CONTRACT SPECIFICATIONS

Terrace Heights Water System
Well No. 4 Pump and Controls
Second Bidding

Yakima County Public Services
Project No. U6 3244
## CONTENTS

### BID DOCUMENTS
- Certificate .......................................................................................................................... 1
- Instructions to Bidders ........................................................................................................ 2
- Proposal .................................................................................................................................. 3
- Letter of Responsibility ......................................................................................................... 5
- Definition of Terms ............................................................................................................... 6
- Non-Collusion Declaration .................................................................................................... 7
- Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion ...... 8
- Contract ..................................................................................................................................... 9
- Performance Bond ................................................................................................................. 10

### STATE PREVAILING WAGE RATES

### SPECIAL PROVISIONS
- General Conditions ............................................................................................................. 1
- Description of Work ............................................................................................................. 1
- Funds ......................................................................................................................................... 2
- 1-01. Definitions and Terms ................................................................................................. 2
- 1-02. Bid Procedures and Conditions .................................................................................... 4
- 1-03. Award and Execution of Contract ................................................................................. 6
- 1-04. Scope of the Work ......................................................................................................... 8
- 1-05. Control of Work .......................................................................................................... 8
- 1-06. Control of Material ...................................................................................................... 9
- 1-07. Legal Relations and Responsibilities to the Public ......................................................... 9
- 1-08. Prosecution and Progress ......................................................................................... 15
- 1-09. Measurement and Payment ........................................................................................ 16

### ENGINEERING SPECIFICATIONS
- Division 1 - General Requirements ...................................................................................... 2
- Division 2 - Site Work .......................................................................................................... 3
- Division 3 - Concrete ........................................................................................................... 5
- Division 11 - Equipment ...................................................................................................... 6
- Division 15 - Mechanical ..................................................................................................... 12
- Division 16 - Electrical
  - 16010 Basic Electrical Requirements .......................................................................... 1-9
  - 16050 Basic Electrical Materials and Methods ................................................................. 1-9
  - 16060 Grounding .............................................................................................................. 1-4
  - 16120 Conductors and Cables .......................................................................................... 1-6
  - 16130 Raceways and Boxes ............................................................................................. 1-10
  - 16140 Wiring Devices ........................................................................................................ 1-4
  - 16210 Utility Service ......................................................................................................... 1-2
  - 16280 Power Filters and Conditioners ............................................................................. 1-2
PLANS

* * * * *
BID DOCUMENTS
CERTIFICATE

I hereby certify that the attached documents, plans and specifications conform to originals which are on file in the office of the County Engineer of Yakima County, Washington.

Joe Stump, P.E.
Utilities Manager
INSTRUCTIONS TO BIDDERS

DELIVERY OF PROPOSALS

Sealed bids will be received at the following location before the specified time:

Office of the Board of County Commissioners of Yakima County, Washington, Room 232, Yakima County Courthouse, Yakima, Washington 98901 until 2:00 p.m. of the bid opening date.

Each proposal, or bid shall be completely sealed in a separate package, addressed to the Engineer of Yakima County with the name of the improvements for which the bid is submitted plainly written on the outside of the package.

No oral, telephonic, facsimile, or telegraphic Bids or modifications shall be accepted.

DATE OF OPENING BIDS

The bid opening date for this project shall be September 13, 2007.

The bids shall be publicly opened and read after 2:00 p.m. on that date at the following location:

Yakima County Road Engineer’s Office, Room 419, Yakima County Courthouse, 128 N. 2nd Street, Yakima, Washington 98901.

RIGHT TO REJECT BIDS:

The right is reserved to reject any and all proposals, to accept the proposal or proposals deemed best for the County or to advertise for new proposals when in the opinion of the Board the best interest of the County shall be promoted thereby.

PROPOSAL GUARANTY:

A certified check, cashiers check, cash or bid bond made payable to the Treasurer of the County of Yakima for an amount equal to at least five percent (5%) of the total amount bid must accompany each bid as evidence of good faith and as a guarantee that if awarded the Contract the bidder shall execute the Contract and give Bond as required.

FORM FURNISHED:

Each bid must be made on the form attached to these Specifications.

CONTACT:

For information regarding this project, please contact Joe Stump in the County Road Engineer’s Office at (509) 574-2300.

YAKIMA COUNTY IS AN EQUAL OPPORTUNITY EMPLOYER
PROPOSAL

This certifies that the undersigned has examined the location of

U6 3244; TERRACE HEIGHTS WATER SYSTEM, WELL NO. 4 PUMP AND CONTROLS

And that the Plans, Specifications and Contract governing the work embraced in this improvement, and the method by which payment will be made for said work, is understood. The undersigned hereby proposes to undertake and complete the work embraced in this improvement, or as much as can be completed with the money available, in accordance with the said Plans, Specifications, and Contract, and the following schedule of rates and prices:

NOTE: Unit Prices for all items, all extensions, and total amount of bid shall be shown. No oral, telephonic, facsimile, or telegraphic Bids or modifications shall be considered or accepted.

<table>
<thead>
<tr>
<th>ITEM NO.</th>
<th>APPROX. QUANTITY</th>
<th>ITEM</th>
<th>PRICE PER UNIT</th>
<th>AMOUNT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>DOLLARS</td>
<td>DOLLARS</td>
</tr>
<tr>
<td>1</td>
<td>LUMP SUM</td>
<td>MOBILIZATION</td>
<td>AT</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>PER LUMP SUM</td>
<td>$</td>
</tr>
<tr>
<td>2</td>
<td>LUMP SUM</td>
<td>SITE WORK</td>
<td>AT</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>PER LUMP SUM</td>
<td>$</td>
</tr>
<tr>
<td>3</td>
<td>LUMP SUM</td>
<td>CONCRETE</td>
<td>AT</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>PER LUMP SUM</td>
<td>$</td>
</tr>
<tr>
<td>4</td>
<td>LUMP SUM</td>
<td>SUBMERSIBLE PUMP</td>
<td>AT</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>PER LUMP SUM</td>
<td>$</td>
</tr>
<tr>
<td>5</td>
<td>126</td>
<td>COLUMN PIPE</td>
<td>AT</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5-INCH DIAMETER</td>
<td></td>
<td>PER LINEAR FOOT</td>
<td>$</td>
</tr>
<tr>
<td>6</td>
<td>LUMP SUM</td>
<td>MECHANICAL</td>
<td>AT</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>PER LUMP SUM</td>
<td>$</td>
</tr>
<tr>
<td>7</td>
<td>LUMP SUM</td>
<td>ELECTRICAL</td>
<td>AT</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>PER LUMP SUM</td>
<td>$</td>
</tr>
</tbody>
</table>

Subtotal $ .

Washington State Sales Tax @ 7.9% $ .

BID TOTAL $ .
The bidder is hereby advised that by signature of this proposal he/she is deemed to have acknowledged all requirements and signed all certificates contained herein.

A proposal guaranty in an amount of five percent (5%) of the total bid, based upon the approximate estimate of quantities at the above prices and in the form as indicated below, is attached hereto:

CASH [ ] IN THE AMOUNT OF __________________________

CASHIER’S CHECK [ ] _______________________________ DOLLARS

CERTIFIED CHECK [ ] ($________) PAYABLE TO THE COUNTY TREASURER

PROPOSAL BOND [ ] IN THE AMOUNT OF 5 PERCENT (5%) OF THE BID

Bidder acknowledges receipt of the following Addendum’s:

<table>
<thead>
<tr>
<th>No.</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The undersigned has telephoned the Office of the Yakima County Engineer for verification of the number of Addendum’s issued.

SIGNATURE OF AUTHORIZED OFFICIAL(S)

Title: __________________________

Firm Name: __________________________

Address: __________________________

Phone No.: __________________________

Washington Registration No.: __________________________

Federal ID Tax No.: __________________________

UBI No.: __________________________

E-Mail Address: __________________________

Signed and sworn (or affirmed) before me on __________________________ (Date)

________________________________________

NOTARY PUBLIC

My appointment expires __________________________

State of ______________ County of ______________ (Seal and Stamp)

NOTE: (1) This proposal is not transferable and any alteration of the firm’s name entered hereon without prior permission from the County Engineer shall be cause for considering the proposal irregular and subsequent rejection of the bid.

(2) Please refer to Section 1-02.6 of the Standard Specifications, re: “Preparation of Proposal” or “Article 4” of the Instruction to Bidders for building construction jobs.

(3) Should it be necessary to modify this proposal either in writing or by electronic means, please make reference to the following proposal number in your communications: 1/6.3244.
LETTER OF RESPONSIBILITY

Date: ____________________
Utilities Project No.: U6 3244

TO:
BOARD OF COUNTY COMMISSIONERS OF YAKIMA COUNTY, WASHINGTON
(Party awarding principal contract)

Dear Sirs:

I hereby maintain that I am a responsible bidder as contemplated by the policies of the State of Washington (Chapter 157, Laws of Washington of 1937).

a. My permanent place of business is ________________________________, which I have maintained for _________ years.

b. I have adequate plant equipment to do expeditiously and properly the work contemplated for Yakima County, Washington.

DESCRIPTION OF WORK:

U6 3244: TERRACE HEIGHTS WATER SYSTEM WELL NO. 4 PUMP AND CONTROLS

List the equipment that will be used on this project:

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

c. I have adequate funds to promptly meet obligations incident to this work.

Bank reference: ____________________________________________________________

________________________________________________________________________

________________________________________________________________________

d. I have had experience in this class of work, having constructed the following improvements.

I hereby certify that the above is a true and accurate statement.

Very truly yours,

________________________________________________________________________

Contractor

NOTE: This “letter of responsibility” shall not be construed to be a request for prequalification of bidder.
DEFINITION OF TERMS

In interpreting these specifications, the following definitions shall prevail:


SECRETARY OF TRANSPORTATION: Secretary of Transportation of the State of Washington.

BOARD: The Board of County Commissioners of Yakima County.

ENGINEER: County, or construction engineer, or his duly authorized assistants by whom all explanations and directions necessary for the satisfactory prosecution and completion of the work described in these specifications will be given.

CONTRACTOR: The person, firm, co-partnership, or corporation, or any lawful agent of such person, firm, partnership or corporation constituting one of the principals to the contract and undertaking to perform the work herein specified.

CONTRACT: The Agreement between the Contractor and the County of Yakima acting through the Board of County Commissioners. The contract shall include the accepted “Proposal”, “Plans”, “Specifications” and “Contract Bond”, also any and all supplemental agreements which reasonably could be required to complete the construction of the work in a substantial and acceptable manner.

PROPOSAL: The written offer, or copy thereof of the bidder to perform the work proposed.

PLANS: The officially approved drawings, or reproductions thereof attached to this contract.

SPECIFICATIONS: The directions, provisions and requirements contained herein, together with all written agreements made, or to be made pertaining to the method and manner of performing the work, or to the quantities and qualities of materials to be furnished under the contract.

CONTRACT BOND: The approved form of security furnished by the Contractor and his surety as a guarantee of good faith on the part of the Contractor to execute the work in accordance with the terms of the contract.

LABORATORY: The laboratories of the Department of Transportation, or other laboratories designated by the engineer.

AMOUNT OF THE CONTRACT: For the purpose of awarding the contract and determining the amount of the bond, the lump sum bid, or the summation of the products of the approximate quantities shown on the plans or otherwise stated by the unit prices will be considered the total amount of the bid and the full amount of the contract price.
NON-COLLUSION DECLARATION

I, by signing the proposal, hereby declare, under penalty of perjury under the laws of the United States that the following statements are true and correct:

1. That the undersigned person(s), firm, association or corporation has (have) not, either directly or indirectly, entered into any agreement, participated in any collusion, or otherwise taken any action in restraint of free competitive bidding in connection with the project for which this proposal is submitted.

2. That by signing the signature page of this proposal, I am deemed to have signed and have agreed to the provisions of this declaration.
Certification Regarding
Debarment, Suspension, Ineligibility and Voluntary Exclusion
Lower Tier Covered Transactions

This certification is required by the regulations implementing Executive Order 12549, Debarment and Suspension, 29 CFR Part 98, Section 98.510, Participant’s responsibilities. The regulations were published as Part VII of the May 26, 1998 Federal Register (pages 19160-19211).

(BEFORE COMPLETING CERTIFICATION, READ ATTACHED INSTRUCTIONS WHICH ARE AN INTEGRAL PART OF THE CERTIFICATION)

(1) The prospective recipient of federal assistance funds certifies, by submission of this proposal, that neither it nor its principals are presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any federal department or agency.

(2) Where the prospective recipient of federal assistance funds is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

Name and Title of Authorized Representative

__________________________
Signature

__________________________
Date
CONTRACT

THIS AGREEMENT, made and entered into between Yakima County acting under and by virtue of Titles 36 and 39 RCW, hereinafter called the “COUNTY” and __________________________, hereinafter called the “CONTRACTOR”.

That in consideration of the terms and conditions contained herein and attached and made a part of this agreement, the parties hereto covenant and agree as follows:

I. The CONTRACTOR shall do all work and furnish all tools, materials and equipment for U6 3244: TERRACE HEIGHTS WATER SYSTEM WELL NO. 4 PUMP AND CONTROLS and shall perform any changes in the work in accordance with the Contract Documents. “Contract Documents” are this Contract, the attached Plans and Specifications and the current edition of the Standard Specifications of the Washington State Department of Transportation and American Public Works Association which are by this reference incorporated herein and made a part hereof. In using said Standard Specifications and Amendments thereto, “Secretary of Transportation”, “Engineer” and like terms used therein will be construed to mean Yakima County Engineer and “State” or “Thurston County” shall mean Yakima County.

II. The CONTRACTOR shall provide and bear the expense of all equipment, material and labor of any sort whatsoever that may be required for the transfer of materials and for constructing and completing the work provided for in the Contract Documents except those items mentioned therein to be furnished by Yakima County.

III. The COUNTY hereby promises and agrees to pay the CONTRACTOR according to the attached Specifications and the schedule of unit or itemized prices at the time and in the manner and upon the conditions provided for in the Contract Documents.

IV. The CONTRACTOR for itself, and for its heirs, executors, administrators, successors and assigns does hereby agree to the full performance of all the covenants herein contained upon the part of the CONTRACTOR.

V. It is further provided that no liability shall attach to the COUNTY by reason of entering into this Contract, except as expressly provided herein.

IN WITNESS WHEREOF, the CONTRACTOR has executed this instrument, on the date indicated below and Yakima County has caused this instrument to be executed in the name of said COUNTY by and through the Board of Yakima County Commissioners on the date indicated below.

Executed by the CONTRACTOR, 20__.

BOARD OF YAKIMA COUNTY COMMISSIONERS

CONTRACTOR

____________________________
Signature

____________________________
Print or Type Name of Person Signing

____________________________
Title

Foregoing Contract approved and ratified, 20__.

____________________________
Surety

____________________________
Attorney-in-fact

Michael D. Leita, Chairman

Ronald F. Gamache, Commissioner

J. Rand Elliott, Commissioner

Constituting the Board of County Commissioners for Yakima County Washington

ATTEST: Clerk of the Board

Christina S. Steiner

Approved as to form:

Deputy Prosecuting Attorney

U6 3244

BID DOCUMENTS

9
PERFORMANCE AND PAYMENT BOND
(RCW 39.08)

KNOW ALL MEN BY THESE PRESENTS, That___________________________, as “PRINCIPAL”, and ______________________________, a corporation authorized to do business in the State of Washington, as “SURETY”, are jointly and severally held and bound unto Yakima County, Washington in the penal sum__________________________ Dollars ($______________) for the payment of which by these presents we jointly and severally bind ourselves, our heirs, executors, administrators, assigns, and successors.

THE CONDITION of this bond is such that WHEREAS, on ___________________, 20___, the PRINCIPAL executed a certain Contract with the County, by the terms of which PRINCIPAL agrees to furnish all material and labor and will undertake and complete the construction of U6 3244, Terrace Heights Water System Well No. 4 Pump and Controls according to the maps, plans and specifications made a part of said Contract, which Contract is attached hereto and by this reference is incorporated herein and made a part hereof. FURTHER, the SURETY agrees to be bound by the laws of the State of Washington and subjected to the jurisdiction of the State of Washington.

NOW, THEREFORE, if the PRINCIPAL shall faithfully perform all the provisions of such contract and pay all laborers, mechanics, subcontractors and materialmen, and all persons who supply such persons or subcontractors with provisions or supplies for the carrying on of such work, including work that may be required during the one year guaranty period, then this obligation to be void, otherwise to remain in full force and effect.

Dated this ______ day of________________________, 20___.

PRINCIPAL

By:__________________________

Title:________________________

SURETY

By:__________________________

Attorney-in-Fact

Name of Local Office of Agent

Address of Local Office Agent

BOND NUMBER

APPROVED: YAKIMA COUNTY

By:__________________________

Chair of the Board of
Yakima County Commissioners

Date:__________________________ 20___

Approved as to form:

Deputy Prosecuting Attorney

YAKIMA COUNTY CONTRACT NUMBER
STATE PREVAILING WAGE RATES
State of Washington  
DEPARTMENT OF LABOR AND INDUSTRIES  
Prevailing Wage Section - Telephone (360) 902-5335  
PO Box 44540, Olympia, WA 98504-4540  

Washington State Prevailing Wage Rates For Public Works Contracts  
The PREVAILING WAGES listed here include both the hourly wage rate and the hourly rate of fringe benefits.  
On public works projects, workers' wage and benefit rates must add to not less than this total. A brief  
description of overtime calculation requirements is provided on the Benefit Code Key.  

YAKIMA COUNTY  
Effective 03-03-07  

<table>
<thead>
<tr>
<th>Classification</th>
<th>PREVAILING WAGE</th>
<th>Over</th>
<th>Time</th>
<th>Holiday</th>
<th>Note</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASBESTOS ABATEMENT WORKERS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>JOURNEY LEVEL</td>
<td>$27.81</td>
<td>1M</td>
<td>5D</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BOILERMAKERS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>JOURNEY LEVEL</td>
<td>$47.47</td>
<td>1C</td>
<td>5N</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BRICK AND MARBLE MASONS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>JOURNEY LEVEL</td>
<td>$35.37</td>
<td>1M</td>
<td>5A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CABINET MAKERS (IN SHOP)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>JOURNEY LEVEL</td>
<td>$19.24</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CARPENTERS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ACOUSTICAL WORKER</td>
<td>$32.70</td>
<td>1M</td>
<td>5D</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BRIDGE, DOCK AND WARD CARPENTERS</td>
<td>$40.99</td>
<td>1M</td>
<td>5D</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CARPENTER</td>
<td>$32.70</td>
<td>1M</td>
<td>5D</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CREOSOTED MATERIAL</td>
<td>$32.70</td>
<td>1M</td>
<td>5D</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DRYWALL APPLICATOR</td>
<td>$32.70</td>
<td>1M</td>
<td>5D</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FLOOR FINISHER</td>
<td>$32.70</td>
<td>1M</td>
<td>5D</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FLOOR LAYER</td>
<td>$32.70</td>
<td>1M</td>
<td>5D</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FLOOR SANDER</td>
<td>$32.70</td>
<td>1M</td>
<td>5D</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MILLWRIGHT</td>
<td>$41.99</td>
<td>1M</td>
<td>5D</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PILEDRIVERS, DRIVING, PULLING, PLACING COLLARS AND WELDING</td>
<td>$40.99</td>
<td>1M</td>
<td>5D</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SAWFILER</td>
<td>$32.70</td>
<td>1M</td>
<td>5D</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SHINGLER</td>
<td>$32.70</td>
<td>1M</td>
<td>5D</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>STATIONARY POWER SAW OPERATOR</td>
<td>$32.70</td>
<td>1M</td>
<td>5D</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>STATIONARY WOODWORKING TOOLS</td>
<td>$32.70</td>
<td>1M</td>
<td>5D</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CEMENT MASONANS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>JOURNEY LEVEL</td>
<td>$31.46</td>
<td>1N</td>
<td>5D</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DIVERS &amp; TENDERS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DIVER</td>
<td>$85.75</td>
<td>1M</td>
<td>5D</td>
<td></td>
<td>8A</td>
<td></td>
</tr>
<tr>
<td>DIVER TENDER</td>
<td>$44.22</td>
<td>1M</td>
<td>5D</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DREDGE WORKERS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ASSISTANT ENGINEER</td>
<td>$42.02</td>
<td>1T</td>
<td>5D</td>
<td></td>
<td>8L</td>
<td></td>
</tr>
<tr>
<td>ASSISTANT MATE (DECKHAND)</td>
<td>$41.51</td>
<td>1T</td>
<td>5D</td>
<td></td>
<td>8L</td>
<td></td>
</tr>
<tr>
<td>BOATMEN</td>
<td>$42.02</td>
<td>1T</td>
<td>5D</td>
<td></td>
<td>8L</td>
<td></td>
</tr>
<tr>
<td>ENGINEER WELDER</td>
<td>$42.07</td>
<td>1T</td>
<td>5D</td>
<td></td>
<td>8L</td>
<td></td>
</tr>
<tr>
<td>LEVERMAN, HYDRAULIC</td>
<td>$43.64</td>
<td>1T</td>
<td>5D</td>
<td></td>
<td>8L</td>
<td></td>
</tr>
<tr>
<td>MAINTENANCE</td>
<td>$41.51</td>
<td>1T</td>
<td>5D</td>
<td></td>
<td>8L</td>
<td></td>
</tr>
<tr>
<td>MATES</td>
<td>$42.02</td>
<td>1T</td>
<td>5D</td>
<td></td>
<td>8L</td>
<td></td>
</tr>
<tr>
<td>OILER</td>
<td>$41.64</td>
<td>1T</td>
<td>5D</td>
<td></td>
<td>8L</td>
<td></td>
</tr>
<tr>
<td>DRYWALL TAPERS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>JOURNEY LEVEL</td>
<td>$29.44</td>
<td>1P</td>
<td>5A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ELECTRICIANS - INSIDE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>JOURNEY LEVEL</td>
<td>$44.54</td>
<td>1E</td>
<td>5A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ELECTRICIANS - POWERLINE CONSTRUCTION</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CABLE SPICER</td>
<td>$55.40</td>
<td>4A</td>
<td>5A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CERTIFIED LINE WELDER</td>
<td>$49.64</td>
<td>4A</td>
<td>5A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GROUNDPERSON</td>
<td>$35.92</td>
<td>4A</td>
<td>5A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HEAD GROUNDPERSON</td>
<td>$37.88</td>
<td>4A</td>
<td>5A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HEAVY LINE EQUIPMENT OPERATOR</td>
<td>$49.64</td>
<td>4A</td>
<td>5A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>JACKHAMMER OPERATOR</td>
<td>$37.88</td>
<td>4A</td>
<td>5A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>JOURNEY LEVEL LINEPERSON</td>
<td>$49.64</td>
<td>4A</td>
<td>5A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LINE EQUIPMENT OPERATOR</td>
<td>$42.26</td>
<td>4A</td>
<td>5A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>POLE SPRAYER</td>
<td>$49.64</td>
<td>4A</td>
<td>5A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>POWDERPERSON</td>
<td>$37.88</td>
<td>4A</td>
<td>5A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Classification</td>
<td>Prevailing Wage</td>
<td>Time Code</td>
<td>Holiday Code</td>
<td>Note Code</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----------------------------------------------------</td>
<td>-----------------</td>
<td>-----------</td>
<td>--------------</td>
<td>-----------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ELECTRONIC TECHNICIANS JOURNEY LEVEL</td>
<td>$23.40</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ELEVATOR Constructors</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MECHANIC</td>
<td>$57.88</td>
<td>4A</td>
<td>6Q</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MECHANIC IN CHARGE</td>
<td>$63.45</td>
<td>4A</td>
<td>6Q</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FENCE ERECTORS</td>
<td>$21.64</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FLAGGERS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>JOURNEY LEVEL</td>
<td>$26.09</td>
<td>1M</td>
<td>5D</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GLAZIERS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>JOURNEY LEVEL</td>
<td>$21.51</td>
<td>1B</td>
<td>6I</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HEAT &amp; FROST INSULATORS AND ASBESTOS WORKERS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MECHANIC</td>
<td>$23.18</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HOD CARRIERS &amp; MASON TENDERS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>JOURNEY LEVEL</td>
<td>$28.29</td>
<td>1M</td>
<td>5D</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>INSULATION APPLICATORS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>JOURNEY LEVEL</td>
<td>$32.91</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IRONWORKERS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>JOURNEY LEVEL</td>
<td>$43.45</td>
<td>1O</td>
<td>5A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LABORERS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ALL CLASSIFICATIONS</td>
<td>$18.12</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LANDSCAPE CONSTRUCTION</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IRRIGATION OR LAWN SPRINKLER INSTALLERS</td>
<td>$7.93</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LANDSCAPE EQUIPMENT OPERATORS OR TRUCK DRIVERS</td>
<td>$15.45</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LANDSCAPING OR PLANTING LABORERS</td>
<td>$7.93</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LATHERS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>JOURNEY LEVEL</td>
<td>$32.70</td>
<td>1M</td>
<td>5D</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PAINTERS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>JOURNEY LEVEL</td>
<td>$20.05</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PLASTERERS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>JOURNEY LEVEL</td>
<td>$41.23</td>
<td>1R</td>
<td>5A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PLUMBERS &amp; PIPEFITTERS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>JOURNEY LEVEL</td>
<td>$51.65</td>
<td>1Q</td>
<td>5A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>POWER EQUIPMENT OPERATORS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ASSISTANT ENGINEERS</td>
<td>$39.57</td>
<td>1M</td>
<td>5D</td>
<td>6L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BACKHOE, EXCAVATOR, SHOVEL (3 YD &amp; UNDER)</td>
<td>$42.35</td>
<td>1M</td>
<td>5D</td>
<td>6L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BACKHOE, EXCAVATOR, SHOVEL (OVER 3 YD &amp; UNDER 6 YD)</td>
<td>$42.84</td>
<td>1M</td>
<td>5D</td>
<td>6L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BACKHOE, EXCAVATOR, SHOVEL (6 YD AND OVER WITH</td>
<td>$43.39</td>
<td>1M</td>
<td>5D</td>
<td>6L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BACKHOES, (75 HP &amp; UNDER)</td>
<td>$41.93</td>
<td>1M</td>
<td>5D</td>
<td>6L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BACKHOES, (OVER 75 HP)</td>
<td>$42.35</td>
<td>1M</td>
<td>5D</td>
<td>6L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BARRIER MACHINE (ZIPPER)</td>
<td>$42.35</td>
<td>1M</td>
<td>5D</td>
<td>6L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BATCH PLANT OPERATOR, CONCRETE</td>
<td>$42.35</td>
<td>1M</td>
<td>5D</td>
<td>6L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BELT LOADERS (ELEVATING TYPE )</td>
<td>$41.93</td>
<td>1M</td>
<td>5D</td>
<td>6L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BOBCAT (SKID STEER)</td>
<td>$39.57</td>
<td>1M</td>
<td>5D</td>
<td>6L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BROOMS</td>
<td>$39.57</td>
<td>1M</td>
<td>5D</td>
<td>6L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BUMP CUTTER</td>
<td>$42.35</td>
<td>1M</td>
<td>5D</td>
<td>6L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CABLEWAYS</td>
<td>$42.84</td>
<td>1M</td>
<td>5D</td>
<td>6L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CHIPPER</td>
<td>$42.35</td>
<td>1M</td>
<td>5D</td>
<td>6L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>COMPRESSORS</td>
<td>$39.57</td>
<td>1M</td>
<td>5D</td>
<td>6L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CONCRETE FINISH MACHINE - LASER SCREED</td>
<td>$39.57</td>
<td>1M</td>
<td>5D</td>
<td>6L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CONCRETE PUMPS</td>
<td>$41.93</td>
<td>1M</td>
<td>5D</td>
<td>6L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CONCRETE PUMP-TRUCK MOUNT WITH BOOM ATTACHMENT</td>
<td>$42.35</td>
<td>1M</td>
<td>5D</td>
<td>6L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CONVEYORS</td>
<td>$41.93</td>
<td>1M</td>
<td>5D</td>
<td>6L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CRANES, THRU 19 TONS, WITH ATTACHMENTS</td>
<td>$41.93</td>
<td>1M</td>
<td>5D</td>
<td>6L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CRANES, 20 - 44 TONS, WITH ATTACHMENTS</td>
<td>$42.35</td>
<td>1M</td>
<td>5D</td>
<td>6L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CRANES, 45 TONS - 89 TONS, UNDER 150 FT OF BOOM (INCLUDING JIB WITH ATTACHMENTS)</td>
<td>$42.84</td>
<td>1M</td>
<td>5D</td>
<td>6L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CRANES, 100 TONS - 199 TONS, OR 150 FT OF BOOM (INCLUDING JIB WITH ATTACHMENTS)</td>
<td>$43.39</td>
<td>1M</td>
<td>5D</td>
<td>6L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CRANES, 200 TONS TO 300 TONS, OR 250 FT OF BOOM (INCLUDING JIB WITH ATTACHMENTS)</td>
<td>$43.96</td>
<td>1M</td>
<td>5D</td>
<td>6L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Classification</td>
<td>PREVAILING WAGE</td>
<td>Over Time</td>
<td>Holiday Code</td>
<td>Note Code</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-------------------------------------------------------------------------------</td>
<td>------------------</td>
<td>-----------</td>
<td>--------------</td>
<td>-----------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WITH ATTACHMENTS)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CRANES, A-FRAME, 10 TON AND UNDER</td>
<td>$39.57</td>
<td>1M</td>
<td>5D</td>
<td>8L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CRANES, A-FRAME, OVER 10 TON</td>
<td>$41.93</td>
<td>1M</td>
<td>5D</td>
<td>8L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CRANES, OVER 300 TONS, OR 300 OF BOOM INCLUDING JIB WITH ATTACHMENTS</td>
<td>$44.52</td>
<td>1M</td>
<td>5D</td>
<td>8L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CRANES, OVERHEAD, BRIDGE TYPE (20 - 44 TONS)</td>
<td>$42.35</td>
<td>1M</td>
<td>5D</td>
<td>8L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CRANES, OVERHEAD, BRIDGE TYPE (45 - 99 TONS)</td>
<td>$42.84</td>
<td>1M</td>
<td>5D</td>
<td>8L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CRANES, OVERHEAD, BRIDGE TYPE (100 TONS &amp; OVER)</td>
<td>$43.39</td>
<td>1M</td>
<td>5D</td>
<td>8L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CRANES, TOWER CRANE UP TO 175' IN HEIGHT, BASE TO BOOM</td>
<td>$43.39</td>
<td>1M</td>
<td>5D</td>
<td>8L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CRANES, TOWER CRANE OVER 175' IN HEIGHT, BASE TO BOOM</td>
<td>$43.96</td>
<td>1M</td>
<td>5D</td>
<td>8L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CRUSHERS</td>
<td>$42.35</td>
<td>1M</td>
<td>5D</td>
<td>8L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DECK ENGINEER/DECK WINCHES (POWER)</td>
<td>$42.35</td>
<td>1M</td>
<td>5D</td>
<td>8L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DERRICK, BUILDING</td>
<td>$42.64</td>
<td>1M</td>
<td>5D</td>
<td>8L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DOZERS, D-9 &amp; UNDER</td>
<td>$41.93</td>
<td>1M</td>
<td>5D</td>
<td>8L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DRILL OILERS - AUGER TYPE, TRUCK OR CRANE MOUNT</td>
<td>$41.93</td>
<td>1M</td>
<td>5D</td>
<td>8L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DRILLING MACHINE</td>
<td>$42.35</td>
<td>1M</td>
<td>5D</td>
<td>8L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ELEVATOR AND MANLIFT, PERMANENT AND SHAFT-TYPE</td>
<td>$39.57</td>
<td>1M</td>
<td>5D</td>
<td>8L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EQUIPMENT SERVICE ENGINEER (OILER)</td>
<td>$41.93</td>
<td>1M</td>
<td>5D</td>
<td>8L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FINISHING MACHINE/BIDWELL GAMACO AND SIMILAR EQUIP</td>
<td>$42.35</td>
<td>1M</td>
<td>5D</td>
<td>8L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FORK LIFTS, (3000 LBS AND OVER)</td>
<td>$41.93</td>
<td>1M</td>
<td>5D</td>
<td>8L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FORK LIFTS, (UNDER 3000 LBS)</td>
<td>$39.57</td>
<td>1M</td>
<td>5D</td>
<td>8L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GRADE ENGINEER</td>
<td>$41.93</td>
<td>1M</td>
<td>5D</td>
<td>8L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GRADE CHECKER AND STAKEMAN</td>
<td>$39.57</td>
<td>1M</td>
<td>5D</td>
<td>8L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GUARDRAIL PUNCH</td>
<td>$42.35</td>
<td>1M</td>
<td>5D</td>
<td>8L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HOISTS, OUTSIDE (ELEVATORS AND MANLIFTS), AIR TUGGERS</td>
<td>$41.93</td>
<td>1M</td>
<td>5D</td>
<td>8L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HORIZONTAL/DIRECTIONAL DRILL LOCATOR</td>
<td>$41.93</td>
<td>1M</td>
<td>5D</td>
<td>8L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HORIZONTAL/DIRECTIONAL DRILL OPERATOR</td>
<td>$42.35</td>
<td>1M</td>
<td>5D</td>
<td>8L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HYDRAULICS/BOOM TRUCKS (10 TON &amp; UNDER)</td>
<td>$39.57</td>
<td>1M</td>
<td>5D</td>
<td>8L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HYDRAULICS/BOOM TRUCKS (OVER 10 TON)</td>
<td>$41.93</td>
<td>1M</td>
<td>5D</td>
<td>8L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LOADERS, OVERHEAD (6 YD UP TO 8 YD)</td>
<td>$42.84</td>
<td>1M</td>
<td>5D</td>
<td>8L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LOADERS, OVERHEAD (8 YD &amp; OVER)</td>
<td>$43.39</td>
<td>1M</td>
<td>5D</td>
<td>8L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LOADERS, OVERHEAD (UNDER 6 YD), PLANT FEED</td>
<td>$42.35</td>
<td>1M</td>
<td>5D</td>
<td>8L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LOCOMOTIVES, ALL</td>
<td>$42.35</td>
<td>1M</td>
<td>5D</td>
<td>8L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MECHANICS, ALL</td>
<td>$42.84</td>
<td>1M</td>
<td>5D</td>
<td>8L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MIXERS, ASPHALT PLANT</td>
<td>$42.35</td>
<td>1M</td>
<td>5D</td>
<td>8L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MOTOR PATROL GRADER (FINISHING)</td>
<td>$42.35</td>
<td>1M</td>
<td>5D</td>
<td>8L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MOTOR PATROL GRADER (NON-FINISHING)</td>
<td>$41.93</td>
<td>1M</td>
<td>5D</td>
<td>8L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MUCKING MACHINE, MINE, TUNNEL DRILL AND/OR SHIELD</td>
<td>$42.84</td>
<td>1M</td>
<td>5D</td>
<td>8L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OIL DISTRIBUTORS, BLOWER DISTRIBUTION AND MULCH SEEDING OPERATOR</td>
<td>$39.57</td>
<td>1M</td>
<td>5D</td>
<td>8L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PAVEMENT BREAKER</td>
<td>$39.57</td>
<td>1M</td>
<td>5D</td>
<td>8L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PILE DRIVER (OTHER THAN CRANE MOUNT)</td>
<td>$42.35</td>
<td>1M</td>
<td>5D</td>
<td>8L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PLANT OILER (ASPHALT, CRUSHER)</td>
<td>$41.93</td>
<td>1M</td>
<td>5D</td>
<td>8L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>POSTHOLE DIGGER, MECHANICAL</td>
<td>$39.57</td>
<td>1M</td>
<td>5D</td>
<td>8L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>POWER PLANT</td>
<td>$39.57</td>
<td>1M</td>
<td>5D</td>
<td>8L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PUMPS, WATER</td>
<td>$39.57</td>
<td>1M</td>
<td>5D</td>
<td>8L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>QUAD 9, D-10, AND HD-41</td>
<td>$42.84</td>
<td>1M</td>
<td>5D</td>
<td>8L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>REMOTE CONTROL OPERATOR ON RUBBER TIRED EARTH MOVING EQUIP</td>
<td>$42.84</td>
<td>1M</td>
<td>5D</td>
<td>8L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RIGGER AND BELLMAN</td>
<td>$39.57</td>
<td>1M</td>
<td>5D</td>
<td>8L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ROLLAGON</td>
<td>$42.84</td>
<td>1M</td>
<td>5D</td>
<td>8L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ROLLER, OTHER THAN PLANT ROAD MIX</td>
<td>$39.57</td>
<td>1M</td>
<td>5D</td>
<td>8L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ROLLERS, PLANTMIX OR MULTILIFT MATERIALS</td>
<td>$41.93</td>
<td>1M</td>
<td>5D</td>
<td>8L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ROTO-MILL, ROTO-GRINDER</td>
<td>$42.35</td>
<td>1M</td>
<td>5D</td>
<td>8L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SAWS, CONCRETE</td>
<td>$41.93</td>
<td>1M</td>
<td>5D</td>
<td>8L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SCRAPERS - SELF PROPELLED, HARD TAIL END DUMP, ARTICULATING</td>
<td>$42.35</td>
<td>1M</td>
<td>5D</td>
<td>8L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SCRAPERS - SELF PROPELLED, HARD TAIL END DUMP, ARTICULATING</td>
<td>$42.84</td>
<td>1M</td>
<td>5D</td>
<td>8L</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Page 3
<table>
<thead>
<tr>
<th>Classification</th>
<th>PREVAILING WAGE</th>
<th>Over Time Code</th>
<th>Holiday Code</th>
<th>Note Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>OFF-ROAD EQUIPMENT (45 YD AND OVER)</td>
<td>$41.93</td>
<td>1M 5D</td>
<td>5D</td>
<td>8L</td>
</tr>
<tr>
<td>SCRAPPERS, CONCRETE AND CARRY ALL</td>
<td>$42.35</td>
<td>1M 5D</td>
<td>5D</td>
<td>8L</td>
</tr>
<tr>
<td>SCREAM MAN</td>
<td>$39.57</td>
<td>1M 5D</td>
<td>5D</td>
<td>8L</td>
</tr>
<tr>
<td>SHOTCRETE GUNITE</td>
<td>$42.84</td>
<td>1M 5D</td>
<td>5D</td>
<td>8L</td>
</tr>
<tr>
<td>SLUFORM PAVERS</td>
<td>$42.35</td>
<td>1M 5D</td>
<td>5D</td>
<td>8L</td>
</tr>
<tr>
<td>SPREADER, TOPSIDE OPERATOR - BLAW KNOX</td>
<td>$42.35</td>
<td>1M 5D</td>
<td>5D</td>
<td>8L</td>
</tr>
<tr>
<td>SUBGRADE TRIMMER</td>
<td>$42.35</td>
<td>1M 5D</td>
<td>5D</td>
<td>8L</td>
</tr>
<tr>
<td>TOWER BUCKET ELEVATORS</td>
<td>$41.93</td>
<td>1M 5D</td>
<td>5D</td>
<td>8L</td>
</tr>
<tr>
<td>TRACTORS, (75 HP &amp; UNDER)</td>
<td>$41.93</td>
<td>1M 5D</td>
<td>5D</td>
<td>8L</td>
</tr>
<tr>
<td>TRACTORS, (OVER 75 HP)</td>
<td>$42.35</td>
<td>1M 5D</td>
<td>5D</td>
<td>8L</td>
</tr>
<tr>
<td>TRANSFER MATERIAL SERVICE MACHINE</td>
<td>$42.35</td>
<td>1M 5D</td>
<td>5D</td>
<td>8L</td>
</tr>
<tr>
<td>TRANSPORTERS, ALL TRACK OR TRUCK TYPE</td>
<td>$42.84</td>
<td>1M 5D</td>
<td>5D</td>
<td>8L</td>
</tr>
<tr>
<td>TRENCHING MACHINES</td>
<td>$41.93</td>
<td>1M 5D</td>
<td>5D</td>
<td>8L</td>
</tr>
<tr>
<td>TRUCK CRANE OILER/DRIVER (UNDER 100 TON)</td>
<td>$41.93</td>
<td>1M 5D</td>
<td>5D</td>
<td>8L</td>
</tr>
<tr>
<td>TRUCK CRANE OILER/DRIVER (100 TON &amp; OVER)</td>
<td>$42.35</td>
<td>1M 5D</td>
<td>5D</td>
<td>8L</td>
</tr>
<tr>
<td>TRUCK MOUNT PORTABLE CONVEYOR</td>
<td>$42.35</td>
<td>1M 5D</td>
<td>5D</td>
<td>8L</td>
</tr>
<tr>
<td>WHEEL TRACTORS, FARMALL TYPE</td>
<td>$39.57</td>
<td>1M 5D</td>
<td>5D</td>
<td>8L</td>
</tr>
<tr>
<td>YO YO PAY DOZER</td>
<td>$42.35</td>
<td>1M 5D</td>
<td>5D</td>
<td>8L</td>
</tr>
<tr>
<td>POWER LINE CLEARANCE TREE TRIMMERS</td>
<td>$35.62</td>
<td>4A 5A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>JOURNEY LEVEL IN CHARGE</td>
<td>$33.82</td>
<td>4A 5A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SPRAY PERSON</td>
<td>$34.27</td>
<td>4A 5A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TREE EQUIPMENT OPERATOR</td>
<td>$31.88</td>
<td>4A 5A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TREE TRIMMER</td>
<td>$24.03</td>
<td>4A 5A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TREE TRIMMER GROUNDPERSON</td>
<td>$51.65</td>
<td>1Q 5A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>REFRIGERATION &amp; AIR CONDITIONING MECHANICS</td>
<td>$29.75</td>
<td>2P 5I</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ROOFERS</td>
<td>$32.75</td>
<td>2P 5I</td>
<td></td>
<td></td>
</tr>
<tr>
<td>JOURNEY LEVEL</td>
<td>$40.51</td>
<td>1B 5A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SHEET METAL WORKERS</td>
<td>$23.11</td>
<td>1N 5A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SOFT FLOOR LAYERS</td>
<td>$7.93</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SPRINKLER FITTERS (FIRE PROTECTION)</td>
<td>$41.70</td>
<td>1R 5Q</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SURVEYORS</td>
<td>$16.81</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>INSTRUMENT PERSON</td>
<td>$12.05</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PARTY CHIEF</td>
<td>$15.05</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TELECOMMUNICATION TECHNICIANS</td>
<td>$20.00</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TELEPHONE LINE CONSTRUCTION - OUTSIDE</td>
<td>$29.89</td>
<td>2B 5A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HOLE DIGGER/GROUND PERSON</td>
<td>$28.68</td>
<td>2B 5A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>JOURNEY LEVEL TELEPHONE LEPERSON</td>
<td>$27.82</td>
<td>2B 5A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SPECIAL APPARATUS INSTALLER I</td>
<td>$29.89</td>
<td>2B 5A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SPECIAL APPARATUS INSTALLER II</td>
<td>$29.89</td>
<td>2B 5A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TELEPHONE EQUIPMENT OPERATOR (HEAVY)</td>
<td>$27.82</td>
<td>2B 5A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TELEVISION GROUND PERSON</td>
<td>$15.96</td>
<td>2B 5A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TELEVISION LINEPERSON/INSTALLER</td>
<td>$21.17</td>
<td>2B 5A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TELEVISION SYSTEM TECHNICIAN</td>
<td>$25.15</td>
<td>2B 5A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TELEVISION TECHNICIAN</td>
<td>$22.64</td>
<td>2B 5A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TREE TRIMMER</td>
<td>$27.82</td>
<td>2B 5A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TERRAZZO WORKERS &amp; TILE SETTERS</td>
<td>$27.57</td>
<td>2B 5A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Classification</td>
<td>PREVAILING WAGE</td>
<td>Time Code</td>
<td>Holiday Code</td>
<td>Note Code</td>
</tr>
<tr>
<td>--------------------------------------------</td>
<td>-----------------</td>
<td>-----------</td>
<td>--------------</td>
<td>-----------</td>
</tr>
<tr>
<td>TILE, MARBLE &amp; TERRAZZO FINISHERS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FINISHER</td>
<td>$23.62</td>
<td>2M</td>
<td>5A</td>
<td></td>
</tr>
<tr>
<td>TRAFFIC CONTROL STRIPERS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>JOURNEY LEVEL</td>
<td>$34.90</td>
<td>1K</td>
<td>5A</td>
<td></td>
</tr>
<tr>
<td>TRUCK DRIVERS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ASPHALT MIX</td>
<td>$14.19</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DUMP TRUCK</td>
<td>$30.93</td>
<td>2G</td>
<td>6I</td>
<td></td>
</tr>
<tr>
<td>DUMP TRUCK &amp; TRAILER</td>
<td>$30.93</td>
<td>2G</td>
<td>6I</td>
<td></td>
</tr>
<tr>
<td>OTHER TRUCKS</td>
<td>$30.93</td>
<td>2G</td>
<td>6I</td>
<td></td>
</tr>
<tr>
<td>TRANSIT MIXER</td>
<td>$30.93</td>
<td>2G</td>
<td>6I</td>
<td></td>
</tr>
<tr>
<td>WELL DRILLERS &amp; IRRIGATION PUMP INSTALLERS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IRRIGATION PUMP INSTALLER</td>
<td>$11.15</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OILER</td>
<td>$9.29</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WELL DRILLER</td>
<td>$17.68</td>
<td>1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
OVERTIME CODES

OVERTIME CALCULATIONS ARE BASED ON THE HOURLY RATE ACTUALLY PAID TO THE WORKER. ON PUBLIC WORKS PROJECTS, THE HOURLY RATE MUST BE NOT LESS THAN THE PREVAILING RATE OF WAGE MINUS THE HOURLY RATE OF THE COST OF FRINGE BENEFITS ACTUALLY PROVIDED FOR THE WORKER.

1. ALL HOURS WORKED IN EXCESS OF EIGHT (8) HOURS PER DAY OR FORTY (40) HOURS PER WEEK SHALL BE PAID AT ONE AND ONE-HALF TIMES THE HOURLY RATE OF WAGE.

A. ALL HOURS WORKED ON SATURDAYS, SUNDAYS AND HOLIDAYS SHALL ALSO BE PAID AT ONE AND ONE-HALF TIMES THE HOURLY RATE OF WAGE.

B. ALL HOURS WORKED ON SATURDAYS SHALL BE PAID AT ONE AND ONE-HALF TIMES THE HOURLY RATE OF WAGE. ALL HOURS WORKED ON SUNDAYS AND HOLIDAYS SHALL BE PAID AT DOUBLE THE HOURLY RATE OF WAGE.

C. THE FIRST TWO (2) HOURS AFTER EIGHT (8) REGULAR HOURS MONDAY THROUGH FRIDAY AND THE FIRST TEN (10) HOURS ON SATURDAY SHALL BE PAID AT ONE AND ONE-HALF TIMES THE HOURLY RATE OF WAGE. ALL OTHER OVERTIME HOURS WORKED SHALL BE PAID AT DOUBLE THE HOURLY RATE OF WAGE.

D. THE FIRST TWO (2) HOURS BEFORE OR AFTER A FIVE - EIGHT (8) HOUR WORKWEEK DAY OR A FOUR - TEN (10) HOUR WORKWEEK DAY AND THE FIRST EIGHT (8) HOURS WORKED THE NEXT DAY AFTER EITHER WORKWEEK SHALL BE PAID AT ONE AND ONE-HALF TIMES THE HOURLY RATE OF WAGE. ALL ADDITIONAL HOURS WORKED AND ALL WORKED ON SUNDAYS AND HOLIDAYS SHALL BE PAID AT DOUBLE THE HOURLY RATE OF WAGE.

E. THE FIRST TWO (2) HOURS AFTER EIGHT (8) REGULAR HOURS MONDAY THROUGH FRIDAY AND THE FIRST EIGHT (8) HOURS ON SATURDAY SHALL BE PAID AT ONE AND ONE-HALF TIMES THE HOURLY RATE OF WAGE. ALL OTHER HOURS WORKED MONDAY THROUGH SATURDAY, AND ALL HOURS WORKED ON SUNDAYS AND HOLIDAYS SHALL BE PAID AT DOUBLE THE HOURLY RATE OF WAGE.

F. THE FIRST TWO (2) HOURS AFTER EIGHT (8) REGULAR HOURS MONDAY THROUGH FRIDAY AND THE FIRST TEN (10) HOURS ON SATURDAY SHALL BE PAID AT ONE AND ONE-HALF TIMES THE HOURLY RATE OF WAGE. ALL OTHER OVERTIME HOURS WORKED, EXCEPT LABOR DAY, SHALL BE PAID AT DOUBLE THE HOURLY RATE OF WAGE. ALL HOURS WORKED ON LABOR DAY SHALL BE PAID AT THREE TIMES THE HOURLY RATE OF WAGE.

G. THE FIRST TEN (10) HOURS WORKED ON SATURDAYS AND THE FIRST TEN (10) HOURS WORKED ON A FIFTH CALENDAR WEEKDAY IN A FOUR - TEN HOUR SCHEDULE, SHALL BE PAID AT ONE AND ONE-HALF TIMES THE HOURLY RATE OF WAGE. ALL HOURS WORKED IN EXCESS OF TEN (10) HOURS PER DAY MONDAY THROUGH SATURDAY AND ALL HOURS WORKED ON SUNDAYS AND HOLIDAYS SHALL BE PAID AT DOUBLE THE HOURLY RATE OF WAGE.

H. ALL HOURS WORKED ON SATURDAYS (EXCEPT MAKEUP DAYS IF WORK IS LOST DUE TO INCLEMENT WEATHER CONDITIONS OR EQUIPMENT BREAKDOWN) SHALL BE PAID AT ONE AND ONE-HALF TIMES THE HOURLY RATE OF WAGE. ALL HOURS WORKED MONDAY THROUGH SATURDAY OVER TWELVE (12) HOURS AND ALL HOURS WORKED ON SUNDAYS AND HOLIDAYS SHALL BE PAID AT DOUBLE THE HOURLY RATE OF WAGE.

J. THE FIRST TWO (2) HOURS AFTER EIGHT (8) REGULAR HOURS MONDAY THROUGH FRIDAY AND THE FIRST TEN (10) HOURS ON SATURDAY SHALL BE PAID AT ONE AND ONE-HALF TIMES THE HOURLY RATE OF WAGE. ALL HOURS WORKED OVER TEN (10) HOURS MONDAY THROUGH SATURDAY, SUNDAYS AND HOLIDAYS SHALL BE PAID AT DOUBLE THE HOURLY RATE OF WAGE.

K. ALL HOURS WORKED ON SATURDAYS AND SUNDAYS SHALL BE PAID AT ONE AND ONE-HALF TIMES THE HOURLY RATE OF WAGE. ALL HOURS WORKED ON HOLIDAYS SHALL BE PAID AT DOUBLE THE HOURLY RATE OF WAGE.

L. ALL HOURS WORKED IN EXCESS OF TEN (10) HOURS PER DAY MONDAY THROUGH SATURDAY AND ALL HOURS WORKED ON SUNDAYS AND HOLIDAYS SHALL BE PAID AT DOUBLE THE HOURLY RATE OF WAGE.

M. ALL HOURS WORKED ON SATURDAYS (EXCEPT MAKEUP DAYS IF WORK IS LOST DUE TO INCLEMENT WEATHER CONDITIONS) SHALL BE PAID AT ONE AND ONE-HALF TIMES THE HOURLY RATE OF WAGE. ALL HOURS WORKED ON SUNDAYS AND HOLIDAYS SHALL BE PAID AT DOUBLE THE HOURLY RATE OF WAGE.

N. ALL HOURS WORKED ON SATURDAYS (EXCEPT MAKEUP DAYS) SHALL BE PAID AT ONE AND ONE-HALF TIMES THE HOURLY RATE OF WAGE. ALL HOURS WORKED ON SUNDAYS AND HOLIDAYS SHALL BE PAID AT DOUBLE THE HOURLY RATE OF WAGE.

O. THE FIRST TEN (10) HOURS WORKED ON SATURDAY SHALL BE PAID AT ONE AND ONE-HALF TIMES THE HOURLY RATE OF WAGE. ALL HOURS WORKED ON SUNDAYS, HOLIDAYS AND AFTER TWELVE (12) HOURS, MONDAY THROUGH FRIDAY, AND AFTER TEN (10) HOURS ON SATURDAY SHALL BE PAID AT DOUBLE THE HOURLY RATE OF WAGE.

P. ALL HOURS WORKED ON SATURDAYS (EXCEPT MAKEUP DAYS IF CIRCUMSTANCES WARRANT) AND SUNDAYS SHALL BE PAID AT ONE AND ONE-HALF TIMES THE HOURLY RATE OF WAGE. ALL HOURS WORKED ON HOLIDAYS SHALL BE PAID AT DOUBLE THE HOURLY RATE OF WAGE.
1. **Q.** The first two (2) hours after eight (8) regular hours Monday through Friday and up to ten (10) hours worked on Saturdays shall be paid at one and one-half times the hourly rate of wage. All hours worked in excess of ten (10) hours per day Monday through Saturday and all hours worked on Sundays and Holidays (except Christmas Day) shall be paid at double the hourly rate of wage. All hours worked on Christmas Day shall be paid at two and one-half times the hourly rate of wage.

2. **R.** All hours worked on Sundays and Holidays shall be paid at two times the hourly rate of wage.

3. **S.** The first two (2) hours after eight (8) regular hours Monday through Friday and the first eight (8) hours on Saturday shall be paid at one and one-half times the hourly rate of wage. All other overtime hours worked, except Labor Day, shall be paid at double the hourly rate of wage. All hours worked on Labor Day shall be paid at three times the hourly rate of wage.

4. **T.** All hours worked on Saturdays, except make-up days, shall be paid at one and one-half times the hourly rate of wage. All hours worked after 6:00PM Saturday to 6:00AM Monday and on Holidays shall be paid at double the hourly rate of wage.

5. **U.** All hours worked on Saturdays shall be paid at one and one-half times the hourly rate of wage. All hours worked on Sundays and Holidays (except Labor Day) shall be paid at two times the hourly rate of wage. All hours worked on Labor Day shall be paid at three times the hourly rate of wage.

6. **V.** All hours worked on Saturdays, Sundays and Holidays (except Thanksgiving Day and Christmas Day) shall be paid at one and one-half times the hourly rate of wage. All hours worked on Thanksgiving Day and Christmas Day shall be paid at double the hourly rate of wage.

7. **W.** All hours worked on Saturdays and Sundays (except make-up days due to conditions beyond the control of the employer) shall be paid at one and one-half times the hourly rate of wage. All hours worked on Holidays shall be paid at double the hourly rate of wage.

8. **X.** The first four (4) hours after eight (8) regular hours Monday through Friday and the first twelve (12) hours on Saturday shall be paid at one and one-half times the hourly rate of wage. All hours worked over twelve (12) hours Monday through Saturday, Sundays and Holidays shall be paid at double the hourly rate of wage. When Holiday Falls on Saturday or Sunday, the day before Saturday, Friday, and the day after Sunday, Monday, shall be considered the holiday and all work performed shall be paid at double the hourly rate of wage.

2. **A.** All hours worked in excess of eight (8) hours per day or forty (40) hours per week shall be paid at one and one-half times the hourly rate of wage.

3. **B.** All hours worked on Holidays shall be paid at one and one-half times the hourly rate of wage.

4. **C.** All hours worked on Sundays shall be paid at one and one-half times the hourly rate of wage. All hours worked on Holidays shall be paid at two times the hourly rate of wage.

5. **D.** All hours worked on Saturdays and Sundays shall be paid at one and one-half times the hourly rate of wage. The first eight (8) hours worked on Holidays shall be paid at straight time in addition to the Holiday Pay. All hours worked in excess of eight (8) hours on Holidays shall be paid at one and one-half times the hourly rate of wage.

6. **E.** All hours worked on Saturdays or Holidays (except Labor Day) shall be paid at one and one-half times the hourly rate of wage. All hours worked on Sundays or on Labor Day shall be paid at two times the hourly rate of wage.

7. **F.** All hours worked on Holidays shall be paid at the straight hourly rate of wage in addition to the Holiday Pay. All hours worked in excess of eight (8) hours on Holidays shall be paid at double the hourly rate of wage.

8. **G.** All hours worked on Sunday shall be paid at two times the hourly rate of wage. All hours worked on Holidays shall be paid at two and one-half times the hourly rate of wage including Holiday Pay.

9. **H.** All hours worked on Sunday shall be paid at two times the hourly rate of wage. All hours worked on Holidays shall be paid at one and one-half times the hourly rate of wage.
BENEFIT CODE KEY - EFFECTIVE 03-03-07

2. I. ALL HOURS WORKED ON SATURDAYS AND HOLIDAYS (EXCEPT LABOR DAY) SHALL BE PAID AT ONE AND ONE-HALF TIMES THE HOURLY RATE OF WAGE. ALL HOURS WORKED ON SUNDAYS AND ON LABOR DAY SHALL BE PAID AT TWO TIMES THE HOURLY RATE OF WAGE.

J. ALL HOURS WORKED ON SUNDAYS SHALL BE PAID AT TWO TIMES THE HOURLY RATE OF WAGE. ALL HOURS WORKED ON PAID HOLIDAYS SHALL BE PAID AT TWO AND ONE-HALF TIMES THE HOURLY RATE OF WAGE, INCLUDING THE HOLIDAY PAY. ALL HOURS WORKED ON UNPAID HOLIDAYS SHALL BE PAID AT TWO TIMES THE HOURLY RATE OF WAGE.

K. ALL HOURS WORKED ON HOLIDAYS SHALL BE PAID AT TWO TIMES THE HOURLY RATE OF WAGE IN ADDITION TO THE HOLIDAY PAY.

M. ALL HOURS WORKED ON SATURDAYS, SUNDAYS AND HOLIDAYS SHALL BE PAID AT DOUBLE THE HOURLY RATE OF WAGE.

O. ALL HOURS WORKED ON SUNDAYS AND HOLIDAYS SHALL BE PAID AT ONE AND ONE-HALF TIMES THE HOURLY RATE OF WAGE.

P. THE FIRST EIGHT (8) HOURS ON SATURDAY SHALL BE PAID AT ONE AND ONE-HALF TIMES THE HOURLY RATE OF WAGE. ALL HOURS WORKED IN EXCESS OF EIGHT (8) HOURS ON SATURDAY AND ALL HOURS WORKED ON SUNDAYS AND HOLIDAYS SHALL BE PAID AT TWO TIMES THE HOURLY RATE OF WAGE.

4A. ALL HOURS WORKED IN EXCESS OF EIGHT (8) HOURS PER DAY OR FORTY (40) HOURS PER WEEK SHALL BE PAID AT DOUBLE THE HOURLY RATE OF WAGE. ALL HOURS WORKED ON SATURDAYS, SUNDAYS AND HOLIDAYS SHALL BE PAID AT DOUBLE THE HOURLY RATE OF WAGE.

HOLIDAY CODES

5. A. HOLIDAYS: NEW YEAR'S DAY, MEMORIAL DAY, INDEPENDENCE DAY, LABOR DAY, THANKSGIVING DAY, FRIDAY AFTER THANKSGIVING DAY, AND CHRISTMAS DAY (7).

B. HOLIDAYS: NEW YEAR'S DAY, MEMORIAL DAY, INDEPENDENCE DAY, LABOR DAY, THANKSGIVING DAY, THE DAY BEFORE CHRISTMAS, AND CHRISTMAS DAY (8).

C. HOLIDAYS: NEW YEAR'S DAY, PRESIDENTS' DAY, MEMORIAL DAY, INDEPENDENCE DAY, LABOR DAY, THANKSGIVING DAY, THE FRIDAY AFTER THANKSGIVING DAY, AND CHRISTMAS DAY (8).

D. HOLIDAYS: NEW YEAR'S DAY, MEMORIAL DAY, INDEPENDENCE DAY, LABOR DAY, THANKSGIVING DAY, THE FRIDAY AND SATURDAY AFTER THANKSGIVING DAY, AND CHRISTMAS DAY (8).

E. HOLIDAYS: NEW YEAR'S DAY, PRESIDENTS' DAY, MEMORIAL DAY, INDEPENDENCE DAY, PRESIDENTIAL ELECTION DAY, THANKSGIVING DAY, THE FRIDAY AFTER THANKSGIVING DAY, AND CHRISTMAS DAY (8).


G. HOLIDAYS: NEW YEAR'S DAY, MEMORIAL DAY, INDEPENDENCE DAY, LABOR DAY, THANKSGIVING DAY, THE LAST WORK DAY BEFORE CHRISTMAS, AND CHRISTMAS DAY (7).


I. HOLIDAYS: NEW YEAR'S DAY, MEMORIAL DAY, INDEPENDENCE DAY, LABOR DAY, THANKSGIVING DAY, AND CHRISTMAS (6).

J. HOLIDAYS: NEW YEAR'S DAY, MEMORIAL DAY, INDEPENDENCE DAY, THANKSGIVING DAY, FRIDAY AFTER THANKSGIVING DAY, CHRISTMAS EVE DAY, AND CHRISTMAS DAY (7).

N. HOLIDAYS: NEW YEAR'S DAY, PRESIDENTS' DAY, MEMORIAL DAY, INDEPENDENCE DAY, LABOR DAY, VETERANS' DAY, THANKSGIVING DAY, THE FRIDAY AFTER THANKSGIVING DAY, AND CHRISTMAS DAY (9).

P. HOLIDAYS: NEW YEAR'S DAY, MEMORIAL DAY, INDEPENDENCE DAY, LABOR DAY, THANKSGIVING DAY, FRIDAY AND SATURDAY AFTER THANKSGIVING DAY, THE DAY BEFORE CHRISTMAS, AND CHRISTMAS DAY (9).

Q. PAID HOLIDAYS: NEW YEAR'S DAY, MEMORIAL DAY, INDEPENDENCE DAY, LABOR DAY, THANKSGIVING DAY, AND CHRISTMAS DAY (6).

R. PAID HOLIDAYS: NEW YEAR'S DAY, MEMORIAL DAY, INDEPENDENCE DAY, LABOR DAY, THANKSGIVING DAY, DAY AFTER THANKSGIVING DAY, ONE-HALF DAY BEFORE CHRISTMAS DAY, AND CHRISTMAS DAY (7 1/2).
5. S. PAID HOLIDAYS: NEW YEAR'S DAY, PRESIDENTS' DAY, MEMORIAL DAY, INDEPENDENCE DAY, LABOR DAY, THANKSGIVING DAY, AND CHRISTMAS DAY (7).


V. PAID HOLIDAYS: SIX (6) PAID HOLIDAYS.

W. PAID HOLIDAYS: NINE (9) PAID HOLIDAYS.

X. HOLIDAYS: AFTER 520 HOURS - NEW YEAR'S DAY, THANKSGIVING DAY AND CHRISTMAS DAY. AFTER 2080 HOURS - NEW YEAR'S DAY, WASHINGTON'S BIRTHDAY, MEMORIAL DAY, INDEPENDENCE DAY, LABOR DAY, THANKSGIVING DAY, CHRISTMAS DAY AND A FLOATING HOLIDAY (8).

Y. HOLIDAYS: NEW YEAR'S DAY, MEMORIAL DAY, INDEPENDENCE DAY, LABOR DAY, PRESIDENTIAL ELECTION DAY, THANKSGIVING DAY, THE FRIDAY FOLLOWING THANKSGIVING DAY, AND CHRISTMAS DAY (8).

Z. HOLIDAYS: NEW YEAR'S DAY, MEMORIAL DAY, INDEPENDENCE DAY, LABOR DAY, VETERANS DAY, THANKSGIVING DAY, THE FRIDAY AFTER THANKSGIVING DAY, AND CHRISTMAS DAY (8).


B. PAID HOLIDAYS: NEW YEAR'S EVE DAY, NEW YEAR'S DAY, MEMORIAL DAY, INDEPENDENCE DAY, LABOR DAY, THANKSGIVING DAY, THE FRIDAY AFTER THANKSGIVING DAY, CHRISTMAS EVE'S DAY, AND CHRISTMAS DAY (9).


L. HOLIDAYS: NEW YEAR'S DAY, MEMORIAL DAY, INDEPENDENCE DAY, LABOR DAY, THANKSGIVING DAY, THE FRIDAY AFTER THANKSGIVING DAY, THE LAST WORKING DAY BEFORE CHRISTMAS DAY, AND CHRISTMAS DAY. (8)

Q. PAID HOLIDAYS: NEW YEAR'S DAY, MEMORIAL DAY, INDEPENDENCE DAY, LABOR DAY, VETERANS DAY, THANKSGIVING DAY, THE DAY AFTER THANKSGIVING DAY AND CHRISTMAS DAY (8). UNPAID HOLIDAY: PRESIDENTS' DAY.


V. PAID HOLIDAYS: NEW YEAR'S DAY, MEMORIAL DAY, INDEPENDENCE DAY, LABOR DAY, THANKSGIVING DAY, DAY AFTER THANKSGIVING DAY, CHRISTMAS EVE'S DAY, CHRISTMAS DAY, AND ONE DAY OF THE EMPLOYEE'S CHOICE (9).

W. PAID HOLIDAYS: NEW YEAR'S DAY, DAY BEFORE NEW YEAR'S DAY, PRESIDENTS DAY, MEMORIAL DAY, INDEPENDENCE DAY, LABOR DAY, THANKSGIVING DAY, DAY AFTER THANKSGIVING DAY, CHRISTMAS DAY, DAY BEFORE OR AFTER CHRISTMAS DAY (10).

X. PAID HOLIDAYS: NEW YEAR'S DAY, DAY BEFORE OR AFTER NEW YEAR'S DAY, PRESIDENTS DAY, MEMORIAL DAY, INDEPENDENCE DAY, LABOR DAY, THANKSGIVING DAY, DAY AFTER THANKSGIVING DAY, CHRISTMAS DAY, DAY BEFORE OR AFTER CHRISTMAS DAY, EMPLOYEE'S BIRTHDAY (11).
8. A. THE STANDBY RATE OF PAY FOR DIVERS SHALL BE ONE-HALF TIMES THE DIVERS RATE OF PAY. IN ADDITION TO THE HOURLY WAGE AND FRINGE BENEFITS, THE FOLLOWING DEPTH PREMIUMS APPLY TO DEPTHS OF FIFTY FEET OR MORE:
   OVER 50' TO 100' - $1.00 PER FOOT FOR EACH FOOT OVER 50 FEET
   OVER 100' TO 175' - $2.25 PER FOOT FOR EACH FOOT OVER 100 FEET
   OVER 175' TO 250' - $5.50 PER FOOT FOR EACH FOOT OVER 175 FEET
   OVER 250' - DIVERS MAY NAME THEIR OWN PRICE, PROVIDED IT IS NO LESS THAN THE SCALE LISTED FOR 250 FEET

C. THE STANDBY RATE OF PAY FOR DIVERS SHALL BE ONE-HALF TIMES THE DIVERS RATE OF PAY. IN ADDITION TO THE HOURLY WAGE AND FRINGE BENEFITS, THE FOLLOWING DEPTH PREMIUMS APPLY TO DEPTHS OF FIFTY FEET OR MORE:
   OVER 50' TO 100' - $1.00 PER FOOT FOR EACH FOOT OVER 50 FEET
   OVER 100' TO 150' - $1.50 PER FOOT FOR EACH FOOT OVER 100 FEET
   OVER 150' TO 200' - $2.00 PER FOOT FOR EACH FOOT OVER 150 FEET
   OVER 200' - DIVERS MAY NAME THEIR OWN PRICE

D. WORKERS WORKING WITH SUPPLIED AIR ON HAZMAT PROJECTS RECEIVE AN ADDITIONAL $1.00 PER HOUR.

L. WORKERS ON HAZMAT PROJECTS RECEIVE ADDITIONAL HOURLY PREMIUMS AS FOLLOWS - LEVEL A: $0.75, LEVEL B: $0.50, AND LEVEL C: $0.25.

M. WORKERS ON HAZMAT PROJECTS RECEIVE ADDITIONAL HOURLY PREMIUMS AS FOLLOWS: LEVELS A & B: $1.00, LEVELS C & D: $0.50.

N. WORKERS ON HAZMAT PROJECTS RECEIVE ADDITIONAL HOURLY PREMIUMS AS FOLLOWS - LEVEL A: $1.00, LEVEL B: $0.75, LEVEL C: $0.50, AND LEVEL D: $0.25.
SPECIAL PROVISIONS
SPECIAL PROVISIONS

U6 3244
TERRACE HEIGHTS WATER SYSTEM
WELL NO. 4 PUMP AND CONTROLS

YAKIMA COUNTY, WASHINGTON

SPECIAL PROVISIONS

The following Special Provisions are made a part of this contract and supersede any conflicting provisions of the 2006 Standard Specifications for Road, Bridge and Municipal Construction (English), and the foregoing Amendments to the Standard Specifications.

Special Provisions noted with a date are General Special Provisions of the 2006 Standard Specifications for Road, Bridge and Municipal Construction.

The numbering system used in the titles, headings, sections, and subsections of the following Special Provisions are not intended to supersede or replace the corresponding section of the 2006 Standard Specifications. The numbering system identifies the section of the 2006 Standard Specification, which most closely relates to the Special Provision under consideration.

GENERAL CONDITIONS

These Special Provisions, together with the Plans, Standard Specifications and Amendments to the Standard Specifications form a complete accomplishment of the work set forth therein. Payment of the items bid upon at the Contract Unit Price, therefore, shall be full and complete reimbursement for the completed project except as is otherwise specifically provided by the Special Provisions. The Engineer, according to these Special Provisions and the applicable provisions of the Standard Specifications, will make the measurement of the quantity of each item of work accomplished.

DESCRIPTION OF WORK

The work to be performed under this Contract consists of the following items, all in accordance with the attached plans and specifications, and the 2006 Standard Specifications and Amendments thereto

- Removing an existing 20 hp submersible pump and motor in an existing well
- Removing the existing electrical and control equipment
• Installing a new 50 hp submersible pump and motor
• Installing new electrical and control equipment including a new variable frequency drive, and
• Replacing wiring in part of the building for lighting and receptacles to bring it up to current code.

All references hereinafter made to Standard Specifications shall refer to the 2006 Standard Specifications for Road, Bridge, and Municipal Construction, English Units, as prepared by the Washington State Department of Transportation and the Washington State Chapter of the American Public Works Association.

FUNDS

This project is funded by reserves from the Yakima County Terrace Heights Water System.

1-01 DEFINITIONS AND TERMS

1-01.3 Definitions
(May 25, 2006 APWA GSP)

This Section is supplemented with the following:

All references in the Standard Specifications to the terms “State”, “Department of Transportation”, “Washington State Transportation Commission”, “Commission”, “Secretary of Transportation”, “Secretary”, “Headquarters”, and “State Treasurer” shall be revised to read “Contracting Agency”.

All references to “State Materials Laboratory” shall be revised to read “Contracting Agency designated location”.

The venue of all causes of action arising from the advertisement, award, execution, and performance of the contract shall be in the Superior Court of the County where the Contracting Agency’s headquarters are located.

Additive
A supplemental unit of work or group of bid items, identified separately in the proposal, which may, at the discretion of the Contracting Agency, be awarded in addition to the base bid.

Alternate
One of two or more units of work or groups of bid items, identified separately in the proposal, from which the Contracting Agency may make a choice between different methods or material of construction for performing the same work.
Contract Documents
See definition for “Contract”.
Contract Time The period of time established by the terms and conditions of the contract within which the work must be physically completed.

Dates
Bid Opening Date
The date on which the Contracting Agency publicly opens and reads the bids.

Award Date
The date of the formal decision of the Contracting Agency to accept the lowest responsible and responsive bidder for the work.

Contract Execution Date
The date the Contracting Agency officially binds the agency to the contract.

Notice to Proceed Date
The date stated in the Notice to Proceed on which the contract time begins.

Substantial Completion Date
The day the Engineer determines the Contracting Agency has full and unrestricted use and benefit of the facilities, both from the operational and safety standpoint, and only minor incidental work, replacement of temporary substitute facilities, or correction or repair remains for the physical completion of the total contract.

Physical Completion Date
The day all of the work is physically completed on the project. All documentation required by the contract and required by law does not necessarily need to be furnished by the Contractor by this date.

Completion Date
The day all the work specified in the contract is completed and all the obligations of the Contractor under the contract are fulfilled by the Contractor. All documentation required by the contract and required by law must be furnished by the Contractor before establishment of this date.

Final Acceptance Date
The date on which the Contracting Agency accepts the work as complete.

Notice of Award
The written notice from the Contracting Agency to the successful bidder signifying the Contracting Agency’s acceptance of the bid.

Notice to Proceed
The written notice from the Contracting Agency or Engineer to the Contractor authorizing and directing the Contractor to proceed with the work and establishing the date on which the contract time begins.
Traffic
Both vehicular and non-vehicular traffic, such as pedestrians, bicyclists, wheelchairs, and equestrian traffic.

1-02 BID PROCEDURES AND CONDITIONS

1-02.1 Prequalification of Bidders

Delete this Section and replace it with the following:

1-02.1 Qualifications of Bidder
(October 1, 2005 APWA GSP)

Bidders shall be qualified by experience, financing, equipment, and organization to do the work called for in the Contract Documents. The Contracting Agency reserves the right to take whatever action it deems necessary to ascertain the ability of the bidder to perform the work satisfactorily.

1-02.2 Plans and Specifications
(October 1, 2005 APWA GSP)

Delete this section and replace it with the following:

Information as to where Bid Documents can be obtained or reviewed will be found in the Call for Bids (Advertisement for Bids) for the work.

After award of the contract, plans and specifications will be issued to the Contractor at no cost as detailed below:

<table>
<thead>
<tr>
<th></th>
<th>No. of Sets</th>
<th>Basis of Distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduced plans (11&quot; x 17&quot;) and Contract Provisions</td>
<td>10</td>
<td>Furnished automatically upon award.</td>
</tr>
<tr>
<td>Large plans (22&quot; x 34&quot;) and Contract Provisions</td>
<td>0</td>
<td>Furnished only upon request.</td>
</tr>
</tbody>
</table>

Additional plans and Contract Provisions may be purchased by the Contractor by payment of the cost stated in the Call for Bids.

1-02.9 Delivery of Proposal
(October 1, 2005 APWA GSP)

Revise the first paragraph to read:

Each proposal shall be submitted in a sealed envelope, with the Project Name and Project Number as stated in the Advertisement for Bids clearly marked on the outside of the
envelope, or as otherwise stated in the Bid Documents, to ensure proper handling and delivery.

1-02.13 Irregular Proposals
(October 1, 2005 APWA GSP)

Revise item 1 to read:

1. A proposal will be considered irregular and will be rejected if:
   a. The bidder is not prequalified when so required;
   b. The authorized proposal form furnished by the Contracting Agency is not used or is altered;
   c. The completed proposal form contains any unauthorized additions, deletions, alternate bids, or conditions;
   d. The bidder adds provisions reserving the right to reject or accept the award, or enter into the contract;
   e. A price per unit cannot be determined from the bid proposal;
   f. The proposal form is not properly executed;
   g. The bidder fails to submit or properly complete a subcontractor list, if applicable, as required in Section 1 02.6.
   h. The bidder fails to submit or properly complete a Disadvantaged, Minority or Women’s Business Enterprise Certification, if applicable, as required in Section 1-02.6; or
   i. The bid proposal does not constitute a definite and unqualified offer to meet the material terms of the bid invitation.

1-02.14 Disqualification of Bidders
(October 1, 2005 APWA GSP)

Revise this section to read:

A bidder may be deemed not responsible and the proposal rejected if:
1. More than one proposal is submitted for the same project from a bidder under the same or different names;
2. Evidence of collusion exists with any other bidder or potential bidder. Participants in collusion will be restricted from submitting further bids;
3. The bidder, in the opinion of the Contracting Agency, is not qualified for the work or to the full extent of the bid, or to the extent that the bid exceeds the authorized prequalification amount as may have been determined by a prequalification of the bidder;
4. An unsatisfactory performance record exists based on past or current Contracting Agency work or for work done for others, as judged from the standpoint of conduct of the work; workmanship; progress; affirmative action; equal employment opportunity practices; or Disadvantaged Business Enterprise, Minority Business Enterprise, or Women’s Business Enterprise utilization;
5. There is uncompleted work (Contracting Agency or otherwise) which might hinder or prevent the prompt completion of the work bid upon;
6. The bidder failed to settle bills for labor or materials on past or current contracts;
7. The bidder has failed to complete a written public contract or has been convicted of a crime arising from a previous public contract;
8. The bidder is unable, financially or otherwise, to perform the work;
9. A bidder is not authorized to do business in the State of Washington (not registered in accordance with RCW 18.27);
10. There are any other reasons deemed proper by the Contracting Agency.

1-03 AWARD AND EXECUTION OF CONTRACT

1-03.1 Consideration of Bids

Section 1-03.1 of the Standard Specification is supplemented with the following:

Bidders are notified that all bids are likely to be rejected if the lowest responsive bid received exceeds the Engineer's estimate by an unreasonable amount, or the funding available for the project. In the event all bids are rejected for this reason, this project may be deferred for readvertising for bids until a more competitive situation exists.

The County may make such investigations as deemed necessary to determine the ability of the Bidder to perform the work, and the Bidder shall furnish to the County all such information and data for this purpose as the County may request. The County reserves the right to reject any bid if the evidence submitted by, or investigation of, such Bidder fails to satisfy the County that such Bidder is properly qualified to carry out the obligations of the Contract and to complete the work contemplated therein.

1-03.3 Execution of Contract
(October 1, 2005 APWA GSP)

Revise this section to read:

Copies of the Contract Provisions, including the unsigned Form of Contract, will be available for signature by the successful bidder on the first business day following award. The number of copies to be executed by the Contractor will be determined by the Contracting Agency.

Within 10 calendar days after the award date, the successful bidder shall return the signed Contracting Agency-prepared contract, an insurance certification as required by Section 1-07.18, and a satisfactory bond as required by law and Section 1-03.4. Before execution of the contract by the Contracting Agency, the successful bidder shall provide any pre-award information the Contracting Agency may require under Section 1-02.15.
Until the Contracting Agency executes a contract, no proposal shall bind the Contracting Agency nor shall any work begin within the project limits or within Contracting Agency-furnished sites. The Contractor shall bear all risks for any work begun outside such areas and for any materials ordered before the contract is executed by the Contracting Agency.

If the bidder experiences circumstances beyond their control that prevents return of the contract documents within the calendar days after the award date stated above, the Contracting Agency may grant up to a maximum of additional calendar days for return of the documents, provided the Contracting Agency deems the circumstances warrant it.

1-03.4 Contract Bond
(October 1, 2005 APWA GSP)

Revise the first paragraph to read:

The successful bidder shall provide an executed contract bond for the full contract amount. This contract bond shall:
1. Be on a Contracting Agency-furnished form;
2. Be signed by an approved surety (or sureties) that:
   a. Is registered with the Washington State Insurance Commissioner, and
   b. Appears on the current Authorized Insurance List in the State of Washington published by the Office of the Insurance Commissioner,
3. Be conditioned upon the faithful performance of the contract by the Contractor within the prescribed time;
4. Guarantee that the surety shall indemnify, defend, and protect the Contracting Agency against any claim of direct or indirect loss resulting from the failure:
   a. Of the Contractor (or any of the employees, subcontractors, or lower tier subcontractors of the Contractor) to faithfully perform the contract, or
   b. Of the Contractor (or the subcontractors or lower tier subcontractors of the Contractor) to pay all laborers, mechanics, subcontractors, lower tier subcontractors, materialperson, or any other person who provides supplies or provisions for carrying out the work;
5. Be accompanied by a power of attorney for the Surety’s officer empowered to sign the bond; and
6. Be signed by an officer of the Contractor empowered to sign official statements (sole proprietor or partner). If the Contractor is a corporation, the bond must be signed by the president or vice-president, unless accompanied by written proof of the authority of the individual signing the bond to bind the corporation (i.e., corporate resolution, power of attorney or a letter to such effect by the president or vice-president).
1-04 SCOPE OF THE WORK

1-04.2 Coordination of Contract Documents, Plans, Special Provisions, Specifications, and Addenda

The second paragraph of Section 1-04.2 is replaced with the following:

Any inconsistency in the parts of the contract shall be resolved by following this order of precedence (e.g., 1 presiding over 2, 3, 4, 5, 6 and 7; 2 presiding over 3, 4, 5, 6 and 7; and so forth):

1. Addenda,
2. Bid Documents,
3. Special Provisions,
4. Plans,
5. Project Details
6. Standard Plans,
7. Amendments to the Standard Specifications,
8. Standard Specifications,

1-05 CONTROL OF WORK

1-05.10 Guarantees

Section 1-05.10 of the Standard Specifications shall be supplemented with the following:

The Contractor shall guarantee all materials and equipment furnished and work performed for a period of one (1) year from the date of Substantial Completion. The Contractor warrants and guarantees for a period of one (1) year from the date of substantial completion of the system that the completed system is free from all defects due to faulty materials or workmanship and the Contractor shall promptly make such corrections as may be necessary by reason of such defects including the repairs of any damage to other parts of the system resulting from such defects. The Owner will give notice of observed defects with reasonable promptness. In the event that the Contractor should fail to make such repairs, adjustments, or other work that may be made necessary by such defects, the Owner may do so and charge the Contractor the cost thereby incurred. The Performance Bond shall remain in full force and effect through the guarantee period.

Operations and Maintenance Manuals

Section 1-05 is supplemented with the following:

The Contractor shall furnish three copies of a complete instruction manual for installation, operation, maintenance and lubrication requirements for components of the system improvements. All equipment suppliers shall be made aware of these
requirements and all associated costs shall be included in the costs for furnishing the equipment. Each manual shall be assembled in one three ring binder, with title page, typed table of contents, and heavy section dividers with numbered plastic index tabs. Each manual shall be divided into sections paralleling the equipment specifications.

**Record Drawings**

Section 1-05 is supplemented with the following:

The Contractor shall maintain and provide to the County a marked-up set of drawings depicting each change incorporated into the work.

**1-06 CONTROL OF MATERIAL**

**1-06.1 Approval of Materials Prior To Use**

Section 1-06.1 of the Standard Specifications shall be supplemented with the following:

The Contractor shall submit to the County for review shop, catalog, and other appropriate drawings and descriptive information prior to fabrication or ordering of all materials specified. Information shall be submitted in sufficient time to allow the County not less than 10 regular working days for review. The minimum number of copies of such information to be submitted shall be four.

When the submittals have been reviewed by the County, two sets will be returned to the Contractor. If major changes or corrections are necessary, the submittals will be returned to the contractor with such changes or corrections indicated, and the Contractor shall correct and resubmit in the same manner and quantity as specified for the original submittals.

No manufactured items or materials shall be installed until the submittals have been approved and appropriately stamped by the County.

**1-06.2(2) Statistical Evaluation of Materials for Acceptance**

Section 1-06.2(2) of the Standard Specifications is deleted.

**1-07 LEGAL RELATIONS AND RESPONSIBILITIES TO THE PUBLIC**

**1-07.2 State Taxes**

Section 1-07.2 is also supplemented with the following:
Retail sales tax to be collected from the County on the Contract amount shall be stated separately in the space provided, as applicable, and shall not be included in the unit or lump sum prices stated in the Proposal. The amount of retail sales tax stated will not be considered as a competitive bid item and will not be included in determining the lowest priced Proposal and will be considered to be an estimate only. Any other federal, state, and local sales, use, or other taxes as required by federal, state, or local laws shall be included in the unit prices, lump sum price, or other prices stated in the Proposal.

1-07.6 Permits and Licenses

Section 1-07.6 is also supplemented with the following:

The Contractor shall be licensed in the state of Washington as defined under RCW 18.27 and shall be legally qualified to perform the work sought by this Contract.

In addition to the expenses that may be incurred by the Contractor for procuring permits and licenses, as specified herein, the Contractor shall be required to submit payment to the Department of Labor and Industries for processing of "Statement of Intent to Pay Prevailing Wages" and "Affidavit of Wages Paid". All costs incurred by the Contractor shall be included in his various Unit Bid Prices, and no further Payment shall be made.

1-07.10 Worker’s Benefits

The fourth paragraph is revised to read:

The Public Works Contract Division of the Washington State Department of Labor and Industries will provide the Contractor with applicable industrial insurance and medical aid classification and premium rates. After receipt of Revenue Release from the Washington State Department of Revenue, the contracting agency will verify through the Department of Labor and Industries that the Contractor is current with respect to the payments of industrial insurance and medical aid premiums.

1-07.17 Utilities and Similar Facilities

Section 1-07.17 is supplemented with the following:

Locations and dimensions shown in the Plans for existing facilities are in accordance with available information obtained without uncovering, measuring, or other verification.

The Contractor is alerted to the existence of Chapter 19.122 RCW, a law relating to underground utilities. Any cost to the Contractor incurred as a result of this law shall be at the Contractor’s expense.

The following addresses and telephone numbers of utility companies known or suspected of having facilities within the project limits are supplied for the Contractor’s convenience:
Cascade Natural Gas Corporation  
401 N. 1st Street  
Yakima, WA 98901  
(509) 457-8175

Terrace Heights Sewer District  
Norm Alderson  
2812 Terrace Heights Drive, Suite 2  
Yakima, WA 98901  
(509) 453-8702

Qwest Communications  
Blake Davis  
8 S. 2nd Ave., Room 304  
Yakima, Washington 98902  
(509) 575-7183

Roza Irrigation District  
1250 Brooks Road Wapato  
(509) 453-6066

Charter Communications  
1005 N. 16th Ave.  
Yakima, Washington 98902  
(509) 575-1698

Pacific Power & Light Co.  
Mike Paulson  
500 N Keyes Road  
Yakima, WA 98901  
(509) 575-3158

Northwest Utility Notification Center  
1-800-424-5555

1-07.18 Public Liability and Property Damage Insurance

Delete this section in its entirety, and replace it with the following:

1-07.18 Insurance  
(May 10, 2006 APWA GSP)

1-07.18(1) General Requirements  
A. The Contractor shall obtain the insurance described in this section from insurers approved by the State Insurance Commissioner pursuant to RCW Title 48. The insurance must be provided by an insurer with a rating of A-: VII or higher in the A.M. Best's Key Rating Guide, which is licensed to do business in the state of Washington (or issued as a surplus line by a Washington Surplus lines broker). The
Contracting Agency reserves the right to approve or reject the insurance provided, based on the insurer (including financial condition), terms and coverage, the Certificate of Insurance, and/or endorsements.

B. The Contractor shall keep this insurance in force during the term of the contract and for thirty (30) days after the Physical Completion date, unless otherwise indicated (see C. below).

C. If any insurance policy is written on a claims made form, its retroactive date, and that of all subsequent renewals, shall be no later than the effective date of this Contract. The policy shall state that coverage is claims made, and state the retroactive date. Claims-made form coverage shall be maintained by the Contractor for a minimum of 36 months following the Final Completion or earlier termination of this contract, and the Contractor shall annually provide the Contracting Agency with proof of renewal. If renewal of the claims made form of coverage becomes unavailable, or economically prohibitive, the Contractor shall purchase an extended reporting period ("tail") or execute another form of guarantee acceptable to the Contracting Agency to assure financial responsibility for liability for services performed.

D. The insurance polices shall contain a “cross liability” provision.

E. The Contractor’s and all subcontractors’ insurance coverage shall be primary and non-contributory insurance as respects the Contracting Agency’s insurance, self-insurance, or insurance pool coverage.

F. All insurance policies and Certificates of Insurance shall include a requirement providing for a minimum of 30 days prior written notice to the Contracting Agency of any cancellation in any insurance policy.

G. Upon request, the Contractor shall forward to the Contracting Agency a full and certified copy of the insurance policy(s).

H. The Contractor shall not begin work under the contract until the required insurance has been obtained and approved by the Contracting Agency.

I. Failure on the part of the Contractor to maintain the insurance as required shall constitute a material breach of contract, upon which the Contracting Agency may, after giving five business days notice to the Contractor to correct the breach, immediately terminate the contract or, at its discretion, procure or renew such insurance and pay any and all premiums in connection therewith, with any sums so expended to be repaid to the Contracting Agency on demand, or at the sole discretion of the Contracting Agency, offset against funds due the Contractor from the Contracting Agency.

J. All costs for insurance shall be incidental to and included in the unit or lump sum prices of the contract and no additional payment will be made.
1-07.18(2) Additional Insured

All insurance policies, with the exception of Professional Liability and Workers Compensation, shall name the following listed entities as additional insured(s):

Yakima County and its officers, elected officials, employees, agents, and volunteers

The above-listed entities shall be additional insured(s) for the full available limits of liability maintained by the Contractor, whether primary, excess, contingent or otherwise, irrespective of whether such limits maintained by the Contractor are greater than those required by this Contract, and irrespective of whether the Certificate of Insurance provided by the Contractor pursuant to 1-07.18(3) describes limits lower than those maintained by the Contractor.

1-07.18(3) Subcontractors

Contractor shall ensure that each subcontractor of every tier obtains and maintains at a minimum the insurance coverages listed in 1-07.18(5)A and 1-07.18(5)B. Upon request of the Contracting Agency, the Contractor shall provide evidence of such insurance.

1-07.18(4) Evidence of Insurance

The Contractor shall deliver to the Contracting Agency a Certificate(s) of Insurance and endorsements for each policy of insurance meeting the requirements set forth herein when the Contractor delivers the signed Contract for the work. The certificate and endorsements must conform to the following requirements:

1. An ACORD certificate or a form determined by the Contracting Agency to be equivalent.
2. Copies of all endorsements naming Contracting Agency and all other entities listed in 1-07.18(2) as Additional Insured(s), showing the policy number. The Contractor may submit a copy of any blanket additional insured clause from its policies instead of a separate endorsement. A statement of additional insured status on an ACORD Certificate of Insurance shall not satisfy this requirement.
3. Any other amendatory endorsements to show the coverage required herein.

1-07.18(5) Coverages and Limits

The insurance shall provide the minimum coverages and limits set forth below. Providing coverage in these stated minimum limits shall not be construed to relieve the Contractor from liability in excess of such limits. All deductibles and self-insured retentions must be disclosed and are subject to approval by the Contracting Agency. The cost of any claim payments falling within the deductible shall be the responsibility of the Contractor.

1-07.18(5)A Commercial General Liability

A policy of Commercial General Liability Insurance, including:
Per project aggregate
Premises/Operations Liability
Products/Completed Operations – for a period of one year following final acceptance of the work.
Personal/Advertising Injury
Contractual Liability
Independent Contractors Liability
Stop Gap / Employers’ Liability
Explosion, Collapse, or Underground Property Damage (XCU)
Blasting (only required when the Contractor’s work under this Contract includes exposures to which this specified coverage responds)

Such policy must provide the following minimum limits:

$1,000,000  Each Occurrence  
$2,000,000  General Aggregate  
$1,000,000  Products & Completed Operations Aggregate  
$1,000,000  Personal & Advertising Injury, each offence  

Stop Gap / Employers’ Liability  
$1,000,000  Each Accident  
$1,000,000  Disease - Policy Limit  
$1,000,000  Disease - Each Employee  

1-07.18(5)B Automobile Liability

Automobile Liability for owned, non-owned, hired, and leased vehicles, with an MCS 90 endorsement and a CA 9948 endorsement attached if “pollutants” are to be transported. Such policy(ies) must provide the following minimum limit:

$1,000,000  combined single limit  

1-07.18(5)C Workers’ Compensation

The Contractor shall comply with Workers’ Compensation coverage as required by the Industrial Insurance laws of the state of Washington.

1-07.23  Public Convenience and Safety

Section 1-07.23 is supplemented with the following:

Contractor’s equipment must meet current State of Washington regulations for noise and odor control. All construction equipment shall be operated only during normal daylight hours; and all construction equipment shall be equipped with noise attenuation devices as specified/recommended by the manufacturer.

Special Provisions  
U6 3244  
14
Construction activities shall be scheduled to reduce traffic and noise impacts in residential areas.

1-08 PROSECUTION AND PROGRESS

1-08.3 Progress Schedule

Section 1-08.3 of the Standard Specifications shall be deleted in its entirety and replaced with the following:

Following Contract award and satisfactory provision of execution of all required Contract documents, the Engineer will schedule a preconstruction conference at a time mutually agreeable to all concerned. The preconstruction conference will be held at the Yakima County Public Services Department. The Contractor and key personnel shall attend this conference.

At this conference several points concerning the Contract Specifications will be discussed including order and coordination of work, means and methods of work, inspection and reporting procedures, etc. The Contractor should satisfy himself that all Contract Provisions and intentions are fully understood.

The Contractor shall prepare and submit to the Engineer at the beginning of the Preconstruction Conference a Construction Progress and Completion Schedule using a critical path, bar graph, or similar format. Items in the Schedule shall be arranged in the order and sequence in which they will be performed. The Schedule shall conform to the working time and time of completion established under the terms of the Contract and shall be subject to modification by the Engineer. The schedule shall be drawn to a time scale, shown along the base of the diagram, using an appropriate measurement per day with weekends and holidays indicated.

The Contractor shall submit, along with the progress schedule, a shift schedule detailing his normal daily working hours. The Contractor shall restrict his operations to weekdays (exclusive of holidays) and daylight hours, except for emergencies or as approved by the Engineer. The Engineer shall be notified at least five (5) days prior to any schedule changes.

1-08.4 Prosecution of Work

Section 1-08.4 of the Standard Specifications shall be supplemented with the following:

The existing pumping equipment shall remain in operation through September 30, 2007. The Contractor shall not begin removing the existing pump and motor or electrical equipment critical to the operation of the existing pump and motor prior to that date.

Special Provisions
U6 3244
15
1-08.5 Time For Completion
(March 13, 1995)
Section 1-08.5 is supplemented with the following:

This contract shall be physically completed within 130 working days.

1-09 MEASUREMENT AND PAYMENT

1-09.9(1) Retainage

The fourth paragraph of Section 1-09.9(1) of the Standard Specifications is revised to read:

Release of the retainage will be made 60 days following the Completion Date (pursuant to RCW 39.12, and RCW 60.28) provided the following conditions are met:

1. On contracts totaling more than $20,000, a release has been obtained from the Washington State Department of Revenue.

2. Affidavits of Wages Paid for the Contractor and all Subcontractors are on file with the Contracting Agency (RCW 39.12.040).

3. A certificate of Payment of Contributions Penalties and Interest on Public Works Contract is received from the Washington State Employment Security Department.

4. Washington State Department of Labor and Industries (per section 1-07.10) shows the Contractor is current with payments of industrial insurance and medical aid premiums.

5. All claims, as provided by law, filed against the retainage have been resolved. In the event claims are filed and provided the conditions of 1, 2, 3 and 4 are met, the Contractor will be paid such retained percentage less an amount sufficient to pay any such claims together with a sum determined by the Contracting Agency sufficient to pay the cost of foreclosing on claims and to cover attorney's fees.
ENGINEERING SPECIFICATIONS
ENGINEERING SPECIFICATIONS

NOTICE TO BIDDERS

These Engineering Specifications are intended to be used in conjunction with the Washington State Department of Transportation’s 2006 Standard Specifications for Road, Bridge, and Municipal Construction, which are not provided herein, and the appropriate Amendments and Special Provisions to the Standard Specifications, which are provided herein. The Standard Specifications are considered to be part of this package, and it is the bidder’s responsibility to obtain a copy for use in preparing a bid for this project, and for constructing the project. A copy of the Standard Specifications can be obtained from the Washington State Department of Transportation in Olympia, Washington.

Bidders are also notified that these Engineering Specifications have been prepared with divisional headings that are consistent with those of the Construction Specification Institute. These headings are not intended to be consistent with those of the Standard Specifications, which do not incorporate all of the work items necessary to complete this project.
DIVISION 1

GENERAL REQUIREMENTS

This division is covered in its entirety in Division 1 of the *Standard Specifications*, and in the attached Amendments and Special Provisions to the *Standard Specifications*. 
DIVISION 2
SITE WORK

2.1 SURFACE RESTORATION

2.1-1 General

This section covers the surface restoration for the electrical service and grounding electrode.

2.1-2 Materials

2.1-2.1 Gravel Surfacing

Gravel Surfacing shall consist of crushed surfacing top course in accordance with Section 9-03.9(3) of the Standard Specifications.

2.1-2.2 Top Soil

Top soil shall consist of native topsoil excavated from the trench free of vegetation, debris, clods and stones.

2.1-3 Construction

2.1-3.1 General

Contractor shall repair damage to areas caused by work operations.

Trenches in the driveway and roadway shall be compacted to not less than 95% of maximum density and trenches in landscaped areas shall be compacted to not less than 85% of maximum density as specified in Section 2-03.3(14)D of the Standard Specifications.

2.1-3.2 Gravel Surfacing

Gravel surfacing shall be placed on the driveway and roadway over the trench for the electrical service. Gravel shall be a minimum depth of 4-inches over the trench and a minimum of 2-inches over the areas disturbed by the work. Grade to match existing elevations at the driveway and roadway edges.

2.1-3.3 Top Soil

Topsoil excavated from the trench shall be placed in the top 6-inches of the trench. Contractor
shall hand rake the topsoil to match the original ground surface. The Owner will reseed the trench area.

2.1-4 Payment

Payment for the work described in this section will be included in the lump sum bid for Site Work.
DIVISION 3
CONCRETE

3.1 CAST IN PLACE CONCRETE

3.1.1 General

This section covers the installation of concrete bases for the variable frequency drive and transformer, and repairing the existing concrete floor.

3.1.2 Materials

Concrete shall have a minimum compressive strength at 28 days of 3,000 psi when cured and tested in conformance with ASTM C31 and C39. Slump range shall be 2 to 4 inches.

3.1.3 Construction

Construction shall be in accordance with Section 6.02 of the Standard Specifications.

3.1.4 Payment

Payment for the work described in this section will be included in the lump sum bid for Concrete.
DIVISION 11
EQUIPMENT

11.1 SUBMERSIBLE PUMP

11.1-1 General

11.1-1.1 Scope

The work under this section consists of removing an existing 20 horsepower submersible pump and replacing it with a 50 horsepower submersible pump. The new pump shall be complete with motor, column pipe and conductors.

11.1-1.2 Applicable Standards

The pump shall conform to the latest Hydraulic Institute and AWWA standards for submersible pumps.

11.1-1.3 Service Conditions

The well in which the pump will be installed is in an enclosed brick building that also encloses a water tank. A hatch is provided in the main roof of the building for removal of the pump. Above the hatch is a cupola that will need to be removed to provide access to the well with a mobile crane.

The well was drilled in 1925 to a depth of 420-feet. The well is cased with 10-inch diameter pipe to a depth of 265-feet, and 8-inch diameter pipe from 265-feet to 420-feet. The well has a 20-foot section of iron casing at the bottom slotted with \( \frac{1}{4} \) by 2-1/2 inch perforations. The last 20 feet reportedly penetrate a water bearing stratum of sand and gravel.

The liquid being pumped will be water for a municipal domestic water supply. A small amount of sand is expected to be pumped from the well, although the exact amount that will be present at startup and the extent to which it may diminish over time are impossible to quantify at this time.

11.1-1.4 Head-Capacity Curve

The head-capacity curve shall exhibit a uniformly rising characteristic from free discharge to shutoff. The pump shall have its rated capacity near the pump’s peak efficiency point and shall be designed to operate with a 50 horsepower motor without overloading.

11.1-1.5 Well and Pump Setting Information
Diameter of Well Casing: 10-inch to 265-ft
8-inch from 265-ft to 420-ft

Static Water Level: 233-ft (April 2007)

Anticipated Pumping Level: 270-ft

Pump Setting (Below Top of Well): 357-ft

11.1-1.6 Existing Pump

The existing 20-hp submersible pump is a seven stage Berkeley Model 6S2AL. The pump and motor were installed in 1986. The column pipe consists of 260-ft of 5-inch diameter pipe, and 21-ft of 4-inch diameter pipe.

11.1-2 Equipment

11.1-2.1 Equipment Requirements

Rated Total Dynamic Head: 330-ft

Flow at Rated TDH: 370 gpm

Normal Operating Head Range: 290 to 330-ft (variable speed)

Maximum Operating Speed at Rated Head: 3,600 rpm

Approx. Minimum Operating Speed, (Percent of maximum speed): 75%

System Curve (Includes static lift below and above pump house floor, system friction losses, and pump column losses).

<table>
<thead>
<tr>
<th>Flow</th>
<th>TDH</th>
</tr>
</thead>
<tbody>
<tr>
<td>200 gpm</td>
<td>291-ft</td>
</tr>
<tr>
<td>300 gpm</td>
<td>309-ft</td>
</tr>
<tr>
<td>400 gpm</td>
<td>330-ft</td>
</tr>
</tbody>
</table>

Minimum Pump Bowl Efficiency at Rated Flow: 70%
Nominal Size of Pump Discharge, inches: 4

11.1-2.2 Materials

Pump Bowls: Cast iron, ASTM A48, Class 30
Impellers: Stainless Steel, ASTM A743 or Bronze, ASTM B584
Bowl Shaft: Type 416 stainless steel
Pump Column: ASTM A53, 5-inch, Grade B steel pipe with threaded couplings, Schedule 40
Pipe Thread Lubricant: Teflon paste type thread sealer, suitable for potable water service

11.1-2.3 Pump

11.1-2.3.1 Pump Bowls and Impellers

Suction case, intermediate bowl, and discharge bowl shall be of cast iron, free of foundry imperfections and other detrimental defects.

The inlet motor adapter shall have a net open area of at least three times the eye of the impeller and shall be protected with a stainless steel screen.

Pump shall be designed to operate throughout its flow range without exceeding 95 percent of the motor’s rated capacity. Pump shall be a Berkeley Model 6T-325, or equal.

11.1-2.3.2 Column Pipe

The pump column shall be no less than 5-inches in diameter, Schedule 40.

11.1-2.3.3 Check Valves

Pump column check valves shall be silent valves, designed to minimize water hammer. Valve body shall be ductile iron with an elastomer seat. Valve shall be Model 80 DI as manufactured by Flomatic Corporation, or equal.

The number and location of pump column check valves installed shall be in accordance with the pump manufacturer’s recommendations. As a minimum, at least one pump column check valve shall be installed within 21-feet of the pump, and one shall be installed at approximately the
midpoint of the column pipe.

11.1-2.4 Electrical Driver

The motor to be furnished shall be a NEMA MG1, Design B with a nameplate rating of 50 horsepower, 460 volts AC, 3 phase, 60 hertz, 3600-rpm synchronous speed, continuous duty. Motor shall be provided with a 1.15 service factor and motor winding temperature detectors. A suitable thrust bearing shall be incorporated in the lower end of the motor adequate to receive the entire hydraulic thrust load of the pump unit plus the weight of the rotating parts.

Motor leads shall be protected against the pump end with a stainless steel cable guard held in place with stainless steel banding.

Motor shall be compatible and suitable for continuous use with the selected variable frequency drive.

11.1-2.5 Power Cable

Power cable shall be a three-conductor cable with integral ground wire. Power cable furnished shall be in accordance with the requirements of the NEC, and shall terminate in the junction box on the discharge elbow.

11.1-3 Installation

11.1-3.1 General

The Contractor shall notify the County five days in advance of when the existing pump is to be removed. The Contractor shall provide all equipment, labor and materials necessary to remove the existing pump and install a new pump. The Contractor shall protect the pump, motor, electrical equipment, and appurtenance from damage. During installation of the new pump, the Contractor shall coat all bolt and coupling threads with NSF approved lubricant to facilitate future removal.

The Contractor shall reuse the existing 5-inch column pipe that is in good condition as directed by the engineer. Column pipe that cannot be reused shall be replaced with new column pipe and paid for per the unit contract price for Column Pipe.

The Contractor shall install the pump in accordance with the pump manufacturer’s directions and these Engineering Specifications.

The completed pump setting shall be a minimum of 357'. The column pipe shall include couplings and any adapters or reducers required to complete the pump assembly.
11.1-3.2 Bailing Well

The Contractor use a top bailer or absorbent socks to remove oil from the top of the water in the well that was discharged from a previous oil lubed pump installed in the well. If using a top bailer, the Contractor shall lower the bailer just enough to allow it to slowly fill and shall retrieve the bailer before it has completely filled and begins displacing any oil in the bailer with water. The Contractor shall provide a sample of the oil to the County for testing.

11.1-3.3 Video Logging

Prior to installing the pump and motor, the Contractor shall provide the necessary equipment and labor to perform a video inspection of the well. The video equipment shall be specifically designed and constructed for underwater operation in wells. The video system shall provide a clear, focused, well-lighted image of the well taken at a time when the water is clear. The video shall be displayed on a screen monitor which can be viewed by the Engineer while the camera is being lowered into the well. The Contractor shall furnish a VHS video cassette tape of the video inspection to the Engineer. The video cassette tape shall also show the camera depth superimposed in the picture.

11.1-3.4 Air Line

An airline shall be installed with the pump column for measuring drawdown. Airline shall consist of flexible vinyl or polyethylene tubing attached to the pump column at 10-ft intervals.

11.1-3.5 Disinfection

Care shall be taken to prevent the entrance of dirt or other contamination into the well. Prior to setting the pump and motor, the Contractor shall disinfect the well and pumping equipment. The pump, motor, column, and piping for level transmitter shall be thoroughly rinsed with a 50-ppm chlorine solution immediately before being placed into the well. The well shall also be disinfected by pouring additional chlorine solution into the well in such volume and strength to result in a concentration of 50 parts per million of free available chlorine in all parts of the well. The chlorine shall remain in the well for 24 hours after the existing pump and motor have been reinstalled, and then be pumped out to waste.

All water flushed from the well shall be discharged to a suitable location secured by the Contractor and will not be allowed to pond on the well site. The Contractor shall restore any property damaged by the water discharge to its original condition.

A water sample will be collected and bacteriological tests obtained by the Engineer. Should the initial treatment result in an unsatisfactory bacteriological test, the well shall be chlorinated and flushed again until satisfactory results are obtained.
11.1-4 Payment

Payment for the work described in this section will be included in the lump sum bid for "Submersible Pump", except that payment for the new column pipe furnished by the Contractor will be included in the per lineal foot bid for "Column Pipe".

The lump sum bid amount for "Submersible Pump" shall be full pay for all work to remove the cupola and the existing pump; bail and video the well, furnish and install the new pump, motor, check valves, air line, power cable, and pressure transmitter; install the column pipe; disinfect the well and pump; and reinstall the cupola.

The unit contract price per lineal foot for "Column Pipe" shall be full pay for all work to furnish the column pipe.
15.1 VALVES, FITTINGS AND ACCESSORIES

15.1-1 General

This section covers the installation of the pressure transmitter and accessories.

15.1-2 Materials

15.1-2.1 Pressure Transmitter

The electronic pressure to current signal converter for pressure measurement shall be of the force balance or strain gauge type and shall convert a pressure input to a proportional current output signal. The pressure sensitive element shall be calibrated for a range of measurements of 0 to 100 psi. The unit shall include fully adjustable span and zero adjustments. Dampening shall be adjustable on the unit.

The transmitter shall be a true two wire device without a separate power supply being required at the transmitter. The unit shall be of modular plug-in-design and circuitry and shall be all solid state. The transmitter output shall be 4-20mA dc. Accuracy shall be adjustable on the unit.

The transmitter shall be Bristol Babcock Model 2808-15B, or equal.

15.1-2.2 Pressure Gauges

Pressure gauges shall be liquid filled with brass case, and 1/4-inch NPT lower connection. Accuracy shall be plus or minus 1.5 percent, or better. Gauge size shall be a minimum of 2-1/2 inches. Gauges shall be Noshok, Series 300, or equal. Pressure gauge range shall be 0-100 psi.

15.1-2.3 Gate Valves

Gate valves, 3-inch and smaller with threaded ends shall be bronze, non-rising stem, wedge disc, rated for 125 pound service. Valves shall be Legend Model T-414, or equal.

15.1-2.4 Brass Pipe and Fittings

Brass pipe shall be red brass screwed pipe conforming to the requirements of Federal Specification No. WW-P-351. Fittings shall be red brass conforming to the requirements of Federal Specification No. WW-P-460.
15.1-3 **Construction**

Install pressure transmitter in accordance with the manufacturer's instructions.

Pipe and fittings shall be screwed together with an application of approved pipe compound or Teflon tape. The pipe compound or tape shall be applied to all male threads. Once a joint has been screwed up, it shall not be backed off unless threads are recleaned and new compound or tape is applied. This application shall be neatly made; all compound and dirt shall be thoroughly wiped off the outside of every joint.

15.1-4 **Payment**

Payment for the work described in this section will be included in the lump sum bid for Mechanical.
SECTION 16010 — BASIC ELECTRICAL REQUIREMENTS

PART 1 — GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Amendments and Special Provisions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. General requirements for electrical work.
   a. Systems Descriptions
   b. Area classifications
   c. Submittals
   d. Records
   e. Coordination

B. Related Sections include but are not necessarily limited to:

1. General Conditions.
2. Division 1 - General Requirements.
3. Division 2 - Site Work.
4. Division 3 - Concrete.
5. Division 11 - Equipment.

C. Installation of systems and equipment is subject to clarification as indicated in reviewed shop drawings and field coordination drawings.

1.3 SYSTEMS DESCRIPTIONS

A. Provide the labor, materials, and equipment necessary to furnish, install, and place into operation the power, instrumentation, control, alarm, and associated electrical systems of this Contract.

B. Provide functioning systems in compliance with manufacturer's instructions, performance requirements specified or indicated, and modifications resulting from reviewed shop drawings and field coordinated drawings.

C. Connect motors, instrumentation, controls, meters, and any other electrical device installed or provided as part of the project.

D. Provide complete 480Y/277 and 120/240 volt power distribution systems including raceways, wiring, and power supply to equipment:

E. Provide complete telemetry and control systems including Zetron RTU, monitoring and/or metering equipment, instrumentation equipment, and associated raceways, wiring, control panels, enclosures, and similar items.
F. Test, adjust and calibrate equipment and start-up all electrical equipment, instrumentation equipment, and its associated mechanical attachments as necessary to place the project into operation.

G. Mark and identify circuits, equipment, and enclosures with wire numbers, nameplates, and warning signs.

1.4 AREA CLASSIFICATIONS

A. Areas of the project are classified as "damp" or "wet" in accordance with Article 100 - Definitions of the NEC. Areas in below grade vaults, chases or pull holes.

1.5 DEFINITIONS

A. Outdoor Areas:
   1. Those locations on the Project site where the equipment is normally exposed to wind, dust, rain, snow, or similar natural environmental conditions.

B. Indoor Areas:
   1. Those locations on the Project site where the equipment is normally protected from wind, dust, rain, snow, and similar natural environmental conditions.

C. Shop Fabricated:
   1. Manufactured or assembled equipment for which a NRTL test procedure has not been established.

D. NRTL: Nationally Recognized Testing Laboratory.

E. NEC: National Electrical Code

1.6 QUALITY ASSURANCE

A. When a specific code or standard has not been cited, the applicable codes and standards of the following code-making authorities and standards organizations apply:
   1. American Association of State Highway and Transportation Officials (AASHTO).
   5. ETL Testing Laboratories, Inc (ETL).
   6. Insulated Cable Engineers Association (ICEA).
   7. Institute of Electrical and Electronic Engineers (IEEE).
   8. Illuminating Engineering Society of North America (IES).
   10. Joint Industrial Council (JIC).
   11. Lightning Protection Institute (LPI).
15. Underwriters Laboratories, Inc. (UL).

B. In case of conflict or disagreement between codes, standards, laws, ordinances, rules, regulations, drawings and specifications, or within either document itself, the more stringent condition governs.

1.7 SUBMITTALS

A. See Section 1-06 of Special Provisions.

B. Make submittals as soon as practicable after the date of notice to proceed, but prior to purchase, fabrication, or installation of materials or equipment. Make submittals grouped by Specification sections.

C. Product Data:

1. Provide manufacturer's product technical data, including, but not limited to:
   a. Identification of the manufacturer.
   b. Manufacturer's product descriptive bulletin.
   c. Current, voltage, nameplate, load, impedance, and other electrical data pertinent to the Project and necessary to assure compliance with the Specifications and Drawings.
   d. Equipment dimensions.

D. Shop Drawings: Submit Shop Drawings containing detailed drawings, diagrams and instructions for installing, operating and maintaining the material and equipment proposed for installation in the electrical work.

1. See individual Division 16 sections for specific requirements.

2. Prior to submittal, coordinate the electrical equipment (particularly variable frequency drives panelboards, telemetry panels, and instrumentation) and materials, with other applicable equipment and systems of the contract documents, particularly process equipment and systems. Any modifications to the electrical equipment or other equipment, due to the use or submittal of process or other equipment which is different from that specified or shown on the drawings, shall be reflected in the submittal of the electrical equipment so affected.

   a. Where electrical equipment submitted by the contractor is a different size than the scaled dimensions shown on the plan, section or elevation drawings of the Contract Documents, or requires clearance for ventilation (or other reasons), the Contractor shall mark and submit copies of the Contract Documents showing the actual size of the proposed equipment and its placement drawn to scale in red pencil on the copies.

   b. Where equipment dimensions, layout, conduit routing, or conductor and conduit quantities, sizes or types are required to be different than indicated on the contract drawings to accommodate the submitted equipment, the submittal shall clearly indicate the required changes (increased sizes, ratings of equipment or devices) and shall note that they are being provided to accommodate the submitted equipment.
without additional cost. The submittal shall indicate increased ratings, and/or sizes.

3. Provide technical drawings as follows. Provide diagrams and drawings similar to the Contract Drawings and named in a similar fashion for all technical drawings submittals. Use diagrams and symbols shop drawings which conform to Joint Industry Conference (JIC) Electrical Standards for Industrial Equipment and/or NEMA, Industrial Control Systems, ANSI, and IEEE standards, latest revisions. Prepare drawings on size A, B or D sheets in a format similar to the Contract Documents or other nationally recognized drawing standard.

   a. Provide diagrams and drawings similar to the Contract Drawings and named in a similar fashion for all technical drawings submittals.

   b. Use diagrams and symbols shop drawings which conform to Joint Industry Conference (JIC) Electrical Standards for Industrial Equipment and/or NEMA, Industrial Control Systems, ANSI and IEEE standards, latest revisions. Prepare drawings on size A, B or D sheets in a format similar to the Contract Documents or other nationally recognized drawing standard.

   c. Provide electrical elementary wiring diagrams for the electrical control systems showing the wiring of electrical control items, such as starters, control systems, interlocks, switches, and relays.

   d. Provide scaled and dimensioned panel or enclosure face layout drawing; panel/subpanel material of construction, dimensions, and weight; conduit and wiring access locations; and material wiring and terminal block drawings for each control panel.

   e. Provide schematic interconnection diagrams and/or Process Instrumentation Drawings (PID) diagrams for each separate control system or control panel. Each control diagram shall show a schematic representation of process equipment and locations of switches, meters, automatic valves, and indicators, controllers and recorders. Correct operating settings and ranges for each control instrument shall be marked on these diagrams.

E. Clearly indicate on submittals that equipment or material is NRTL listed or is constructed utilizing listed or recognized components. Where a NRTL standard has not been established clearly identify that no NRTL standard exists for that equipment.

F. Operation and Maintenance Manuals:

1. See specific sections for information specific to each type of equipment which is to be included in O&M manuals.

2. Provide preliminary manuals to the Engineer for review in the quantities indicated in Division 1 no later than when the electrical equipment is shipped to the job site. Drawings and Bill of Materials included in preliminary manuals shall show “as shipped” wiring and components. Provide final manuals with Record Drawings of the work upon completion of the work, folded and punched for insertion into the manual after they are reviewed by the Engineer.

3. Manuals for the electrical system consist of 3-ring binders labeled with the job name and the Contractor's name with tab dividers for each major type of equipment.
a. Provide manufacturer's installation, operation, maintenance, and service information for each item of equipment furnished under Division 16.

b. Assemble and index each section listing the contents individually on the tab divider for that section.

c. Compile a spare parts list and a suppliers index for each section and assemble in the section provided.

d. Assemble records of tests, measurements, and calibration settings made for each device. Provide Record ("As Built") Drawings of the work upon completion of the work. Fold, punch, and insert these records into the manual after they are reviewed by the Engineer.

1.8 RECORDS

A. Maintain and annotate on the job at all times a separate set of Record Drawings in accordance with the General Conditions. Show changes from the Contract Documents plan drawings including: routing of hidden raceways, stubouts, actual fixture and equipment locations, equipment sizes and dimensions and building or structure outline changes. Review the drawings with the Engineer as the work progresses whenever requested. At the end of the project, forward to the Engineer a complete set of drawings marked in red pencil in a manner consistent with the Contract Drawings, indicating the changes made on the job. Equipment furnished under this Contract for use on future work and all concealed materials, including conduits, shall be dimensioned, on the record drawings, from visible and permanent building features.

B. Equipment furnished under this Contract for use on future work and all concealed materials, including conduits, shall be dimensioned, on the record drawings, from visible and permanent building features.

C. Record voltage, current, and megohm meter and ground Ohm meter resistance test measurements made on the electrical work, the trip units, fuses, and overload relay elements installed in the equipment. Record the setting of all pressure, flow, level, and similar instrumentation and control devices. When the project is operating, turn over these records to the Engineer.

1.9 COORDINATION

A. Coordinate and schedule connecting electrical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.

B. Coordinate the interruption of electrical systems to any part of the facility in use by the Owner at least 48 hours before interruption of the system.

C. Coordinate the cutting of existing structures with the new and existing electrical systems. Identify, locate, and protect existing embedded conduits where cutting of existing structures is to be performed.

D. Coordinate installing electrical identifying devices and markings prior to installing acoustical ceilings and similar finishes that conceal such items.

E. Where modifications to the specified electrical system or systems are required to accommodate actual electrical requirements of equipment which is specified under other Divisions of the Contract but which has electrical requirements different from those specified for the equipment, make modifications to the electrical system or systems required to accommodate the equipment.
F. Coordinate the electrical work with the requirements of equipment provided under other Divisions. Portions of the electrical design are based upon the equipment specified in other Divisions. Where modifications to the specified electrical system or systems are required to accommodate actual electrical requirements of equipment which is specified under other Divisions of the Contract but which has electrical requirements different from those specified for the equipment, make modifications to the electrical system or systems required to accommodate the equipment, and pay for all such changes. No additional payment or "extras" are allowed for changes required to accommodate substitutions or changes proposed by the Contractor.

G. Where changes in the work, or substitutions in material or equipment specified under this Division are proposed, ensure that sizes, weights, openings, etc., are provided that do not require changes in the work outside this Division. If changes to work outside this Division are required to accommodate substitutions or changes proposed by the Contractor, submit complete descriptions of these changes for approval by the Engineer, and pay for all such changes. No additional payment or "extras" are allowed for changes required to accommodate substitutions or changes proposed by the Contractor.

H. Coordinate the installation of electrical equipment with other trades:

1. Accurately locate outlets, switches, control stations, panelboards and similar devices with respect to equipment, doors, partitions, cabinets and the finished work of others. Verify dimensions and locations with the civil, structural, mechanical, and general Drawings, shop drawings/suppliers and trades.

2. Arrange for the building in of anchors, supports, sleeves, or other equipment and materials during concrete pours, framing, precasting or other structure construction.

3. Where equipment cannot be built-in during construction, arrange for chases, slots, sleeves, box-outs, openings, etc., as required to allow installation of equipment after structure construction is complete.

4. Where penetration of completed construction is required, obtain approval from structural Engineer for penetration (drilling, cutting, shooting, punching) of structural components prior to penetrating the component.

5. Coordinate installing large equipment requiring positioning prior to closing in the building.

I. Coordinate electrical work with work under other Divisions. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work. Cooperate in locating equipment to avoid interference with work of others, and plan this work to harmonize with the work of other trades so that all work may proceed as expeditiously as possible. No extras are allowed because of moving work required to avoid interference with work of other trades or contractors.

J. Coordinate connecting electrical circuits to components furnished under other Divisions. Coordinate the location of motors, switches, panel connections and other points of connection with the equipment manufacturers or vendors prior to conduit installation, and route circuits to the actual connection point. Remove and reinstall conduit, outlet boxes and other electrical connections, even if removal and reinstallation of building materials is necessary, where electrical connections are not made to the appropriate equipment location.

K. Coordinate installing electrical identification after completion of finishing where identification is applied to field-finished surfaces.
L. Coordinate requirements for access panels and doors where electrical items requiring access are concealed by finished surfaces.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Ensure that equipment is not used as steps, ladders, scaffolds, platforms, or for storage - either inside or on top of enclosures.

B. Protect nameplates on electrical equipment from defacing.

C. Repair, restore, or replace damaged, corroded and rejected items at no additional cost to the Owner.

PART 2 — PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Refer to individual Division 16 sections.

   1. Provide equipment, which is of a similar type, made by one manufacturer throughout the project unless otherwise noted in the Specifications.

B. Submit requests for substitution in accordance with Specification Division 1.

2.2 APPROVALS AND LABELING

A. Provide material or equipment approved and labeled for the purpose for which it is to be used by a nationally recognized electrical testing laboratory (NRTL) or other organization acceptable to the State of Washington Department of Labor and Industries.

   1. Where NRTL test procedures have been established for the product type, provide electrical equipment approved under that procedure and bearing the NRTL label.

2.3 MATERIALS

A. Except as otherwise indicated, provide new materials and equipment which are standard products of manufacturers regularly engaged in production of such equipment. Provide similar items of equipment of the same quality from a single manufacturer. Where systems are specified, provide components of the system from a single manufacturer.

B. Trade names and catalog numbers may be used in the Drawings or Specifications to establish quality standards and basics of design:

   1. Other listed manufacturers in the applicable specification sections with equal equipment may be acceptable.

   2. If no other manufacturer is listed then any manufacturer of equal equipment may be acceptable.

C. Where voltage, current, power, temperature or other ratings are specified that do not correspond to standard ratings of the manufacturer selected by the Contractor, furnish the next rating level which increases the capacity of the device or material in question.

D. Furnish materials, devices, equipment or supplies of materials that are inherently non-corrosive or are coated or covered in a manner, acceptable to the Engineer, which
renders them non-corrosive. Material that may cause rusting, bleeding, or streaking on a 
building surface shall not be used.

E. Provide materials and equipment which do not contain polychlorinated biphenyls, 
asbestos or other hazardous or detrimental materials.

F. Fabricate equipment or devices in the field equivalent in every respect to manufactured 
items used for the same purpose. Where cutting, drilling, grinding, or similar actions are 
performed on galvanized or painted metal, regalvanize or repaint, respectively, to match 
original finish.

G. Shop or Factory Finishes:
   1. Interiors of painted equipment shall be either white or light gray.

PART 3 — EXECUTION

3.1 INSTALLATION

A. Make arrangements for and pay for necessary permits, licenses, and inspections.

B. Equipment shall be installed in accordance with the requirements of the National 
   Electrical Code, National Electrical Safety Code, and applicable state and local 
   regulations and ordinances.

C. Install equipment in accordance with the manufacturer's instructions and the NECA 
   "NEIS" (National Electric Installation Standards).

D. Equipment Dimensions and Clearances:
   1. Dimensions indicated for electrical equipment and dimensions indicated for the 
      installation of electrical equipment are restrictive dimensions. Verify that 
      equipment will fit within the indicated locations and spaces. Do not use 
      equipment that impinges upon required clearances, reduces actual clearance, or 
      exceeds the indicated dimensions:
         a. Except as approved in writing by the Engineer.
   2. Do not use arrangements of equipment that impinge upon required clearances, 
      reduce actual clearances, or exceed the space allocation.

E. Equipment Access:
   1. Install equipment so it is readily accessible for operation and maintenance.
   2. Access to equipment shall not be blocked or concealed by conduits, supporting 
      devices, boxes, or other items.
   3. Do not install electrical equipment such that it interferes with normal maintenance 
      requirements of other equipment.

F. Equipment shall be installed plumb, square and true with the building construction and 
   shall be securely fastened.

G. Install materials and equipment in a manner, location and construction that does not 
   produce galvanic action or any other materials corroding or eroding action. Equipment 
   fabricated from aluminum shall not be placed in direct contact with earth or concrete.
H. Outdoor wall-mounted equipment and indoor equipment mounted on earth or water bearing walls shall be provided with corrosion-resistant spacers to maintain 1/4 IN separation between the equipment and the wall.

I. Screen or seal all raceways or other openings into equipment to prevent the entrance of moisture, rodents and insects.

J. Drawings indicate the approximate location and arrangement of electrical equipment and the approximate location of other equipment requiring electrical work. The general arrangement of panelboards, outlets and other equipment is diagrammatic and approximate as to locations. To avoid interference with structural members and equipment of other trades, it may be necessary to adjust the intended location of electrical equipment. Where minor changes are required because of structural or finish conditions or for the convenience of the Owner, provide such changes without additional expense to the Owner. Unless specifically dimensioned or detailed, the Contractor may, at his discretion, make minor adjustments in equipment location without obtaining the Engineer's approval. Minor adjustments are defined as a distance not to exceed:

1. 1 FT at grade, floor and roof level in any direction in the horizontal plane.
2. 1 FT for equipment other than lighting at ceiling level in any direction in the horizontal plane.
3. 1 FT for lighting fixtures at ceiling level in any direction in the horizontal plane.
4. 1 FT on walls in a horizontal direction within the vertical plane.
5. Changes in equipment location exceeding those defined above require the Engineer's approval.
6. Particular attention shall be paid to door swings, piping, radiation, ductwork, and structural steel:
   a. In general, waste and vent lines and large pipe mains and ductwork shall be given priority for the locations and space shown.
   b. Electrical lighting fixtures shall, in general, be given priority for ceiling space.
   c. No additional compensation will be allowed for the moving of misplaced outlets, wiring, or equipment.

3.2 DEMONSTRATION
A. Demonstrate equipment to owner at completion of Contract.
B. Provide assistance to the Engineer during the demonstration or observation of equipment by operating devices and equipment, opening enclosures for inspection, checking record drawing information, and similar tasks, as necessary in the Engineer's judgement to verify all work provided.

PART 4 — PAYMENT

4.1 PAYMENT
A. Payment for the work described in this section will be included in the lump sum bid for Electrical.

END OF SECTION
SECTION 16050 — BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 — GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Amendments and Special Provisions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Supporting devices for electrical components.
   2. Electrical identification.
   3. Electrical demolition.
   4. Cutting and patching
   5. Cleaning and finish touchup painting.
   6. Testing

1.3 SUBMITTALS

A. General: Submit each item below according to the Conditions of the Contract and Division 1 Specification Sections.

B. Test reports.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7, or a full member company of the International Electrical Testing Association (NETA).

   1. Testing Agency Field Supervision: Use persons currently certified by NETA or the National Institute for Certification in Engineering Technologies, or equal, to supervise on-site testing specified in Part 3.

B. Comply with NEC for components and installation.

C. Listing and Labeling: Provide products specified in this Section that are listed and labeled.

   1. The Terms "Listed and Labeled": As defined in the NEC, Article 100.

   2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Receive, handle, and store electrical materials and equipment in accordance with the manufacturer's instructions.

B. Provide dry, heated storage for materials and equipment intended to be installed indoors and for equipment that that requires electric heaters to mitigate water condensation and like hazards.
C. Ensure that equipment is not used as steps, ladders, scaffolds, platforms, or for storage - either inside or on top of enclosures.

D. Protect materials and equipment from damage, corrosion, or disfiguring; protect nameplates on electrical equipment from defacing. Repair, restore, or replace damaged, corroded and rejected items at no additional cost to the Owner.

PART 2 — PRODUCTS

2.1 SUPPORTING DEVICES

A. Provide channel and angle support systems, hangers, anchors, sleeves, brackets, fabricated items, and fasteners for secure support of electrical components.

1. Material:
   a. Outdoors, Wet and Damp locations: Hot-dip galvanized steel, or stainless steel.
   b. Other locations: Steel, except as otherwise indicated, protected from corrosion with zinc coating, cadmium plating, or with treatment of equivalent corrosion resistance using approved alternative finish or inherent material characteristics.

B. Conduit clamps: one hole or beam clamps

1. Rigid Steel Conduit: cast iron clamps with cast iron “foot”.
2. EMT: stamped steel clamps

C. Anchors: cadmium plated or galvanized steel in dry areas; stainless steel or hot dipped galvanized steel in damp or wet areas.

1. Lag screws or Type A tapping screws for wood.
2. Rockwell "well-nut" for light loads in masonry.
3. Thru-bolt with fender washers for heavy loads in masonry.
4. Toggle bolts with springhead for hollow partitions.
5. Self drilling anchors with threaded studs for concrete.
6. Clamps or U-bolts for structural steel.
7. Self drilling anchors with extension rods for hollow tile over concrete.
8. Hanger rods: 1/4-inch diameter or larger threaded steel, except as otherwise indicated.

D. Sleeves:

1. PVC, schedule 40.
2. 0.0276-inch or heavier galvanized sheet steel, round tube, closed with welded longitudinal joint.
3. ASTM A 53, Type E, Grade A, Schedule 40, galvanized steel, plain ends.
4. Cast iron, with weep rings.
2.2 ELECTRICAL ENCLOSURES

A. Enclosures for Use with Electrical Equipment:

   1. Standards:

      a. NEMA ICS-6, Enclosures for Industrial Controls and Systems.
      b. UL 508, Industrial Control Equipment.
      c. UL 698, Industrial Control Equipment for Use in Hazardous Locations.

   2. Provide NEMA enclosure types as indicated on the contract documents. Where the enclosure type is not indicated on the contract documents provide enclosures as follows.

   3. NEMA 12: Use in unclassified (non-hazardous and non-corrosive) indoor locations which are neither wet nor damp.

   4. NEMA 3R: Use with HVAC equipment in wet or outdoor locations.

B. NEMA 4:

   1. Use in unclassified wet indoor locations.

   2. Use in unclassified outdoor locations except with HVAC equipment.

C. Shop or Factory Finishes:

   1. See Section 09900.

   2. Exteriors of painted enclosures shall be ANSI gray.

   3. Interiors of painted enclosures shall be white.

2.3 ELECTRICAL IDENTIFICATION

A. Manufacturer's Standard Products: Where more than one type is listed for a specified application, selection is Contractor's option, but provide single type for each application category. Use colors prescribed by ANSI A13.1, NEC and these Specifications.

B. Colored Adhesive Marking Tape for Raceways, Wires, and Cables: Self-adhesive vinyl tape not less than 3 mils thick by 1 inch wide.

C. Underground Line Warning Tape: Permanent, bright-colored, continuous-printed, vinyl tape with the following features:

   1. Size: Not less than 4 mils thick by 6 inches wide.

      a. Compounded for permanent direct-burial service.

D. Tape Markers: Vinyl or vinyl-cloth, self-adhesive, wraparound type with preprinted numbers and letters.

E. Color-Coding Cable Ties: Type 6/6 nylon, self-locking type. Colors to suit coding scheme.
F. Engraved, Plastic-Laminated Labels, Signs, and Instruction Plates: Engraving stock, melamine plastic laminate punched for mechanical fasteners 1/16-inch minimum thick for signs up to 20 sq. in., 1/8 inch thick for larger sizes. Engraved legend in white letters on black face.

G. Fasteners for Plastic-Laminated and Metal Signs: Self-tapping stainless-steel screws or stainless-steel No. 10/32 machine screws with nuts and flat and lock washers.

H. Wire markers: machine printed, black ink, alpha-numerical identifiers on yellow polyolefin shrink tubing. Kroy K4350 Shrink Tube, or approved equal.

2.4 TOUCHUP PAINT

A. For Equipment: Provided by equipment manufacturer and selected to match equipment finish.

B. For Non-equipment Surfaces: Matching type and color of undamaged, existing adjacent finish.

C. For Galvanized Surfaces: Zinc-rich paint recommended by item manufacturer.

PART 3 — EXECUTION

3.1 INSTALLATION

A. Install the equipment and materials in a neat and workmanlike manner employing workmen skilled in the particular trade and in accordance with the manufacturer’s instructions and industry standards. Maintain adequate supervision of the work by a person in charge at the site during any time that work under this division is in process or when necessary for coordination with other work.

B. Install components and equipment to provide the maximum possible headroom where mounting heights or other location criteria are not indicated. Mount enclosures for individual units at fifty-four inches above floors to centerline of controls.

C. Install items level, plumb, and parallel and perpendicular to other building systems and components, except where otherwise indicated.

D. Install equipment to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.

E. Fastening: Unless otherwise indicated, securely fasten electrical items and their supporting hardware to the building structure. Attach enclosures with a minimum of three fasteners, and more if the manufacturer so recommends.

1. Attach enclosures mounted on equipment with machine screws or clamps as required. Do not drill equipment frames or sheets without permission of supplier/manufacturer or the Engineer.

2. Stand equipment off wall surfaces a minimum of one-quarter inch where enclosures are mounted on walls in wet areas (outdoors, below grades, etc.) with neoprene, fiberglass or plastic shim washers.

3. Welding to steel structure may be used only for threaded studs, not for conduits, pipe straps, or any other items.

4. Select fasteners so the load applied to any fastener does not exceed 25 percent of the proof-test load.
F. Give right of way to raceways and piping systems installed at a required slope.

G. Sleeves: Install for cable and raceway penetrations of concrete slabs and walls, except where core-drilled holes are used. Install for cable and raceway penetrations of masonry and fire-rated gypsum walls and of all other fire-rated floor and wall assemblies. Install sleeves during erection of concrete and masonry walls.

H. Make all penetrations of electrical work through walls and roofs water and weather-tight.

I. Install concrete pads and bases according to requirements of Division 3 Section "Cast-in-Place Concrete."

3.2 ELECTRICAL SUPPORTING METHODS

A. Wet or Damp Locations and Outdoors: Hot-dip galvanized materials, or stainless steel materials, and system components.

B. Dry Locations: Steel materials anodized or electro plated.

C. Support electrical equipment, devices and materials from framing members or structure with sufficient clearance for maintaining and servicing.
   1. Provide backing plates, and/or framing material to support equipment, devices and materials which are located between the framing members which are part of the building or facility structure.
   2. Provide metal structure fabricated of structural shapes such as C-channel or tubing for mounting cabinets, panelboards, disconnects, control enclosures, pull boxes, junction boxes, transformers, and other devices except where components are mounted directly to structural features of adequate strength.

D. Raceway Supports: Comply with NFPA 70 and the following requirements:
   1. Conform to manufacturer's recommendations for selecting and installing supports.
   2. Install individual and multiple raceway hangers and riser clamps to support raceways. Provide U bolts, clamps, attachments, and other hardware necessary for hanger assembly and for securing hanger rods and conduits.
   3. Support parallel runs of horizontal raceways together on trapeze- or bracket-type hangers.
   4. Spare Capacity: Size supports for multiple conduits so capacity can be increased by a 25 percent minimum in the future.
   5. Support individual horizontal raceways with separate, malleable iron pipe hangers or clamps.
   6. In vertical runs, arrange support so the load produced by the weight of the raceway and the enclosed conductors is carried entirely by the conduit supports, with no weight load on raceway terminals.
   7. Use double nuts or jam nuts with regular nuts on threaded rods and bolts.
   8. Trim rod ends to within ¼ inch after installation of last nut, clamp or similar hardware: smooth cut ends or install cap nut.

E. Fasten electrical items and their supporting hardware securely to the building or structure. Provide all necessary anchoring devices and supports:
1. Use supports as detailed on the Drawings and as specified:
   a. Where not detailed on the Drawings or specified, use supports and anchoring devices rated for the equipment load and as recommended by the manufacturer. Select anchoring devices, fasteners, and supports so the load applied to any anchoring device, fastener, or support does not exceed 25 percent of the proof-test load.

2. Base rating and size of supports and anchoring devices on dimensions and weights verified from approved equipment submittals.

3. Attach enclosures with a minimum of three fasteners, and more if the manufacturer so recommends. Install outdoor wall-mounted equipment and indoor equipment mounted on earth or water bearing walls with corrosion-resistant spacers to maintain 1/4 IN separation between the equipment and the wall.

4. Attach enclosures mounted on equipment with machine screws or clamps as required. Do not drill equipment frames or sheets without permission of supplier/manufacturer or the Engineer. Do not mount safety switches or external equipment to other equipment enclosures, unless enclosure mounting surface is adequately reinforced structurally to accept mounting of external equipment.

5. Do not cut, or weld to, building structural members.

6. Do not mount safety switches and external equipment to other equipment enclosures, unless enclosure mounting surface is properly braced to accept mounting of external equipment.

F. Provide concrete foundations or pads required for electrical equipment:

1. Floor-mounted equipment shall be mounted on a 4 IN high concrete housekeeping pad except the concrete base shall be shortened in height by the thickness of the channel base when equipment is provided with channel bases such as typically provided with motor control centers and switchboards. Pad shall be poured on top of the finished floor or slab.

G. Install hangers, inserts, supports, and anchors prior to installation of fireproofing.

H. Miscellaneous Supports: Install metal structure fabricated of structural shapes such as C-channel or tubing for mounting cabinets, panelboards, disconnects, control enclosures, pull boxes, junction boxes, transformers, and other devices except where components are mounted directly to structural features of adequate strength.

I. Support raceway, equipment, and devices from framing members or structure with sufficient clearance for maintaining and servicing. Provide backing plates, and/or framing material to support equipment, devices and materials which are located between the framing members which are part of the building or facility structure.

J. Cable supports - provide cable ties and straps for clamping, tying, securing and banding wires and cables in all junction boxes, panelboards and terminal cabinets. Support each circuit independently; group phases of three phase circuits.

3.3 IDENTIFICATION

A. Install labels where indicated and at locations for best convenience of viewing without interference with operation and maintenance of equipment.
B. Coordinate names, abbreviations, colors, and other designations used for electrical identification with corresponding designations indicated on the Contract Documents or required by codes and standards. Use consistent designations throughout the Project.

C. Self-Adhesive Identification Products: Clean surfaces of dust, loose material, and oily films before applying.

D. Tag or label power circuits for future connection and circuits in raceways and enclosures with other circuits. Identify source and circuit numbers in each cabinet, pull box, junction box, and outlet box. Color coding may be used for voltage and phase indication.

E. Identify Paths of Underground Electrical Lines: During trench backfilling, for exterior underground power, control, signal, and communication lines, install continuous underground plastic line marker located directly above power and communication lines. Where multiple lines installed in a common trench or concrete envelope do not exceed an overall width of 16 inches, use a single line marker.

F. Provide engraved phenolic name plates (white with black background) on equipment enclosures giving the name and circuit identification of the enclosed device/equipment in one-quarter inch letters.

G. For panelboards, provide framed, typed circuit schedules with explicit description and identification of items controlled by each individual breaker.

H. Provide electrical danger, caution, warning or safety instruction signs in accordance with Section 01140.

3.4 DEMOLITION

A. Demolish all existing electrical devices and circuits which are noted for demolition. Demolition includes, but is not limited to:

1. Remove all conduit, conductors, fittings, device boxes, hangers, panels, devices, etc., which are not concealed in the building structure or below grade/slab.

B. Do not remove or damage fireproofing materials. Repair or replace fireproofing removed or damaged.

C. Locate, identify, and protect electrical equipment and materials to remain. Where existing work to remain is damaged in the course of the Work, remove damaged portions and install new products of equal capacity, quality, and functionality.

D. Remove existing conductors from conduits, unless otherwise indicated, where existing work is to be abandoned in place. Cut and remove buried raceway indicated to be abandoned in place, 2 inches below the surface of adjacent construction. Cap and patch surface to match existing finish.

E. Remove demolished material from the Project site and legally dispose of demolished material.

F. Remove, store, clean, reinstall, reconnect, and make operational components indicated for relocation and/or reconnection. Coordinate the process, mechanical, HVAC, and other equipment scheduled to be relocated and/or reused with other Divisions, and disconnect the equipment from and reconnect the equipment to the electrical systems.

3.5 CUTTING AND PATCHING

A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for electrical installations. Perform cutting by skilled mechanics of the trades involved.
B. Repair disturbed surfaces to match adjacent undisturbed surfaces.

3.6 CLEANING AND TOUCHUP PAINTING

A. Clean dirt and debris from all surfaces. Thoroughly vacuum the interior of enclosures to remove dirt and debris.

B. Replace nameplates damaged during installation.

C. Apply touch-up paint as required to repair scratches, etc. Field paint in accordance with Section 09900. Thoroughly clean damaged areas and provide primer, intermediate, and finish coats to suit the degree of damage at each location. Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.

3.7 TESTING

A. Testing shall be performed by a person currently certified by the InterNational Electrical Testing Association.

B. Additional testing requirements specific to other sections are specified in those sections.

C. Test electrical equipment after installation but before it is energized and placed in service. Report all test results in writing. Where tests disclose a defect in the work, rework or repair work at no additional expense to the Owner and retest to confirm the rework or repair until retesting confirms that the defect has been corrected. Test in accordance with the manufacturer's installation and testing instructions and the applicable electrical standards (i.e., NEMA, IEEE, ISA, ANSI, or other) for the class of equipment.

1. Test the equipment and electrical circuits for proper connection, continuity, and absence of undesirable shorts and grounds. Test wire and cable installation, when complete and seventy-two hours prior to energization of the system. Check for continuity, visual damage, marking, and proper phase sequence before performing insulation testing.

2. Megger equipment bus work, switches, breakers and circuits phase-to-phase and phase-to-ground disconnecting and reconnecting equipment which cannot be meggered as required. The minimum acceptable steady-state value is 50 megohms. Record ambient temperature and humidity during testing.

3. Test operation, calibration, and settings of the meters, relays and indicating devices.

4. Test all operating controls for proper operation.

5. Test auxiliary equipment, i.e., heaters, thermostats, lights, and illuminated indicating devices and lamps, and audible alarm devices which are an integral part of equipment to verify that they function properly.

6. Adjust installed equipment for proper operation of all electrical and mechanical components.

7. Take load readings on each panelboard after loads are connected. Record these measurements to give the maximum reading for each phase and neutral obtained with lighting, appliances, motors, and other loads, connected to the panels in service.

8. Check fuses with an ohmmeter; Ring out wiring and busing; Check operation of control and safety interlocks; Check grounding of potential transformers, current
transformers, lightning and surge arresters; Check control connections at terminal blocks, relays, meters, switches, etc.

   
   a. Perform load tests of each motor and prepare a written report of the findings showing the following:
      
      1) Nameplate Ratings (horsepower), (speed), (voltage), (phase), (ampere rating of motor at full load).
      
      2) Measured Load in amperes on each phase
   
   b. For load tests for each pump/blower/process equipment motor
      
      1) Note the operating conditions at the time of the test.
      
      2) Note the suction and discharge conditions (pressure, temperature, humidity, where such conditions affect load).

10. After installation, all equipment shall be tested as recommended by the manufacturer.

D. Rework or repair equipment which performs unsatisfactorily during or as a result of testing at no additional expense to the Owner. Replace equipment and systems found inoperative or defective and retest:

   1. If equipment or system fails retest, replace it with products which conform with Contract Documents.
   
   2. Continue remedial measures and retests until satisfactory results are obtained.
   
   3. Remedial measures and retests will be done at no cost to the Owner.

E. Demonstrate to the Owner that the electrical installation is working by operating all electrical systems and equipment. Simulate control and emergency conditions, artificially where necessary, for complete system tests.

PART 4 — PAYMENT

4.1 PAYMENT

A. Payment for the work described in this section will be included in the lump sum bid for Electrical.

END OF SECTION
SECTION 16060 — GROUNDING

PART 1 — GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Amendments and Special Provisions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes grounding of electrical systems and equipment and basic requirements for grounding for protection of life, equipment, circuits, and systems. Grounding requirements specified in this Section may be supplemented in other Sections of these Specifications.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Section 16120 "Conductors and Cables" for requirements for grounding conductors.

1.3 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Field tests and observation reports certified by the testing organization and indicating and interpreting the test reports for compliance with performance requirements.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7, or a full member company of the InterNational Electrical Testing Association (NETA).

1. Testing Agency Field Supervision: Use persons currently certified by NETA, or equal, to supervise on-site testing specified in Part 3.

B. Comply with NEC.

C. Comply with UL 467.

D. Listing and Labeling: Provide products specified in this Section that are listed and labeled.

1. The Terms "Listed" and "Labeled": As defined in the NEC, Article 100.

2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

PART 2 — PRODUCTS

2.1 GROUNDING AND BONDING PRODUCTS

A. Governing Requirements: Where types, sizes, ratings, and quantities indicated are in excess of NEC requirements, the more stringent requirements and the greater size, rating, and quantity indications govern.
2.2 WIRE AND CABLE GROUNDING CONDUCTORS
A. Comply with Division 16 Section "Wires and Cables." Conform to NEC Table 8, except as otherwise indicated, for conductor properties, including stranding.
B. Equipment Grounding Conductors: Insulated with green color insulation.
C. Grounding-Electrode Conductors: Stranded cable, bare or varnish coated.
D. Ground Rods: ¾ inch diameter, 10 foot long, copper clad steel.

2.3 CONNECTOR PRODUCTS
A. Pressure Connectors: High-conductivity-plated units.
B. Bolted Clamps: Heavy-duty type.
C. Exothermic-Welded Connections: Provided in kit form and selected per manufacturer's written instructions for specific types, sizes, and combinations of conductors and connected items. Burndy, Thermoweld, or Cadweld.

PART 3 — EXECUTION

3.1 APPLICATION
A. Equipment Grounding Conductors: Comply with NEC Article 250 for types, sizes, and quantities of equipment grounding conductors, except where specific types, larger sizes, or more conductors than required by NEC are indicated.

1. Install insulated equipment grounding conductor with circuit conductors for the items below.
   a. Service and Feeders.
      1) Bond the conductor full size to the equipment to which the circuit connects and to the raceway if it is metallic.
   b. Single-phase motor or appliance branch circuits.
   c. Three-phase motor or appliance branch circuits.
   d. Flexible raceway runs.

2. Nonmetallic Raceways: Install an equipment grounding conductor in nonmetallic raceways unless they are designated for telephone or data cables. Bond the conductor at each end to grounded metallic raceway or equipment.

B. Separately Derived Systems: Where NEC requires grounding, ground according to NEC Paragraph 250-30.

3.2 INSTALLATION
A. General: Ground electrical systems and equipment according to NEC requirements, except where Drawings or Specifications exceed NEC requirements.

B. Ground the secondary electrical system to the building structure, metallic piping system and supplemental grounding electrodes. Coordinate grounding connections made to the water system with the mechanical work and install bonding jumpers wherever deemed necessary.
3.3 CONNECTIONS

A. General: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

1. Use electroplated or hot-tin-coated materials to assure high conductivity and to make contact points closer in order of galvanic series.

2. Make connections with clean, bare metal at points of contact.

3. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

B. Exothermic-Welded Connections: Use for connections to structural steel and for underground connections, except those at test wells. Acceptable manufacturers are Burndy, Thermoweld, or Cadweld. Comply with manufacturer's written instructions. Clean all varnish, oxide, scale, concrete, etc. from conductors before firing joints. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.

C. Equipment Grounding-Wire Terminations: Make the grounding conductor connections to motors or equipment ten horsepower and above, or twenty amperes and above, with conductor termination and a 5/16 inch minimum bolt tapped to the motor frame or equipment housing. Ground connection to smaller motors and equipment may be made by fastening the conductor termination to a connection box.

D. Noncontact Metal Raceway Terminations: Where metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a metallic, insulating grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically noncontinuous conduits at both entrances and exits with grounding bushings and bare grounding conductors, except as otherwise indicated.

E. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. Where these requirements are not available, use those specified in UL 486A and UL 486B.

F. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by manufacturer of connectors. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.

3.4 FIELD QUALITY CONTROL

A. Independent Testing Agency: Engage an independent electrical testing organization to perform tests described below.

B. Tests:

1. Subject the completed grounding system to a megger test at each service disconnect enclosure grounding terminal. Measure ground resistance not less than 2 full days after the last trace of precipitation, and without the soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance. Perform tests by the 2-point method according to IEEE 81.

2. Equipment grounding connections shall be checked by the Contractor in the presence of the Engineer with a Biddle ground ohmmeter.
C. Maximum grounding resistance values are as follows:
   1. Main Service (grounding electrode): 3 ohms.

D. Excessive Ground Resistance: Where resistance to ground exceeds specified values, notify Engineer. Check connections of affected equipment and conductors. Replace, repair, or correct defective connections or conductors. Provide additional ground rods where the grounding electrode resistance is greater than specified. Revise and retest until resistance is within specifications.

E. Report: Prepare test reports, certified by the testing organization, of ground resistance at each test location. Include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

PART 4 — PAYMENT

4.1 PAYMENT

A. Payment for the work described in this section will be included in the lump sum bid for Electrical.

END OF SECTION
SECTION 16120 — CONDUCTORS AND CABLES

PART 1 — GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including Amendments and Special Provisions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY
A. This Section includes building wires and cables and associated connectors, splices, and terminations for wiring systems rated 600 V and less.

1.3 SUBMITTALS
A. General: Submit each item in this article according to the conditions of the contract and Division 1 Specification Sections.
   1. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.
   2. Product data: for low voltage instrument wire, VFD cable.

1.4 QUALITY ASSURANCE
A. Testing Agency: Utilize an independent testing agency meeting OSHA criteria for accreditation of testing laboratories, Title 29, Part 1907; or which is a full-member company of the InterNational Electrical Testing Association.
   1. Testing Agency's Field Supervisor: Person currently certified by NETA, or equal, to supervise on-site testing specified in Part 3.
B. Listing and Labeling: Provide wires and cables specified in this Section that are listed and labeled.
   1. The Terms "Listed" and "Labeled": As defined in NEC, Article 100.
C. Comply with NEC.

PART 2 — PRODUCTS

2.1 BUILDING WIRES AND CABLES
A. UL-listed building wires and cables with conductor material, insulation type, cable construction, and rating as specified in Part 3 "Wire and Insulation Applications" Article.
B. Thermoplastic Insulation Material: Comply with NEMA WC 5.
C. Cross-Linked Polyethylene Insulation Material: Comply with NEMA WC 7.
D. Ethylene Propylene Rubber Insulation Material: Comply with NEMA WC 8.
E. Conductor Material: Copper.
F. Stranding:
   1. Class B for power applications.
2. Class C for control applications.

G. Size and Type:
1. Solid or stranded conductor for No. 10 AWG and smaller gauge power circuits;
2. Stranded conductor for larger gauge than No. 10 AWG power circuits.
3. Stranded conductors for control circuits.
4. Grounding conductors: solid conductor in sizes No. 6 AWG and smaller gauge; stranded in No. 4 AWG and larger gauge.

H. Cords: Type SO, size #14 or larger.

2.2 INSTRUMENTATION AND SPECIALTY WIRE

A. Low voltage instrument wire: 600 volt rated, multi-conductor cable with overall neoprene or PVC jacket. Individual conductors PVC or polyethylene insulated, with or without nylon overcoat.

1. Unshielded instrument cable Beldon 9486 (18 gauge), 9488 (14 gauge) or equal, Alpha or NEC.
2. Shielded single pair instrument wire (2/C#18) Beldon 9341 or equal, Alpha or NEC.
3. Shielded three conductor instrument wire (3/C#18) Beldon 1121A or equal, Alpha or NEC.
4. Shielded multi-pair (#18 gauge) instrument wire equal to Beldon 1048 (2 pair), 1049 (4 pair), 1050 (8 pair), 1051 (12 pair) or equal, Alpha or NEC.

B. Specialty wire: As specified in the section describing the system it serves.

2.3 CONNECTORS AND SPLICES

A. Provide UL-listed, factory-fabricated wiring connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

B. Conductor Taps:

1. Solid Conductors size 18 through 10 AWG: Twist on insulated spring connectors.
2. Stranded Conductors size 18 through 6 AWG: insulated, solid barrel, crimp type plated copper alloy connectors.
3. Conductors size 4 AWG and larger: plated copper alloy compression splicing sleeves installed by high pressure compression tools and insulated with heat shrink Raychem sleeves.
4. Outdoors or wet areas: wire splice kits, epoxy resin, hardener, and mold. 3M Scotchcast or equal.

C. Terminations: suitable for 75 degree Celsius rated copper conductor.

1. Service and feeder circuits: compression indent barrel connectors with one or two hole spade lug ends.
2. Conductor size 18 through 10 AWG: insulated, solid copper barrel, crimp type, plated copper alloy spade tongue terminal, made for the wire size and terminal on
which they are installed and crimped with an approved plier or tool for the connector.

3. Conductor size 8 AWG and larger: compression, indent, solid copper barrel, one or two hole lugs.

D. Motor connections: insulated, solid barrel, crimp type, ring tongue plated copper alloy.

2.4 INSULATING MATERIALS

A. Fillers: 3M Scotchfill, or equal.
B. Tape: 7 mil vinyl plastic tape, Scotch 33+, or equal.

PART 3 — EXECUTION

3.1 EXAMINATION

A. Examine raceways and building finishes to receive wires and cables for compliance with requirements for installation tolerances and other conditions affecting performance of wires and cables. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 WIRE AND INSULATION APPLICATIONS

A. Feeders: Type USE/RHW/RHH, in raceway.
B. Branch circuits: Type USE/RHW/RHH, in raceway. Type THHN/THWN may be used for 120 volt lighting and receptacle branch circuits in sizes #12 AWG and #10 AWG.
C. Grounding Conductors (other than equipment grounding conductors): bare copper with varnish coat.
D. Equipment Grounding Conductors: Same type insulation and conductor as the circuit conductors supplying the equipment to be grounded.
E. Class 1 and 2 Control Circuits: Type MTW/THWN, size #14 AWG or larger, in raceway.
F. Instrumentation Circuits: Shielded or unshielded instrument cable, as indicated on the Contract Documents.

3.3 INSTALLATION

A. Install wires and cables in raceway system, according to manufacturer's written instructions and NECA's "Standard of Installation", after raceway system is complete, and following "Examination" article of this section.
B. Provide individual neutral conductors for each circuit. Common neutral conductors for multi branch circuits are not permitted unless specifically shown on the drawings.
C. Install service, feeder, motor and grounding circuits continuously without splices from equipment terminal to equipment terminal or motor lead. 120 and 277 volt single phase branch circuits may be spliced at taps. Do not splice circuits at other locations without written permission from the Engineer.
D. Install instrumentation and control circuits continuously except for termination on terminal strips in control panels or terminal cabinets.
E. Color code conductors as follows:

2. 480/277 volt, three phase systems:
   a. Phase A - brown
   b. Phase B - orange
   c. Phase C - yellow
   d. Neutral - gray

3. 240/120 volt, single phase systems:
   a. Phase A - black
   b. Phase B - red
   c. Neutral - white

4. Use wire with insulation of required color for conductors of #8 AWG and smaller. For wire larger than No.8 AWG which is not available in specified colors, use self-adhesive, wrap-around cloth type markers of solid colors to code the conductors. When conductors are marked in this manner, mark each conductor at all accessible locations such as panelboards, junction boxes, pullboxes, auxiliary gutters, outlets, switches, and control centers.

5. Do not use white or green color for any power, lighting, or control conductor not intended for neutral or grounding purposes.
   a. low voltage control circuits, or 18 AWG or smaller control conductors, may use green or white singly or as part of a trace color in addition to the base color.

6. Use control wiring of colors different than power wiring or supplied with a trace of color in addition to the basic color of the insulation. Use the same color scheme throughout a given system for any control or signal wires performing the same function.

7. Connect circuit conductors of the same color to the same phase throughout the installation. Viewing all equipment from the front, make connections so phase color sequence is in the same order as that for panelboards, switchboards, motor control centers, etc.

F. Install wiring to equipment neutral and grounding blocks on the bottom or furthest back row first. Leave unconnected blocks accessible for future neutral or grounding connections.

G. Leave six inches or more of free conductor at each connected device or equipment terminal and nine inches of free conductors at each unconnected outlet. Tape free ends of conductors at unconnected outlets and coil neatly in outlet box.

H. Install wires neatly in enclosures. Bend or form wires in neat runs from conduits to terminals. Arrange wires so that they may be grouped by conduit or function in the enclosure. Install cable ties and straps to support and bundle wires in enclosures. Arrange wires to allow wire tags and numbers to be easily read without bending or flexing wiring.

I. Install grounding conductors in non-metallic raceways, and in flexible conduit connecting to mechanical equipment.
J. Pulling Conductors:
   1. Make all cable pulls by hand. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, or wrapping extra conductor into an eye, that will not damage cables or raceway.
   2. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values. Install pullboxes where necessary to prevent exceeding manufacturer's recommendations.
   3. Cut cable or conductor ends off after pulling and clean all lubricant and/or pulling compound from conductors before terminating.

K. Support cables according to Section 16050 "Basic Electrical Materials and Methods."

L. Identify wires and cables according to Section 16050 "Basic Electrical Materials and Methods."
   1. At each connection, except at motors, tag for phase rotation.
   2. At each motor tag for winding lead numbers. Make all phase rotation changes for motor direction changes at the motor to maintain correct color phase sequence in equipment.
   3. In each enclosure or box where more than one ungrounded power conductor is spliced or connected, tag for panelboard identification and pole number.

3.4 CONNECTIONS
   A. Use the proper high pressure compression tool for terminating indent type compression connectors or terminations on conductors of size #8 AWG or larger gauge. Use an approved pliers or tool for crimping connectors for conductors of size #10 AWG or smaller gauge.
   B. Make splices or bolted connections with filler, and tape that possess equivalent or better mechanical strength and insulation ratings than conductors being spliced. Insulate to same thickness as connectors being spliced or connected.
   C. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches of slack.
   D. Connect outlets and components to wiring and to ground as indicated and instructed by manufacturer, and in compliance with other Sections of Division 16.
   E. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
   F. Make connections so phase color sequence at equipment, when viewed from the front, is in the same order as that for panelboards, switchboards, or other distribution equipment.

3.5 FIELD QUALITY CONTROL
   A. Testing Agency: Engage a qualified independent testing agency to perform field quality-control testing.
   B. Test installation of wires and cables before electrical circuitry has been energized.
1. Procedures: Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Section 7.3.1. Certify compliance with test parameters.

2. Remove and replace conductors with visible damage on conductor insulation ends due to installation in an incomplete or damaged conduit system such as, but not limited to, missing bushings or burrs on conduit ends.

C. Correct malfunctioning conductors, cables, and connections at Project site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new materials and retest.

PART 4 — PAYMENT

4.1 PAYMENT

A. Payment for the work described in this section will be included in the lump sum bid for Electrical.

END OF SECTION
SECTION 16130 — RACEWAYS AND BOXES

PART 1 — GENERAL

1.1 RELATED DOCUMENTS

1. Drawings and general provisions of the Contract, including Amendments and Special Provisions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

1. Raceways include the following:
   a. RMC.
   b. PVC externally coated, rigid steel conduits.
   c. EMT.
   d. FMC.
   e. LFMC.
   f. RNC.

2. Boxes, enclosures, and cabinets include the following:
   a. Device boxes.
   b. Outlet boxes.
   c. Pull and junction boxes.
   d. Cabinets and hinged-cover enclosures.

B. Related Sections include the following:

1. Section 16050 "Basic Electrical Materials and Methods" for raceway and box supports.

2. Section 16140 "Wiring Devices" for devices installed in boxes.

3. Section 16120 "Conductors and Cables" for conductors installed in raceways and boxes.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. FMC: Flexible metal conduit.

C. LFMC: Liquidtight flexible metal conduit.

D. RMC: Rigid metal conduit.

E. RNC: Rigid nonmetallic conduit.
1.4 SUBMITTALS
A. General: Submit each item in this article according to the conditions of the contract and Division 1 Specification Sections.

1.5 QUALITY ASSURANCE
A. Listing and Labeling: Provide raceways and boxes specified in this Section that are listed and labeled.
   1. The Terms "Listed" and "Labeled": As defined in NEC, Article 100.
B. Comply with NECA's "Standard of Installation."
C. Comply with NEC.

1.6 COORDINATION
A. Coordinate layout and installation of raceways and boxes with other construction elements to ensure adequate headroom, working clearance, and access.

PART 2 — PRODUCTS
2.1 METAL CONDUIT AND TUBING
A. RMC:
   1. Conduit: Hot dipped galvanized steel with threaded ends meeting ANSI C80.1.
   2. Couplings: unsplit, NPT threaded steel cylinders with galvanizing equal to the conduit.
   3. Nipples: same as conduit, factory made through eight inches, no running threads.
B. Plastic-Coated Steel Conduit and Fittings: NEMA RN 1.
C. EMT:
   1. Conduit: Galvanized steel tubing meeting ANSI C80.3.
   2. Couplings: steel, cast iron, or malleable iron compression type employing a split, corrugated ring and tightening nut, with integral bushings and locknuts. No indent or setscrew type.
D. FMC:
   2. Connectors: galvanized steel, screw in, approved for grounding.
E. LFMC:
   1. Conduit: flexible, galvanized steel convolutions forming a continuous raceway, covered by a liquid tight PVC layer. Electri-Flex Type LA or American Sealite, Type UA
2. Connectors: galvanized steel, screw in, grounding type with a ferrule which covers the end of the conduit inside and out.

F. Fittings: NEMA FB 1; compatible with conduit/tubing materials.

2.2 NONMETALLIC CONDUIT AND TUBING

A. RNC: NEMA TC 2, Schedule 40 or 80 PVC.

B. Fittings: NEMA TC 3; match to conduit or conduit/tubing type and material.

2.3 OUTLET AND DEVICE BOXES

A. Concealed in dry (not wet, corrosive, or hazardous) Locations: Stamped steel, deep drawn one piece (without welds or tab connections), galvanized, with knockouts for conduit or connector entrance, meeting NEMA OS 1, and with plaster or extension rings to suit construction and application.

B. Outdoors, below grade, wet locations, or exposed in indoor locations which are not hazardous: galvanized, cast iron alloy or cast aluminum box, one piece, with threaded holes or hubs, and with neoprene gaskets. Covers shall be of the same material and finish as the device box.

1. Surface mount boxes have integral mounting lugs.

2.4 PULL AND JUNCTION BOXES

A. Dry locations: Stamped steel, deep drawn one piece (without welds or tab connections), galvanized, with knockouts for conduit or connector entrance, meeting NEMA OS 1. Boxes 6"x6"x4" or larger may be code gauge fabricated steel continuously welded at seams and painted after fabrication.

B. Wet locations, outdoors, or below grade:

1. Cast-Metal Boxes meeting NEMA FB 1, with gasketed screw down cover.

2. Boxes 6"x6"x4" or larger may be code gauge fabricated stainless steel continuously welded at seams and with rubber gasketed covers and hinged doors with clamps, Hoffman or equal. Covers and hinges shall be of the same material and finish as the device box.

C. Underground circuits: In accordance with the Washington State Department of Transportation's Standard Plan No. J-11a, Design B.

2.5 MISCELLANEOUS FITTINGS AND ACCESSORIES

1. Conduit bodies shall be cast or malleable iron, hot dipped galvanized. Covers shall be of the same material and finish as the fitting. Appleton, Crouse Hinds, OZ Gedney, or equal.

2. Locknuts and conduit bushings shall be malleable iron. Appleton, Crouse Hinds, OZ Gedney, or equal.

3. Conduit sealing bushings shall be OZ Gedney Type CSM series. Cabinet sealing bushing shall be OZ Gedney Type GRK.

4. Conduit sealing fittings, drains and breathers shall be OZ Gedney Type EY and DB, or equal Appleton or Crouse Hinds.

5. Through wall and floor seals shall be OZ Gedney FS and WS series.
6. Cord grip connectors shall be OZ Gedney CGA, or equal Appleton or Crouse Hinds.

7. External Cable Grip: Woven wire mesh type made of high-strength galvanized or stainless steel wire strand and matched to cable diameter and with attachment provision designed for the corresponding connector.

8. Conduit spacers for direct buried or encased in concrete raceways shall be Underground Devices, Inc. "Wunpeece Spacers", or equal.

PART 3 — EXECUTION

3.1 EXAMINATION

A. Examine surfaces and spaces to receive raceways, boxes, enclosures, and cabinets for compliance with installation tolerances and other conditions affecting performance of raceway installation. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 WIRING METHODS

A. Where the manufacturer of equipment provided by the Contractor recommends or requires rigid metal conduit for circuits associated with the equipment, provide rigid metal conduit for the entire circuit, even if other conduit types would otherwise be permitted under these specifications.

B. Outdoors: Use the following wiring methods:

1. Exposed: RMC.

2. Underground: RNC or PVC coated rigid steel, except use only PVC coated rigid steel where rigid steel conduit is indicated on the Contract Documents for underground circuits. Where RNC is used, transition to PVC coated rigid steel at stub up locations and at entrances to buildings or other locations where the raceway changes from buried to encased in concrete or exposed conditions.

3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC. Do not use flexible conduit in place of elbows offsets or fittings to attach to equipment. See below for further requirements for the installation of raceway terminations and connections using flexible connections.

C. Indoors: Use the following wiring methods:

1. Exposed raceway runs in areas which are dry, above grade, and not exposed to the process: EMT or RMC.

2. Exposed in process areas: RMC.

3. Damp or Wet Locations: RMC.

4. Concealed in wood frame walls: EMT or RMC.

5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC; except where RMC is used, use LFMC. Do not use flexible conduit in place of elbows, offsets, or fittings to attach to equipment. See below for further requirements for the installation of raceway terminations and connections using flexible connections.
3.3 INSTALLATION

A. Install raceways, boxes, enclosures, and cabinets as indicated, according to manufacturer's written instructions. Provide a raceway for each circuit indicated. Do not gang raceway into wireways, pullboxes, junction boxes, etc., without specific approval. Do not group home runs or circuits without approval of the Engineer.

B. Minimum Raceway Size: 3/4 inch trade size for underground circuits and communications circuits, 1/2 inch trade size for other circuits.

C. Install rigid metal conduit unless other raceways are shown on the Contract Documents, are required by Code, or are permitted under these specifications.

D. Provide PVC coated rigid metal conduit for conduit runs containing VFD secondary cables. Provide long radius sweep elbows to match cable bending requirements of VFD cable manufacturer.

E. Install conduit as a complete, continuous system without wires, mechanically secure and electrically connected to all metal boxes, fittings and equipment. Blank off all unused openings using factory made knockout seals.

F. Install conduit exposed, except in finished areas or unless shown otherwise on the drawings. Do not install raceway below grade/slab unless specifically shown on the Drawings as being installed below grade/slab.

G. Install exposed raceways in lines parallel or perpendicular to the building or structural members lines except where the structure is not level. Follow the surface contours as much as practical. Do not install crossovers or offsets that can be avoided by installing the raceway in a different sequence or a uniform line. Provide adequate headroom.

1. Run parallel or banked raceways together, on common supports where practical.

2. Make bends in parallel or banked runs from same centerline to make bends parallel. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.

H. Support raceways as specified in Division 16 Section "Basic Electrical Materials and Methods."

1. Provide anchors, hangers, supports, clamps, etc. to support the raceways from the structures in or on which they are installed. Do not space supports further apart than ten feet.

2. Provide sufficient clearance to allow conduit to be added to racks, hangers, etc. in the future.

3. Support raceway within three feet of every outlet box, junction box, gutter, panel, fitting, etc.

4. Raceway in "wet" areas shall have clamp backs or other appropriate spacers to hold them a minimum of 1/2 inch off the surface. Install concealed raceway in wall or ceiling construction and/or place below the slab in a shallow trench.

I. Underground raceway runs

1. Install RNC or RMC where underground runs are shown. Provide a half lapped wrap of Scotchrap No. 51 plastic tape or a coat of Kopper's Bitumastic No. 505 or factory PVC coating, 20 mils minimum thickness, for rigid steel conduit which is installed underground or encased in concrete.
2. Install conduit run below slab in a trench. Do not run conduit just below the slab or at the edge of the slab.

3. Run as straight as practicable. Make changes in direction and/or grade of sufficient length to allow a gradual change (three foot radius minimum). Make slight offsets with five degree couplings.

4. Provide conduit spacers for underground raceways where more than one conduit is placed in a trench.

5. Run trench true, and clear of stones or soft spots. Place three inches of fine sand in the trench bottom and tamp into place. Provide preformed plastic spacers on top of sand spaced five feet on center. After the raceway is placed in the trench, backfill six inches with sand, then with native earth backfill passing a No. 8 sieve, free of stones. Do not tamp on top of the conduit until the final backfill is placed. Tamp or water settle the final backfill to finish the grade. Compact the backfill as specified under Division 2 "Earthwork".

6. Mark direct buried conduit by a one inch thick concrete ribbon painted red or yellow or a strip of yellow marking tape placed a minimum of twelve inches below grade during backfilling of the trench.

7. Clean underground and embedded conduit two-inch size and above with a wire brush or swab, followed by a mandrel not less than twelve inches long and approximately one-quarter inch smaller in diameter than the conduit internal diameter.

J. Where raceway exits from grade or concrete, provide the following:

1. For equipment to be moved into place at a later date, install a coupling flush with the floor slab and a threaded flush plug.

2. In "wet" areas, provide rigid steel conduit or elbow coated with 20 mils PVC for a minimum of 24 inches before exiting. Extend rigid steel conduit 2" or 3" above exiting point from grade or concrete.

3. For runs exiting from grade, slabs or encasement, provide a rigid steel elbow and adapter. In "wet" areas, use elbows 20 mil PVC coated.

4. Do not extend plastic conduit above grade, into buildings, or equipment.

K. Stub-ups:

1. Where conduits are stubbed up into switchgear, motor control centers, floor standing switchboards, and similar open bottom equipment, do not extend the conduit, including end fittings, more than 3 inches above the bottom of the enclosure. Stub conduits to a uniform height (plus or minus 1/8 inch) and align conduit centers within plus or minus 1/4 inch in rows parallel or perpendicular to the building structure.

2. Locate stub-ups directly under the section gutter into which the conductors they contain are to be routed. Terminate conduit with an insulating, grounding type bushing bonded to the ground bus of the equipment.

3. Protect stub-ups from damage where conduits rise through floor slabs. Arrange stubups so that no curved portion of bends are visible above the finished slab.

L. Bend and offset metal conduit with hickey or power bender, standard elbows, conduit fittings or pull boxes. Bending of PVC shall be by hot box bender and, for PVC two inches in diameter and larger, expanding plugs. Make elbows, offsets and bends uniform and
symmetrical. Make bends and offsets so ID is not reduced. Keep legs of bends in the same plane and straight legs of offsets parallel, unless otherwise indicated.

M. Support conduit connections to motors or other equipment independently of the motor or equipment. Rise or drop vertically to the nearest practicable point of connection to the unit. Run vertical drops to the floor and fasten with a floor flange. Unsupported drops are not permitted. Horizontal runs on the floor or on equipment are not permitted. Drop or rise at the appropriate closest location. Run conduit on equipment frames or supports to closely follow the contours of the equipment. Locate conduit to maintain access to all equipment services and adjustment points and so as not to interfere with operation of the equipment.

N. Connect conduit to hubless enclosures, cabinets and boxes with double locknuts and with insulating type bushings. Use grounding type bushings where connecting to concentric or eccentric knockouts. Connect to enclosures, boxes and devices from below in wet areas. Make conduit connections to enclosures at the nearest practicable point of entry to the enclosure area where the devices are located to which the circuits contained in the conduit will connect.

O. Penetrations for raceways:

1. Do not bore holes in floor and ceiling joists outside center third of member depth or within two feet of bearing points. Holes shall be one inch diameter maximum.

2. Penetrate through building wall or surfaces with a PVC or sheet metal sleeve with at least 1/4" greater interior diameter (ID) than conduit exterior diameter (OD), set flush with walls, pack with fiberglass and seal with silicone sealant and cover with escutcheon plate.

3. Penetrate through poured-in-place walls and free slabs, with a cast iron or, (above-grade only) Schedule 40 black pipe sleeve with retaining ring or washer. Set sleeves flush with forms or edges of slab. Pack around conduit with fiberglass and seal with silicone sealant. For penetrations below exterior grade, provide a floor or wall sealing fitting on the interior of the building wall.

4. Penetrate through roofs with core drill hole 1/2 inch to 1 inch larger than conduit, flash with neoprene, caulk conduit in place and seal with silicone sealant under flashing. Sleeve roof opening where non-concrete roof construction occurs.

P. Raceway terminations and connections:

1. Join raceways with fittings designed and approved for the purpose and make joints tight.

2. Make connections waterproof and rustproof by application of a watertight, conductive thread compound. Clean threads of cutting oil before applying thread compound.

3. PVC Externally Coated, Rigid Steel Conduits: Use only fittings approved for use with that material. Patch all nicks and scrapes in PVC coating after installing conduits.

4. Apply PVC adhesive by brush.

5. Make raceway terminations tight. Use bonding bushings or wedges at connections subject to vibration. Use bonding jumpers where joints cannot be made tight.

6. Cut ends of conduit square with hand or power saw or pipe cutter. Ream cut ends to remove burrs and sharp ends. Make conduit threads which are cut in the
field to have same effective length and same thread dimensions and taper as specified for factory-cut threads.

7. Flexible Connections: Use maximum of 18 inches of flexible conduit for equipment subject to vibration, noise transmission, or movement; and for all motors. Install flexible conduit in a straight length. Do not use flexible conduit in place of elbows, offsets, or fittings to attach to fixed equipment. With the Engineer's approval, longer lengths of flexible conduit may be used for connection to items of equipment which require longer lengths for installation and removal of the equipment for maintenance or replacement purposes. Recessed and semi-recessed lighting fixtures may use up to 6 feet of flexible conduit, or 11 feet of pre-manufactured lighting "whips". Use liquid-tight flexible metal conduit in wet or damp locations. Do not strap flexible conduit to structures or other equipment.

8. Provide double locknuts and insulating bushings at conduit connections to boxes and cabinets. Align raceways to enter squarely and install locknuts with dished part against the box. Use grounding type bushings where connecting to concentric or eccentric knockouts. In "wet" areas, use locknuts of the sealing type or use Myers hubs.

9. Connect conduits to enclosures at the location of the gutter or device to which the contained conductors will be routed. Route or stub conduits to motors and/or mechanical equipment directly to the connection and locate as close as possible to equipment terminals.

10. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into the hub so the end bears against the wire protection shoulder. Where chase nipples are used, align raceways so the coupling is square to the box and tighten the chase nipple so no threads are exposed.

11. Place conduits at panelboards in the rear line of knockouts where possible. Install spare conduits from flush-mounted panels up to accessible spaces. Install a minimum of one spare three-quarter inch conduit for every three single-pole spare breakers or spaces, or fraction thereof (three conduits minimum).

Q. Keep conduits clean and dry and close each end left exposed. When blowing through conduits, cover electrical components installed in enclosures to avoid blowing dirt or water into equipment. Use temporary closures to prevent foreign matter from entering raceways.

R. Install pull wires in empty raceways. Use No. 14 AWG zinc-coated steel or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 8 inches of slack at each end of the pull wire.

S. Seal interior of raceways around conductors where conduits pass from warm to cold locations, such as the boundaries of air conditioned or refrigerated spaces and where conduits enter or exit buildings from outdoor areas, including underground ducts or conduit runs or where otherwise required by NFPA 70.

1. Methods used to seal interior of raceways around conductors shall be as follows:

   a. Install raceway sealing fittings according to manufacturer's written instructions. Locate fittings at suitable, approved, and accessible locations. For non-hazardous areas, fill with expansive foam or Duceal. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces.
b. Seal conduits using expansive foam or Ducseal where conduits enter through the bottom of motor control centers and control panels.

c. Seal conduits using expansive foam or Ducseal for individual items of equipment where it is not practical to install raceway seal fittings such as building mounted convenience receptacles.

d. Where otherwise required by NFPA 70.

T. Surface Raceways: Install a separate, green, ground conductor in raceways from junction box supplying the raceways to receptacle or fixture ground terminals.

1. Select each surface raceway outlet box, to which a lighting fixture is attached, of sufficient diameter to provide a seat for the fixture canopy.

2. Provide surface metal raceway outlet box, and the backplate and canopy, at the feed-in location of each fluorescent lighting fixture having end-stem suspension.

U. Device and Outlet Boxes

1. Coordinate box locations with building surfaces and finishes to avoid bridging wainscots, joints, finish changes, etc.

2. Recess boxes in the wall, floor, and ceiling surfaces in finished areas. Set boxes plumb, level, square and flush with finished building surfaces within one-sixteenth inch for each condition. Set boxes so that box openings in building surfaces are within one-eighth inch of edge of material cut-out and fill tight to box with building materials. Back boxes with structural material to prevent rotation on studs or joists. Use gang boxes wherever more than one device is used at one location.

3. Attach boxes to building structure with a minimum of two fasteners. Provide attachments to withstand a force of one-hundred pounds applied vertically or horizontally.

4. Set exposed device boxes four feet above the finished floor to top of the box.

5. Set boxes for lighting switches at 44 inches above the finished floor and within one foot of the door opening on the strike or lock side of the door or on the side closing last.

6. Arrange boxes used in wet areas to drain moisture away from devices or enclosures for equipment and make conduit connections from below.

7. Set floor boxes level and adjust to finished floor surface.

V. Install pullboxes for underground raceway systems true to line and grade. Provide a compacted foundation of fine sand or three-eighths minus crushed rock for the bearing surface edges of the pullboxes.

W. Install hinged-cover enclosures and cabinets plumb. Support at each corner.

3.4 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure coatings, finishes, and cabinets are without damage or deterioration at the time of Substantial Completion.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.5 CLEANING

A. On completion of installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish, including chips, scratches, and abrasions.

PART 4 — PAYMENT

4.1 PAYMENT

A. Payment for the work described in this section will be included in the lump sum bid for Electrical.
SECTION 16140 — WIRING DEVICES

PART 1 — GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including Amendments and Special Provisions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY
A. This Section includes various types of receptacles, connectors, switches, and finish plates.

1.3 SUBMITTALS
A. No submittals are required.

1.4 QUALITY ASSURANCE
A. Comply with NEC for devices and installation.
B. Listing and Labeling: Provide products that are listed and labeled for their applications and installation conditions and for the environments in which installed.
   1. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.
   2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

PART 2 - MATERIALS

2.1 MANUFACTURERS
A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include the following:
   1. Wiring Devices:
      a. Cooper Wiring Devices.
      b. Bryant Electric, Inc.
      c. Hubbell Inc.
      e. Leviton Mfg. Co., Inc.
      f. Pass & Seymour/Legrand.
      g. Crouse-Hinds
      h. Paragon
      i. Mulberry
      j. Square-D
2.2. WIRING DEVICES

A. Comply with NEMA Standard WD 1, "General Purpose Wiring Devices."

B. Enclosures: NEMA 1 equivalent, except as otherwise indicated.

C. Color: Ivory except as otherwise indicated or required by Code.

D. Receptacles, Straight-Blade and Locking Type: Except as otherwise indicated, comply with Federal Specification W-C-596 and heavy-duty grade of UL Standard 498, "Electrical Attachment Plugs and Receptacles." Provide NRTL labeling of devices to verify compliance.

1. General purpose Convenience Outlets
   a. Duplex receptacle configuration
   b. Nylon face
   c. Staked screw terminals for line, neutral, and ground connections.
   d. Provisions for split bus
   e. NEMA 5–15R or 5–20R

2. Special Purpose Receptacles
   a. Staked screw terminals for line, neutral, and ground connections.
   b. NEMA configuration as indicated.

E. Receptacles, Straight–Blade, Special Features: Comply with the basic requirements specified above for straight-blade receptacles of the class and type indicated, and with the following additional requirements:

1. Ground-Fault Circuit Interrupter (GFCI) Receptacles: UL Standard 943, "Ground Fault Circuit Interrupters," with integral NEMA 5-20R duplex receptacle arranged to protect only the connected receptacle and no other receptacles connected on the same circuit.


1. Lighting Switches: 240/120V ac only, rated 20 amperes.

G. Motor rated switches: horsepower rated for application indicated.

H. Wall Plates: Single and combination types that mate and match with corresponding wiring devices. Features include the following:

1. Color: Matches wiring device except as otherwise indicated.
2. Plate–Securing Screws: Metal with heads colored to match plate finish.
3. For areas with concealed electrical construction: stainless steel, except as otherwise indicated.
4. For areas with exposed electrical construction: Galvanized steel.

I. Device Box Covers: Cast aluminum or cast iron to match box to which installed.
PART 3 — EXECUTION

3.1 INSTALLATION

A. Arrangement of Devices: Except as otherwise indicated, mount flush, with long dimension vertical, and grounding terminal of receptacles on bottom. Group adjacent switches under single, multigang wall plates.

   1. See "Raceways and Boxes" Section for mounting height of devices.
   2. Verify locations of outlets and switches in cabinetry with cabinet supplier and Architect prior to installation.

B. Install devices and assemblies plumb, level, flush and secure. Provide spacers on device screws to flush yokes or flanges to surface of wall within 1/16 inch where boxes are not flush with the wall surface. Install wiring devices such as receptacles to withstand 50 pounds force applied perpendicular to the device face with a maximum deflection of 1/16 inch.

C. Install switches with the "Off" position down. Install three and four way switches so the load is "off" when all switch handles are down.

D. Connect phase, neutral, and grounding wires to devices with full loops around screws installed to tighten with tightening of the screw. Trim insulation to within one-eighth inch of screw terminal.

E. Flush mounted devices and wall plates:

   1. Provide spacers on device screws to flush yokes or flanges to surface of wall within 1/16 inch where boxes are not flush with the wall surface.
   2. Protect devices and assemblies during painting.
   3. Install wall plates after painting is complete. Install with an alignment tolerance of 1/16 inch to plumb. Install at flush mounted devices so that all four edges are in continuous contact with finished wall surface without the use of mats or similar devices. Do not use plaster fillings.

F. Use corrosion resistant devices outdoors.

3.2 GROUNDING

A. Connect receptacle or switch ground lug to device box for devices other than isolated ground type.

3.3 FIELD QUALITY CONTROL

A. Testing:

   1. Test wiring devices for proper connections, polarity and ground continuity. Perform this testing with testing equipment designed for testing polarity and connections.
   2. Operate each operable device at least 6 times.
   3. Test ground-fault circuit interrupter operation with local fault simulations, using a tester designed for such testing, and according to manufacturer recommendations. Testing with integral test switches on the receptacle is not sufficient for this testing.
B. Replace damaged or defective components, and retest.

3.4 CLEANING

A. General: Internally clean devices, device outlet boxes, and enclosures. Replace stained or improperly painted wall plates or devices.

PART 4 — PAYMENT

4.1 PAYMENT

A. Payment for the work described in this section will be included in the lump sum bid for Electrical.

END OF SECTION
SECTION 16210 — ELECTRICAL UTILITY SERVICES

PART 1 — GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Amendments and Special Provisions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: The electrical service and connection to the commercial power Utility system (Pacific Power) and the work required in conjunction with Pacific Power for their revenue metering.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Section 16120 "Conductors and Cables" for service entrance conductors not provided by the utility.

2. Section 16440 "Panelboards" for equipment used as Service Entrance Equipment.

PART 2 — PRODUCTS

2.1 MATERIALS

A. Primary Circuit: provided by Pacific Power.

B. Power transformer: provided by Pacific Power.

C. Secondary Circuit to Service Point: provided by Pacific Power.

D. Current and Potential transformers for revenue metering: provided by Pacific Power.

E. Revenue Meters: provided by Pacific Power.

F. Meter Sockets and Enclosures:

1. Provide equipment as required by Pacific Power for their revenue metering.

2. Provide accessory equipment and wiring as required by Pacific Power.

PART 3 — EXECUTION

3.1 APPLICATION

A. Coordinate with Pacific Power to ensure that their metering and service requirements are met.

1. The Contractor is responsible for any work necessary to place the service in operation as a complete installation. Provide any materials required and do any work necessary that is not provided or completed by Pacific Power.

2. Service charges or construction fees required by Pacific Power for the new electrical service to the project shall be paid to Pacific Power by the Owner.

3. Provide excavation and backfill for Pacific Power's circuits. Locate the trench for such circuits as directed by the utility.
3.2 INSTALLATION

A. The Pacific Power will:
   1. Install the primary conductors and primary distribution and switching equipment
   2. Install the power transformers.
   3. Install the revenue meters
   4. Install the secondary conductors to the service point and make the secondary connections to the power transformers.

B. Current transformers and potential transformers furnished by Pacific Power

C. The Contractor is responsible to provide the following:
   1. Meter sockets and enclosures, including current transformer or other enclosures associated with Pacific Power's revenue metering equipment.
   2. Conduits for the Pacific Power secondary circuits from the transformers to the service point.

PART 4 — PAYMENT

4.1 PAYMENT

A. Payment for the work described in this section will be included in the lump sum bid for Electrical.

END OF SECTION
SECTION 16280 — POWER FILTERS AND CONDITIONERS

PART 1 — GENERAL

1.1 RELATED DOCUMENTS
   A. Drawings and general provisions of the Contract, including Amendments and Special Provisions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY
   A. This Section includes power filtering and conditioning equipment, whether individually mounted or group mounted in switchboards, motor control centers, panelboards, and similar equipment.

1.3 SUBMITTALS
   A. Manufacturer's Product Data for equipment, devices, and accessories specified in this Section.

1.4 QUALITY ASSURANCE
   A. Testing Agency: Utilize an independent testing agency meeting OSHA criteria for accreditation of testing laboratories, Title 29, Part 1907; or which is a full-member company of the InterNational Electrical Testing Association (NETA).
   B. Source Limitations: Obtain equipment of each type specified from one source and by a single manufacturer.
   C. Comply with NEC for components and installation.
   D. Listing and Labeling: Provide equipment and devices specified in this Section that are listed and labeled.
      1. The Terms "Listed" and "Labeled": As defined in the NEC, Article 100.
      2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

PART 2 — PRODUCTS

2.1 MANUFACTURERS
   A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering equipment that may be incorporated into the Work include, but are not limited to, the following:
      1. Transient Voltage Surge Suppressors -
         a. General Electric Co
         b. Eaton Electrical
         c. Square-D Co.
      2. SURGE AND LIGHTNING ARRESTERS
         a. General Electric Company Catalog No. 9L15 ECA001 for single phase, and 9LECC001 for three phase, or equal.
2.2 TRANSIENT VOLTAGE SURGE SUPPRESSORS

A. TVSS devices shall provide surge current diversion paths for all modes of protection; L-N, L-G and N-G in WYE systems. Each mode including N-G shall be fused with a 200kA/IR UL recognized surge rated fuse and incorporate a thermal cutout device. Audible diagnostic monitoring shall be by way of audible alarm. This alarm shall activate upon a fault condition. An alarm on/off switch shall be provided to silence the alarm. An alarm push to test switch shall be provided.

B. Minimum surge current capability (single pulse rated) per phase shall be 240kA per phase UL 1449 Suppression Voltage Ratings shall be:

<table>
<thead>
<tr>
<th>VOLTAGE</th>
<th>L-N</th>
<th>L-G</th>
<th>N-G</th>
</tr>
</thead>
<tbody>
<tr>
<td>480Y/277V</td>
<td>600V</td>
<td>600V</td>
<td>600V</td>
</tr>
</tbody>
</table>

C. Minimum EMI/RFI filtering shall be -50dB at 100 kHz with an insertion ratio of 50:1 using MIL-STD-220A methodology.

PART 3 — EXECUTION

3.1 INSTALLATION

A. Install in the main distribution switchboard as shown on the drawings. TVSS devices shall be integral to the switchboard or motor control center and shall be part of the listed equipment to meet the requirements of Article 230.71 (A) of the 2005 National Electrical Code and shall be installed by the electrical distribution equipment manufacturer’s factory.

B. Connect equipment, devices and components to wiring system and to ground as indicated and as instructed by manufacturer.

1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

C. Identify each item of equipment according to requirements specified in Division 16 Section "Basic Electrical Materials and Methods."

3.2 FIELD QUALITY CONTROL

A. Testing Agency: Provide the services of a qualified independent testing agency to perform specified field quality-control testing.

B. Testing: After installing equipment and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.

1. Procedures: Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Section 7.19 for surge suppressors. Certify compliance with test parameters.

C. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units and retest.
4.1 PAYMENT

A. Payment for the work described in this section will be included in the lump sum bid for Electrical.

END OF SECTION
SECTION 16410 — ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 — GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including Amendments and Special Provisions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY
A. This Section includes switches and circuit breakers, whether individually mounted or group mounted in switchboards, motor control centers, panelboards, and similar equipment.
B. Related Sections: The following Sections contain requirements that relate to this Section:
   1. Division 16 Section "Wiring Devices" for attachment plugs and receptacles, and snap switches used for disconnect switches.

1.3 SUBMITTALS
A. Manufacturer's Product Data for disconnect switches, circuit breakers, and accessories specified in this Section.
B. Maintenance data for tripping devices to include in the operation and maintenance manual specified in Division 16010.

1.4 QUALITY ASSURANCE
A. Testing Agency: Utilize an independent testing agency meeting OSHA criteria for accreditation of testing laboratories, Title 29, Part 1907; or which is a full-member company of the InterNational Electrical Testing Association (NETA).
B. Source Limitations: Obtain disconnect switches and circuit breakers from one source and by a single manufacturer.
C. Comply with NEC for components and installation.
D. Listing and Labeling: Provide disconnect switches and circuit breakers specified in this Section that are listed and labeled.
   1. The Terms "Listed" and "Labeled": As defined in the NEC, Article 100.
   2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

PART 2 — PRODUCTS

2.1 MANUFACTURERS
A. Available Manufacturers: Subject to compliance with additional requirements noted in this section, manufacturers offering switches and circuit breakers that may be incorporated into the Work include, but are not limited to, the following:
   1. Disconnect switches, safety switches, and circuit breakers:
      b. General Electric Co.; Electrical Distribution and Control Division.
2.2 ENCLOSED CIRCUIT BREAKERS

A. Molded-Case Circuit Breaker: NEMA AB 1, with lockable handle.

B. Characteristics: Frame size, trip rating, number of poles, and auxiliary devices as indicated with interrupting rating to meet available fault current.
   1. Main and feeder breakers shall be molded case breakers with thermal magnetic trip.
   2. Motor circuit breakers shall be magnetic only trip with adjustable trip setting.
   3. Branch circuit breakers shall be molded case, thermal-magnetic trip, trip-free with non-interchangeable, non-adjustable trip unless otherwise noted.

C. Application Listing: Appropriate for application, including switching lighting loads (SWD) or heating, air-conditioning, and refrigerating equipment (HACR).

D. Circuit Breakers, 200 A and Larger: Trip units interchangeable within frame size.

E. Lugs: Mechanical lugs and power-distribution connectors suitable for conductors of the material, number and size provided.

F. Accessories: As indicated.

G. Enclosure: per application, as described in Section 16050, unless otherwise specified or required to meet environmental conditions of installed location.

PART 3 — EXECUTION

3.1 INSTALLATION

A. Install switches and circuit breaker enclosures level and plumb in locations as indicated, according to manufacturer's written instructions.

B. For equipment at walls, bolt units to wall or mount on structural–steel channels bolted to wall. For controllers not at walls, provide freestanding racks conforming to Division 16 Section "Basic Electrical Materials and Methods."

C. Install wiring between switches, circuit breakers, control, and indication devices.

D. Connect switches and circuit breakers and components to wiring system and to ground as indicated and as instructed by manufacturer.
   1. Tighten electrical connectors and terminals according to manufacturer's published torque-lightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

E. Identify each switch and circuit breaker according to requirements specified in Division 16 Section "Basic Electrical Materials and Methods."

3.2 FIELD QUALITY CONTROL

A. Testing Agency: Provide the services of a qualified independent testing agency to perform specified field quality-control testing.
B. Testing: After installing switches and circuit breakers and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.

1. Procedures: Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.

C. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units and retest.

3.3 ADJUSTING

A. Set field-adjustable circuit-breaker trip setting ranges as indicated.

1. Where circuit breakers are included in the short circuit study, set the trip as recommended in the study.

2. Set trip to 1.25 times the full load circuit amps for non-motor circuits, 2 times the full load motor amps for thermal-magnetic circuit breakers on motor circuits, or lowest setting which permits starting and running for magnetic only circuit breakers on motor circuits.

3.4 CLEANING

A. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish including chips, scratches, and abrasions.

PART 4 — PAYMENT

4.1 PAYMENT

A. Payment for the work described in this section will be included in the lump sum bid for Electrical.

END OF SECTION
SECTION 16422 — MOTOR CONTROLLERS

PART 1 — GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Amendments and Special Provisions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes ac motor-control devices rated 600 V and less that are supplied as enclosed units, or as individual units for mounting in equipment specified under other sections.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Section 16050 "Basic Electrical Materials and Methods" for general materials and installation methods.

1.3 SUBMITTALS

A. Manufacturer’s Product Data for motor controllers and accessories specified in this Section.

1. For variable frequency drives, submittals shall be custom prepared by the VFD manufacturer for this specific application, and shall include the following:

a. Equipment dimensions, including stub-up locations, shipping splits and shipping weights.

b. Spare parts list

c. Manufacturer's published installation, set-up and configuration, operation, and maintenance manuals.

d. Wiring diagrams specific to the application of the drive under this Contract.

e. Initial configuration and program parameters specific to the application of the drive under this Contract, including all parameters that will be set to other than manufacturer's default values, and that demonstrate the drive is capable of operating in the manner intended by the project design.

f. Shop Drawings: submit complete Elementary Wiring Diagrams and One Line Diagrams of control and power wiring, specific to the actual motor or item to be controlled, which clearly indicate field wiring and field wired devices, and wiring provided as part of the manufacturer's assembled unit.

B. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

C. Maintenance data for tripping devices to include in the operation and maintenance manual specified in Division 16010.

D. Load-Current and Overload-Relay Heater List: Compile after motors have been installed and arrange to demonstrate that selection of heaters suits actual motor nameplate full-load currents.
1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain similar motor-control devices through one source from a single manufacturer.
B. Comply with NEC.
C. Listing and Labeling: Provide motor controllers and circuit breakers specified in this Section that are listed and labeled.
   1. The Terms "Listed" and "Labeled": As defined in the NEC, Article 100.
   2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

1.5 COORDINATION

A. Coordinate features of controllers and accessory devices with pilot devices and control circuits to which they connect.
B. Coordinate features, accessories, and functions of each motor controller with the ratings and characteristics of the supply circuit, the motor, the required control sequence, and the duty cycle of the motor and load.

1.6 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.
   1. Spare Fuses and Incandescent Indicating Lamps: Furnish 1 spare for every 5 installed units, but not less than 1 set of 3 of each kind.

PART 2 — PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers for 18 Pulse Variable Frequency Drives: Subject to compliance with additional requirements of this section, manufacturers offering 18 pulse variable frequency drives that may be incorporated into the Work include the following:
   2. Siemens-Robicon
   3. Eaton Electrical (Cutler-Hammer)
   4. Square D Company

2.2 VARIABLE FREQUENCY CONTROLLERS

A. The variable frequency drive shall be UL or ETL listed and labeled and shall comply with the latest applicable standards of ANSI, NEMA, IEEE, and the National Electrical Code.
B. The adjustable frequency controller shall be a space vector sine-coded Pulse-Width Modulated (PWM) design. Modulation methods which incorporate "gear-changing" techniques are not acceptable. The final responsibility of distributor or packager modifications to a third-party standard product shall reside with the VFD manufacturer. All drives shall be supplied by one manufacturer. The VFD shall be manufactured within the United States of America to alleviate concerns of future serviceability and parts availability.
C. The VFD system must fit in the space indicated on the drawings.

D. Conduit entries into the drive enclosure must be coordinated with the number and location of those shown on the drawings. Auxiliary 12" wide pull sections shall be provided with the drive to accommodate bottom or top conduit entries where the drive enclosure is not suitable for such entries.

E. Harmonic Mitigation

1. The variable frequency drive(s) when installed and operating at the Owner’s facility, shall not cause excessive voltage and/or current total harmonic distortion (THD) levels greater than allowed by the serving utility on the serving utility's electrical system at the point of common coupling. The point of common coupling for this requirement is defined as the utility’s revenue metering equipment.
   a. The voltage and current total harmonic distortion limits shall be as listed in IEEE 519 (1992), unless modified by the serving utility. The serving utility is Pacific Power.
   b. The drives shall be provided with necessary harmonic mitigation equipment including, but not limited to, line reactors, active or passive filtering components, and/or isolation transformers, as required to meet this specification. Where provided, such devices and/or equipment shall be provided for each drive. “Sharing” of internally or externally mounted devices/equipment is not permitted.

2. VFDs shall be provided as 18 pulse type units.

3. Harmonic compliance shall be verified with onsite field measurements of both the voltage and current harmonic distortion at the drive input terminals with and without the VFDs operating. A recording type Fluke 41 or equivalent harmonic analyzer displaying individual and total harmonic currents and voltages must be utilized.

F. The drive unit shall have an input circuit breaker or disconnect switch, interlocked with the enclosure door, with through-the-door handle to provide positive disconnect of incoming AC power.

G. The drive system shall be 96% efficient at full load and full speed and 95.5% efficient at 51% load and 80% speed. Losses to be utilized in drive system efficiency calculation shall include input transformer, harmonic filter and power factor correction if applicable, VFD converter and output filter if applicable. Auxiliary controls, such as internal VFD control boards, cooling fans or pumps, shall be included in all loss calculations.

H. The drive shall provide variable speed control of a standard NEMA MG 1, Design B, 3-phase, induction motor by adjusting output voltage and frequency. It shall have an output voltage regulator to maintain correct output V/Hz ratio despite incoming voltage variations. Output power shall be of suitable capacity and wave form to provide stepless speed control of the specified three phase 480 volt motors throughout a continuous speed range under variable or constant load (as applicable) not exceeding the motor’s full load rating.

I. The controller shall be suitable for use with any standard NEMA-B 3 phase squirrel-cage induction motor having a 1.15 Service Factor. The drive shall be capable of being located up to 300 feet from the motor without requiring special cabling or separate motor protection devices. If special cabling or separate motor protection devices are required, they shall be supplied by the VFD supplier at the VFD manufacturer’s expense. At any time in the future, it shall be possible to substitute any standard motor (equivalent horsepower, voltage and RPM) in the field.
J. 18 pulse VFDs shall be supplied with a transformer to provide phase shifting for the converter bridge. The phase shift transformers required shall be factory wired and mounted within the VFD enclosure as an integral part of the VFD assembly. Transformers external to the VFD enclosure are not acceptable. Separate isolation transformers arranged in delta/delta, delta/wye will not be acceptable. The converter section shall be 18-pulse minimum utilizing diodes. The converter shall be a clean power controller which inherently provides sinusoidal current to the inverter section with minimal harmonics to flow back to the incoming power source.

K. The inverter output shall be generated by IGBTs (Insulated Gate Bipolar Transistors). Pulse Width Modulation strategy will be of the space vector type implemented to generate a sine-coded output voltage. The VFD shall not induce excessive power losses in the motor. The worst case RMS motor line current measured at rated speed, torque and voltage shall not exceed 1.05 times the rated RMS motor current for pure sine wave operation.

L. Features

1. 480 volt, 3 phase 60 Hz input.
   
   a. Voltage Dip Ride-Through: VFD shall be capable of sustaining continued operation with a 40% dip in nominal line voltage. Output speed may decline only if current limit rating of VFD is exceeded.
   
   b. Power Loss Ride-through: VFD shall be capable of a minimum 3 cycle power loss ride-through without fault activation.

2. Pulse-width modulated output.
   
   a. Full wave diode bridge converter converts incoming voltage to controlled DC voltage which is inverted to an adjustable frequency output.
   
   b. Capable of providing variable or constant volts/Hz excitation up to nominal 60 Hz rating.
      
      1) Variable Torque Output Rating: 3-phase, 6 to 60 Hz, with voltage proportional to frequency throughout voltage range.
      
      2) Constant Torque Output Rating: 3-phase, 6 to 60 Hz, with torque constant as speed changes.

3. All VFD components shall be factory mounted and wired on a dead front, grounded, NEMA-1 enclosure.

4. Operates in an ambient temperature of 0-40 degrees Celsius.

5. Maintains displacement power factor of 0.95 or better over the entire speed range.

6. Input line reactors.

7. Controller shall be suitable for and coordinated with the thermal, electrical, and mechanical characteristics of the motor actually furnished and to which it is connected.

8. Coordinate the drive capability with the torque characteristics (variable or constant torque) of the actual equipment furnished which is driven by the motor to which the drive is connected.

M. Protection
1. Capable of 110% rated current continuous, 150% rated current for one minute, at rated temperature.

2. Includes self-diagnostics for detection of failed circuitry.
   a. Fault detection trip circuits to prevent damage to the unit and the connected motor.
   b. Upon tripout the drive automatically resets and attempts to restart one time. This feature shall be programmable as to number of retries, and shall be capable of being disabled.
   c. Upon return of power after an outage, the drive shall automatically restart if no fault condition exists, and the start command is present.

3. Electronic circuits and circuit boards shall be conformally coated to resist degradation by chemically corrosive agents which may be present in a water treatment facility environment.

4. In addition to other specified standard protective functions provide the following:
   a. Instantaneous overcurrent and overvoltage trip.
   b. Undervoltage and power loss protection.
   c. Power unit overtemperature alarm and protection. Upon sensing an overtemperature condition, the VFD is to automatically trip.
   d. Electronic motor inverse time overload protection.
   e. Responsive action to motor winding temperature detectors or thermostatic switches. A dry contact (NC) input to the VFD is required.
   f. When power is restored after a complete power outage, the VFD shall be capable of catching the motor while it is still spinning and restoring it to proper operating speed without the use of an encoder.
   g. The VFD shall be protected from damage due to the following, without requiring an output contactor:
      1) Three-phase short circuit on VFD output terminals.
      2) Loss of input power due to opening of VFD input disconnect device or utility power failure during VFD operation.
      3) Loss of one (1) phase of input power.
   h. The VFD shall continue to operate at a reduced capacity under a single-phase fault condition.
   i. The VFD shall be able to withstand the following fault conditions without damage to the power circuit components:
      1) Failure to connect a motor to the VFD output.
      2) VFD output open circuit that may occur during operation.
      3) VFD output short circuit that may occur during operation.
   j. Motor overload protection: Adjustable and capable of NEMA 250, Class 10 performance.
   k. Fault current protection of AC to DC rectifier section.
   l. Adjustable current limit of 50-110% of full load rating.
   m. Stall prevention.
   n. Surge protection from input line AC transients (lightning arrester).
   o. Electrical isolation between power and logic circuits.

N. Control
1. Microprocessor based digital logic control fully programmable from the front panel with nonvolatile memory for the programmed functions. The control logic section shall be fully digital and not require analog adjustment pots or fixed selector resisters. A power failure will not necessitate a reload of any drive parameter or configuration.

2. Speed Control
   a. PID utilizing an internal or external setpoint.
   b. 3 selectable critical speed avoidance bands with programmable bandwidths.
   c. Auto start functions: On/Off, Delay On/Off. Operable from a 4-20mA signal or from the PID output, command, or feedback signal.
   d. Speed Profile: Programmable entry and exit points. Programmable entry and exit speeds.
   e. Programmable loss of signal control: Stop, maintain last speed, or default to preselected setpoint.
   f. Minimum speed is field adjustable from 0 to 100 percent of motor rpm.
   g. Minimum speed is field adjustable from 0 to 100 percent of maximum rpm.
   h. The minimum speed (zero point) and the maximum speed (span) are independently field adjustable.
   i. The speed increases or decreases at a linear time ramp, independently adjustable for acceleration and deceleration control.
      1) acceleration time adjustable from 0-3200 seconds.
      2) deceleration time adjustable from 0-3200 seconds.
   j. The controller shall be capable of operation in remote and local modes. Selection of mode shall be from front of panel controls.
      1) In local mode the drive is started and stopped from the front of drive controls (keypad or pushbuttons), and the speed setpoint is entered to the controller via the front panel controls.
      2) In remote mode the drive is started or stopped by a remote dry contact, and speed control is provided via an analog input.

3. A door-mounted membrane keypad with integral 2-line, 24 character LCD display shall be furnished, capable of controlling the VFD and setting drive parameters. The keypad shall include the following features:
   a. The digital display must present all diagnostic message and parameter values in English engineering units when accessed, without the use of codes.
   b. The digital keypad shall allow the operator to enter exact numerical settings in English engineering units. A plain English user menu (rather than codes) shall be provided in software in nonvolatile memory as a guide to parameter setting and resettable in the field through the keypad.
c. All drive setting adjustments and operation parameters shall be stored in a parameter log which lists allowable maximum and minimum points as well as the present set values. This parameter log shall be accessible via the RS-232, RS-422, or RS-485 serial port as well as on the keypad display.

d. The following digital door-mounted keypad indications may be selectively displayed:

1) Speed demand in percent.
2) Output current in amperes.
3) Output Frequency in hertz.
4) Input voltage.
5) Output voltage.
6) Total 3-phase KW.
7) Kilowatt hour meter.
8) Lapsed time running meter.
9) RPM.
10) DC bus voltage.

4. The following control functions shall be provided on the front of the drive enclosure, either as discrete devices or as part of a digital display keypad unit:

a. Local/Off/Remote mode selection
b. Manual start/stop
c. Manual speed control
d. "POWER ON" light
e. "RUN" light
f. VFD "fault" light
g. VFD "reset" pushbutton
h. Overcurrent, Overvoltage, Undervoltage, and Overtemperature indication
i. Speed indicating meter, calibrated in RPM to indicate speed of the converter powered motor
j. Voltmeter
k. Ammeter
l. Run Time meter

5. The following system configuring settings shall be provided and field adjustable, without exception, through the keypad/display unit. Except for Motor Nameplate Data, all parameters must be adjustable while the processor is on-line and the drive is running.


1) Motor frequency.
2) Number of poles.
3) Full load speed.
4) Motor volts.
5) Motor full load amperes.
6) Motor HP.
7) Current limit, max.

b. VFD Configuration Parameters.

1) Independent accel/decel rates.
2) Max/Min speed (frequency).
3) Catch-a-spinning load selection.
4) No load boost.
5) Full load boost.
6) Volts/Hertz ratio.
7) Overspeed trip.
8) Overload trip curve selection.
9) Overload trip time selection.

6. In addition to other specified basic features provide the following:

a. Low frequency voltage boost
b. Coast to rest
c. Insensitive to line rotation
d. Slip compensation
e. Jump frequency

7. Input/Output signals. Include the following inputs and outputs.

a. Two wire discrete input for motor temperature fault (requiring a normally closed contact signaling high temperature on opening). A high motor winding temperature condition shall cause the drive to fault.
b. Two wire discrete input for drive start (call).
c. Two wire discrete input for drive enable. Removal of the enable signal shall not require resetting of the drive in order for drive operation to resume upon return of the enable signal.
d. Two wire discrete input for selection of speed reference source (pot or 4-20mA input).
e. Four additional two wire discrete inputs for faults from remote devices. Each input shall be selectable for normally open or normally closed (loss of signal).
f. Two separate discrete outputs for drive run.
g. Discrete output for drive ready.
h. 3 wire potentiometer analog input for speed reference (from remote potentiometer).
i. Two analog inputs (4-20mA) programmable for speed reference, or measured process variable.
j. Two analog outputs (4-20mA) each programmable for speed, or current.
k. Isolated contact on L-O-R switch closed in “remote” position.

O. Diagnostic Features and Fault Handling

1. The VFD shall include a comprehensive microprocessor based digital diagnostic system which monitors its own control functions and displays faults and operating conditions.

2. A "Fault Log" shall be accessible via a RS-232, RS-422, or RS-485 serial link as well as line by line on the keypad display. All faults and events shall be stored and displayed in English, not fault codes. The "FAULT LOG" shall record, store, display and output to a serial port upon demand, the following for the 64 most recent events:

a. Date and time of day.
b. Type of fault.

3. An "HISTORIC LOG" shall record, store, and output to a RS-232, RS-422, or RS-485 serial link port upon demand, the following selectable control variables at 1 msec. intervals for the 58 intervals immediately preceding and the 20 intervals immediately following a fault trip:

a. Torque demand.
b. Torque command.
c. Torque feedback.
d. Torque error.
e. Torque maximum.
f. Current demand.
g. Peak current.
h. Motor current.
i. DC bus voltage.
j. Line voltage.
k. Velocity demand.
l. Velocity reference.
m. PI min/max limit.
n. Boost.
o. VFD mode (Auto/Manual).

P. Spare Parts: Provide spare parts for each drive consisting of (at a minimum) the manufacturer's recommended spare parts, plus (if not included in the manufacturer's recommendations) one spare controller main board for each different type of board, one set of power output semiconductor devices (IGBTs) for each different type of drive, one spare base driver board for each different type of board, one set of power semiconductor devices (diodes, SCRs, or similar) used in the power conduction path (AC to DC conversion), one spare keypad assembly, and three spare fuses for each type of fuse in the unit.

Q. Provide complete documentation of each drive including operation and maintenance manuals, as shipped drawings specific to the drive with non-applicable information clearly marked as non-applicable, and a listing of the configuration/programming parameters as programmed in the drive at the time of project acceptance.

R. Any modifications of the standard drive which are necessary to meet the requirements of this specification shall be provided by the manufacturer. Distributor or system integrator changes to the VFD manufacturer's product are specifically disallowed.

2.3 ENCLOSURES
A. Description: Surface-mounted or free standing enclosures per the application as described in Section 16050.

2.4 ACCESSORIES
A. Devices are factory installed in controller enclosure, unless otherwise indicated.
B. Provide auxiliary devices meeting the requirements of Section 16050 "Basic Electrical Materials and Methods".

PART 3 — EXECUTION

3.1 APPLICATION
A. Select features of each motor controller to coordinate with ratings and characteristics of supply circuit and motor; required control sequence; duty cycle of motor, drive, and load; and configuration of pilot device and control circuit affecting controller functions.
B. Select horsepower rating of controllers to suit motor controlled.

3.2 INSTALLATION
A. Install independently mounted motor—control devices according to manufacturer's written instructions.
B. Location: Locate controllers within sight of motors controlled, unless otherwise indicated.
C. For control equipment at walls, bolt units to wall or mount on structural–steel channels bolted to wall. For controllers not at walls, provide freestanding racks conforming to Division 16 Section "Basic Electrical Materials and Methods."

D. Install freestanding equipment on concrete housekeeping bases conforming to Section 03300 "Cast-in-Place Concrete."

3.3 IDENTIFICATION
A. Identify motor–control components and control wiring according to Division 16 Section "Basic Electrical Materials and Methods."

3.4 CONTROL WIRING INSTALLATION
A. Install wiring between motor–control devices according to Division 16 Section "Wires and Cables."
B. Bundle, train, and support wiring in enclosures.
C. Connect hand–off–automatic switch and other automatic control devices where available.
   1. Unless shown otherwise, connect selector switches to bypass only the manual and automatic control devices that have no safety functions when switch is in the hand position.
   2. Unless shown otherwise, connect selector switches with motor–control circuit in both hand and automatic positions for safety–type control devices such as low– and high–pressure cutouts, high–temperature cutouts, and motor overload protectors.

3.5 CONNECTIONS
A. Tighten connectors, terminals, bus joints, and mountings. Tighten field–connected connectors and terminals, including screws and bolts, according to manufacturer's published torque–tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.6 START-UP AND TRAINING SERVICES
A. Provide the services of the manufacturer's factory authorized representative for start up of variable frequency drives and training of the Owner's personnel for operation and maintenance of the drives.
   1. Inspect the installation of each drive for conformance with the manufacturer’s recommended installation practices.
   2. Program and/or configure each drive to properly operate the actual motor to which it is connected. Set programming parameters such as motor horsepower, voltage, current, code letter, full load amps, and similar items. Coordinate with the operational requirements of the process equipment and set parameters such as minimum and maximum speed, ramp times, span and range of analog inputs, and similar items. Document all programming and configuration parameters and include in the O&M manuals for the project.
   3. Test the operation of each drive after fully programming/ configuring the drive. Reprogram and/or reconfigure and then retest as required to obtain proper operation of the driven equipment and control of the process. Document the final configuration and programming parameters after successful startup and provide copies of the documentation to the Engineer.
4. Provide a minimum of two hours training to the Owner, at the Owner’s facility, prior to start-up of the drives. Training shall cover installation, maintenance, operation, and problem troubleshooting for each type of drive provided, and shall delineate differences between individual drives where configuration, programming, or control functions are different for otherwise similar model drives.

5. Provide a minimum of eight hours additional training, program revisions, and maintenance at the Owner’s facility approximately one to three months after completion of the project.

3.7 FIELD QUALITY CONTROL

A. Testing: After installing motor controllers and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.

1. Procedures: Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Sections 7.5, 7.6, and 7.16. Certify compliance with test parameters.

2. Remove and replace malfunctioning units with new units, and retest.

3.8 CLEANING

A. Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish. Clean devices internally, using methods and materials recommended by manufacturer.

PART 4 — PAYMENT

4.1 PAYMENT

A. Payment for the work described in this section will be included in the lump sum bid for Electrical.

END OF SECTION
SECTION 16440 — PANELBOARDS

PART 1 — GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Amendments and Special Provisions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes lighting and power panelboards and associated auxiliary equipment rated 600 V and less.

B. Related Sections include the following:

1. Section 16050 "Basic Electrical Materials and Methods" for general materials and installation methods.

2. Section 16410 "Enclosed Switches and Circuit Breakers" for circuit breakers installed in panelboards.

1.3 SUBMITTALS

A. Product Data: For each type of panelboard, accessory item, and component specified.

B. Shop Drawings: For panelboards. Include dimensioned plans, sections, and elevations. Show tabulations of installed devices, major features, and voltage rating. Include the following:

1. Enclosure type and mounting.

2. Bus configuration and current ratings.


4. Features, characteristics, ratings, and factory settings of individual protective devices and auxiliary components.

C. Panelboard Schedules: For installation in panelboards and inclusion in the maintenance manuals specified in Divisions 1 & 16. Submit final versions prior to closeout of project.

D. Maintenance Data: For panelboard components to include in the maintenance manuals specified in Divisions 1 & 16. Include manufacturer's written instructions for testing circuit breakers.

1.4 QUALITY ASSURANCE

A. Testing Agency: Utilize an independent testing agency meeting OSHA criteria for accreditation of testing laboratories, Title 29, Part 1907; or which is a full-member company of the InterNational Electrical Testing Association.

B. Listing and Labeling: Provide products specified in this Section that are listed and labeled.

1. The Terms "Listed" and "Labeled": As defined in the NEC, Article 100.


C. Comply with NEC.
D. Comply with NEMA PB 1.

1.5 EXTRA MATERIALS

A. Keys: Provide 3 spares of each type for panelboard cabinet lock.

PART 2 — PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

4. Square D Co.

2.2 PANELBOARD FABRICATION

A. Enclosures: Flush- or surface-mounted cabinets as indicated. NEMA PB 1, 20" minimum width, of NEMA type complying with Section 16050 for the location installed. Provide same size boxes for multisection panelboards.

B. Front: Secured to box with concealed trim clamps or screws. Front for surface-mounted panelboards shall be same dimensions as box. Fronts for flush panelboards shall overlap box, unless otherwise indicated.

C. Directory Frame: Metal, mounted inside each panelboard door.


E. Main and Neutral Lugs: Compression type.

F. Main Breaker: Vertical mounting.

G. Special Features: Include the following features for panelboards where indicated:

1. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front, removable, with flanges for attachment to panelboard, wall, and floor.

H. Future Devices: Equip with mounting brackets, bus connections, and necessary appurtenances, for the overcurrent protective device ampere ratings indicated for future installation of devices.

2.3 DISTRIBUTION, LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Feeder and Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

B. Doors:

1. Dry locations: In panelboard front, with concealed hinges. Secure with flush catch and tumbler lock, all keyed alike.

2.4 OVERCURRENT PROTECTIVE DEVICES

A. In accordance with Section 16410, except as modified herein.

PART 3 — EXECUTION

3.1 INSTALLATION

A. Install panelboards and accessory items according to NEMA PB 1.1.

1. Setup, adjust and fasten in place flush trim and interiors.

2. Install circuit breakers as shown on the "Circuit Schedule" for each panelboard. Record all circuit breaker installation deviations from the "Circuit Schedule" which result from changes or additions to the work and show on the Record Drawings the actual size and pole position of all circuit breakers installed.

B. Mounting Heights: Top of trim 74 inches above finished floor, unless otherwise indicated.

C. Mounting: Plumb and rigid without distortion of box. Mount flush panelboards uniformly flush with wall finish. Space surface mounted panelboard with washers of neoprene or fiberglass to shim out from irregular surfaces or from damp surfaces.

D. Circuit Directory: Prepare panelboards directories neatly typewritten in the same pole sequence as the panelboard stamping. Send a copy to the Engineer for his records. Prior to typing the final directories, verify room and equipment names and numbers with the Owner and modify circuit descriptions of areas/spaces to conform with the Owner's desires. Obtain approval of names and numbers before typing and installing.

E. Do not remove knockouts for breaker positions unless a breaker is to be installed. Where twistouts or knockouts are removed in error, provide a circuit breaker (one pole, twenty ampere) to fill each position removed.

F. Provision for Future Circuits: Install panelboards in such a manner as to leave access to the box, building chases, knockouts, etc. for future circuit additions. Install conduits in rearmost knockouts, install neutral and ground bus wires in rear or least accessible locations first, leaving access for future additions.

3.2 IDENTIFICATION

A. Panelboard Nameplates: Label the exterior of each panelboard with engraved laminated-plastic or metal nameplates mounted with corrosion-resistant screws.

3.3 CONNECTIONS

A. Tighten electrical connectors and terminals, including grounding connections, according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 FIELD QUALITY CONTROL

A. Prepare for acceptance tests as follows:

1. Make insulation-resistance tests of each panelboard bus, component, and connecting supply, feeder, branch and control circuits.

2. Make continuity tests of each circuit.
3. Testing of circuit breakers shall only be required for main circuit breakers or circuit breakers 100 Ampere and larger.

B. Testing Agency: Provide services of a qualified independent testing agency to perform specified testing.

C. Testing: After installing panelboards and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.

   1. Procedures: Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.

   2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units, and retest.

3.5 ADJUSTING

A. Set field-adjustable circuit-breaker trip ranges as indicated, or requested by the Engineer.

PART 4 — PAYMENT

4.1 PAYMENT

A. Payment for the work described in this section will be included in the lump sum bid for Electrical.

END OF SECTION
SECTION 16460 — DRY TYPE TRANSFORMERS

PART 1 — GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including Amendments and Special Provisions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY
A. This Section includes dry-type distribution and specialty transformers rated 1000 V and less.

1.3 SUBMITTALS
A. Product Data: Submit the following:
   1. Nameplate ratings
   2. Mounting methods
   3. Dimensioned plans, sections, elevation views and minimum clearances
B. Wiring Diagrams: Submit manufacturer's wiring diagrams and clearly identify terminals for tap changing and connecting field-installed wiring.
C. Field Test Reports: Indicate and interpret test results for tests specified in Part 3.
D. Maintenance Data: Include in the maintenance manuals specified in Division 1.

1.4 QUALITY ASSURANCE
A. Testing Agency Qualifications: Employ an independent testing agency meeting the requirements specified in Division 1 Section "Quality Control," and meeting OSHA criteria for accreditation of testing laboratories, Title 29, Part 1907; or a full-member company of the InterNational Electrical Testing Association.
B. Listing and Labeling: Provide transformers specified in this Section that are listed and labeled.
   1. The Terms "Listed" and "Labeled": As defined in NEC, Article 100.
C. Comply with NFPA 70.

1.5 DELIVERY, STORAGE, AND HANDLING
A. Temporary Heating: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit throughout periods during which equipment is not energized and is not in a space that is continuously under normal control of temperature and humidity.

PART 2 — PRODUCTS

2.1 MANUFACTURERS
A. Manufacturers: Subject to compliance with requirements, provide transformers by one the following:
2. Square D; Groupe Schneider.
3. Tierney Transformer.

2.2 TRANSFORMERS, GENERAL
A. Description: Factory-assembled and -tested, air-cooled units of types and sizes specified, designed for 60-Hz service.
B. Cores: Grain-oriented, nonaging silicon steel.
C. Coils: Continuous copper windings without splices, except for taps.
D. Internal Coil Connections: Brazed or pressure type.
E. Enclosure: Complies with Section 16050 and NEMA 250 for the environment in which installed.

2.3 GENERAL-PURPOSE ENERGY EFFICIENT DISTRIBUTION AND POWER TRANSFORMERS
A. Comply with NEMA ST 20 and list and label as complying with UL 1561.
B. Comply with energy standards set forth in NEMA Standard TP-1.
C. Cores: One leg per phase.
D. Windings: One coil per phase in primary and secondary.
E. Insulation Class: 150 deg C class for transformers smaller or equal to 15 kVA.
   1. Rated Temperature Rise: 80 deg C maximum rise above 40 deg C.
F. Taps: For transformers 3 kVA and larger, full-capacity taps in high-voltage windings are as follows:
   1. Taps, 3 through 25 kVA: Two 5-percent taps below rated high voltage.

2.4 FINISHES
A. Indoor Units: Manufacturer's standard paint over corrosion-resistant pretreatment and primer.
B. Outdoor Units: Comply with ANSI C57.12.28.

2.5 CONTROL AND SIGNAL TRANSFORMERS
A. Units comply with NEMA ST 1 and are listed and labeled as complying with UL 506.
B. Ratings: Continuous duty. If rating is not indicated, provide capacity exceeding peak load by 50 percent minimum.
C. Description: Self-cooled, 2 windings.

2.6 FINISHES
A. Indoor Units: Manufacturer's standard paint over corrosion-resistant pretreatment and primer.
B. Outdoor Units: Comply with ANSI C57.12.28.
2.7 SOURCE QUALITY CONTROL
A. Factory Tests: Design and routine tests comply with referenced standards.

PART 3 — EXECUTION

3.1 INSTALLATION
A. Arrange equipment to provide adequate spacing for access and for circulation of cooling air per manufacturer's recommendations.
B. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.2 GROUNDING
A. Comply with Division 16 Section "Grounding" and NEC for materials and installation requirements.

3.3 FIELD QUALITY CONTROL
A. Test to ensure transformer is operational within industry and manufacturer's tolerances, is installed according to the Contract Documents, and is suitable for energizing.
C. Tests: Include the following minimum inspections and tests according to manufacturer's written instructions. Comply with IEEE C57.12.91 for test methods and data correction factors.
   1. Inspect accessible components for cleanliness, mechanical and electrical integrity, and damage or deterioration. Verify that temporary shipping bracing has been removed. Include internal inspection through access panels and covers.
   2. Inspect bolted electrical connections for tightness according to manufacturer's published torque values or, if not available, those specified in UL 486A and UL 486B.
   3. Insulation Resistance: Perform winding to winding and winding to ground megohmmeter tests of each primary and secondary winding.
D. Test Failures: Compare test results with specified performance or manufacturer's data. Correct deficiencies identified by tests and retest. Verify that transformers meet specified requirements.

3.4 ADJUSTING
A. Adjust transformer taps to provide optimum voltage conditions at utilization equipment throughout normal operating cycle of facility. Record primary and secondary voltages and tap settings and submit with test results.

PART 4 — PAYMENT

4.1 PAYMENT
A. Payment for the work described in this section will be included in the lump sum bid for Electrical.
END OF SECTION
SECTION 16940 — CONTROL PANELS

PART 1 — GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including Amendments and Special Provisions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY
A. Section Includes:
   1. Control panels (whether provided under Division 16, or provided, or specified to be provided, with equipment specified under other Divisions).
   2. Control panels specified under this Section include:
      a. Telemetry Panel

B. Related Sections: The following Sections contain requirements that relate to this Section

1.3 REFERENCES
A. Referenced Standards:
   1. National Electrical Manufacturers Association (NEMA):
      a. ICS 1, General Standards for Industrial Control and Systems.
      b. ICS 4, Terminal Blocks for Industrial Use.
      c. ICS 6, Enclosures for Industrial Controls and Systems.
      d. Publication No.250, Enclosures for Electrical Equipment (1000 V maximum).
   2. National Fire Protection Association (NFPA):
   3. Joint Industrial Council
      a. JIC-EMP-1.

1.4 SYSTEM DESCRIPTION
A. Control Panels
   1. The system includes new control panels for control and/or monitoring of the process equipment. Control panels, whether provided under Division 16 or other Divisions, shall meet the requirements of this Section.

1.5 SUBMITTALS
A. Shop Drawings:
   1. See Division 1
   2. Dimensioned and to-scale panel layout drawings.
4. Drawings showing conduit and wiring access locations.
5. Elementary wiring diagrams and terminal block drawings, differentiating between panel and field wiring.
6. Bill of Materials including the reference name or number, quantity, complete English language description, manufacturer, model number, local supplier and wiring or piping reference. Information shall include manufacturer name, catalog descriptions, wiring and piping diagrams, dimensional drawings, anchoring details, installation instruction, and test results.
7. Product Information: including manufacturer name, catalog descriptions, ratings, wiring and piping diagrams, dimensional drawings, anchoring details, installation instruction, and test results.
8. Loop diagrams with all components connected per ISA standards.
9. Nameplate text.

B. Operation and Maintenance Manuals:
1. See Division 1
2. Provide manufacturer’s operating and maintenance manuals for each device or item provided.
3. Recommended spare parts stocking list.
4. Record Drawings of completed control panels.

1.6 QUALITY ASSURANCE

A. Control panels supplied under this Section shall be provided by Total Energy Management (Richland, WA), Townsend Controls (Pasco, WA) and TSI (Lynnwood, WA).

B. Provide control panels bearing the label of a testing laboratory recognized by the State of Washington, or otherwise acceptable to the State of Washington Department of Labor and Industries.

C. Submit and obtain approval of shop drawings and make approved shop drawings available prior to placement of conduits in slabs to ensure placement is coordinated with panel access locations.

D. Test panels in the presence of the Engineer prior to shipment to project site. Notify the Engineer at least one week before testing. Testing shall be performed at the panel fabricator’s shop.
1. Provide a test plan at time of notification of testing.
2. The entire assembled panel shall be meggered and tested to be free from grounds and shorts.
3. Controllers, circuits and interlocks shall be rung out and tested to assure that they function correctly before the panel is shipped. Each device and control loop shall be tested and demonstrated to function properly in each mode (such as “hand”, “local”, “automatic”). Discrete input signals shall be tested in both the “on” and “off” state. Analog signals (4-20 milliamp, or similar type) shall each be tested at
not less than three values (4.08 mA or 0.5%, 12 mA or 50%, and 19.92 mA or 99.5%). Test results shall be documented.

4. Correct, replace, or repair panel wiring, and/or components until testing demonstrates proper operation. Do not ship panels to the site until testing has demonstrated satisfactory operation of the panels.

5. Provide updated and complete ‘as shipped’ drawings at the time of final testing. The Engineer shall review the drawings against the panel construction at the time of final testing. Drawings which do not reflect the actual construction of the panel will need to be revised and reviewed again by the Engineer against the actual construction prior to shipment of the panel to the job site. ‘As shipped’ drawings which require revisions shall be submitted to the Engineer for review prior to the actual field review of these drawings against the panel construction. This process of revision and review of the drawings will be repeated as necessary to produce drawings which reflect the actual construction of the panel at the time of shipment. Do not ship panels to the site until the ‘as-shipped’ drawings are updated, complete, and reflect the actual ‘as-shipped’ status of the panel.

6. Attention of the Contractor is directed to the fact that more than one shop test and/or review of the panel wiring/drawings may be required. If the first shop test is not satisfactory, or results in the need to make revisions to the panel and/or ‘as-shipped’ drawings that cannot be effected during the course of the shop test, then a repeat shop test and/or review of the drawings against the construction will be required. The presence of the Engineer at up to two shop tests/reviews will be without cost to the Contractor. If more than two shop tests/reviews are required, then the Contractor shall be required to reimburse the Engineer for the Engineer’s costs for the third and each subsequent shop test/review.

E. Revise all drawings upon completion of the work to show "as shipped" condition of the panel.

F. Conduct a field test of the panel in the presence of the Engineer after installation of the panel at the site. Testing shall be conducted by physically actuating signaling devices (where possible), installing temporary jumpers, or artificially imposing signals on the field wiring. The purpose of the test is to establish proper operation of the field devices, the integrity of the field wiring, and proper connection of field devices to the panel. The Contractor shall coordinate with the Engineer to provide for as complete a testing of the control and monitoring systems as is practical prior to placing the panel on line for actual control and/or monitoring of the process. The Contractor shall make corrections or repairs to the wiring and/or devices as necessary to provide proper operation of the system.

1.7 STORAGE AND HANDLING

A. After completion of shop assembly and testing, enclose panels in heavy-duty polyethylene envelopes or secured sheeting to provide complete protection from dust and moisture. Place dehumidifiers inside the polyethylene covering.

B. Skid-mount the equipment for final transport. Show shipping weight on shipping tags, together with instructions for unloading, transporting, storing, and handling on job site.

PART 2 — PRODUCTS

2.1 MATERIALS

A. Control panel enclosures are factory UL labeled enclosures fabricated into a rigid, self supporting structure. Panels shall be of NEMA type construction as required for the location indicated on the Plans.
2.2 COMPONENTS

A. Fuses

1. Control power fuses are FRN for ratings above ten amperes and FNQ for ten amperes and below. FRN fuses are mounted in phenolic blocks with a fuse puller mounted adjacent to them. FNQ fuses are mounted in a buss HPC fuseholder. Label all fuseholders with fuse identification number and fuse size and type. Provide three spare fuses of each type and size in each panel. Provide box mounted on panel interior marked “SPARE FUSES” to hold the spares.

B. Pilot devices (control units and stations): heavy duty, oil-tight type per NEMA ICS-1; pilot lights push-to-test transformer type.

1. Allen-Bradley
2. Cutler-Hammer
3. Furnas
4. General Electric
5. Square D

C. Relays

1. Control relays for logic control circuits shall be permitted to be enclosed octal or 11 pin socket mounted type relays. Coils shall be rated 120 VAC or 24 VDC (as required). Contacts shall be double break type rated B300 by NEMA standards. Potter-Brumfield, Finder or equal.

D. Terminals:

1. Phenolic barrier type strip screw terminals for power circuits. Marathon, or equal.
2. Rail mounted, thermoplastic or thermoset insulating frame, compression clamp style terminal blocks for control and instrumentation circuits. Entrelec, or equal.

E. Power supplies shall be 120 VAC input, 24 VDC output as designated on drawings. Power supplies shall be switching type or linear power type. Sola SDN2.5-24-100P, Deltron Inc, W112A or equal.

F. Power supplies shall be 120 VAC input, 12 VDC output as designated on drawings. Deltron Inc, W105B, or equal.

G. Batteries shall be 4 Amp-hour capacity or better, 12 volt sealed rechargeable units specifically rated for stand-by (float) service. Power Sonic PS-1270, Yuasa Exide NP2.6-12, or equal.

H. Circuit breakers shall be Allen-Bradley 1492-GS, Cutler Hammer WMS, or approved equal.
I. Analog signal isolators shall be Absolute Process Instruments (API) 4380 DD, Action Instruments Action I/Q, or approved equal. The signal isolator shall be able to convert a proportional 0-5volt signal to 4-20 mA signal.

J. Provide grounding bus bar and mount to panel. Connect grounding bus bar to ground from electrical panel.

2.3 ACCESSORIES

A. Panel Nameplates and Identification:

1. Identify each item on the control panel with rectangular nameplates.

2. Provide nameplates of rigid phenolic plastic laminate with engraved lettering or engraved metal plate with filled lettering. Use black background with white lettering.

3. Minimum letter height is 1/2 inch for instrument description and 1/4 inch height for instrument tag number.

4. Provide each panel with a 2" by 10" (minimum) main nameplate with 1 inch high lettering with panel identification.

5. Abbreviations are not permitted unless approved by the Engineer or specifically shown on the nameplates, schedules, or drawings.

6. Install nameplates plumb and parallel to the lines of doors or structure to which they are attached. Attach to the sheet metal structure by a thin coat of adhesive and sheet metal screws. Make adhesive and screw application in a manner to avoid buckling or distorting nameplates due to use of excessive adhesive or over tightening of screws.

2.4 FABRICATION

A. General:

1. Control panels shall be factory or shop fabricated units completely assembled, wired and tested before shipment to the job site.

2. Panel construction, in general, shall meet JIC EMP-1 standards and applicable NEMA and IEEE standards.

3. The panels shall be constructed in accordance with electrical testing laboratory standards and shall be so labeled (the standards of a recognized electrical testing laboratory).

4. Size panels for the enclosed equipment and the available space for mounting of the panel, but not smaller than as shown on the Contract Documents.

5. Panels shall be descaled, cleaned and primed in preparation for painting. Painting shall consist of one coat of flat white enamel in the interior and two coats of hard finish exterior enamel, gray in color for the exterior. Paint shall be suitable for field touch-up. Spare paint (one quart) shall be provided for touch-up purposes.

B. Wall-Mounted Panels:

1. Welded construction

2. Completely enclosed, self-supporting, and gasketed dust-tight.
3. Seams and corners welded and ground smooth.
4. Provide full length piano hinges rated for 1.5 times the weight of the door and door mounted instruments.
5. Furnish doors with keyed alike locking handles and three point catch.
6. Provide each panel with lifting eyebolts. Furnish stainless steel base channels.

C. Component Installation.
1. Minimize welding to panel fronts and avoid distortion of panel metal.
2. Reinforce around areas of the enclosure weakened by openings or mounting of heavy equipment/components.
3. Accurately and cleanly cut or nibble cut-outs, and finish free of sharp edges or burrs. Make cutouts plumb, level, and on-line vertically or horizontally within 1/32 of an inch where components are in rows or columns.
4. Provide minimum 1-5/8 inches spacing between horizontal rows of externally mounted components; 1-1/2 inches minimum between vertical columns of components.
5. Provide minimum 1/4 inch spacing between components mounted on the panel sub-plate. Provide minimum spacing between the component and the wire duct of 1-1/2 inches above and one inch below. Provide additional space if required to access terminals, adjusting screws, and similar items.
6. Components mounted in the interior shall be fastened to an interior subpanel using machine screws plus adhesive to insure vibration-free attachment.
7. Interior component mounting and wiring shall be grouped as much as possible by function and then by component type. Interiors shall be so arranged that control relays, terminal blocks, fuses, etc., can be replaced or added without disturbing adjacent components.

D. Panel Wiring:
1. Line voltage (120 volt or higher) wiring in panels shall be Class C stranded copper conductor with Type MTW or SIS insulation. Color coding of insulation shall be black for power, white for 120V neutrals, red for AC controls which derive their source from within the panel, yellow for AC controls which derive their source external to the panel, blue for low voltage DC controls, green for grounding conductors.
2. Instrumentation wiring for DC analog circuits shall be stranded #18 AWG, minimum size copper conductor with conductor insulation of thermoplastic with foil or stranded wire shielding and overall gray PVC jacket.
3. Shop or factory wire panels to identified terminal blocks equipped with screw type lugs.
4. Provide raceways for panel wiring.
   a. Size raceways per the requirements of NEC.
   b. Provide panel wireways between each row of components, and adjacent to each terminal strip.
c. Wireways shall be a minimum of one inch wide and three inches deep with removable snap-on covers and perforated walls for easy wire entrance. Wireways shall be constructed of non-metallic materials with a voltage insulation in excess of the maximum voltage carried therein. Panduit type LG, Panel Channel or equal

5. Provide wire bending space per NEMA ICS 6.

6. Label wiring within the panel with wire numbers and run in wiring duct neatly tied and bundled with tie wraps or similar materials. Identify each wire termination, including all jumpers, with permanently marked, heat shrink type wire markers. Arrange wire labels to permit reading of identification when installed. Apply heat per manufacturer's instructions to create a tight fit of the label to the wire.

7. Connect wiring internal to the panel to the "inside" of the terminal strip. Connect field wiring to the 'outside' of the terminal strip. Wires to enclosure door mounted components are considered as internal wires. Connect no more than two wires to any one control terminal point. Provide terminal jumpers where more than two wires terminate at the same point.

8. Arrange wiring inside the panel to separate low voltage control signals of the milliamp-millivolt or other low energy type from inductive power circuits

9. Connect grounds and shields of circuits which derive power internal to the panel to a panel common ground bus which shall be grounded by the electrical contractor in the field.

10. Physically separate signals entering controllers for amplification as control outputs from all line voltage wiring and shield with continuous foil shielding or enclose them in metal raceway.

11. Provide necessary power supplies for control equipment.

12. Termination requirements:
   a. Terminate panel wiring on device or terminal block screw terminals using slip-on spade tongue insulated crimp (compression) terminators.
   b. Terminate panel wiring on compression clamp style terminals using slip-on stud insulated crimp (compression) terminators.
   c. Stranded conductors shall not be terminated bare to terminals or devices.
   d. Provide terminal strips for the termination of panel wiring not directly connected to panel mounted devices.
   e. Terminals shall facilitate wire sizes as follows:
      1) VAC applications: Wire size 12 AWG and smaller.
      2) Other: Wire size 14 AWG and smaller.
   f. Label each I/O terminal to indicate tag number of the conductor and connected device.
   g. Provide terminals for individual termination of each signal shield. Do not connect shield to ground in the panel unless specifically shown as connected to ground on the loop diagram, or directed by the Engineer.
   h. Provide 20 percent excess terminals for future expansion.
i. In general, mount terminal strips on the bottom horizontal edge of the sub-plate. Mount additional terminal strips, if required, on a thirty degree angle bracket at the bottom of the sub-plate. Where terminal strips are mounted side-by-side, elevate one set of terminals 1-1/2 inches above the sub-plate to allow wire to pass underneath.

j. Provide a minimum of two inches between terminal strips and wireways or between terminal strips.

E. Panel Lighting and Power:

1. Provide one convenience electrical outlet.

2.5 SOURCE QUALITY CONTROL

A. Testing

1. The entire assembled panel shall be meggered and tested to be free from grounds and shorts.

2. Controllers, circuits and interlocks shall be rung out and tested to assure that they function correctly before the panel is shipped.

3. Revise all drawings upon completion of the work to show "as shipped" condition of the panel.

PART 3 — EXECUTION

3.1 INSTALLATION

A. Anchor panels rigidly in place with approved anchorage devices.

3.2 START-UP

A. The Engineer will provide RTU configuration information for installation by the Contractor.

PART 4 — PAYMENT

4.1 PAYMENT

A. Payment for the work described in this section will be included in the lump sum bid for Electrical.

END OF SECTION
SECTION 16950 — RADIO TELEMETRY EQUIPMENT

PART 1 — GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Amendments and Special Provisions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes UHF radios, and related hardware and accessories such as antennas, antenna and radio feed line, connectors, suppressors.

B. Related Sections include the following:

1. Section 16940 – Control Panels for control panels in which telemetry radios will be located.

1.3 SUBMITTALS

A. Product Data.

1. Manufacturer’s information for hardware.

2. Manufacturer’s installation and programming manuals.

B. Operation and Maintenance Manuals:

1. Provide specific information including:

   a. the manufacturer’s installation and programming manual.

   b. information for obtaining assistance from the manufacturer.

1.4 SYSTEM DESCRIPTION

A. Design Requirements.

1. Provide complete and functioning 450MHz UHF radio system. System shall provide for communications between well house RTU and the RTU at the County Building.

2. This includes providing and installing the following:

   a. UHF radio transceiver.

   b. Antenna

   c. Antenna Feedline

   d. Lightning Surge Arrestor

   e. Cabling and hardware to interface transceiver with a RTU

   f. Other components and accessories as required to ensure reliable performance of the Radio Telemetry System

B. Performance Requirements
1. The installed system will provide stable and reliable communications between the well house RTU and RTU installed at the County Building.

1.5 QUALITY ASSURANCE

A. Comply with NEC for devices and installation.

B. Listing and Labeling: Provide products that are listed and labeled for their applications and installation conditions and for the environments in which installed.

1. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.

2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

C. Qualifications:

1. The installer shall be proficient in the installation and configuration of radio telemetry systems similar to that specified herein, including
   a. Antenna feedline installation and end connector termination
   b. Antenna mounting

PART 2 - MATERIALS

2.1 MANUFACTURERS

A. Provide products by the following manufacturers.

1. UHF Radio: Johnson Data Telemetry (Dataradio)

2. Lightning Surge Arrestor: Polyphaser

3. Antenna: Antenna Specialists, or equal.

4. Antenna Feedline:
   a. Andrew's Heliax.
   b. Amphenol.
   c. Or approved equal.

2.2 COMPONENTS

A. Radio telemetry sites shall include:

1. Radio:
   a. Johnson Data Telemetry (Dataradio) DL-3412

2. Polyphaser Model IS-B50LN-C2 Lightning Arrester

3. Antenna:
   a. 10dB directional YAGI antenna, as indicated on the drawings.

4. Coaxial antenna feedline:
   a. Antenna feedline from the antenna to the lightning arrester. Times Microwave LMR-400, LMR-500, LMR-600, or equal.
b. Flexible antenna jumper from the lightning arrester to the radio. Connectorize one end with "N" Type Male Connector and the other end with a SMA Type Male connector to match radio.

5. Communications cable:
   a. Cable connecting Zetron 1716 to the Johnson Data Telemetry radio DL-3412.

2.3 SPARES
   A. Provide one spare for each of the major components.
      1. Flexible antenna jumper.
      2. Lightning Arrester.

PART 3 — EXECUTION

3.1 CONFIGURATION
   A. The Engineer will provide radio program configuration information for installation by the Contractor.

3.2 HARDWARE INSTALLATION
   A. Antenna feedline
      1. Feedline shall be sized such that signal losses between the antenna and the transceiver do not exceed 3dB (this includes through connectors and the lightning arrester).
   B. Antenna
      1. Mount antenna per the manufacturer's requirements and recommendations as shown on the contract drawings.
      2. Provide a #8 ground conductor from antenna to the building ground system, install a shown on the contract drawings.
   C. UHF Radio
      1. Mount the radio in the telemetry panels as shown on the contract drawings.

3.3 FIELD QUALITY CONTROL
   A. Test, verify and demonstrate the complete configuration of the Radio Telemetry System.
      1. Test, verify and demonstrate communications between the RTU at the Wellhouse and the master RTU in the existing County Building.

PART 4 — PAYMENT

4.1 PAYMENT
   A. Payment for the work described in this section will be included in the lump sum bid for Electrical.

END OF SECTION
PLANS
TERRACE HEIGHTS WATER SYSTEM
WELL #4
IMPROVEMENT PROJECT
U6 3244

INDEX

SHEET 1 COVER SHEET, VICINITY MAP, INDEX, LEGEND, ABBREVIATIONS, AND GENERAL NOTES
SHEET 2 MISCELLANEOUS DETAILS
SHEET 3 ELECTRICAL SCHEDULES
SHEET 4 SITE PLAN, ONE LINE DIAGRAM AND DETAILS
SHEET 5 EXISTING / DEMOLITION ELECTRICAL PLAN
SHEET 6 REVISIONS TO ELECTRICAL PLAN AND SCHEDULE
SHEET 7 TELEMETRY PANEL ELEVATIONS, AND WIRING DIAGRAMS
SHEET 8 ELECTRICAL DETAILS

ABBREVIATIONS

<table>
<thead>
<tr>
<th>ELEVATION</th>
<th>EL</th>
</tr>
</thead>
<tbody>
<tr>
<td>FLOW LINE</td>
<td>FL</td>
</tr>
<tr>
<td>PLAN IND</td>
<td>PI</td>
</tr>
<tr>
<td>MANHOLE</td>
<td>MH</td>
</tr>
<tr>
<td>DIAMETER</td>
<td>DA</td>
</tr>
<tr>
<td>MALE IRON PIPE</td>
<td>MLP</td>
</tr>
<tr>
<td>PIPE THREAD</td>
<td>PT</td>
</tr>
<tr>
<td>MECHANICAL JOINT</td>
<td>MJ</td>
</tr>
<tr>
<td>OUTSIDE DIAMETER</td>
<td>OD</td>
</tr>
<tr>
<td>DUCTILE IRON</td>
<td>DI</td>
</tr>
<tr>
<td>VALVE BOX</td>
<td>VB</td>
</tr>
<tr>
<td>DRAIN PIPE</td>
<td>DP</td>
</tr>
<tr>
<td>STEEL</td>
<td>ST</td>
</tr>
<tr>
<td>CONCRETE</td>
<td>CON</td>
</tr>
<tr>
<td>CAST IRON</td>
<td>CI</td>
</tr>
<tr>
<td>GATE VALVE</td>
<td>GV</td>
</tr>
<tr>
<td>FEMALE IRON PIPE THREAD</td>
<td>FPT</td>
</tr>
</tbody>
</table>

GENERAL NOTES:

1) LOCATIONS SHOWN ON THE PLANS FOR EXISTING UTILITIES ARE BASED ON AVAILABLE RECORDS AND UTILITY LOCATES MANAGED DURING DESIGN. THE CONTRACTOR SHALL CALL THE UTILITY LOCATION REQUEST CENTER WELL IN ADVANCE OF CONSTRUCTION, AS DESCRIBED IN THE SPECIAL PROVISIONS. THE CONTRACTOR SHALL VERIFY THE EXACT LOCATION AND SIZE OF ALL EXISTING UTILITIES.

2) LOCATIONS SHOWN ON THE PLANS FOR COUNTY ROAD RIGHT-OF-WAY ARE APPROXIMATE. THE CONTRACTOR SHALL ERECT CONSTRUCTION OPERATIONS TO THE TRAVELED AREAS WITHIN THE COUNTY ROAD RIGHT-OF-WAY.

3) CONTRACTOR SHALL SCHEDULE THEIR WORK TO MINIMIZE THE LENGTH OF TIME THE PUMP IS OUT OF SERVICE.
REMOVE AND REPLACE EXISTING SHINGLES, 24 INCHES, AND SHATTER AS REQUIRED ON CURVOLA TO REMOVE EXISTING PUMP AND INSTALL NEW PUMP. USE CAUTION TO PREVENT DAMAGE TO SHINGLES.

PRESSURE Transmitter DETAIL

NOTE:
REMOVE EXISTING PRESSURE GAUGE AND FITTINGS FROM EXISTING 1/2" TAP AND PROVIDE TO OWNER.
DETAIL 1/20

DETAIL 2/20

FREESTANDING ENCLOSURE MOUNTING

DETAIL 3/20

DETAIL 4/20

DETAIL 5/20

YAGI ANTENNA MOUNTING

DETAIL 6/20

RECEPITABLE MOUNTING

DETAIL 7/20

YAGI ANTENNA MOUNTING

NOTES:
1. MOUNT ANTENNA AT 6'-6" ABOVE PUCK OF ROOF.
2. PROVIDE WEATHER SEAL AT ANTENNA/ANTENNA PANEL CONNECTION.
3. NOT ALL CONNECTIONS/CONECTIONS SHOWN.