These Special Provisions to the City of Cheyenne and Board of Public Utilities Construction Specifications and Standard Drawings, 2014 Edition were prepared by, or under the direct supervision, the respective parties, who are licensed professional engineers in the State of Wyoming:

Civil Engineer

Electrical Engineer
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GENERAL PROVISIONS

The standard specifications governing this project shall be the *City of Cheyenne and BOPU Construction Specifications and Standard Drawings*, 2014 Edition and any amendments at the time of this contract. It is the contractor’s responsibility to keep himself current of these amendments.

These Special Provisions amend or supplement the *City of Cheyenne and BOPU Construction Specifications and Standard Drawings*, 2014 Edition with the same section numbers and titles. Added sections are so identified.

Where these Special Provisions are in conflict with the Plans and Supplemental Documents, Standard Plans, or the *City of Cheyenne and BOPU Construction Specifications and Standard Drawings*, 2014 Edition these Special Provisions will govern.

The term “Owner,” as used in these Special Provisions, shall mean Laramie County Community College or an authorized representative, and not the City of Cheyenne or the Cheyenne Board of Public Utilities.

The term “Engineer” as used in these Special Provisions shall mean BenchMark Engineers, P.C. or an authorized representative.

No separate measurement of payment will be made for any work which is included in the scope of this project, but not listed as a bid item, and there being no special provision for such work. Full compensation shall be considered as included in the prices paid for the various contract items and no additional compensation will be allowed therefore.
Add the following to Subsection 1.01 of this Section:

I. The Owner reserves the right to reduce or eliminate items and/or quantities to meet the budget.

J. Omissions from the drawings or specifications of details of work which are necessary to carry out the intent of the drawings and specifications, or which are customarily performed, shall not relieve the Contractor from performing such details of the work.

K. The Contractor shall limit his use of the premises to the work indicated and confine operations at the site to the areas permitted under the Contract. Portions of the site beyond areas on which work is indicated are not to be disturbed. The Contractor shall not unreasonably encumber the site with materials or equipment and confine stockpiling of materials to the areas designated by the Owner.

L. The Owner and/or their representatives, or their contractors, may require access through the project area at times during the construction period. The Contractor shall coordinate the work schedule with the Owner’s Representative and make reasonable adjustments to the schedule to permit required access.

1.02 TESTING

A. The Contractor shall employ an independent testing laboratory (approved by the Owner), staffed with a Professional Engineer, licensed in the State of Wyoming, to perform all testing as outlined in the contract documents. Copies of all tests shall be furnished to the Engineer and Owner’s representative. The Owner reserves the right to withhold payment of Quality Control Testing until results are received.

1.03 CLEANUP AND SITE RESTORATION

A. Except as otherwise called out in the Contract Documents, the Contractor shall restore to pre-existing conditions all facilities, land, streets, ditches, culverts, utilities, and improvements disturbed by the Contractor’s operations.

1.04 REMOVED OR DEMOLISHED MATERIALS

A. The Contractor shall remove and properly dispose from the site all demolished or removed materials at his expense. Unless otherwise specified, all removed materials or items shall become the property of the Contractor.

1.05 MAINTENANCE OF THE WORK DURING CONSTRUCTION

A. The Contractor shall maintain the roadways, driveway accesses, etc. within the project limits of this contract during construction and until the project has been accepted by the Owner.

B. This maintenance shall consist of continuous and effective work prosecuted daily, with adequate equipment and forces, so that the roadways and pedestrian accesses within the project limits of this contract are kept in satisfactory condition at all times. All cost of
maintenance work during construction, and before the project is accepted, shall be included in the unit prices bid on various pay items, and the Contractor will not receive additional payment for this work.

C. If the work is not maintained in accordance with the section, the Engineer will immediately notify the Contractor. If the unsatisfactory maintenance is not corrected within 6 hours after the receipt of the notice, the Engineer / Owner may immediately proceed to maintain the project and deduct the entire cost of this maintenance from monies due the Contractor.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

The work described in this section will not be measured or paid directly but will be considered subsidiary to other contract items.
Add the following to Subsection 1.01, A of this Section:

1) The Contractor shall obtain the Grading, Erosion and Sediment Control permit from Laramie County, if required.

Remove Subsection 1.01, C of this Section and replace with the following:

C. A pre-construction conference will be scheduled with the Contractor, Owner and Engineer following the execution of the Agreement and issuance of the Notice to Proceed. The Contractor’s assigned supervisory personnel shall attend. Other appropriate representatives of the Contractor and/or subcontractor shall also attend.

Add the following to Subsection 1.01 of this Section:

K. No work will be allowed on recognized Federal Holidays, unless authorized by the Owner.

Add the following to Subsection 1.02 of this Section:

F. The Contractor will be responsible to coordinate and notify all adjacent property owners whom will be affected by construction. A minimum notification period of 48 hours will be required. It shall be the responsibility of the Contractor to coordinate construction activities with the adjacent property owners, maintain access to their property and minimize conflicts. In the event conflicts arise that cannot be resolved, the Contractor shall immediately notify the Engineer or Owner.

G. The Contractor may be required to coordinate and/or adjust the sequence of work for this project due to other construction projects within the area and/or haul routes.
Add the following to Subsection 2.03, B of this Section:

4. Crushed Base aggregate shall be from a granite source.
Add the following Subsection to Part 3 of this Section:

3.04  WEIGH TICKETS

   A. Weigh tickets for base material shall be provided to the Engineer to verify quantities.

Remove Part 4 of this Section and Replace with the following:

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01  METHOD OF MEASUREMENT

   A. Measurement for payment for materials under this Section shall be per the unit described on the bid schedule for the respective material at the depth specified, complete in place. Any minor items of labor, haul or materials not specifically noted under this Special Provision or in the Contract Documents which are necessary for the proper completion of the work described shall be considered incidental and are to be included in the contract.

   B. No separate measurement shall be allowed for other items under this Section that are not specifically defined under this Section or in the contract bid schedule.

4.02  BASIS OF PAYMENT

   A. The accepted quantities of aggregate subbase and base courses of the size specified will be paid at the contract unit described in the bid schedule at the depth called for, complete in place and accepted, including any additives. Payment includes reuse of existing material of supplying new material, stockpiling, scarifying substrate surface, placing where required and compacting with moisture control and density control. Payment also includes hauling and delivery of material, as well as any water necessary for moisture control.
Add the following to Subsection 1.04 of this Section:

F. Weigh tickets for plant mix pavement shall be provided to the Engineer to verify quantities.
Add the following to Subsection 1.01 of this Section:

1. In landscaped areas disturbed by the work, the Contractor shall complete grading, place topsoil, and install sod.

Add the following to Subsection 1.01 of this Section:

B. Work also includes repairs and modifications to provide a working irrigation and sprinkler system in the project area. The contractor shall coordinate with LCCC to verify location of lines, sprinkler heads, control boxes, etc.
PART 1    GENERAL

1.01 SUMMARY

A. The work shall consist of the mobilization of the Contractor’s forces and equipment necessary for performing the work required under the contract. Mobilization shall include transportation of personnel, equipment and operating supplies to the site; establishment of office, buildings, or other necessary facilities at the site; and other site preparatory work.

1.02 JOB OFFICES AND STAGING AREA

A. The Contractor and Subcontractors may maintain such office and storage facilities on the site as necessary for the project. These sites shall be located so as to cause no interference to any Work to be performed on the site, adjacent businesses and properties, or to vehicular traffic. The Owner and the Engineer shall be consulted with regard to locations. The Contractor shall verify potential locations with the Owner and Engineer prior to bidding. The Contractor is cautioned that locations selected after the bid opening may not be acceptable.

PART 2    PRODUCTS (Not used)

PART 3    EXECUTION (Not used)

PART 4    METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

A. Mobilization shall be measured on a lump sum basis, but payment shall be made with the monthly estimate based on the percentage of the original contract amount earned in accordance with the following table:

<table>
<thead>
<tr>
<th>Percent of Original Contract Amount Earned</th>
<th>Percent of Lump Sum Price for Mobilization</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Request</td>
<td>25</td>
</tr>
<tr>
<td>25</td>
<td>50</td>
</tr>
<tr>
<td>50</td>
<td>75</td>
</tr>
<tr>
<td>75</td>
<td>100</td>
</tr>
</tbody>
</table>

Notes:
1. Upon substantial completion of the work on the project, payment of any amount bid for mobilization in excess of 10 percent of the original contract amount will be paid.
2. Mobilization is subject to the retainage that will be withheld for final payment.
### 4.02 BASIS OF PAYMENT

<table>
<thead>
<tr>
<th>Pay Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mobilization</td>
<td>LS</td>
</tr>
</tbody>
</table>
PART 1 GENERAL

1.01 SUMMARY

A. This section consists of furnishing materials, labor, and equipment for applying pavement markings in accordance with this special provision, the current edition of the Manual of Uniform Traffic Control Devices (MUTCD) for Streets and Highways, and in conformity to the lines, dimensions, patterns, locations and details shown on the plans.

B. ADA Accessible (handicap) parking stalls and loading areas shall be delineated with white paint and blue symbols per MUTCD standards. Other stall markings and directional areas shall be yellow per LCCC requirements.

1.02 SUBMITTALS

A. Contractor shall furnish manufacturer’s certified test reports for materials used on the project prior to use on the project. Certified test reports shall include a statement that the materials meet or exceed the specification requirements. The manufacturer shall certify that the products do not contain mercury, lead, hexavalent chromium, halogenated solvents, or any carcinogen as defined by 29 CFR 1910.1200.

PART 2 PRODUCTS

2.01 MATERIALS

A. Pavement marking paint shall conform to the composition and quantitative requirements established by the Wyoming Department of Transportation Specifications for Furnishing Fast Drying White and Yellow Acrylic Waterborne Traffic Line Paint dated September 14, 2001.

B. Glass beads for Traffic Paint shall conform to AASHTO M 247, Type I or Type II, non-floatation grade as recommended by the paint manufacturer.

2.02 EQUIPMENT

A. The Contractor shall be responsible for measurement of the work in accordance with the following requirements. The Contractor’s pavement marking equipment, other than for performed material, shall be equipped with an odometer graduated to one-hundredth (0.01) of a mile. Failure of the odometer to function properly shall be a cause to stop the work until the odometer is made to function properly.

B. The pavement marking equipment shall be equipped with an air jet to remove debris from the pavement in advance of the applicator gun. The air jet shall operate when marking material is being applied and be synchronized with marking material application.

E. Equipment shall be capable of painting a reasonably clean-edged stripe of the designated width (± ¼-inch) and shall have a bead dispenser directly behind, synchronized with the
paint applicator. In area where machines are not practical, suitable hand-operated equipment may be used as approved by the Engineer.

F. The Contractor shall be responsible for protection of all newly painted surfaces until completely dry. All costs associated with the removal and/or replacement of striping and/or markings due to the Contractor’s failure to properly protect the work area shall be the responsibility of the Contractor and corrected at no additional cost to the Owner.

PART 3 EXECUTION

3.01 SURFACE PREPARATION

A. The Contractor shall clean all visible loose or foreign material from the surface to be marked. The Contractor shall power broom clean all surfaces where gore markings or edge lines are to be applied. When required, other surfaces shall also be power broom cleaned.

3.02 WEATHER LIMITATIONS

A. Painting shall be performed only when the pavement surface is dry, and the surface temperature is 40°F and rising. Additionally, the pavement surface temperature shall be at least 5°F above the dew point.

3.03 LAYOUT AND PRE-MARKING

A. The Contractor shall be responsible to layout the locations of all lines to assure their proper placement and compliance with MUTCD standards, as modified by LCCC standards described previously. The layout and pre-marking of all lines shall be approved by the Engineer prior to any painting operations.

B. The Contractor shall establish reference points to assure proper placement of markings.

3.04 APPLICATION REQUIREMENTS

A. Pavement markings shall be applied only when the surface is clean and dry, the pavement and ambient air temperatures are 5°F or more above the dew point, and the pavement and ambient air temperatures are above 40°F.

B. The Contractor shall transfer the entire contents of each paint container to the striping tank. The paint shall be thoroughly and continuously mixed during the paint application.

C. Glass beads shall be applied to the wet paint so that the beads are embedded and retained in the paint and uniformly cover the paint surface. The rate of application shall be not less than six (6) pounds of glass beads per gallon of paint applied or as directed by the Engineer.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

A. Parking stall striping, pavement markings and other miscellaneous markings shall be included under this item and included in the bid price.
4.02 BASIS OF PAYMENT

A. Payment for all pavement striping and pavement markings shall include all labor, equipment and materials necessary to complete the work.
PART 1  GENERAL

1.01  EXTRA AND FORCE ACCOUNT WORK

A. New or unforeseen Work shall be classified as “extra work” when the Engineer determines that it is not covered by the Contract Unit Prices or stipulated unit prices. The Contractor shall perform this Work, whenever it is deemed necessary or desirable in order to complete fully the Work contemplated. Such Work will require an approved extra Work order; and shall be performed in accordance with the specifications, as directed and will be paid for as provided herein.

B. Extra Work performed in accordance with the requirements of the Supplementary General Conditions will be paid for in accordance with one or more of the following methods:
   1. Contract unit bid prices, providing that the unit bid prices are representative of the Work being performed;
   2. Approved rental rates;
   3. Lump Sum, as stipulated in the order authorizing the Work;
   4. The Owner may require the Contractor to do such Work on a Force Account basis, and the Contractor shall be reimbursed as follows.

1.02  SUBMITTALS

A. The Engineer will provide the Contractor, and Owner, with a detailed description of the Work proposed. Authorized approval signatures will be required on the document by the Contractor, Owner, and the Engineer prior to any Work being done.

PART 2  REIMBURSEMENT TO CONTRACTOR

2.01  LABOR

A. For all laborers and foremen in direct charge of the specific operations, the Contractor shall receive the actual cost of wages paid by him, but at rates not to exceed those for comparable labor currently employed on the Work, for each and every hour that said laborers and foremen are actually engaged in such Work.

B. An amount equal to twenty percent (20%) of the sum of the above items will also be paid to the Contractor to cover overhead, property damage, and liability insurance, Worker’s Compensation Insurance premiums, Unemployment Insurance contributions, and Social Security taxes.

C. In addition to the above payments, the Contractor shall receive the actual costs paid to or on behalf of workers by reason of subsistence and travel allowances, health or welfare benefits, pension fund benefits, or other bona fide benefits, when such amounts are required by collective bargaining agreement or are legitimate fringe benefits applicable to the classes of labor employed on the project.

2.02  MATERIALS
A. For materials accepted by the Engineer and the Owner and incorporated into the Work, the Contractor shall receive the actual cost of such materials delivered on the Work, including transportation charges paid by him (exclusive of machinery rentals as hereinafter set forth), to which cost fifteen percent (15%) will be added. The fifteen percent (15%) addition will not apply to materials furnished under Specialized Work.

2.03 EQUIPMENT

A. For any machinery or special equipment (other than small tools) including fuel and lubricants, plus transportation costs, the use of which has been authorized by the Engineer and Owner, the Contractor shall receive payment in accordance with the latest approved schedule of Equipment Rental Rates of the Wyoming State Highway Commission. In the event that any of the equipment to be used is not shown in said schedule, the rental rate for such equipment shall be agreed upon in writing before the Work is started.

B. Rental of equipment will be measured by time in hours of actual working time and necessary traveling time of the equipment within the limits of the project. If special equipment has been ordered by the Engineer and Owner and is to be used in connection with Force Account Work, travel time to the project will be measured for payment.

C. Payment will be based on the number of hours as outlined above.

D. Standby time will be paid only on equipment ordered brought to the job site and/or ordered held on the job by the Engineer or Owner. Equipment already on the project to complete regular contract items will not be considered for payment on standby time.

2.04 MISCELLANEOUS

A. No additional allowance will be made for general superintendence, the use of small tools, or other costs for which no specific allowance is herein provided, including tool, machine or storage buildings.

2.05 COMPENSATION

A. The Contractor’s representative and the Engineer shall compare record of the cost of the Work done as ordered on a Force Account basis.

2.06 STATEMENTS

A. No payment will be made for Work performed on a Force Account basis until the Contractor has furnished the Engineer with duplicate itemized statements of the costs of such Force Account Work detailed as follows:

1. Date, daily hours, total hours, rate, and extension for each classification of laborers and foremen;
2. Date, daily hours, total hours, rental rate, and extension for each code designation unit of machinery and equipment;
3. Quantities of materials, prices and extensions;
4. Transportation of materials

B. Statements shall be accompanied and supported by receipted invoices for all materials used and transportation charges. However, if materials used on the Force Account Work
are not specifically purchased for such Work but are taken from the Contractor’s stock in lieu of the invoices, the Contractor shall furnish a certified correct statement that such materials were taken from his stock, that the quantity claimed was actually used, and that the price and transportation claimed represent the actual cost to the Contractor.

2.07 SUBCONTRACTORS

A. When extra Work paid for on a Force Account basis is performed by forces other than the Contractor’s organization, the Contractor shall reach agreement with such other forces as to the distribution of the payment made by the Owner for such Work. No additional payment therefore will be made by the Owner by reason of the performance of the Work by a Subcontractor or other forces.

2.08 SPECIALIZED WORK

A. When the Engineer, Owner, and Contractor, by agreement, determine that a special service or an item of extra Work ordered by the Engineer or Owner requires skills, tools and equipment unlike those normally used by the Contractor or his authorized subcontractors, such service or Work may be performed by a specialist. Invoices for such service or item or extra Work on the basis or the current market price thereof may be accepted without completed itemization of labor, material and equipment rental costs when it is impractical and not in accordance with normal procedure of the special service industry to provide a complete itemization. Any hourly employee working on specialized Work, on the project, is subject to minimum wage determination for that project, and when payrolls are required, these employees must be carried on the Contractor’s or Subcontractor’s payroll.

B. Where Contractor is required to perform extra Work necessitating a fabrication or machining process in a fabrication or machine shop facility away from the job site, the charges for that portion of the extra Work may, by agreement, be accepted as a specialist billing.

C. To the specialist invoice price, less a credit to the Owner for any cash or trade discount taken, will be added the following percentages as reimbursement for administrative expenses:
   1. For total cost of the Work up to $1,000, add 10%;
   2. For total cost of the Work from $1,000.01 to $10,000, add 5% of the amount over $1,000 plus $100;
   3. For total costs of the Work over $10,000.01, add 3% of the amount over $10,000 plus $550.

D. These percentages will be paid in lieu of those percentages listed in 2.01- Labor and 2.02 - Materials of this Section.

PART 3 EXECUTION (Not used)

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Payment will be made under:
<table>
<thead>
<tr>
<th>Pay Item</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Force Account</td>
<td>$</td>
</tr>
</tbody>
</table>
SECTION 26 05 00
COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. All drawings associated with the entire project, including the General Conditions of the Contract for Construction, General and Supplementary Conditions, and Division 01 specification sections shall apply to the Division 26 specifications and drawings. The Contractor shall be responsible for reviewing and becoming familiar with the aforementioned and all other Contract Documents associated with the project.

B. Where contradictions occur between this section and Division 01, the more stringent requirement shall apply.

C. Contractor shall be defined as any and all entities involved with the construction of the project.

1.2 SUMMARY:

A. This Section specifies the basic requirements for electrical installations and includes requirements common to more than one section of Division 26. It expands and supplements the requirements specified in other sections of Division 01 through 50.

1.3 ELECTRICAL INSTALLATIONS:

A. Drawings are diagrammatic in character and do not necessarily indicate every required conduit, box, fitting, etc.

B. Drawings and specifications are complementary. Whatever is called for in either is binding as though called for in both. Report any discrepancies to the Engineer and obtain written instructions before proceeding. Where any contradictions occur between the specifications and the drawings the more stringent requirement shall apply. The contractor shall include pricing for the more stringent and expensive requirements and the installation shall be worked out during construction.

C. Conflicting Requirements: Where compliance with two or more standards is specified, and the standards establish different or conflicting requirements for minimum quantities or quality levels, clarify uncertainties with the Engineer prior to quotation.

1. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. In complying with these requirements, indicated numeric values are minimum or maximum, as appropriate for the context of the requirements. Refer uncertainties to the Engineer for a decision before proceeding.

2. Clarification methods: At the time of bidding, bidders shall familiarize themselves with the drawings and specifications. Any questions, misunderstandings, conflicts, deletions, discontinued products, catalog number discrepancies, discrepancies between the equipment supplied and the intent or function of the equipment, etc., shall be submitted to the Engineer in writing for clarification prior to issuance of the final addendum and bidding of the project. Where discrepancies or multiple interpretations occur, the most stringent (which is generally recognized as the most costly) that meets the intent of the documents shall be enforced.
D. Drawings shall not be scaled for rough-in measurements or used as shop drawings. Where drawings are required for these purposes or have to be made from field measurement, take the necessary measurements and prepare the drawings.

E. The exact location for some items in this specification may not be shown on the drawings. The location of such items may be established by the Engineer during the progress of the work.

F. The contractor shall make the installation in such a manner as to avoid obstructions and keep openings and passageways clear, without further instructions or costs to the Owner. All equipment shall be installed so access is maintained for serviceability.

G. Before any work is begun, determine that equipment will properly fit the space and that conduit can be run as contemplated without interferences between systems, with structural elements or with the work of other trades.

H. Verify all dimensions by field measurements.

I. Arrange for chases, slots, and openings in other building components to accommodate electrical installations.

J. Sequence, coordinate, and integrate installations of electrical materials and equipment for efficient flow of the work. Give particular attention to large equipment requiring an access path for positioning prior to closing-in the building or space.

K. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.

1.4 COORDINATION:

A. Work out all installation conditions in advance of installation. The Contractor shall be responsible for preparing coordination drawings, showing all work, in all areas. The Contractor shall be responsible for providing all labor and necessary to overcome congested conditions at no increase in contract sum. The Contractors base bid shall include any and all time and manpower necessary to develop such coordination efforts and drawings. Increases to contract sum or schedule shall not be considered for such effort.

B. Provide proper documentation of equipment, product data and shop drawings to all entities involved in the project. Refer to individual sections for requirements.

C. Coordination Drawings:

1. Coordination drawings shall be prepared by the Contractor for his utilization and are his responsibility to assure systems will be installed in a manner to allow all systems to function properly.

2. CADD Drawings: Electronic AutoCAD drawings are available for purchase by the Contractor from the Engineer. Contact Engineer for further information in acquiring CADD drawings. The Engineers Construction documents cannot be used directly for coordination drawings. They are for information and initial coordination only.

3. Start of work constitutes a material requirement for the aforementioned Coordination Drawings. Contractor shall bear any and all costs associated with changes that are not specifically addressed on the Coordination Drawings that were reviewed by the Engineer of Record.

D. Existing Conditions:

1. Contractor shall carefully survey existing conditions prior to bidding work.
2. Provide proper coordination of electrical work with existing conditions.
3. Contactor shall report any issues or conflicts immediately to Engineer before commencing with work and prior to purchasing equipment and materials. Start of work indicates acceptance of conditions.

1.5 COORDINATION WITH OTHER DIVISIONS:

A. General:
   1. Coordinate all work to conform to the progress of the work of other trades.
   2. Complete the entire installation as soon as the conditions will permit. No extras will be allowed for corrections of ill-timed work, when such corrections are required for proper installation of other work.

B. Chases, Inserts and Openings:
   1. Provide measurements, drawings and layouts so that openings, inserts and chases in new construction can be built in as construction progresses.
   2. Check sizes and locations of openings provided, including the access panels for equipment in hard lid ceilings and wall cavities.
   3. Any cutting and patching made necessary by failure to provide measurements, drawings and layouts at the proper time shall be done at no additional cost in contract sum.

C. Support Dimensions: Provide dimensions and drawings so that concrete bases and other equipment supports to be provided under other sections of the specifications can be built at the proper time.

D. Coordinate the installation of required supporting devices and sleeves to be set in poured in place concrete and other structural components, as they are constructed.

E. Modifications required as result of failure to resolve interferences, provide correct coordination drawings or call attention to changes required in other work as result of modifications shall be paid for by responsible Contractor/Subcontractor.

1.6 DESIGN WORK REQUIRED BY CONTRACTOR:

A. The construction of this project requires the Contractor to include the detailing and design of select systems and/or subsystems. All such design work associated with the development of the coordination drawings shall be the complete responsibility of the Contractor.

B. The Contractor shall take the full responsibility to develop and complete routing strategies which will allow fully coordinated system to be installed in a fully functional manner. The Engineers’ contract drawings shall be for system design intent and general configurations.

1.7 PROJECT CONDITIONS:

A. The contractor shall attend a pre-bid walk-thru, and shall make themselves familiar with the existing conditions. No additional costs to the Owner shall be accepted for additional work required to overcome existing conditions.

B. Provide field verification of all conditions prior to submitting bids.

C. Report any damaged equipment or systems to the Owner prior to any work.
D. Protect all work against theft, injury or damage from all causes until it has been tested and accepted.

E. Be responsible for all damage to the property of the Owner or to the work of other contractors during the construction and guarantee period. Repair or replace any part of the work which may show defect during one year from the final acceptance of all work, provided such defect is, in the opinion of the Engineer, due to imperfect material or workmanship and not due to the Owner's carelessness or improper use.

F. The Contractor shall coordinate and co-operate with Owner at all times for all new to existing connections.

G. Provide temporary electrical connections where required to maintain existing areas operable.

H. Coordinate all services shut-down with the Owner; provide temporary services. Coordinate any required disruptions with Owner, at a minimum one week in advance.

I. Minimize disruptions to operation of electrical systems in occupied areas.

J. After entering into contract, Contractor will be held to complete all work necessary to meet the intent of the engineered system shown on the Construction Documents and defined within these specification requirements without additional expense to the Owner.

1.8 SAFETY:

A. Refer to Division 01.

1.9 EQUAL EMPLOYMENT OPPORTUNITY REQUIREMENTS:

A. Refer to Division 01 and conform with the Owners requirements.

1.10 REQUIREMENTS OF REGULATORY AGENCIES:

A. Refer to Division 01.

B. Execute and inspect all work in accordance with Underwriters Laboratories (UL), and all local and state codes, rules and regulations applicable to the trade affected as a minimum, but if the plans and/or specifications call for requirements that exceed these rules and regulations, the more stringent requirement shall be followed. Follow application sections and requirements and testing procedures of NFPA, IEEE, NEMA, CBM, ANSI, NECA, ICEA and IETA.

C. Comply with standards in effect at the date of these Contract Documents, except where a standard or specific date or edition is indicated.

D. The handling, removal and disposal of regulated liquids or other materials shall be in accordance with U.S. EPA, state and local regulations.

E. All material used on this project shall be UL listed and labeled and be acceptable to the authority having jurisdiction as suitable for the use intended.

1.11 PERMITS AND FEES:

A. Refer to Division 01.
B. Owner shall pay all fees required for connection to municipal and public utility facilities through their service contract with each respective service provider.

C. Contractor shall arrange for and pay for all permits, inspections, licenses and certificates required in connection with the work.

1.12 PROJECT SEISMIC REQUIREMENTS:

A. Installation shall comply with the local seismic requirements for the area of installation. Provide restraints, bracing, anchors, vibration isolation, seismic snubbers, and all other components required for the installation.

B. All electrical systems shall be installed to meet NFPA and IBC Seismic requirements.

1. Where any conflicts arise the more stringent requirements shall be applicable.
2. The design of the seismic requirements shall be the responsibility of the contractor.

1.13 TEMPORARY FACILITIES:

A. Light, Heat, Power, Etc. Responsibility for providing temporary electricity, heat and other facilities shall be as identified in these specifications, as shown on the drawings and as specified in Division 01.

B. Building distribution equipment and devices (existing or new) shall not be used without written permission of the Owner. If used for temporary power, the equipment shall be properly maintained and any damage resulting from use shall be repaired by the Contractor. The guarantee period for new equipment shall not begin until the equipment is turned over to the Owner.

C. If AC power systems or their backup systems serving telecommunications, computer equipment, or their associated HVAC equipment and controls are taken out of service, for any reason, the Contractor shall be responsible for providing temporary systems during the period when the AC power systems or their backup systems are out of service. The Contractor shall be responsible for providing temporary power to all loads being interrupted.

1.14 PRODUCT OPTIONS AND SUBSTITUTIONS:

A. Refer to the Instructions to Bidders and Division 01.

B. The burden of proof that proposed equipment is equal in size, capacity, performance, and other pertinent criteria for this specific installation, or superior to that specified is up to the Contractor. Substituted equipment will only be allowed where specifically listed in a written addendum. If substitutions are not granted, the specified materials and equipment must be installed. Where substituted equipment is allowed, it shall be the Contractor's responsibility to notify all related trades of the accepted substitution and to assume full responsibility for all costs caused as a result of the substitution.

C. Materials and equipment of equivalent quality may be submitted for substituted prior to bidding. This may be done by submitting to the Engineer at least ten (10) working days prior to the bid date requesting prior review. This submittal shall include all data necessary for complete evaluation of the product.

1. Substitutions shall be allowed only upon the written approval of the Engineer. NO EXCEPTIONS.
2. The Contractor shall be responsible for removal, replacement and remedy of any system or equipment which has been installed which does not meet the specifications or which does not have prior approval.

1.15 SUBMITTALS:

A. General

1. Refer to the Conditions of the Contract (General and Supplementary), Division 01.
2. Contractor shall provide a submittal schedule appropriate for the size and duration of the project. Limit the number of large submittals being reviewed at one time and coordinate timing of sections that are dependent on each other.
3. The front of each submittal package shall have a cover page that identifies the specification section number, job name, Owner's project number, date, Prime Contractor and Subcontractor's names, addresses, and contact information, etc.
4. Each Specification Section shall be submitted individually and shall adequate annotation to indicate the equipment/materials/etc. within the section. Submittals with incomplete information will not be reviewed and will be sent back to be corrected.
5. Submittals shall be provided electronically. All electronic submittals need to be complete with all design information and stamped for conformity by the contractor. Submittals will be reviewed, marked appropriately and returned by the same means received.
6. An index shall be provided which includes:
   a. Product
   b. Specification Section
   c. Manufacturer and Model Number
7. Submittal schedule shall be provided for review within four (4) working weeks from award of contract to successful bidder.

B. Basis of Design: The manufacturer's material or equipment listed first in the specifications or on the drawing key notes are the basis of design and are provided for the establishment of size, capacity, grade and quality. If alternates are used in lieu of the first names, the cost of any changes in construction required by their use shall be borne by this Contractor. Product names used in construction details are not necessarily considered to be basis of design and specific operating parameters should be confirmed with manufacturer prior to submitting a bid.

C. Contractor Review: Submittal of shop drawings, product data, and samples will be accepted only when submitted by the Contractor. Each submittal shall be reviewed by the contractor for general conformance with contract requirements and stamped by the respective contractor prior to submittal to the Engineer. Any submittal not stamped or complete will be sent back. Data submitted from subcontractors and material suppliers directly to the Engineer will not be processed unless written prior approval is obtained by the Contractor.

D. Submittal Review Process: Before starting work, prepare and submit to the Engineer shop drawings and descriptive product data required for the project. Continue to submit in the stated format after each Engineer's action until a "No Exception Taken" or "Make Correction Noted" action is received. When a "Make Corrections Noted" is received, make the required corrections for inclusion in the operation and maintenance manual (O&M). Submittals marked "Make Corrections Noted" shall not be resubmitted during the submittal process. Unless each item is identified with specification section and sufficient data to identify its compliance with the specifications and drawings, the item will be returned "Revise and Resubmit". Where an entire submittal package is returned for action by the Contractor, the Engineer may summarize comments in letter format and return the entire set. Submittals shall be prepared per the requirements listed in each Division 26 Section.
E. The Design Professional’s review and appropriate action on all submittals and shop drawings is only for the limited purpose of checking for conformance with the design concept and the information expressed in the contract documents. This review shall not include:

1. Accuracy or completeness of details, such as quantities, dimensions, weights or gauges, fabrication processes
2. Construction means or methods
3. Coordination of the work with other trades
4. Construction safety precautions

F. The Design Professional’s review shall be conducted with reasonable promptness while allowing sufficient time in the Design Professional’s judgment to permit adequate review. Review of a specific item shall not indicate that the Design Professional has reviewed the entire assembly of which the item is a component.

G. The Design Professional shall not be responsible for any deviations from the contract documents not brought specifically to the attention of the Design Professional in writing by the Contractor. This shall clearly identify the design and the specific element which vary from the Design. The Contractor shall be responsible for all remedy for lack of strict conformance associated with this criteria.

H. The Design Professional shall not be required to review partial submissions or those for which submissions of correlated items have not been received.

I. The contractor shall cloud all changes made on submittals that are marked “Revise and Resubmit.”

J. Mark submittals with designations as shown on the drawings and identify as required by Specification Sections. Identification shall contain the information as required in details and each label shall be submitted in list form.

1.16 SPECIFIC CATEGORY SUBMITTAL REQUIREMENTS:

A. Product Listing:

1. Prepare listing of major electrical equipment and materials for the project, within (2) two weeks of signing the Contract Documents and transmit to the Engineer of Record.
2. Unless otherwise specified, all materials and equipment shall be of domestic (USA) manufacture and shall be of the best quality used for the purpose in commercial practice.
3. When two or more items of same material or equipment are required (lighting, wiring devices, switchgear, panelboards, protective devices, etc.) they shall be of the same manufacturer. Product manufacturer uniformity does not apply to raw materials, bulk materials steel bar stock, welding rods, solder, fasteners, except as otherwise indicated.

B. Schedule of Values

1. Provide Preliminary Schedule of Values to Engineer with product data submittal within four (4) weeks from award of contract to successful bidder. Provide according to the following descriptions:
   a. General Construction (total)
   b. Mobilization/Demobilization
   c. Demolition
   d. Basic Materials/Devices/Equipment Connections
2. Provide a final Schedule of Values at close-out of project including updated values based on actual installation.

C. Product Data:
   1. Where pre-printed data covers more than one distinct product, size, type, material, trim, accessory group or other variation, mark submitted copy to indicate which of the variations is to be provided. Improperly marked sheets will be rejected and returned.
   2. Delete or mark-out portions of pre-printed data which are not applicable.
   3. Where operating ranges are shown, mark data to show portion of range required for project application.

D. Shop Drawings:
   1. Shop Drawings are defined as electrical system layout drawings prepared specifically for this project, or fabrication and assembly type drawings of system components to show more detail than typical pre-printed materials.
   2. Prepare Electrical Shop Drawings, except diagrams, to accurate scale, min 1/8"-1'-0", unless otherwise noted.

E. Coordination Drawings: See applicable paragraph in this specification section.

F. Test Reports:
   1. Submit test reports which have been signed and dated by the accredited firm or testing agency performing the test.
   2. Prepare test reports in the manner specified in the standard or regulation governing the test procedure (if any) as indicated.
   3. Submit test reports as required for O & M manuals.

G. Operation and Maintenance Data: See applicable paragraph in this specification section.

H. Record Drawings: See applicable paragraph in this specification section.

1.17 DELIVERY, STORAGE AND HANDLING:
   A. Refer to the Division 01, Sections on Transportation and Handling and Storage and Protection.
   B. Deliver products to project properly identified with names, model numbers, types, grades, compliance labels, and similar information needed for distinct identifications; adequately packaged and protected to prevent damage during shipment, storage, and handling.
   C. Check delivered equipment against contract documents and submittals.
   D. Store equipment and materials at the site, unless off-site storage is authorized in writing. Protect stored equipment and materials from damage and weather.
   E. Coordinate deliveries of electrical materials and equipment to minimize construction site congestion. Limit each shipment of materials and equipment to the items and quantities needed for the smooth and efficient flow of installations.

1.18 DEMOLITION/REMODEL WORK:
   A. During the demolition phase of this contract it is the responsibility of this Contractor to carefully remove existing equipment, conduits, boxes, and related items either as shown on the
CONSTRUCTION DOCUMENTS
February 7, 2020

demolition drawings as being removed, or as required for the work. These items shall be
tagged, protected from damage and stored as directed by the Owner. A list of all items stored
shall be turned over to the Engineer. At the completion of the remodeling works or when
directed by the Engineer, all stored items not reused or wanted by the Owner shall be removed
from the premises.

B. Existing equipment that is removed and not scheduled to be reused shall remain the property
of the Owner and be delivered for disposition unless specifically indicated otherwise and shall
be stored in a location designated by the Owner. Items which are removed and not wanted by
the Owner shall become the property of the Contractor and shall be removed from the site.

C. Existing equipment that is removed and is to be reused shall be cleaned, serviced and operable
before being reinstalled.

D. Revise panelboard schedules to reflect removal or relocation of equipment. Circuit integrity of
equipment in adjacent areas shall be left intact.

E. Where remodeling interferes with existing circuits and equipment which are not to be removed,
such circuits and equipment shall be reworked and relocated as required to complete the
project.

F. The Contractor shall remove all distribution equipment, conductors, etc., which are indicated to
be removed or which must be removed to accommodate demolition. Equipment to be removed
may require reworking conduit and wiring in order to maintain service to other equipment.

G. Where remodeling interferes with circuits serving areas outside of the project or phase limits or
which are remodeled in later phases of the project, circuits shall be reworked or temporary
circuits provided as required. Take care to avoid overloading any one of the three phases in
existing three phase panels.

H. Existing equipment and circuiting shown are based on field surveys and/or Owner furnished
drawings. The Contractor shall verify conditions as they exist with necessary adjustments being
made to the drawing information.

I. Coordinate the routing of all conduits with the existing mechanical and plumbing systems in
order to avoid conflicts with ducts, pipes, etc. Where existing electrical boxes, conduit, or
equipment interfere with installation of new ducts, plumbing, walls, soffits, luminaires, outlets,
etc., the Contractor shall resolve the conflict with the appropriate trade.

J. Reuse of existing luminaires, devices, conduits, boxes, or equipment will be permitted only
where specifically indicated on the drawings or allowed under the appropriate section of the
specifications.

1.19 CUTTING AND PATCHING:

A. This Article specifies the cutting and patching of electrical equipment, components, and
materials to include removal and legal disposal of selected materials, components, and
equipment. Coordinate the cutting and patching of building components to accommodate the
installation of electrical equipment and materials.

B. Refer to the Division 01 Section covering cutting and patching for general requirements.

C. Do not endanger or damage installed Work through procedures and processes of cutting and
patching.
D. Arrange for repairs required to restore other work, because of damage caused as a result of electrical installations.

E. No additional compensation will be authorized for cutting and patching Work that is necessitated by ill-timed, defective, or non-conforming installations.

F. Cut, remove and legally dispose of selected electrical equipment, components, and materials as indicated, including, but not limited to removal of conductors, conduit, luminaires, boxes, devices and other electrical items made obsolete by the new Work.

G. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.

H. Locate, identify, and protect electrical services passing through remodel or demolition area and serving other areas required to be maintained operational.

1.20 ROUGH-IN:

A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.

B. Refer to equipment shop drawings and manufacturer's requirements for actual provided equipment for rough in requirements.

C. Work through all coordination before rough-in begins. See applicable Article above.

1.21 ACCESSIBILITY:

A. Install equipment and materials to provide required code clearances and access for servicing and maintenance. Allow ample space for removal of parts, fuses, lamps, etc. that require replacement or servicing.

B. Extend all conduits so that junction and pull boxes are in accessible locations.

C. Provide access panel or doors where equipment or boxes are concealed behind finished surfaces.

1.22 TESTING:

A. Submit test reports as outlined in Division 01 Sections on Quality Control Services and each Division 26 Section.

B. Testing as required by these specifications shall pertain to all equipment, wiring, devices, etc. installed and/or being reused under this contract.

C. General Scope:

1. Perform all tests and operational checks to assure that all electrical equipment, both Contractor and Owner-supplied, is operational within industry and manufacturer's tolerances and is installed in accordance with design specifications.

2. The tests and operational checks shall determine the suitability for energization.

3. Schedule tests and give a minimum of two weeks advance notice to the Engineer. Reschedule testing for Owner convenience if required.
D. Test Report: Submit electronic copies of the completed report to the Engineer no later than fifteen (15) days after completion of test unless directed otherwise. The test report shall be bound and its contents certified. A final compilation of all Test Reports shall be submitted with the Testing and Equipment Settings Report (Refer to Operation and Maintenance Data paragraphs).

E. Failure to Meet Test:

1. Contractor shall replace the defective material or equipment as necessary, and have test repeated until test proves satisfactory without additional cost to the Owner.

F. The Contractor or testing agency shall have a calibration program which maintains all applicable test instrumentation within rated accuracy. The accuracy shall be traceable to the National Institute of Standards and Technology (NIST) in an unbroken chain. Instruments shall be calibrated in accordance with manufacturer recommendations. Dated calibration labels shall be visible on all test equipment.

1.23 EXCAVATING AND BACKFILLING:

A. General:

1. In general, follow all regulations of OSHA as specified in Part 1926, Subpart P, "Excavations, Trenching and Shoring." Follow specifications of Division 26 as they refer specifically to the electrical work.

B. Contact Owners of all underground utilities to have them located and marked, at least 2 business days before excavation is to begin. Prior to starting excavation, brief employees on marking and color codes and train employees on excavation and safety procedures for Utilities including electrical lines and natural gas lines. When excavation approaches electrical or gas lines, expose lines by carefully probing and hand digging.

C. Trenching:

1. Provide all necessary pumping, cribbing and shoring.
2. Walls of all trenches shall be a minimum of 6 inches clearance from the side of the nearest electrical work. Install conduits with a minimum of 6 inches (or as identified on the drawings) clearance between them when located in same trench.
3. Dig trenches to depth, width, configuration, and grade appropriate to the materials being installed. Dig trenches to 6 inches below the level of the bottom of the material to be installed. Install 6 inches bed of sand, pea gravel, or squeegee, mechanically tamp to provide a firm bed, true to line and grade without irregularity. Provide depressions only at hubs, couplings, flanges, or other normal protrusions.

D. Backfilling shall not be started until all work has been inspected, tested and accepted. All backfill material shall be accepted by the soils engineer. In no case shall lumber, metal or other debris be buried in with backfill.

1. Provide warning tape for marking and locating underground utilities. Tape shall be specifically manufactured for this purpose and shall be polyethylene film, 6 inches wide, 0.004 inches thick and have a minimum strength of 1750 psi. Tape shall carry continuous inscription naming the specific utility.
   a. Tape shall have magnetic strip and be used for exterior underground system only.

E. Trench Backfill
1. Backfill to 4 inches above top of conduits with sand, the same as used for conduit bed, compact properly.
2. Continue backfill to finish grade, using friable material free of rock and other debris. Install in 6 inch layers, each properly moistened and mechanically compacted prior to installation of ensuing layer. Compaction by hydraulic jetting is not permissible.

F. After backfilling and compacting, any settling shall be refilled, tamped, and refinished at contractor's expense.

G. This contractor shall repair and pay for any damage to finished surfaces.

H. Backfill near manholes or hand holes using sand, installing it in 6 inch layers to 4 inches above the shallowest conduit. Use suitable excavated material to complete the backfill, installed in 6 inch layers and mechanically compacted to seal against water infiltration. Compact to 95% below paving and slabs and 90% elsewhere.

I. Use suitable excavated material to complete the backfill, installed in 6 inch lifts and mechanically compacted to seal against water infiltration. Compact to 95 percent for the upper, 30 inches below paving and slabs and 90 percent elsewhere.

1.24 CLEANING:

A. Refer to the Division 01 Section on project closeout or final cleaning for general requirements for final cleaning.

B. Clean all luminaires, LEDs and lenses per manufacturer’s recommendations prior to final acceptance. Replace all inoperative LEDs.

1.25 RECORD DOCUMENTS:

A. Refer to the Division 01 Section on Project Closeout or Project Record Documents for requirements. The following paragraphs supplement the requirements of Division 01.

B. Keep a complete set of record document prints in custody during entire period of construction at the construction site. Documents shall be updated on a weekly basis.

C. Mark Drawings to indicate revisions to conduit size and location both exterior and interior; actual equipment locations, dimensioned from column lines; concealed equipment, dimensioned to column lines; distribution and branch electrical circuitry; fuse and circuit breaker size and arrangements; support and hanger details; Change Orders; concealed control system devices, and any other relevant deviations from the Contract Documents.

D. Mark shop drawings to indicate approved substitutions; Change Orders; actual equipment and materials used.

E. Schedules:
   1. Mark luminaire schedule on drawings to indicate manufacturer and complete catalog numbers of installed equipment.
   2. Mark schedules on drawings to indicate installed equipment and materials used, and any deviations and final revisions to electrical load data and calculations.

F. Revisions to the Contract Documents shall be legible and shall be prepared using the following color scheme.
1. Red shall indicate new items, deviations and routing.
2. Green shall indicate items removed or deleted.
3. Blue shall be used for relevant notes and descriptions.

G. At the completion of the project, obtain a complete set of the Contract Documents in a read-only electronic format (.pdf unless otherwise noted). This set will include all revisions officially documented through the proper channels. Using the above color scheme, transfer any undocumented revisions from the construction site record drawings to this complete set. Submit completed documents for review. This contract will not be considered completed until these record documents have been received and accepted.

H. Contractor may propose methods of maintaining record documents on electronic media. Obtain approval of Engineer and Owner prior to proceeding. Marked-up .pdf format readable by Bluebeam is preferred.

1.26 OPERA TI ON AND MAINTENANCE DATA:

A. Refer to the Division 01 Section on project closeout or operation and maintenance data for procedures and requirements for preparation and submittal of maintenance manuals.

B. No later than four (4) weeks prior to the completion of the project provide complete set of operating and maintenance manuals, or as specified in Sections of Division 01 (whichever is more stringent). Operation and Maintenance Data shall be submitted in electronic format.

C. Operation and Maintenance Data: Submit operation and maintenance data in maintenance manual in accordance with requirements of applicable Division 26 Sections and Division 01. Provide Operating and Maintenance Instructions in electronic format covering all equipment furnished. Manuals shall include all information required below, as indicated in each Division 26 Section, and the following for each piece of equipment:

1. The job name and address, contractor's name, address, and phone number, and each subcontractor's name, address, and phone number shall be identified at the front of the electronic submittal.
2. Name, address and telephone number to be contacted of the local authorized service organization/company and individual to be contacted for service and maintenance for each item of equipment.
3. Submit operation and maintenance data, schedule of recommended service and parts lists for all materials and products specified and intended for installation. Include description of function, normal operating characteristics and limitations.
4. Manufacturer's service manuals for all electrical equipment provided under this contract.
5. Complete equipment and protection wiring diagrams. All wiring diagrams shall show color coding of all connections and mounting dimensions of equipment.
6. Equipment identification numbers and adjustment clearly indicated for each piece of equipment.
7. Electrical System and Equipment Warranties.
8. Provide manuals tabbed and divided into major sections and special equipment. Mark the individual equipment when more than one model or make is listed on a page. Provide detailed table of contents.
9. Record Set of Shop Drawings: Shop drawings corrected to show as-built conditions. Transfer modifications from field set.

D. This contract will not be considered completed nor will final payment be made until all specified material, including test reports, settings reports, and final Schedule of Values with all Electrical
change order costs included and identified is provided and the manual is reviewed by the Engineer.

1.27 PROJECT CLOSEOUT LIST:

A. In addition to the requirements specified in Division 01, complete the requirements listed below.

B. The contractor shall be responsible for providing the items listed on the Electrical Submittal Checklist prior to applying for certification of substantial completion. Refer to individual specification sections for additional requirements.

1.28 WARRANTIES:

A. Refer to the Division 01 Section on Warranties and Bonds for procedures and submittal requirements for warranties. Refer to individual equipment specifications for warranty requirements. In no case shall the warranty for the total electrical system be less than one year from date of acceptance by the Owner.

B. Compile and assemble the warranties specified in Division 26 into a separated set of vinyl covered, three ring binders, tabulated and indexed for easy reference.

C. Provide complete warranty information for each item. Information to include product or equipment description, date of beginning of warranty or bond; duration of warranty or bond; and names, addresses, and telephone numbers and procedures for filing a claim and obtaining warranty services.

1.29 CONSTRUCTION REQUIREMENTS:

A. The contractor shall maintain and have available at the jobsite current information on the following at all times:

1. Up to date record drawings.
2. Submittals
3. Site observation reports with current status of all action items.
4. Test results; including recorded values, procedures, and other findings.
5. Outage information.

END OF SECTION 26 05 00
SECTION 26 05 19
ELECTRICAL CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY:

A. This section includes wires, cables, and connectors for power, lighting, signal, control, and related systems rated 600 volts and less.

1.2 QUALITY ASSURANCE:

A. Manufacturers: Firms regularly engaged in manufacture of electrical wire and cable products of types, sizes, and ratings required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Conform to applicable code regulations regarding toxicity of combustion products of insulating materials.

1.3 SUBMITTALS:

A. See Section 26 05 00 Common Work Results for Electrical for Submittal requirements. Supplemental information is listed within this section.

B. Record Documents: Record actual installed circuiting arrangements for underground circuits.

1.4 DELIVERY, STORAGE, AND HANDLING:

A. Deliver wire and cable properly packaged in factory-fabricated type containers, or wound on NEMA-specifed type wire and cable reels.

B. Store wire and cable in clean dry space in original containers. Protect products from weather, damaging fumes, construction debris and traffic.

C. Handle wire and cable carefully to avoid abrading, puncturing and tearing wire and cable insulation and sheathing. Ensure that dielectric resistance integrity of wires/cables is maintained.

PART 2 - PRODUCTS

2.1 APPLICATIONS

A. General: Provide wire and cable suitable for the temperature, conditions, and location where installed. Wire shall be single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.

B. Underground Installation

1. Provide single conductor building wire in suitable raceway system.

C. Cable types that will NOT be permitted are listed as follows:

1. Metal-clad Cable assemblies (MC)
2. Armored Cable assemblies (AC)
3. Flat Cable assemblies (FC / FCC)
4. Integrated Gas Spacer cables assemblies (IGS)
5. Medium Voltage cable assemblies (MV)
6. Mineral-Insulated, metal sheathed cable assemblies (MI)
7. Nonmetallic-Sheathed cable assemblies (NM / NMC / NMS)
8. Service-Entrance cable assemblies (SE / USE)
9. Underground Feeder and branch-circuit cable assemblies (UF)

2.2 **CONDUCTOR AND CABLE REQUIREMENTS**

A. **General Requirements**

1. Provide products listed, classified, and labeled as suitable for the purpose intended.
2. Provide copper conductors
3. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B 787M unless otherwise indicated.
4. Tinned Copper Conductors: Comply with ASTM B33.

B. **Single Conductor Building Wire**

1. Description: Single conductor insulated wire.
2. Conductor Stranding:
   b. Size 8 AWG and Larger: Stranded.
3. Insulation: Type THHN/THWN or THHN/THWN-2.
4. Conductor: Copper.
5. Insulation Voltage Rating: 600 volt.

2.3 **CONNECTORS:**

A. Description: Provide UL-type factory-fabricated, solderless metal connectors of sizes, ampacity ratings, materials, types and classes for applications and for services indicated. Use connectors with temperatures equal to or greater than those of the wires upon which used.

B. Provide connectors that are designed to accept stranded conductors where stranded conductors are used.

**PART 3 - EXECUTION**

3.1 **INSTALLATION OF WIRES AND CABLES:**

A. General: Install electrical cables, wires and connectors in compliance with applicable requirements of NEC, NEMA, UL, and NECA's "Standard of Installation", and in accordance with recognized industry practices.

B. Per Laramie County Community College (LCCC) Construction Quality Standards:

1. Circuits shall be furnished with a dedicated neutral conductor. Neutrals common to more than one circuit will not be permitted for this project.
2. Copper conductors ONLY.

C. Coordinate wire/cable installation work, including electrical raceway and equipment connection work, with other work.
D. Pull conductors simultaneously where more than one is being installed in same raceway. Use pulling compound or lubricant, where necessary; compound used must not deteriorate conductor or insulation.

E. Use pulling means including, fish tape, cable, rope and basket weave wire/cable grips which will not damage cables or raceway. Do not use rope hitches for pulling attachment to wire or cable.

F. Install splices and taps which possess equivalent or better mechanical strength and insulation ratings than conductors being spliced.

G. Use splice and tap connectors which are compatible with conductor material.

H. Tighten electrical connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values. Where manufacturer's torqueing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Std. 486A for copper.

I. Provide adequate length of conductors within electrical enclosures and train the conductors to terminal points with no excess. Bundle multiple conductors, with conductors larger than No. 10 AWG cabled to individual circuits. Make terminations so there is no bare conductor at the terminal.

J. Use solderless pressure connectors with insulating covers for copper wire splices and taps, 8 AWG and larger. For 10 AWG and smaller, use insulated screw on type spring wire connectors with plastic caps, push on type are not acceptable.

K. Make splices, taps and terminations to carry full ampacity of conductors without perceptible temperature rise.

L. Thoroughly tape the ends of spare conductors in boxes and cabinets.

M. Install exposed cable, parallel and perpendicular to surfaces, or exposed structural members, and follow surface contours, where possible.

N. Make all ground, neutral and line connections to receptacle and wiring device terminals as recommended by manufacturer. Provide ground jumper from outlet box to individual ground terminal of devices.

O. Parallel conductors shall be cut to the same length.

P. Provide wire training, lacing, labeling, as required in all enclosures. All wiring shall be installed neat and be labeled to match wiring diagrams, control devices, etc.

Q. Color coding of switch legs, travelers, etc. shall be different and distinct from phase and neutral conductors. Where systems utilize two (2) different voltages, the color coding of switch legs, travelers, etc. shall be different and distinct for each voltage system.

3.2 FIELD QUALITY CONTROL:

A. Prior to energization, test wires and cables for electrical continuity and for short-circuits.

3.3 COLOR CODING SCHEDULE:

A. Color code secondary service, feeder, and branch circuit conductors as follows:

<table>
<thead>
<tr>
<th>Phase</th>
<th>277/480 Volts</th>
</tr>
</thead>
</table>
A Brown
B Orange
C Yellow
Neutral Gray
Ground Green

B. Conductors shall be solid color for entire length.

END OF SECTION 26 05 19
SECTION 26 05 26
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY:

A. This Section includes solid grounding of electrical systems and equipment. It includes 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.

1.2 SUBMITTALS:

A. See Section 26 05 00 Common Work Results for Electrical for Submittal requirements. Supplemental information is listed within this section.

B. Product Data: Provide manufacturer's catalog information showing dimensions and materials, for ground rods, connectors and connection materials, and grounding fittings.

C. Field Quality Control Test Reports: Submit record of testing as described below. Refer to Section 26 05 00 – Common Work Results for additional requirements.

1.3 QUALITY ASSURANCE:

A. Listing and Labeling: Provide products specified in this Section that are listed and labeled. The terms "listed" and "labeled" shall be defined as they are in the National Electrical Code, Article 100.

B. Manufacturer's Qualifications: Firms regularly engaged in manufacture of grounding and bonding products, of types, and ratings required, and ancillary grounding materials, including stranded cable, copper braid and bus, grounding electrodes and plate electrodes, and bonding jumpers whose products have been in satisfactory use in similar service for not less than 5 years.

PART 2 - PRODUCTS

2.1 GROUNDING AND BONDING PRODUCTS:

A. Products: Of types indicated and of sizes and ratings to comply with NEC. 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.

B. Conductor Materials: Copper.

2.2 WIRE AND CABLE CONDUCTORS:

A. General: Comply with Division 26 Section on Conductors and Cables. Conform to NEC, except as otherwise indicated, for conductor properties, including stranding.

B. Equipment Grounding Conductor: Green insulated.

2.3 CONNECTOR PRODUCTS:

A. General: Listed and labeled as grounding connectors for the materials used.
B. Pressure Connectors: High-conductivity-plated units.

C. Bolted Clamps: Heavy-duty units listed for the application. Provide 2-hole compression lugs for all grounding connections when installed on bus bars.

PART 3 - EXECUTION

3.1 APPLICATION:

A. Equipment Grounding Conductor Application: Comply with NEC for sizes and quantities of equipment grounding conductors, except where larger sizes or more conductors are indicated.

1. Install separate insulated equipment grounding conductors with circuit conductors for all feeders and branch circuits, in addition to those locations where required by Code:
   - Nonmetallic Raceways: Install an insulated equipment ground conductor in nonmetallic raceways unless they are designated for telephone or data cables.

B. Underground Conductors: Bare, tinned, stranded copper except as otherwise indicated.

3.2 INSTALLATION:

A. General: Ground electrical systems and equipment in accordance with NEC requirements except where the Drawings or Specifications exceed NEC requirements. Connect together system neutral, service equipment enclosures, exposed noncurrent carrying metal parts of electrical equipment, metal raceway systems, grounding conductor in raceways and cables, receptacle ground connectors, and plumbing systems.

B. Route grounding conductors along the shortest and straightest paths possible without obstructing access or placing conductors where they may be subjected to strain, impact, or damage, except as indicated.

C. Where grounding conductors, grounding electrode conductors, or bonding conductors are non-exposed, identify each with a 6-inch band of green tape at each end and at 10 foot intervals. When run in conduits, provide color banding on conduit per section on Electrical Identification.

3.3 CONNECTIONS:

A. General: Make connections in such a manner as to minimize possibility of galvanic action or electrolysis. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

1. Use electroplated or hot-tin-coated materials to assure high conductivity and 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 involving dissimilar metals with inert material such as red lead paint to prevent future penetration of moisture to contact surfaces.

B. Terminate insulated equipment grounding conductors for feeders and branch circuits with pressure-type grounding lugs. Where metallic raceways terminate at metallic housings without mechanical and electrical connection to the housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to the ground bus in the housing. Bond electrically non-continuous conduits at both entrances and exits with grounding...
bushing and bare grounding conductors. Terminate each conductor on an individual ground lug terminal.

C. Tighten grounding and bonding connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values for connectors and bolts. Where manufacturer's torqueing requirements are not indicated, tighten connections to comply with torque tightening values specified in UL 486A.

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

E. Moisture Protection: Where insulated ground conductors are connected to ground rods or ground buses, insulate the entire area of the connection and seal against moisture penetration of the insulation and cable.

3.4 FIELD QUALITY CONTROL:

A. Provide all test results to Engineer in Substantial Completion Submittals prior to scheduling Substantial Completion observations. Test results shall be tabulated to show name of tested device, measured value, expected values, acceptable standard deviation, and test conditions, as well as any miscellaneous variables that may be applicable to test being performed.

B. Upon completion of installation of electrical grounding and bonding systems, test ground resistance with ground resistance tester. Where tests show resistance-to-ground is over 5 ohms, take appropriate action to reduce resistance to 5 ohms, or less, by driving additional ground rods; then retest to demonstrate compliance.

C. Ground Resistance Test:

1. Grounding electrode resistance testing shall be accomplished with a clamp-on ground resistance test meter. Test at all affected points covered under NETA standards. Perform test following final termination of all grounding and bonding connections associated with scope of project. IEEE Fall of Potential Method may also be used to calculate ground resistance with a direct read meter and two reference probes. At a minimum provide test results at the following locations:
   a. Service Entrance
   b. Panelboards
   c. Utilization equipment connection

D. Correct Deficiencies, Retest and Report:

1. Correct unsatisfactory conditions and retest to demonstrate compliance; replace conductors, units and rods as required to bring system into compliance.
2. Prepare a written report and show temperature, humidity and condition of soil at time of tests. Report shall be certified by testing agency that identifies components checked and describes results. Include notation of deficiencies detected, remedial action taken, and observations and test results after remedial action.

3.5 CLEANING AND ADJUSTING:

A. Restore surface features at areas disturbed by excavation and reestablish original grades except as otherwise indicated. Where sod has been removed, replace it as soon as possible after backfilling is completed. Restore areas disturbed by trenching, storing of dirt, cable laying, and other Work to
their original condition. Include necessary top-soiling, fertilizing, liming, seeding, sodding, sprigging,
or mulching. Restore vegetation and disturbed paving to original condition.

END OF SECTION 26 05 26
PART 1 - GENERAL

1.1 SUMMARY:
A. This Section includes secure support from the building structure for electrical items by means of hangers, supports, anchors, sleeves, inserts, seals, and associated fastenings.

1.2 SUBMITTALS:
A. See Section 26 05 00 Common Work Results for Electrical for Submittal requirements. Supplemental information is listed within this section.
B. Shop Drawings: Contractor shall indicate details of fabricated products and materials.
C. Design Data: Indicate details and engineering analysis for any suspended transformers, cable trays, and trapeze hangers for multiple conduit runs.

PART 2 - PRODUCTS

2.1 COATINGS:
A. Coating: Supports, support hardware, and fasteners shall be protected with zinc coating or with treatment of equivalent corrosion resistance using approved alternative treatment, finish, or inherent material characteristic. Products for use outdoors shall be hot-dip galvanized.

2.2 MANUFACTURED SUPPORTING DEVICES:
A. Conduit Sealing Bushings: Factory-fabricated watertight conduit sealing bushing assemblies suitable for sealing around conduit, or tubing passing through concrete floors and walls. Construct seals with steel sleeve, malleable iron body, neoprene sealing grommets or rings, metal pressure rings, pressure clamps, and cap screws.

B. U-Channel Systems: 12-gage steel channels, with 9/16 inch-diameter holes, at a minimum of 8 inches on center, in top surface. Provide fittings and accessories that mate and match with U-channel and are of the same manufacture.

PART 3 - EXECUTION

3.1 INSTALLATION:
A. Install supporting devices to fasten electrical components securely and permanently in accordance with NEC requirements.

B. Raceway Supports: Comply with the NEC and the following requirements:
   1. Conform to manufacturer's recommendations for selection and installation of supports.
   2. Strength of each support shall be adequate to carry present and future load multiplied by a safety factor of at least four. Where this determination results in a safety allowance of less than 200 lbs., provide additional strength until there is a minimum of 200 lbs. safety allowance in the strength of each support.
C. Conductor or Cable Supports: Comply with the NEC and the following requirements:

1. Support individual conductors or cables by separate clamps with rubber or plastic grommet, fasten using a non-metallic bolt and nut, and secure clamps to channel supports anchored to structure (multiple clamps may be secured to a single channel support). Individual conductors or cables may be served utilizing a vinyl or fiberglass clamp which shall be anchored to the structure.
2. Install simultaneously with installation of conductors.

D. Miscellaneous Supports: Support miscellaneous electrical components separately and as required to produce the same structural safety factors as specified for raceway supports. Install metal channel racks for mounting cabinets, panelboards, disconnects, control enclosures, pull boxes, junction boxes, transformers, and other devices.

E. Conduit Seals: Install seals for conduit penetrations of exterior walls below grade. Tighten sleeve seal screws until sealing grommets have expanded to form watertight seal.

F. Fastening: Unless otherwise indicated, fasten electrical items and their supporting hardware securely to the building structure, including but not limited to conduits, raceways, cables, cable trays, busways, cabinets, panelboards, transformers, boxes, disconnect switches, and control components in accordance with the following:

1. Fasten by means of wood screws or screw-type nails on wood, toggle bolts on hollow masonry units, concrete inserts or expansion bolts on concrete or solid masonry, and machine screws, welded threaded studs, or spring-tension clamps on steel. Threaded studs driven by a powder charge and provided with lock washers and nuts may be used instead of expansion bolts and machine or wood screws, where authorized by the Owner and structural engineer. Do not weld conduit, pipe straps, or items other than threaded studs to steel structures. In partitions of light steel construction, use sheet metal screws.
2. Holes cut to depth of more than 1-1/2 inches in reinforced concrete beams or to depth of more than 3/4 inch in concrete shall not cut the main reinforcing bars. Fill holes that are not used.
3. Ensure that the load applied to any fastener does not exceed 25 percent of the proof test load. Use vibration- and shock-resistant fasteners for attachments to concrete slabs.

3.2 PERSONNEL PROTECTION:

A. Where U-channel systems, angles, brackets or other standard structural metal shapes are readily accessible and exposed to personnel, provide plastic or rubber end caps.

END OF SECTION 26 05 29
PART 1 - GENERAL

1.1 SUMMARY:

A. Extent of raceway work is indicated by drawings and schedules. Provide complete conduit systems for all conductors unless otherwise specified.

B. Types of raceways specified in this section include the following:

1. Rigid Polyvinyl Chloride (PVC)

C. The following raceway systems are either specified in other sections or are not anticipated to be provided under this scope of work.

1. High Density Polyethylene (HDPE)
2. Nonmetallic Underground Conduit with Conductors (NUCC)
3. Reinforced Thermosetting Resin Conduit (RTRC)
4. Liquidtight Flexible Nonmetallic Conduit (LFNC)
5. Flexible Metallic Tubing (FMT)
6. Electrical Nonmetallic Tubing (ENT)
7. Intermediate Metallic Conduit (IMC)
8. Rigid Metal Conduit (RMC)
9. Flexible Metal Conduit (FMC)
10. Liquidtight Flexible Metal Conduit (LFMC)
11. Electrical Metallic Tubing (EMT)
12. Auxiliary Gutters / Wireways
13. Surface Raceway
14. Busways and/or Cablebus
15. Cellular Concrete Floor Raceways
16. Underfloor Raceways
17. Cable Trays

1.2 QUALITY ASSURANCE:

A. Manufacturers: Firms regularly engaged in manufacture of raceway systems of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Installer's Qualifications: Firm with at least 3 years of successful installation experience on projects with electrical raceway work similar to that required for this project.

1.3 SUBMITTALS:

A. See Section 26 05 00 Common Work Results for Electrical for Submittal requirements. Supplemental information is listed within this section.

B. Record Documents: Record actual installed circuiting arrangements and routing for underground circuits.
PART 2 - PRODUCTS

2.1 CONDUIT AND TUBING:

A. General: Aluminum, Brass, and Stainless Steel tubing are not allowed unless specifically noted otherwise and/or for specialty systems such as use in corrosive or special condition environments. Provide galvanizing as indicated below. All fittings shall comply with NEMA FB 1.

B. Rigid Polyvinyl Chloride (PVC)

1. Conduit: rigid, nonmetallic conduit listed and labeled as complying with UL 651. Provide Schedule 40 wall thickness unless subject to physical damage, where Schedule 80 is required. Rated for use with 90deg C conductors.
2. Fittings: Mate and match conduit type and material. Cement as recommended by manufacturer.
4. Fittings: Steel compression fittings for rain-tight and concrete-tight applications. Steel set-screw for all other connections. Set-screw quick fit type for 2-1/2 inches and larger may be used. Bushings shall be threaded and have nylon insulated throat or nylon bushing.
5. Do not use die-cast or indentor type connectors and couplings.

2.2 CONDUIT SIZES:

A. Conduit sizes shall be as shown on the drawings. If the conduit size is not given on the drawings, the conduit shall be sized in accordance with NEC based on the number of conductors enclosed plus parity sized equipment ground.

2.3 RACEWAY SEALING COMPOUND:

A. Non-hardening, safe for human skin contact, not deleterious to cable insulation, workable at temperatures as low as 35 deg. F (1 deg. C), withstands temperature of 300 deg. F (149 deg. C) without slump, and adheres to clean surfaces of plastic ducts, metallic conduits, conduit coatings, concrete, masonry, lead, cable sheaths, cable jackets, insulation materials and the common metals.

PART 3 - EXECUTION

3.1 INSPECTION:

A. Examine areas and conditions under which raceways are to be installed, and substrate which will support raceways. Provide notification in writing of conditions detrimental to proper completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to Installer. Start of work constitutes acceptance of conditions.

3.2 CONDUIT SCHEDULE:

A. General: Unless otherwise indicated and where not otherwise restricted, use the conduit types indicated for the specified applications. Where more than one listed application applies, comply with the most restrictive requirements. Where conduit type for a particular application is not specified, use galvanized steel rigid metal conduit.

B. Buried Raceways (direct contact with Earth): Schedule 40 PVC or RMC with external PVC coating. Where PVC conduit is provided, transition to RMC where emerging from underground. Where PVC conduit larger than 2 inch trade size is provided, use RMC elbows for bends.
### 3.3 INSTALLATION OF CONDUITS:

**A. General:** Install electrical raceways in accordance with manufacturer's written installation instruction, applicable requirements of NEC, and as follows:

1. Conceal all conduits unless indicated otherwise, within finished walls, ceilings, and floors. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot water pipes. Install raceways level and square and at proper elevations.

2. **Elevation of Raceway:**
   - a. Where horizontal raceway is installed near water and steam piping, route raceway above piping and as close to structure as possible and practical.
   - b. Route raceway as close to structure as possible.

3. Complete installation of electrical raceways before starting installation of conductors within raceways.

4. Provide supports for raceways as specified elsewhere in Division 26.

5. Prevent foreign matter from entering raceways by using temporary closure protection.

6. Protect stub-ups from damage where conduits rise from floor slabs. Arrange so curved portion of bend is not visible above the finished slab.

7. Make bends and offsets so the inside diameter is not effectively reduced. Unless otherwise indicated, keep the legs of a bend in the same plane and the straight legs of offsets parallel.

8. Use raceway fittings that are types compatible with the associated raceway and suitable for the use and location. Install expansion fittings across all structural construction joints and expansion/deflection couplings across all structural expansion joints.

9. Run raceways parallel and perpendicular to building elements and other equipment with a minimum of bends in the shortest practical distance considering the type of building construction and obstructions except as otherwise indicated.

10. Install exposed raceways parallel and perpendicular to nearby surfaces or structural members and follow the surface contours as much as practical.

11. Run parallel raceways together. Make bends in parallel runs from the same center line so that the bends are parallel. Factory elbows may be used only where they can be installed parallel. In other cases provide field bends for parallel raceways.

12. Make raceway joints tight. Where joints cannot be made tight, use bonding jumpers to provide electrical continuity of the raceway system. Make raceway terminations tight.

13. Where terminations are subject to vibration, use bonding bushings or wedges to assure electrical continuity. Where subject to vibration or dampness, use insulating bushings to protect conductors. Joints in non-metallic conduits shall be made with solvent cement in strict accordance with manufacturer's recommendations.

14. **Terminations:** Where raceways are terminated with locknuts and bushings, align the raceway to enter squarely and install the locknuts with dished part against the box. RMC and IMC shall be secured with double locknuts and an insulated metallic bushing. EMT shall be secured with one locknut and shall have nylon insulated throats or threaded nylon bushings from 1/2" to 1". 1-1/4" and above shall be metal with nylon insulated throats. Use grounding type bushings for feeder conduits at switchboards, panelboards, pull boxes, transformers, motor control centers, VFD's, etc.

15. Where terminating in threaded hubs, screw the raceway or fitting tight into the hub so the end bears against the wire protection shoulder. Where chase nipples are used, align the raceway so the coupling is square to the box, and tighten the chase nipple so no threads are exposed.

16. Provide nylon pull string with printed footage indicators having not less than 200 pounds tensile strength. Leave not less than 12 inches of slack at each end of the pull string. Identify with tags at each end the origin and destination of each empty conduit and indicate same on all empty or spare conduits on the as-built drawings.

17. Install raceway sealing fittings in accordance with the manufacturer's written instructions. Locate fittings at suitable, approved, accessible locations and fill them with UL-listed sealing
compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points and elsewhere as indicated:

a. Where required by the NEC.

18. Flexible Connections: Use short length (maximum of 6 feet) of flexible conduit for recessed and semi-recessed luminaires, for equipment subject to vibration, noise transmission, or movement; and for all motors. Use liquid-tight flexible conduit in wet locations. Install separate ground conductor across flexible connections. PVC externally coated rigid steel conduit: Patch all nicks and scrapes in PVC coating after installing conduit.

19. Ream the ends of all cut and/or threaded conduit. Ends shall be cut square.

20. Use of running threads for rigid or intermediate metallic conduit are not permitted. When threaded couplings cannot be used, provide 3 piece union or solid coupling.

21. Route conduit through roof openings for piping and ductwork where possible; otherwise, rout through jack with pitch pocket.

22. Conduit stub-ups from below grade or thru the slab shall be PVC coated or PVC taped rigid steel galvanized conduit and shall extend 6 inches above grade.

23. Conduits shall not cross pipe shafts or ventilation duct openings. Where conduits must penetrate air-tight spaces or plenums, seal around the conduit with a mastic acceptable to the Engineer.

24. Install an insulated ground conductor in all conduits.

25. Use PVC-coated rigid steel or Fiberglass factory elbows for bends in plastic conduit runs longer than 100 feet, or in plastic conduit runs which have more than two bends regardless of length. Use long sweep bends for wiring larger than 350 mcm.

26. Wipe plastic conduit clean and dry before joining. Apply full even coat of cement to entire area that will be inserted into fitting. Let joint cure for 20 minutes minimum.

27. No PVC conduit shall be run exposed or inside stud or masonry walls unless specifically called for on the drawings. Transition from PVC to metal conduit shall be made below grade.

B. Install buried electrical line warnings per Division 26 section - “Electrical identification”.

C. Install labeling as required in Division 26 section - “Electrical Identification”.

3.4 ADJUSTING AND CLEANING:

A. Upon completion of installation of raceways, inspect interiors of raceways; clear all blockages and remove burrs, dirt and construction debris.

END OF SECTION 26 05 33
SECTION 26 05 43
UNDERGROUND RACEWAYS FOR ELECTRICAL

PART 1 - GENERAL

1.1 SUMMARY:

A. This Section includes underground conduits and hand-holes.

1.2 DEFINITIONS:

A. Hand-hole: An underground junction box.

B. Man-hole: An underground utility structure, large enough for a person to enter connecting with ducts to afford facilities for installing and maintaining cables.

C. Vault: An underground utility structure, large enough for a person to enter connecting with ducts to afford facilities for installing, operating, and maintaining equipment and wiring.

1.3 SUBMITTALS:

A. See Section 26 05 00 – Common Work Results for submittal procedures.

B. Product Data: Provide manufacturer’s catalog information showing dimensions, materials, colors, and configurations data for metal accessories for hand-holes, conduit, duct bank materials, and miscellaneous components.

C. Record Documents: Record actual routing for underground utility raceways and electrical ducts.

1.4 QUALITY ASSURANCE:

A. Manufacturer Qualifications: Firm experienced in manufacturing underground precast concrete utility structures of types and sizes required and similar to those indicated for this Project. Firm must have a record of successful in-service performance.


C. Coordinate elevations of hand-holes with final profiles of conduits as determined by coordination with other utilities and underground obstructions. Revise locations and elevations from those indicated as required to suit field conditions and as approved by the Engineer.

1.5 DELIVERY, STORAGE, AND HANDLING:

A. Store precast concrete units at site as recommended by manufacturer to prevent physical damage. Arrange so identification markings are visible.

B. Lift and support precast concrete units only at designated lifting or supporting points.

PART 2 - PRODUCTS

2.1 CONDUIT AND DUCT:

2.2 PULL BOXES AND HANDHOLES:

A. Fiberglass Handholes: Molded fiberglass, sized as indicated, with 6-inch square (150 mm) cable entrance at each side, weatherproof cover with non-skid finish.

B. Structural Design Loading: ANSI, Tier 22.

C. Cover Legend: LIGHTING.

2.3 PRECAST CONCRETE HANDHOLES:

A. Precast Units: Interlocking, mating sections complete with accessory items, hardware, and features as indicated. Include concrete knockout panels for conduit entrance and sleeve for ground rod.


C. Cover Legend: LIGHTING.

2.4 ACCESSORIES:

A. Ground Rods: Solid copper clad steel, 3/4 inch (18 mm) diameter by 10-feet (3 m) length.

B. Ground Wire: Stranded bare copper, No. 6 AWG minimum.

C. Raceway Sealing Compound: Non-hardening, safe for human skin contact, not deleterious to cable insulation, workable at temperatures as low as 35 degrees F (1 degrees C), withstands temperature of 300 degrees F (149 degrees C) without slump, and adheres to clean surfaces of plastic ducts, metallic conduits, conduit coatings, concrete, masonry, lead, cable sheaths, cable jackets, insulation materials, and the common metals.

PART 3 - EXECUTION

3.1 EXAMINATION:

A. Examine site to receive pathways/handholes for compliance with installation tolerances and other conditions affecting performance of the system. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 EARTHWORK:

A. Excavation and Backfill: Conform to Division 02 Section "Earthwork," but do not use heavy-duty, hydraulic-operated compaction equipment.

B. Restore surface features at areas disturbed by excavation, and reestablish original grades except as otherwise indicated. Replace removed sod as soon as possible after backfilling is completed. Restore all areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary top soiling, fertilizing, liming, seeding, sodding, sprigging, or mulching. Perform according to Division 02 Section "Landscape Work."

C. Warning Tape: Tape specifically manufactured for marking and locating underground utilities. Tape shall be polyethylene film, 6 inches wide, 0.004 inches thick and a minimum strength of 1,750 psi. Tape shall carry continuous inscription naming the specific utility. Color shall be:

1. Electric - Red
2. Tape for nonmetallic utility lines shall have foil backing or wires sufficient for detection by metal detector to a depth of 3 feet. Tape to be run continuously from manhole to manhole and have 3 feet slack rolled up at each end.

D. Restore disturbed paving. Refer to "Cutting and Patching" in Division 01.

3.3 CONDUIT INSTALLATION:

A. Install nonmetallic conduit as indicated according to manufacturer's written instructions.

B. Curves and Bends: Use manufactured elbows for stub-ups at equipment. Use manufactured long sweep bends. Use only factory fittings for elbows, bends or offsets. Field bending is not permitted. Risers to grade to be PVC coated steel elbows.

C. Make joints in ducts and fittings watertight according to manufacturer's instructions. Stagger couplings so those of adjacent ducts do not lie in the same plane.

D. Separation Between Direct-Buried, Non-encased Ducts: 3 Inches (75 mm) minimum for like services, and 6 inches (150 mm) minimum between power and signal ducts.

E. Stub-Ups: Use rigid steel conduit for stub-ups to equipment. For equipment mounted on outdoor concrete pads, extend steel conduit a minimum of 5 feet (1.5 m) from edge of pad. Install insulated grounding bushings on the terminations. Couple steel conduits to the ducts with adapters designed for the purpose and then encase coupling with 3 inches (75 mm) of concrete.

F. Sealing: Provide temporary closure at terminations of ducts that are wired under this Project. Seal spare ducts at terminations. Use sealing compound and plugs to withstand at least 15 psi (1.03 MPa) hydrostatic pressure.

G. Pulling Cord: Provide nylon pull string with printed footage indicators having not less than 200 pounds tensile strength. Leave not less than 12 inches of slack at each end of the pull string. Identify with tags at each end the origin and destination of each empty conduit and indicate same on all empty or spare conduits on the as-built drawings.

H. Install raceway sealing fittings in accordance with the manufacturer’s written instructions. Locate fittings at suitable, approved, accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points and elsewhere as indicated:

1. Where required by the NEC.

3.4 CLEANING:

A. Pull brush through full lengths of ducts. Use round bristle brush with a diameter 1/2 inch greater than internal diameter of duct.

B. Clean internal surfaces of manholes including sump. Remove foreign material.

END OF SECTION 26 05 43
SECTION 26 05 53
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY:

A. This Section includes identification of electrical materials, equipment, and installations. It includes requirements for electrical identification components including but not limited to the following:

1. Buried electrical line warnings
2. Identification labeling for raceways, cables, and conductors

1.2 SUBMITTALS:

A. See Section 26 05 00 Common Work Results for Electrical for Submittal requirements. Supplemental information is listed within this section.

1.3 QUALITY ASSURANCE:

A. ANSI Compliance: Comply with requirements of ANSI Standard A13.1, "Scheme for the Identification of Piping Systems," with regard to type and size of lettering for raceway and cable labels.

PART 2 - PRODUCTS

2.1 ELECTRICAL IDENTIFICATION PRODUCTS:

A. Underground Line Marking Tape: Metal-detector detectable, permanent, bright-colored, continuous-printed, plastic tape compounded for direct-burial service not less than 6 inches wide by 4 mils thick. Printed legend indicative of general type of underground line below.

B. Wire/Cable Designation Tape Markers: Vinyl or vinyl-cloth, self-adhesive, wraparound, cable/conductor markers with preprinted numbers and letter.

C. Cable Ties: Fungus-inert, self-extinguishing, one-piece, self-locking nylon cable ties, 0.18-inch minimum width, 50 lb minimum tensile strength, and suitable for a temperature range from minus 50 degrees F to 350 degrees F. Provide ties in specified colors when used for color coding.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Lettering and Graphics: Coordinate names, abbreviations, colors, and other designations used in electrical identification work with corresponding designations specified or indicated. Install numbers, lettering, and colors as approved in submittals and as required by code.

B. Install identification devices in accordance with manufacturer's written instructions and requirements of NEC.

C. Sequence of Work: Where identification is to be applied to surfaces that require finish, install identification after completion of finish work.

D. Underground Electrical Line Identification: During trench backfilling, for exterior underground power, signal and communications lines, install continuous underground plastic line marker, located directly
above line at 6 to 8 inches below finished grade. Where multiple lines installed in a common trench or concrete envelope, do not exceed an overall width of 16 inches; install a single line marker. Tape shall be 6 inches wide, 0.004 inches thick and 1750 psi minimum strength, trace wire run continuous length manhole to manhole and to equipment. Provide 3 feet slack rolled at each end.

1. Install line marker for underground wiring, both direct-buried and in raceway. Red for electrical.

E. Circuit Identification: Tag or label enclosures and conductors as follows:

1. Multiple Circuits: Where multiple branch circuits, control wiring or communications/signal conductors are terminated or spliced in a box or enclosure, label each conductor or cable with circuit number. For control and communications/signal wiring, use wire/cable marking tape at terminations in wiring boxes, troughs and control cabinets. Use consistent letter/number conductor designations throughout on wire/cable marking tapes.

2. Match previously established identification schemes for the facility's electrical installations.

3. Circuit Directory: Typed and reflective of final circuit changes required to balance panel loads. Every circuit and/or circuit modification shall be uniquely identified to be distinguishable from all other circuits. The identification description shall include an “APPROVED” degree of detail as determined by the State Fire Marshall's Office. Obtain approval before installing.

F. Tag all grounding electrode conductors, associated bonding conductors, and grounding conductors at their point of attachment to any ground bus and grounding electrode (where possible) with a 2 inch diameter round green phenolic nameplate. Lettering shall be 1/4 inch high with 1/5 inch between lines centered on the tag stating “DO NOT DISCONNECT,” "MAIN GROUND." Nameplate shall attach to conductor with a short length of small chain.

G. Install labels at locations as required and at locations for best convenience of viewing without interference with operation and maintenance of equipment.

END OF SECTION 26 05 53
SECTION 26 05 83
WIRING CONNECTIONS

PART 1 - GENERAL

1.1 SUMMARY:

A. Extent of electrical connections for equipment is indicated by drawings and schedules. Electrical connections are hereby defined to include connections used for providing electrical power to equipment.

B. Applications of electrical power connections specified in this section include the following:

1. From electrical source to equipment
2. Other connections as shown within the electrical drawings

1.2 QUALITY ASSURANCE:

A. Manufacturers: Firms regularly engaged in manufacture of electrical connectors and terminals, of types and ratings required, and ancillary connection materials, including electrical insulating tape, soldering fluxes, and cable ties, whose products have been in satisfactory use in similar service for not less than 5 years.

1.3 DEFINITIONS:

A. Load voltage wiring shall be defined as:

1. Conduit and wiring required to carry power to motors and other equipment or devices. Wiring from control devices to equipment that carry power to modulate that equipment such as line voltage thermostats, etc., shall be included as control wiring. Wiring that provides power to control panels, control transformers, control relays, time clocks, etc., shall be included as load voltage wiring.

PART 2 - PRODUCTS

2.1 MATERIALS AND COMPONENTS:

A. General: For each electrical connection indicated, provide complete assembly of materials, including but not necessarily limited to, pressure connectors, terminals (lugs), electrical insulating tape, electrical solder, electrical soldering flux, heat-shrinkable insulating tubing, cable ties, solderless wire-nuts, disconnect, starter, contactor, relays, etc., and other items and accessories as needed to complete splices and terminations of types indicated.

B. Wires, Cables, and Connectors:

1. General: Provide wires, cables, and connectors complying with Division 26 section on Wires and Cables.
2. Wires/Cables: Unless otherwise indicated, provide wires/cables (conductors) for electrical connections which match, including sizes, ratings, and material of wires/cables which are supplying electrical power.
3. Connectors and Terminals: Provide electrical connectors and terminals which mate and match, including sizes and ratings, with equipment terminals and are recommended by equipment manufacturer for intended applications.
4. Electrical Connection Accessories: Provide electrical insulating tape, heat-shrinkable insulating tubing and boots, electrical solder, electrical soldering flux, wire-nuts and cable ties as recommended for use by accessories manufacturers for type services indicated.

PART 3 - EXECUTION

3.1 INSPECTION:

A. Inspect area and conditions under which electrical connections for equipment are to be installed and provide notification in writing of conditions detrimental to proper completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to Installer. Start of work constitutes acceptance of conditions.

3.2 INSTALLATION OF ELECTRICAL CONNECTIONS:

A. Per Laramie County Community College (LCCC) Construction Quality Standards:
   1. Circuits shall be furnished with a dedicated neutral conductor. Neutrals common to more than one circuit will not be permitted for this project.

B. Furnish, set in place, and wire (except as may be otherwise indicated) all devices in accordance with the following schedule and in accordance with equipment manufacturer's written instructions and with recognized industry practices, and complying with applicable requirements of UL, NEC and NECA's "Standard of Installation" to ensure that products fulfill requirements. Carefully coordinate work performed under the Mechanical Division of these Specifications.

C. Coordinate with other work, including wires/cables, raceway and equipment installation, as necessary to properly interface installation of electrical connections for equipment with other work.

D. Connect electrical power supply conductors to equipment conductors in accordance with equipment manufacturer's written instructions and wiring diagrams. Mate and match conductors of electrical connections for proper interface between electrical power supplies and installed equipment.

E. Maintain existing electrical service and feeders to equipment serving occupied areas and operational facilities, unless otherwise indicated, or when authorized otherwise in writing by Owner, or Engineer. Provide temporary service during interruptions to existing facilities. When necessary, schedule momentary outages for replacing existing wiring systems with new wiring systems. When that "cutting over" has been successfully accomplished, remove, relocate, or abandon existing wiring as indicated.

F. Cover splices with electrical insulating material equivalent to, or of greater insulation resistivity rating, than electrical insulation rating of those conductors being spliced.

G. Prepare cables and wires, by cutting and stripping covering armor, jacket, and insulation properly to ensure uniform and neat appearance where cables and wires are terminated. Exercise care to avoid cutting through tapes which will remain on conductors. Also avoid "ringing" copper conductors while skinning wire.

H. Trim cables and wires as short as practicable and arrange routing to facilitate inspection, testing and maintenance.

I. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturers published torque tightening values for equipment connectors. Accomplish tightening by utilizing proper torquing tools, including torque screwdriver, beam-type torque wrench, and ratchet wrench with adjustable torque settings. Where manufacturer's torquing requirements are not available, tighten connectors and terminals to comply with NEC Appendix I.
J. Provide suitable strain relief clamps for cord connection to outlet boxes and equipment connection boxes.

K. Make wiring connections in control panel or in wiring compartment of pre-wired equipment and interconnecting wiring in accordance with manufacturer's instructions.

L. Install disconnect switches, controllers, control stations, and control devices such as limit switches and temperature switches as indicated or per manufacturer's instructions.

M. Provide circuit disconnect switches as indicated and where required by Code. Comply with switch manufacturers printed installation instructions. Install within sight of motors.

N. Each branch circuit shall be furnished with a dedicated neutral conductor. Neutrals common to more than one circuit are not permitted.

3.3 EQUIPMENT CONNECTION SCHEDULES:

A. The exact furnishing and installation of the equipment is left to the Contractors involved. Contractor should note that the intent is to have the Contractor responsible for coordinating all wiring as outlined, whether or not specifically called for by the Division 23 or Division 26 drawings and specifications. Comply with the applicable requirements of Division 26 for all electrical work which is not otherwise specified. No extras will be allowed for contractor's failure to provide for these required items. Contractor shall refer to the Division 26 and Division 23 specifications and plans for all power and control wiring and shall advise the Engineer of any discrepancies prior to bidding.

B. Owner Furnished Equipment:
   1. Existing Light Heads and Poles.

END OF SECTION 26 05 83