time hours
   2) run time loaded
   3) run time unloaded
   4) number of starts
   5) factory test date
   6) last run data including date, duration, and whether loaded or unloaded
   7) kW hours

E. The following operational records must also be available in a re-settable form for maintenance purposes:
   1) run time hours
   2) run time loaded
   3) run time unloaded
   4) kilowatt hours
   5) days of operation
   6) number of starts
   7) start date after reset

F. The controller must store the last one hundred generator system events with date and time of the event.

G. For maintenance and service purposes, the following information must be stored in the control and displayed on demand:
   1) manufacturer's model and serial number
   2) battery voltage
   3) generator set kilowatt rating
   4) rated current
   5) system voltage
   6) system frequency
   7) number of phases

6. The control must be capable of detecting the following conditions, indicate if the condition will shutdown the generator or provide a warning, and annunciate the situation, using words and phrases, on the digital display.

A. Will cause a system shutdown:
   1) air damper tripped (if used)
   2) customer programmed digital auxiliary input ON (any of the 21 inputs available)
   3) customer programmed analog auxiliary input out of bounds (any of 7 inputs for ECM equipped engines and 5 inputs for non ECM engines)
   4) emergency stop
   5) high coolant temperature
   6) high oil temperature
   7) controller internal fault
   8) locked rotor - fail to rotate
   9) low coolant level
   10) low oil pressure
   11) Master switch error
   12) NFPA common alarm
   13) over-crank

14) over-speed with user adjustable level, range 65-70 Hz on 60 Hz systems and 55-70 Hz on 50 Hz systems
15) generator over-voltage with user adjustable level, range 105% to 135%
16) over-frequency with user adjustable level, range 102% to 140%
17) under-frequency with user adjustable level, range 80% to 90%
18) generator under-voltage with user adjustable level, range 70% to 95%
19) coolant temperature signal loss
20) oil pressure gauge signal loss

B. Will cause a warning but leave the generator running:
1) battery charger failure
2) customer programmed digital auxiliary input on (any of the 21 inputs available)
3) customer programmed analog auxiliary input on (any of the 7 inputs available on ECM engines and 5 inputs for non ECM engines)
4) power system supplying load
5) ground fault detected - detection by others
6) high battery voltage - Level must be user adjustable.
7) Range 29-33 volts for 24-volt systems.
8) high coolant temperature
9) load shed
10) loss of AC sensing
11) under frequency
12) low battery voltage – level must be user adjustable, Range 20-25 volts for 24-volt systems.
13) low coolant temperature
14) low fuel level or pressure
15) low oil pressure
16) NFPA common alarms
17) over-current
18) speed sensor fault
19) weak battery
20) alternator protection activated

7. Inputs and Outputs

A. Inputs
1) There shall be 21 dry contact inputs that can be user configured to shutdown the generator or provide a warning.
2) There shall be 7 user programmable analog inputs for ECM engines (5 for non ECM engines) for monitoring and control.
3) Each analog input can accept 0-5 volt analog signals.
4) Resolution must be 1 part in 10,000.
5) Each input can be programmed to provide up to 4 trip values – 2 warnings and 2 shutdowns.
6) It must be possible to view the analog value on the display.
7) It shall be possible to define each user configured input using words or phases that will be viewable on the digital display.
8) Additional standard inputs required:
   a) Input for an external ground fault detector. Digital display must show "ground fault" upon detection of a ground fault.
   b) Reset of system faults.

c) c) Remote two wire start.
d) Remote emergency stop.
9) Idle mode enable

B. Outputs
1) All NFPA 110 Level 1 outputs must be available.
2) There shall be thirty outputs available for interfacing to other equipment:
a. Any of these outputs shall be able to be user configured from a list of over 25 functions and faults.
3) These outputs shall drive optional dry contacts.
4) A programmable user defined common fault output with over 40 selections shall be available.

8. System Programming

A. It must be possible to disable programming so the system can only be monitored.

B. It shall be possible to program the control with the controller keypad or using an IBM compatible personal computer.

C. Programming access is to be enabled only at the controller and must be password protected.

D. The following must be programmable from the controller keypad:
1) Time delay settings:
a) generator run time (0 to 72 hours) - exercise
b) load shed
c) engine start
d) engine cool-down
e) over-voltage and under-voltage delays
f) starting aid
g) crank on and crank pause time
h) idle time
2) Trip point settings:
a) high battery voltage
b) low battery voltage
c) over-speed
d) under-frequency
e) over-frequency
f) over-voltage
g) under-voltage
h) load shed

9. Communications

A. If the generator engine is equipped with an ECM (engine control module), the controller must communicate to the ECM for control, monitoring, and diagnostics. SAE J1939 standard communications is required.

B. Industry standard Modbus RTU communication shall be available.

C. A Modbus master will be able to monitor controller data.

D. A Modbus master will be able to alter parameters.

E. The Modbus master must be capable of starting and stopping the generator.

10. Communications & Personal Computer Software

A. The controller must have the capability to communicate to a personal computer (IBM or compatible) running Windows '9X or Windows NT.

B. Both RS-232 and RS-485 communication formats shall be available.

C. A variety of connections shall be available based on requirements:
1) A single connection to a PC. A cable length of up to 4000 feet must be supported.
2) Multiple devices at a single location connected to a PC.
3) A single connection from a device to a PC over phone lines.
4) Multiple devices to a PC over phone lines.

D. When equipped with communications modules, transfer switches and power monitors along with generator controllers must be able to be connected to the same communication network with no additional interfaces being required.

E. The capability to connect up to 128 devices (genset controls and transfer switches) on a single network must be supported.

F. Cabling is to be device to device in a daisy chain fashion with no limitation on device locations within the network.

G. The network must be self- powered. No power wiring between devices is allowed.

D. A single software package with the following capabilities is required:
1) Any combination of transfer switches and generator controls.
2) Up to 128 devices at a single site must be supported.
3) The same software package must support communications over phone lines. The software shall allow communications with up to 128 sites (phone numbers) including phone number fields large enough for International communication.
4) Access to individual devices by the software shall be protected by password.
5) To support future expansion, it must be possible to add devices (ATS and generator set controllers), up to 128 and sites up to 128, with the installed software. Changing to a different software package is not acceptable.
6) All displays, data inquires, and program functions allowed on the controllers, both generator and ATS, shall also be available through the software.
7) A single software screen must be capable of displaying data from multiple devices simultaneously.
8) It shall be possible to reset shutdown faults, and restart the generator using the software.
9) If a transfer switch is used, it must be possible to start the generator and transfer the loads to the generator.

16811.2.4.5 ACCESSORIES

1. Line circuit breaker of 150 amperes, 150 amps sensor, 600 volt rated, molded case type, thermal Magnetic, and generator mounted.

2. Engine block heater. Thermostatically controlled and sized to maintain manufacturers recommended engine coolant temperature (110-120V, 1500W) to meet the start-up requirements of NFPA-99 and NFPA-110, Level 1.

3. Battery rack, and battery cables, capable of holding the manufacturer's recommended batteries, shall be supplied.

4. 12-volt lead-antimony battery(ies) capable of delivering the manufacturer's recommended minimum cold-cranking Amps required at 0oF, per SAE Standard J-537, shall be supplied.

5. 10-Ampere automatic float and equalize battery charger with +/- 1% constant voltage regulation from no load to full load over +/-10% AC input line variation, current limited during engine cranking and short circuit conditions, temperature compensated for ambient temperatures from -40°C to +60°C, 5% accurate voltmeter and ammeter, fused, reverse polarity and transient protected. Battery charger equipped with alarm contacts, and shall be wired to the digital controller.

6. The engine exhaust silencer shall be coated to be temperature and rust resistance, rated for critical application. The silencer will reduce total engine exhaust noise by 25-35 dB(A).

7. Gas-proof, seamless, stainless steel, flexible exhaust bellows with threaded NPT connection.

8. Two flexible fuel lines rated 300°F and 100 psi ending in pipe thread.

9. Air cleaner restriction indicator to indicate the need for maintenance of the air cleaners.

10. The 10 relay dry contact kit provides normally open and normally closed contacts in a form C configuration to activate warning devices and other customer provided accessories allowing remote monitoring of the generator set. Typically, lamps, audible alarms, or other devices signal faults or status conditions.

11. Remote annunciator panel enabling the generator status to be viewed remotely. This remote annunciator panel shall include a fourteen (14) relay dry contact box for connection to the controller terminal strip. The panel shall have the capability to be either flush mounted or surface mounted.

12. Run Relay to provide a three-pole, double-throw relay with 10 amps at 250 VAC contacts for indicating that the generator is running, and provide a signal to the power louvers if applicable.

13. Common Failure relay to remotely signal auxiliary faults, emergency stop, high engine temperature, low oil pressure, over-crank, and over-speed via one single-pole, double-throw relay with 10 amps at 120 VAC contacts.

14. Generator heater to prevent the accumulation of moisture for dampness in the generator windings.

15. A radiator duct flange to provide a convenient connection to duct work for the radiator discharge air.

16. Generator pre-alarm senders.

17. Generator rodent guards.

18. Exhaust wall thimble shall be provided by the supplier, shipped loose for installation by the contractor.

19. A heavy duty rain cap shall be provided at the end of the exhaust piping

20. The entire exhaust system shall be provided with high heat insulation blankets as manufactured by Advanced thermal Products and to include the manifold, turbo's, exhaust flex, silencer, and piping to the exhaust thimble.

21. Supply four (4) complete sets of operation, maintenance, and parts manuals. Provide one (1) installation manual shipped with the set at time of delivery.

16811.2.5 TRANSFER SWITCH

16811.2.5.1 Testing. To assure that the equipment has been designed and built to the highest reliability and quality standards, the manufacturer and/or local representative shall be responsible for three separate tests: design prototype tests, final production tests, and site tests.

1. Design Prototype Tests: Components of the emergency system such as the engine/generator set, transfer switch, and accessories shall not be subjected to prototype tests since the tests are potentially damaging. Rather, similar design prototypes and pre-production models, which will not be sold, shall have been used for the following tests.

2. Production Tests

A. Final Production Tests: Each transfer switch shall be tested under load with all guards in place. Tests shall include:

1) The complete automatic transfer switch shall be tested to ensure proper operation of the individual components and correct overall sequence of operation and to ensure that the operating transfer time, voltage, frequency, and time delay settings are in compliance with the specification requirements.

2) The complete automatic transfer switch shall be subjected to a dielectric strength test per NEMA Standard ICS 1-109.05.

3) The control panel shall meet or exceed the voltage surge withstand capability in accordance with ANSI C37.90a-2978 and the impulse withstand voltage test in accordance with NEMA Standard ICS 1-109.

B. Upon request, arrangements to either witness this test will be made, or a certified test record will be sent prior to shipment.

3. Site Tests

A. Site Tests: The manufacturer's local representative shall perform an installation check, start-up, and building load test. The engineer, regular operators, and the maintenance staff shall be notified of the time and date of the site test.

16811.2.5.2 Electrical Requirements

1. Automatic transfer switches not intended for continuous duty or repetitive load transfer switching are not acceptable.

2. The automatic transfer switch shall be rated in amperes for total system transfer including control of motors, electric-discharge lamps, electric heating, and tungsten-filament lamp load. Switches rated 400 amperes and below shall be suitable for 100% tungsten-filament lamp load. Switches rated above 400 amperes shall be suitable for 30% tungsten-filament load.

3. The automatic transfer switch shall be rated to withstand the rms symmetrical short circuit current available at the automatic transfer switch terminals, with the type of over-current protection shown on the plans.

16811.2.5.3 Equipment

1. The automatic transfer switch shall be a Kohler model 300-2-200-E-1-F-11BG-240V program open transition type or equal.

2. The transfer switch shall have the following characteristics:

A. 200 Amp current rating
B. 2 Pole
C. 3 wire, 1 phase
D. 240 Volt-60Hz
E. Solid Neutral
F. The withstand and closing ratings with a current-limiting fuse shall be 200,000 Amps.
G. The withstand and closing ratings with any over-current protective device shall be 35,000 Amps.

3. The ATS shall be furnished in a NEMA 3R enclosure.

4. The switch shall be a 600 volt class.

16811.2.5.4 Mechanical Requirements

1. All main contacts shall be of silver composition. The main contacts shall be protected by Arcing contacts in sizes 400 amperes and above. The main contacts shall be of the blow-on configuration and of segmented construction in ratings 600 amperes and above.

2. All contacts, coils, springs, and control elements shall be conveniently removable from the front of the transfer switch without major disassembly or disconnection of power conductors.

3. The contact transfer time shall not exceed one-sixth of a second.

4. All moveable parts of the operating mechanism shall remain in positive mechanical contact with the main contacts during the transfer operation without the use of separate mechanical interlocks.

5. All contacts, coils, springs, and control elements shall be conveniently removable from the front of the transfer switch without major disassembly or disconnection of power conductors.

6. The neutral conductor shall be solidly connected as shown on the plans, a neutral conductor terminal plate with fully rated AL-CU pressure connectors shall be provided.

16811.2.5.5 Transfer Switch Control System

1. The control module shall direct the operation of the transfer switch. The module's sensing and Logic shall be a built-in microprocessor-based system for maximum reliability, minimum maintenance, and inherent digital communications capability. The control settings shall be stored in nonvolatile EEPROM. The module shall contain an integral battery-backed programmable clock and calendar. The control module shall have a keyed disconnect plug to enable the control module to be disconnected from the transfer mechanism for routine maintenance.

2. The control module shall be mounted separately from the transfer mechanism unit for safety and ease of maintenance. Interfacing relays shall be industrial control grade plug-in type with dust cover.

3. The control module shall include a user interface keypad with tactile feedback pushbuttons and light-emitting diode status indication. These features shall be user accessible when the enclosure door is closed;

   A. Keypad pushbuttons:
      1) Start/end system test
      2) Set/end exercise
      3) End time delay
      4) Lamp test/service reset

   B. Light-emitting diode status indicators:
      1) Contactor Position: Normal, Off, Emergency
      2) Source Available: Normal, Emergency
      3) Service required: immediate, maintenance
      4) Not in automatic mode
      5) Four stage time delay remaining
      6) Exercise: load, no load, set/disabled
      7) Test: load, no load
      8) Load control active: peak shave, load shed, pre/post-transfer signal
      9) In-phase monitor active

4. Outputs:

   A. Generator engine start gold flashed contact rated 2 amps @ 30 VDC/250 VAC.

B. Pre-transfer load control, one normally open contact rated 10 amps @ 30 VDC/250 VAC.

C. One Programmable output, factory-set to load bank control rated 2 amps @ 30 VDC/250 VAC.

16811.2.5.6 Operation

1. All phases of normal and all phases of emergency shall be monitored for over and under voltage and single phase of normal and emergency for over-and-under frequency. In addition, the controller shall use anti-single phasing protection that detects regenerative voltage (using the phase angle of the source to determine a failed source condition.

2. Voltage and frequency sensing:

A. Under-voltage pick-up set at 90% of nominal voltage, adjustable 85% - 100% of nominal voltage.

B. Under-voltage dropout set at 90% of pickup voltage, adjustable 75% -98% of pickup voltage.

C. Over-voltage dropout set at 110% of nominal voltage, adjustable 105% - 135% of nominal voltage.

D. Over-voltage pick-up set at 95% of dropout voltage, adjustable 85% - 100% of nominal voltage.

E. Voltage dropout time set at 0.5 seconds adjustable 0.1 – 9.9 seconds.

F. Voltage accuracy: 2%.

G. Under frequency pick-up set at 90% of nominal frequency, adjustable 85% - 95% of nominal frequency.

H. Under frequency dropout set at99% of pickup frequency, adjustable 95% - 99% of pickup frequency.

I. Over frequency dropout set at 101% of pickup frequency, adjustable 101% - 105% of nominal frequency.

J. Over frequency pickup set at 110% of nominal frequency, adjustable 105% - 120% of nominal frequency.

K. Frequency accuracy: 1%.

3. Time Delays:

A. Time delay for engine start to delay initiation of transfer for momentary source outages: Range 0-6 seconds. Factory set at 3 seconds.

B. Time delay for transfer to standby: Range 0-60 minutes. Factory set at 1 second.

C. Time delay for transfer back to normal: Range 0-60 minutes. Factory set at 15 minutes.

D. Time delay for engine cool down: Range 0-60 minutes. Factory set at 0 minutes.

E. Failure to acquire standby source: Range 0-60 minutes. Factory set at 1 minute.

F. Pre-transfer to normal signal: Range 0-60 minutes. Factory set at 3 seconds.

G. Pre-transfer to standby signal: Range 0-60 minutes. Factory set at 3 seconds.

H. Post-transfer to normal signal: Range 0-60 minutes. Factory set at 0 minute.

I. Post-transfer to standby signal: Range 0-60 minutes. Factory set at 0 minute.

4. User terminals shall be available to connect a normally open contact that, when closed, signals the control module to start and transfer load to the engine-generator. Opening these contacts shall initiate a retransfer and engine cool down sequence. The load shall be transferred to an available utility source immediately if the generator source should fail.

5. The following features shall be built into the control module logic. These features shall be enabled at the factory or in the field.

A. Phase rotation sensing programmable ABC or CBA.

B. In-phase monitoring shall continuously monitor the contactor transfer times, source voltage, frequency and phase angle to provide a self-adjusting, zero crossing contactor transfer signal. A flashing LED on the user interface panel shall indicate active in-phase monitoring.

C. Plant Exerciser: Programmable seven-day or fourteen-day exerciser with user selectable load or no-load operation. An LED, on the user interface, shall indicate the type of exercise (load or no load). The time remaining on the exercise shall be indicated. The exercise time may be reset at any time with a single keystroke. The engine shall be allowed to run when the exercise period is terminated. The exerciser may be disabled for maintenance purposes. An amber LED shall flash on the user interface if the exerciser has been disabled. The exerciser shall have the capability of being programmed using up to twenty-one (21) events for a calendar mode. The controller shall have provisions for disconnecting a load bank (during exercise) if there is a loss of normal power.

D. The control module must be upgradeable with the following options:
   1) Load she (programmed-transition models only) to force the transfer switch from Emergency to an off position.
   2) Provide four programmable input/output (I/O) modules with two inputs and six outputs each rated 2 amps @ 30 VDC/250 VAC.

16811.2.5.7 Monitoring, Programming and Communications:

1. Modbus link:

A. Industry standard Modbus® RTU communication shall be available with network and setup connections.

B. A Modbus® master will be able to monitor controller data.

C. A Modbus® master will be able to alter parameters.

D. The Modbus® master must be capable of starting and stopping the generator.

E. The manufacturer shall provide a Modbus® communications protocol manual to facilitate communications with a Modbus® master by a third party developer.

F. The Modbus® network shall communicate to the controller using a twisted pair of wire.

2. Personal Computer Set-up/monitoring Software

A. The controller must have the capability to communicate to a personal computer (IBM or compatible) running Windows 9X or Windows NT through an RS-232 communication format (in addition to the Modbus® connection).

B. The software shall be Windows® based.

C. The programming capability shall be password protected.

3. It shall be possible to start the generator and transfer the loads to the generator.

4. Event monitoring shall be accessible using either a personal computer with the personal computer software or Modbus®

A. Historical data (total and re-settable)
1) Days in operation
2) Hours in standby
3) Hours not in preferred
4) Switch transfers
5) Failure to transfer
6) Transfers due to loss of preferred
7) Start up date
8) Last maintenance date
9) Switch transfer count since last maintenance

B. Transfer switch information
1) ATS serial number
2) Controller serial number
3) Contactor serial number
4) Load description
5) Location
6) Branch
7) Network connection ID
8) Baud rate
9) Parity bit

C. System events (time and date stamped) of the last 100 events which include all failures of the sources, transfer switch and all functions of the controller and contactor:

D. Line to line voltage

E. System frequency

F. Time delay active

G. Time delay remaining

H. System status

I. Source available

J. Contactor position

K. Exerciser schedule, mode and time remaining on active exercise.

5. Programmable features may be viewed, selected or adjusted as follows:

A. System voltage
B. System frequency
C. Single/three-phase operation
D. Open/closed-transition operation
E. ABC or CBA phase rotation
F. In-phase monitor
G. Commit/no commit transfer mode
H. User defined password

6. Programmable inputs shall be defined using either a personal computer with the personal computer software or Modbus® link:

A. End time delay input
B. Inhibit transfer
C. Low external battery fault
D. Peak shave/area protection input
E. Remote common fault
F. Remote test

7. Programmable outputs shall be defined using either a personal computer with the personal computer software or Modbus® link:

A. Auxiliary switch fault
B. Common fault
C. Contactor position
D. Exercise active
E. Failure to acquire standby source
F. Failure to transfer fault
G. Generator engine start
H. Load bank control

I. Los of phase fault
J. Low backup battery
K. No in automatic mode
L. Non-emergency transfer
M. Over and under voltage faults
N. Over and under frequency faults
O. Peak shave/area protection active
P. Phase rotation error
Q. Modbus® - controlled relay outputs
R. Source available
S. Test active

8. Supply four (4) complete sets of operation, maintenance, and parts manuals. Provide one (1) installation manual at time of delivery with automatic transfer switch.

16811.3 CONSTRUCTION REQUIREMENTS

16811.3.1 Equipment and equipment installation shall meet all applicable state and local codes. Equipment supplied shall meet or exceed requirements of the following, as applicable:

NFPA 70 National Electrical Code
NFPA 110 Emergency and Standby Power Systems
NFPA 99 Health Care Facilities
NFPA 37 Installation of Stationary Engines
Underwriter's laboratories Standard 1008 Transfer Switch Equipment

16811.3.2 It is intended that all products specified herein be of standard ratings, therefore the kW and kVA ratings, ampere ratings, withstand and closing ratings, etc., shall be the manufacturer's next larger size or rating when the specifications cannot be exactly met.

16811.3.3 Package engine generator sets shall be anchored to the floor as per manufacturer's instructions.

16811.3.4 The CONTRACTOR shall follow all manufacturer's installations instructions.

16811.4 METHOD MEASUREMENT

16811.4.1 Measurement of the completed, functioning, and accepted standby generator and transfer switch will be made by the Lump Sum as shown on the BID schedule.

16811.5 BASIS OF PAYMENT

16811.5.1 The accepted quantities will be paid for at the contract unit price for:

PAY ITEM	UNIT
Standby Generator and Transfer Switch	Lump Sum