COLORADO
Parks and Wildlife
Department of Natural Resources

Rifle Falls SFU - Isolation Building
PART 2 - SPECIFICATIONS

PROJECT I.D. NO. SCA23A
IFB1: 2025*012

PRE-BID CONFERENCE: July 31, 2024 at 11:00 AM

BID OPENING: August 14, 2024 at 1:00 PM

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SCA23A

DIVISION 1 - GENERAL REQUIREMENTS

GENERAL CONDITION:

Please read the most current "General Conditions for Capital Construction" in your possession. They apply to all Divisions of these specifications, accompanying drawings and to this proposed project.

SECTION 01010 - SUMMARY OF WORK

1. LOCATION:

   Non-Mandatory Pre-bid conference: July 31, 2024 at 11:00 AM at the project site.

   Project Address: Rifle Falls SFU
   11466 State Highway 325
   Rifle, 81650
   Garfield County

   Project Coordinates: Latitude: 39°41'36"N
   Longitude: 107°41'59"W

2. DESCRIPTION OF THE WORK:

   The project consists of the complete furnishing and installation of a 33'x26' Isolation Building in accordance with these bid documents.

3. CONSTRUCTION COMMENCEMENT:

   The Contractor shall be allowed from the date of approval of contract documents through the CONTRACT START DATE (as indicated on the Notice to Proceed letter) to submit shop drawings and product approvals and order and delivery of materials.

4. ADDITIONAL PROVISIONS:

   The work and the compensation, therefore, shall be as covered by these specifications consisting of furnishing all plant, labor, equipment and materials required to perform the work shown on the drawings and listed in the bid schedule, unless otherwise stipulated or approved in writing by the Capital Development Program Manager.

   Division field engineering personnel are authorized to supervise the construction of this project in accordance with the previously approved plans and specifications and change orders. All changes in the work shall be approved in writing by the Capital Development Program Manager before being activated in accordance with Section 4, Item 4.2 of the General Conditions for Capital Construction.

   The specifications included herein are the Specifications for this project. If there should be a difference between the Specifications and the drawings, the Specifications shall govern.

5. CONTRACTOR RESPONSIBILITY:

5. CONTRACTOR RESPONSIBILITY:

Visit the site and determine to your own satisfaction the amount and type of work to be performed to complete the project in accordance with the drawings, specifications and Contract Documents before submitting your bid.

Furnish sufficient qualified help to the Project Manager for setting construction controls.

Before final payment will be made on the completed contract, submit to the Owner all specified warranties, and other product warranties.

6. SITE LAYOUT AND STAKING:

Location points for the work will be defined with stakes and/or other means of identification prior to the start of construction. These location points, grades, and elevations are shown on the drawings. The drawings indicate existing and proposed elevations, but may be modified on the site by the Project Manager.

7. CONSTRUCTION LIMITS:

At the commencement of construction, the Project Manager will designate the area allowed for the construction process. Restrict work to that designated area. Any changes deemed necessary shall be discussed with and approved by the Project Manager.

8. MARSHALLING AND ACCESS:

Limits and access to the site for use: before taking possession and use of the site, meet with the Project Manager to determine the marshalling area(s) and access points to be used to execute the work. Limit access and marshalling areas agreed to at that meeting. Obtain written permission from the Division of any changes other than first agreed upon. Upon completion of all work, restore all areas to original or improved conditions.

9. JOB CONDITIONS:

Examine the site, determine the nature of conditions to be encountered and accept the site as found upon the examination. Examination must be made prior to bidding as no additional compensation will be considered after receipt of bids for existing conditions which are required to be worked, adapted, or modified to these specifications.

10. BUILDING CODES:

Local city or county building codes shall be used for all construction. Where there is no local authority and/or code, the current codes required by the Office of the State Architect, State Electrical Board or State Plumbing Board shall be utilized. Appropriate inspections and certificates shall be obtained from the state or local inspector. See relative specification section(s) for additional detail.

11. PROTECTION AND SAFETY PRACTICE:

I. All work shall be carried out in a safe manner in accordance with local codes and the safety requirements of the Colorado State Division of Labor.

II. Provide shoring, sheeting, barricading, bracing to prevent caving, erosion and gullying of side of excavation. The design, engineering, construction and maintenance of all temporary protection, including its adequacy and safety shall be the Contractor's responsibility and shall comply with the Occupational Safety and Health Administration (OSHA).

III. Contactor shall be required to conform to all industry standard safety requirements as well as OSHA requirements (i.e. Confined Space Entry, etc.) in effect at the time of construction.

IV. Existing Utilities: Colorado SB 93-155 requires that anyone that engages in any type of excavation must provide advance notice to the underground facility owners. Prior to any moving or excavating of earth, the Contractor shall call the Utility Notification Center of Colorado (UNCC) or "Common Ground Alliance" (CGA) – the "Call Before You Dig" number – at 811. Utility owners have three business days to perform locates. If facilities are not marked within the three business days, you are required to call back to UNCC and process a Second Notice Request. UNCC encourages both Contractors and Sub-Contractors to obtain a locate ticket. A "no response" from the utility owner does not allow the Contractor to start digging. Notify the Project Manager when working near utility lines or appurtenances.

V. Location Markers: Carefully maintain and protect all bench marks, corner monuments and other points. If disturbed or destroyed, replace at no cost to the Owner as directed by the Project Manager.

SECTION 01023 - MINOR CONTRACT REVISION

1. SCOPE OF WORK:

Furnish all labor, materials and equipment required as additional work for completion of the project.

2. WORK INCLUDED:

The work shall include unanticipated extra work in excess of the quantities included in the bid schedule.

3. PAYMENT:

Payment for minor contract revisions shall be made at the contract unit price, negotiated basis or force account in accordance with Section 9.4 of the General Conditions for Capital Construction.

SECTION 01050 - FIELD SURVEY

1. SCOPE OF WORK

This work shall consist of the construction staking of the project in accordance with the drawings and specifications and includes labor, equipment, instruments, materials,

transportation, and other incidentals necessary to complete the construction staking in accordance with these specifications and acceptable engineering practices.

This work shall also include providing final "as-built" drawings. Construction shall be accomplished under the direction of a professional land surveyor licensed to practice in Colorado and acceptable to the Project Manager.

Each subcontractor shall lay out his work from the base lines as established by Contractor. Any discrepancies found shall be promptly documented to the Project Manager. NO work shall be conducted in areas where discrepancies are discovered.

Any work done without being properly located and established by base lines, offset stakes, bench marks, or other basic reference points located, established, or changed by the Project Manager may be ordered removed and replaced at the Contractor's expense.

2. QUALIFICATIONS OF SURVEYOR:

Qualified Registered Professional Land Surveyor registered in Colorado, acceptable to Contractor and Owner.

3. SURVEY REFERENCE POINTS:

Existing basic control points for the project are those designated on drawings. Locate and protect control points prior to starting site work, and preserve all permanent reference points during construction. Make no changes or relocations without prior written notice to Project Manager, and report to Project Manager when any reference point is lost or destroyed.

SECTION 01200 - CONSTRUCTION MEETINGS

1. PRECONSTRUCTION CONFERENCE:

The Contractor or his representative after award of the contract shall attend a preconstruction conference to be held at the Colorado Parks and Wildlife regional office, Denver office or other office in proximity to the project as designated by the Project Manager.

SECTION 01202 - ALLOWANCES

1. GENERAL:

Allowance shall be paid on a force account basis in accordance with Section 9.4.(a), (b) and or (c) as determined by the Project Manager - Materials of Extra and Force Account Work of the General Conditions for Capital Construction or as noted in the bid schedule.

2. ADJUSTMENT OF COSTS:

Should the net cost be more or less than the specified amount of the allowance, the contract sum will be adjusted accordingly by change order.

SECTION 01300 - SUBMITTALS

1. Provide the manufacturer's literature for products specified or approved equal products as stated in Section 6 of the General Conditions for Capital Construction.

2. The following is the list of required submittals for this Contract. Refer to each Contract Section for any additional requirements for each submittal.

SECTION	TITLE	SUBMITTAL DESCRIPTION	DATE RECEIVED	STATUS
01050	SURVEY CONTROL	Name and Address and list of local experience of Surveyor		
01310	CONSTRUCTION SCHEDULES	Schedule of Construction		
01720	AS-CONSTRUCTED AND RECORD DOCUMENTS	Construction drawings and technical specifications indicating changes to the original project design		
02200, 02221, 02545	EARTHWORK, TRENCHING AND BACKFILLING, AGGREGATE BASE COURSE	Firm name, address and phone number for Geotechnical Firm used for testing		
		Imported or Select Material Certified Gradation		
		Imported or Select Material Standard Proctor Test		
02610, 02640	PIPE AND FITTINGS, VALVES AND GATES	Manufacturer's Descriptive Literature and Recommended Methods of Installation		
		Manufacturer's Certification that Products Meet Specification Requirements		
02934	SEEDING AND MULCHING	Signed Testing Certificate Statement by Vendor		
		Data Sheet of Seed Mix with Supplier Information		
03100	STRUCTURAL CONCRETE FORMWORK	Description of Forming System with Complete Details		

SECTION	TITLE	SUBMITTAL DESCRIPTION	DATE RECEIVED	STATUS
03200	CONCRETE REINFORCEMENT	Placing Drawings, Bending and Cut Sheet Schedules		
		Mill Test Reports for Each Shipment of Reinforcement		
03252	INSERTS AND FASTENING DEVICES	Manufacturer's Certification that Products Meet Specification Requirements		
03300	CAST-IN-PLACE STRUCTURAL CONCRETE	Firm name, address and phone number for testing agency		
		Certified Concrete Design Mix		
		Laboratory Test Results		
		Aggregate: Gradation Analysis and Specific Gravity		
03600	GROUT	Manufacturer's Application Instructions		
06100	CARPENTRY	Shop Drawings		
		Lumber Grading Certification		
06600	PVC WALL AND CEILING PANELS	Manufacturer's Certification that Products Meet Specification Requirements		
07200	INSULATION	Samples of Insulation		
		Testing Agency Reports		
		Manufacturer's Written Certification that Product Meets Specified Requirements		
		Testing Agency Reports Verifying Proper Density, Distribution and Placement in Proper Thickness		
		Affidavit that Loose Fill Thermal Insulation is Water Repellent		

SECTION	TITLE	SUBMITTAL DESCRIPTION	DATE RECEIVED	STATUS
07250, 07410, 07620, 07900	WEATHER BARRIER, METAL ROOFING AND SIDING, FLASHING, SEALANTS AND JOINT FILLERS	Manufacturer's Data Sheets		
08100	METAL DOORS AND FRAMES	Manufacturer's Data Sheets for doors frames and hardware		
		Executed Warranty		
08530	VINYL WINDOWS	Manufacturer's Data Sheets		
		Test Reports Demonstrating the Window Meets Specification Requirements		
		Executed Warranty		
09900	PAINTING	Color Samples (2 – 12"x12", material used for sample should be the same as the material the paint will be applied to)		
		Manufacturer's Application Recommendations		
10200	LOUVERS AND VENTS	Manufacturer's Data Sheets		
11265	ULTRAVIOLET WATER STERILIZER EQUIPMENT	Manufacturer's Certification that Products Meet Specification Requirements		
		Operation and Maintenance Manuals		

SECTION	TITLE	SUBMITTAL DESCRIPTION	DATE RECEIVED	STATUS
15440, 15453	PLUMBING FIXTURES AND TRIM, TANKLESS WATER HEATERS	Manufacturer's Certification that Products Meet Specification Requirements		
		Operation and Maintenance Manuals		
15500	HEATING	Manufacturer’s Data Sheet		
		Shop Drawings – Drawings shall include all fuel, ductwork, vent and electrical connections and schedule of required equipment.		
		Operation and Maintenance Manual		
15890	DUCTWORK	Shop Drawings		
		Manufacturer's Data		
16010	GENERAL PROVISIONS	Shop Drawings- Submit the shop drawings showing each item of equipment, whether specified or substituted, to the Project Manager for approval. In addition, submit a complete catalog of product cuts of equipment that will be installed. Include the name or description of the item, the name of manufacturer, the model or type, the catalog number and other pertinent designations.		
		As-Built Drawings		
		Additional Drawings		
		Manufacturer's Data Sheets		
		Operation and Maintenance Manuals		
16500	LIGHTING FIXTURES	Manufacturer’s Mounting Details		
		Executed Warranty		

SECTION 01310 - CONSTRUCTION SCHEDULES

1. CONSTRUCTION SCHEDULE SUBMITTAL:

   Submit to the Project Manager, 15 calendar days before commencing construction, a schedule of construction. The schedule shall include provisions for time necessary to acquire and provide shop drawings and product submittals, the allowed period for submittal review, time required for ordering and delivery of materials, a normal time period allowed based on climate, location of project, season of year, weather patterns for temperature, and precipitation conditions which reasonably will hinder or prevent construction progress.

   The construction schedule shall be updated within 7 calendar days after starting work or upon issuance of any Contract Modification which substantially affects the scheduling, and monthly thereafter until completion.

   Newly updated construction schedules shall be forwarded to the Project Manager, as directed, immediately upon preparation.

2. PRODUCT DELIVERY:

   Order products in a timely, properly sequenced manner so that delivery schedule of products corresponds with anticipated installation periods of these products.

SECTION 01410 - LABORATORY TESTS

1. REQUIRED TESTS:

   I. Concrete Testing - provided and paid for by the Contractor.

   II. Compaction Tests - provided by the Contractor as specified. Compaction test reports shall be provided to Owner upon completion of tests.

   III. Proctor Tests - the Contractor shall provide samples and tests of on-site material and aggregate base course as specified.

SECTION 01500 - TEMPORARY UTILITIES AND CONTROLS

1. TEMPORARY ELECTRIC FACILITIES:

   Contractor shall provide and maintain during the course and progress of the contract work all electrical power and wiring requirements to facilitate the work of all trades and services associated with the contract work.

2. FIRE PROTECTION:

   Fire Plan:

   I. Maintain, at least, two all purpose 10 lb. fire extinguishers at each work zone at the construction site. Maintain the site in an orderly condition to prevent fire hazards.

II. The Colorado Parks and Wildlife (hereafter referred to as the operator) shall do everything reasonable within its power and shall require its employees, contractors and employees of contractors to do everything reasonable within their power to prevent and suppress fires on or near the lands to be occupied under this contract. The operator is responsible for all suppression costs and resource damage for any fire resulting from its operations and practices.

III. The operator is responsible to insure that each employee, subcontractor, or any other individual or company working on the project site is aware of the provisions of this fire plan, is familiar with the location and proper use of firefighting equipment, and conducts themselves in a fire safe manner.

IV. No material shall be disposed of by burning in open fires.

V. Exhaust systems of vehicles and engine generators shall have an acceptable muffler and shall be in proper working condition. All motorized equipment and machinery shall be equipped with the spark arresters.

VI. Fire extinguishers required, Type ABC:

One 2 lbs. Per pickup, or one 5 lb. For trucks over 1 Ton GW.

One 10 lb. per dozer, motor patrol, scraper or other earthmoving equipment.

VII. Vehicles shall be parked only in cleared, approved areas.

VIII. All smoking shall be done only inside of vehicles or in areas cleared of flammable material.

IX. Blasting: Use of explosives is not authorized.

X. All trucks operated on the project area shall be equipped with a round-pointed shovel, mounted where it is readily accessible for suppression of fires.

XI. Refueling:

Special care will be taken to prevent fires when refueling tractors and other equipment. Preferably, equipment should be moved to an area of mineral soil before refueling.

XII. Oil Filters, Cartridges and Oily Rags:

Used and discarded oil filters, cartridges and oil rags or waste will be removed from the site. Glass jugs or bottles will not be used for gas, oil or water containers.

XIII. Storage of Inflammables:

Fuels, lubricants and/or other highly inflammable material will be stored either in a separate building, or "job box" type container and/or approved containers. If materials are not stored in a separate building there must be a basin to catch spills. Storage buildings or sites shall be a minimum distance of 50 feet from other

structures. Storage buildings shall be adequately posed to warn of the inflammables and to prohibit smoking in or around the building.

3. HERITAGE RESOURCES:

All persons associated with operations under this authorization must be informed that any objects or sites of cultural, paleontological, or scientific value such as historic or prehistoric resources, graves or grave markers, human remains, ruins, cabins, rock art, fossils, or artifacts shall not be damaged, destroyed, removed, moved, or disturbed. If in connection with operations under this authorization any of the above resources are encountered, the proponent shall immediately suspend all activities in the immediate vicinity of the discovery that might further disturb such materials and notify the Project Manager of the findings. The discovery must be protected until notified in writing to proceed by the Project Manager. (36 CFR 800.110 &112, 43 CFR 10.4)

4. TEMPORARY SANITARY FACILITIES:

Contractor shall provide adequate temporary sanitary conveniences for the use of all employees and persons engaged on the work, including subcontractors, Owner, Project Manager, and their employees, as required by law, ordinances, or regulations of public authorities having jurisdiction.

Toilet facilities shall be enclosed chemical toilets, or water closets and urinals connected to a holding tank, and shall meet with the approval of State and County authorities. Open pit or trench latrines will not be permitted.

5. TEMPORARY WATER:

Water will be made available on site for light construction use. Commercial water quantities shall be provided by the contractor.

6. TEMPORARY HEAT:

Contractor shall provide, at his own expense, all temporary heat as necessary for the proper installation of all work, equipment, and materials and for the protection of all work and materials against injury from dampness, cold, and freezing. Fuel, equipment, and methods of heating shall be in accordance with federal, state, and local regulations.

7. EXTERIOR STORAGE:

All operations of the Contractor, including storage of materials, shall be confined to areas approved by the Project Manager. Contractor shall be liable for any and all damage caused by him during such use by him of property of the Owner or other parties. Contractor shall save the Owner, its officers and agents, and the Project Manager and his employees free and harmless from liability of any nature or kind arising from any use, trespass, or damage occasioned by his operations on premises of third persons or parties.

8. TEMPORARY TELEPHONE SERVICE:

The Contractor shall maintain an operating cell phone and be available by phone during work hours assuming available cell phone service.

9. SECURITY:

The Contractor shall make all necessary provisions and be responsible for the security of the contract work and the work site until final inspection and acceptance of the contract work.

SECTION 01710 - PROJECT CLEANING

All areas shall be cleared and cleaned upon completion of work at all construction site locations. All debris and construction materials scattered and blown about the site shall be gathered, returned and secured to their proper location or disposed of during the construction process and upon completion.

SECTION 01720 – AS-CONSTRUCTED AND RECORD DOCUMENTS

1. SCOPE OF WORK:

Maintaining and providing As-Constructed and Record documents for the work described in project drawings and specifications.

2. WORK INCLUDED:

The work shall include, but is not necessarily limited to, maintaining a clear and concise set of construction documents clearly indicating changes to the original project design. Contractor shall provide all necessary measurements, survey, and product changes to indicate As-Constructed conditions for the each element of the project.

3. PAYMENT:

Payment for As-Constructed and Record documents shall not be made as a line item but shall be included in Mobilization.

4. SUBMITTALS:

Refer to Section 01300 – Submittals, for requirments. Final payment will not be made until As-Constructed and Record documents are received and accepted as complete by the Project Manager.

5. MAINTENANCE OF DOCUMENTS:

I. Store documents in clean, dry area seperate from documents used for construction.

II. Documents shall be made available for inspection by Project Manager upon request.

6. RECORDING:

I. The Project Manager will provide the contractor one set of design drawings and specifications to record information.

II. Label each drawing sheet "AS-CONSTRUCTED" and cover sheet of specifications in neat large printed letters.

III. Record information concurrently with construction progress.

A. Do not backfill work until required information is recorded.

B. Use dark pen or pencil. Ink shall not be water based and lettering shall be legible and not subject to easy smearing.

IV. Mark drawings to record actual construction.

A. Field dimensions, elevations, and details.

B. Changes made by Project Manager in approved modifications.

C. Details not on original drawings.

D. Horizontal and vertical locations of underground facilities (pipelines, electric line, valves, fittings, etc.) and appurtenances referenced to a minimum of two permanent surface improvements or project coordinates/datum.

End of Section

End of General Requirements

SECTION 02050 - MOBILIZATION

1. SCOPE OF WORK:

   Furnish all labor, materials and equipment required to complete the work of the noted Sections of this Division described herein and on the drawings.

2. WORK INCLUDED:

   The work shall include, but is not necessarily limited to moving onto and off the site all the equipment and personnel required. It also includes cleaning up the site upon completion of the Contract and other items as identified in this section. Shipping/freight charges for materials covered by other specifications sections shall not be paid under this item.

3. PAYMENT:

   I. Payment for mobilization will be made on a contract lump sum basis as shown in the Bid Schedule. The lump sum price bid will be paid once only and shall include complete mobilization and demobilization regardless of the number of times the equipment is moved or additional equipment transported to the construction site.

      Of the lump sum price bid, 60% will be paid on the first month's pay estimate. The remaining 40% will be paid when the equipment is removed from the site and after the final cleanup has been completed, and as-built documents have been submitted and approved.

   II. Mobilization shall include the obtaining of all permits, insurance, and bonds, and the moving onto the site of all plant and equipment; for furnishing and erecting plants, temporary buildings, and other construction facilities; all as required for the proper performance and completion of the work. Such work shall include but not be limited to the following principal items:

      A. Moving onto the site of all the Contractor's plant and equipment required.

      B. Installing temporary construction power and wiring.

      C. Establish fire protection system.

      D. Provide on-site sanitary facilities as specified.

      E. Arrange for and erect the Contractor's work and storage area.

      F. Submit all required insurance certificates and bonds.

      G. Obtain all required permits. Contractor is responsible for providing all additional drawings and documentation as may be required to obtain these permits.

         1. State Electrical Permit
         2. State Plumbing Permit

H. Have the Contractor's superintendent at job site at least 50% of the time and available full time via phone.

I. Construction schedule.

J. List of subcontractors and their scope of work.

K. Perform Onsite Utility Locates (Contractor Responsible for hiring private utility locator to locate private utility lines as shown on the drawings prior to construction.)

L. General cleanup of the project area.

M. Shop drawings and product submittals.

N. Maintaining and submitting As-Constructed and Record documents per specifications.

End of Section

SECTION 02200 - EARTHWORK

1. SCOPE OF WORK:

   Furnish all labor, materials and equipment required to complete the work of the noted Sections of this Division described herein and on the drawings.

2. WORK INCLUDED:

   The earthwork for structures shall include excavation, trenching, filling, compacting and grading.

   Excavate and fill to elevations and dimensions indicated on the drawings and on the site. Allow additional space as required for construction operations.

3. SUBMITTALS:

   Refer to Section 01300 - Submittals, for requirements.

4. QUALITY ASSURANCE:

   I. Classification of Soils: ASTM D 2487.

   II. Density Relations of Soils: Maximum Dry Density as determined by ASTM D 698 or AASHTO T 99 (Standard Proctor).

   III. Density for Sands and Gravels: Relative Density Method ASTM D 4253 and ASTM D 4254.

   IV. In-place Density Determination: Nuclear Method ASTM D 2922 or Sandcone Method ASTM D 1556.

5. FIELD QUALITY CONTROL:

   Quality control for excavation and backfill shall be provided by the Contractor's independent laboratory.

   I. Density and moisture content testing shall be performed at the bottom of excavation for at least two (2) tests per side of building.

   II. (2) Density tests for each layer of backfill material.

   III. Tests which fail density specification shall be reported verbally to the Project Manager within four (4) hours, either in person or via telephone.

   IV. Soil within the failed area shall be subjected to additional compaction, moisture conditioning with additional compaction, or other corrective measures, and shall be retested. Implementation of corrective measures and retesting shall continue until the effected soil meets specification.

   V. All test results, description of corrective measures, and retest results shall be provided to the Project Manager in writing within 48 hours of testing.

VI. Any failed areas for which corrective measures and retesting do not document that the material meets specification shall be removed and replaced to specification at the contractors expense.

6. MATERIALS:

I. Select Material:

A. Class I: Angular, ¼ to 1½ inches, graded stone including slag, cinders and crushed stone.

B. Class II: Coarse sand and gravels with maximum particle size of ½ inch with no more than 12% passing a No. 200 sieve. Soil Types GW, GP, SW and SP are included.

C. Class III: Fine sand and clayey gravels including sands, sand-clay and gravel-clay mixtures. Soil Types GM, GC, SM and SC are included.

II. Imported Material:

Imported material is defined as material imported by the Contractor for use in place of native material.

III. Relative Density:

Where Class I or Class II select material is used, compaction shall be measured by relative density to the percentages as follows corresponding to the specified Standard Proctor values in these Specifications.

A. 95% Standard Proctor - 75% Relative Density

1. Required beneath all structures, slabs, parking lots, roads, and culverts.

B. 90% Standard Proctor - 70% Relative Density

1. Landscaped areas 10' and greater from structures, slabs and culverts.

7. EXCAVATION:

I. General:

Excavation shall be open-cut, except as shown or approved.

Excavation may be sloped or kept vertical where sloping of the excavation does not endanger any existing utility or structure.

Excavation shall be performed in accordance with applicable federal, state or local safety codes.

Control grading around the structure so that the ground is pitched to prevent water from flowing into excavated areas or damaging the foundation. Provide pumping to keep excavations clear of water.

II. Underground Obstructions:

Locate utilities prior to excavating. Unless otherwise specified, preserve intact pipe or utilities encountered during construction. If utilities or structures are accidentally damaged, replace immediately to their original condition.

A. Unsuitable Bearing:

Excavate such that uniform bearings are obtained throughout. If suitable bearing is not obtained at the depth indicated on the drawings for the foundations, immediately notify the Project Manager. Do not proceed until further instructions are given.

Completely remove subsurface debris and abandoned construction materials including broken pieces of concrete. Remove such materials within construction lines to 6 inches below the excavation. Dispose of materials where designated.

B. Freezing:

When freezing temperatures are expected, do not excavate to the full depth indicated unless the work can be performed immediately after the excavation has been completed.

C. Dimensions:

Excavate to elevations and dimensions where shown. Allow additional space as required for construction operations and inspection.

III. Shoring:

Shore, sheet pile and brace excavations as required to maintain them secure. Remove shoring as backfilling progresses, but only when banks are safe against caving or collapse.

IV. Classification of Excavation:

Excavation shall be classified as common unless otherwise specified.

A. Common Excavation:

Common excavation consists of grass, sod, humus, peat, earth, clay, sand, silt, gravel, hard and compacted materials, such as hardpan, loosely cemented gravel, soft or disintegrated rock and similar materials that can be removed by hand, heavy ripping equipment such as tracked equipment with a single ripper with a 15,000 pound pry-out force or a hydraulic excavator with a weight in excess of 50,000 pounds and a drawbar pull in excess of 40,000 pounds. Boulders and loose rock less than 1 cu. yd. are also classified as common excavation.

V. Overexcavation:

Excavate so that uniform bearing shall be obtained for the foundation. Do not excavate below the depth specified. If over excavation occurs, backfill with select material.

VI. Unsuitable Foundation:

The foundation is considered unsuitable when after dewatering, the existing soils are unstable. Unstable soils are those that are too soft, provide low load bearing or are otherwise inadequate. Unstable soils include organic soils, fine grain soils saturated with water in excess of their liquid limit, low density fine sands or silts, and expansive soils. Cohesive soils or granular cohesive soils with shear strength measured using ASTM D 2166 or ASTM D 2573 of less than 500 psf or sands with penetration resistance measured using ASTM D 1586 of less than 8 blows per foot are unsuitable.

Where excavation is in shale or rock, or broken concrete occurs, excavate six inches below grade. No rock, shale or broken concrete shall be within 6 inches of the structure.

8. BACKFILLING FOR STRUCTURES:

I. General:

Backfill against the structure only after approval. Place and compact backfill materials to minimize settlement and to avoid damage to the structure, waterproofing and connecting construction. Before placing backfill, remove debris subject to rot or corrosion and other detrimental materials.

Water shall not be allowed to rise until the concrete has set a minimum of 24 hours, and the forms have been removed. Water shall not be allowed to rise unequally against unsupported structural walls.

Do not place brush, sod, frozen material or other perishable or unsuitable materials in the fill. Distribute material to avoid lenses differing substantially from the surrounding material.

Deliver material to achieve well and uniformly compacted backfill.

II. Placement:

Place and spread backfill material in 4 in. layers.

Compact backfill to a minimum of 95% of maximum dry density as determined by ASTM D 698 or AASHTO T 99 (Standard Proctor).

III. Concrete Structures:

Do not backfill or place loads against concrete (including patched areas) before the concrete has developed at least 70% of the specified strength, or before 7 days after placing the concrete.

From 7 days to 14 days after placing concrete, backfill operations may be initiated, but no rolling or hauling equipment will be permitted within 2 feet of the structure. At this time, backfill may be placed against concrete surfaces to a thickness of not more than 2 feet if compaction is accomplished by power tampers.

IV. Imported Backfill:

Notify the Project Manager when imported material is to be used and indicate where material is to be placed. Do not place imported fill until approved by the Project Manager.

A. The grading requirements of the material, Colorado Department of Transportation, Section 703.03, Class 1 Structure Fill , are as follows:

Sieve size or designation	Percentage by Weight passing square mesh sieve sizes
2½ inch	100
2 inch	95-100
No. 4	30-65
No. 200	3-15

V. Grading:

Perform finish grading for smooth transitions between lines. Grades shall be free of abrupt or irregular changes.

Grade between existing and final grades not otherwise shown to a uniform slope. Round abrupt change in slopes.

9. INSPECTION:

Backfilling shall not commence until all tests and inspections have been made. Areas to receive backfill are to be cleared of all rubbish and debris.

End of Section

SECTION 02210 - FINISH GRADING

1. SCOPE OF WORK:

   Furnish all labor, materials and equipment required to complete the work of the noted Sections of this Division described herein and on the drawings.

2. WORK INCLUDED:

   The work shall include, but is not necessarily limited to, all cutting, filling, compacting of fills and rough grading required to bring project areas to grade.

3. FILLS:

   Where fill is required to raise the existing grades to the new subgrade elevation indicated on drawings, such fill shall be of earth placed and compacted as specified. The quality of fill material shall be approved.

4. MATERIALS:

   Material for fill shall be reasonably free from roots, wood and other organic material. Fill under surfaced areas shall not contain more than 15 percent clay or loam and no humus. Stones larger than 4 inches, maximum dimension, shall not be used in the upper 6 inches of fill or embankment. Place the material in successive horizontal layers in loose depths as specified, for the full width of the cross section. Deposit fill layers not more than 8 inches thick under surface areas.

5. FINISH GRADING:

   Perform finish grading for transition between lines. Grades shall be free of abrupt or irregular changes.

   Grade between existing and finished grades. Round abrupt change in slopes.

   Stockpiled topsoil shall be used in the areas used for backslopes and other areas exposed through construction and equipment damage.

End of Section

SECTION 02221 - TRENCHING AND BACKFILLING

1. SCOPE OF WORK:

   Furnish all labor, materials and equipment required to complete the work of the noted Sections of this Division described herein and on the drawings.

2. WORK INCLUDED:

   The earthwork for the pipe installations shall include excavation, trenching, backfilling, compacting and grading.

3. SUBMITTALS:

   Refer to Section 01300 - Submittals, for requirements.

4. QUALITY ASSURANCE:

   I. Classification of Soils: ASTM D 2487 and ASTM D 2488.

   II. Density Relations of Soils: Maximum Dry Density as determined by ASTM D 698 or AASHTO T 99 (Standard Proctor).

   III. Density for Sands and Gravels: Relative Density Method ASTM D 4253 and ASTM D 4254.

   IV. In-place Density Determination: Nuclear Method ASTM D 2922 or Sandcone Method ASTM D 1556.

   V. Pipe Embedment Materials: ASTM D 2321.

5. MATERIALS:

   I. Select Material:

      A. Class I: Angular, 1/4 to 1-1/2 inches, graded stone including slag, cinders and crushed stone.

      B. Class II: Coarse sand and gravels with maximum particle size of 1-1/2 inch with no more than 12% passing a No. 200 sieve. Soil Types GW, GP, SW and SP are included.

      C. Class III: Fine sand and clayey gravels including sands, sand-clay and gravel-clay mixtures. Soil Types GM, GC, SM and SC are included.

      D. Class IV: Inorganic silts or clays, silty or clayey fine sands, gravelly or silty clays. Soil Types ML, CL, MH and CH are included.

II. Imported Material:

Imported material is defined as material imported by the Contractor for use as backfill material when used in place of native material or material used for pipe embedment where select material is not required by the Plans and Specifications.

III. Relative Density:

Where Class I or Class II select material is used, compaction shall be measured by relative density or Standard Proctor to the percentages as follows corresponding to the specified Standard Proctor values in these Specifications.

A. 95% Standard Proctor - 75% Relative Density

B. 85% Standard Proctor – 65% Relative Density

6. EXCAVATION:

I. General:

Excavation shall be open-cut, except as shown or approved.

Trenches may be sloped or kept vertical where sloping of the trench does not endanger any existing utility or structure.

Trench excavation shall be performed in accordance with applicable federal, state and local safety codes.

Perform grading necessary to prevent surface water from causing damage to the work. Place material compactly on the sides of the excavation so as not to endanger the work. Dispose of surplus material as directed on the site.

II. Dewatering:

Where running water, quicksand, or unsuitable foundation conditions are encountered, push the work with the utmost vigor. Drain water in the trench to sumps through well points, underdrains or other approved methods, providing a suitable foundation with no running or standing water for pipe laying operations. Ensure that subsurface water does not interfere with maintaining proper soil moisture for a suitable foundation and proper compaction of backfill.

Maintain dewatering until the pipe has been installed and backfill has been placed to a height above the water table.

III. Trench Width:

Minimum trench width shall be as shown on the drawings. Use the minimum width only when it provides adequate space for workers to place and join the pipe properly. Use additional width where required for compaction equipment.

IV. Dimensions:

Excavate to elevations and dimensions shown. Allow additional space as required for construction operations and inspection.

V. Obstructions:

Completely remove subsurface debris and abandoned construction materials including broken pieces of concrete. Remove such materials within construction lines to 6 inches below excavation. Dispose of the materials where designated. No blasting will be permitted.

Locate utilities prior to excavating. Unless otherwise specified, preserve intact pipe or utilities encountered. If utilities or structures are damaged, replace immediately to their original condition.

VI. Shoring:

Shore, sheet pile and brace excavations as required to maintain them secure for protection of workmen or work. Remove shoring as work progresses, but only when banks are safe from caving or collapse.

VII. Classification of Excavation:

Excavation shall be classified as common unless otherwise specified.

A. Common Excavation:

Common excavation consists of grass, sod, humus, peat, earth, clay, sand, silt, gravel, hard and compacted materials, such as hardpan, loosely cemented gravel, soft or disintegrated rock and similar materials that can be removed by hand, heavy ripping equipment such as tracked equipment with a single ripper with a 15,000 pound pry-out force or a hydraulic excavator with a weight in excess of 50,000 pounds and a drawbar pull in excess of 40,000 pounds. Boulders and loose rock less than 1 cu. yd. are also classified as common excavation.

VIII. Overexcavation:

Excavate so that uniform bearing shall be obtained for the length of the pipe. Do not excavate below the depth specified. If over excavation occurs, backfill with select material.

IX. Disturbed Foundation:

Where excavation results in the foundation being disturbed, scarify to a depth of 6 inches and compact to a density equal to that of the surrounding earth or a minimum of 95% of maximum dry density, whichever is greater.

X. Unsuitable Foundation:

The trench bottom is considered unsuitable when after dewatering, the existing soils are unstable. Unstable soils are those that are too soft, provide low load bearing or are otherwise inadequate. Unstable soils include organic soils, fine grain soils saturated with water in excess of their liquid limit, low density fine sands or silts, and expansive soils. Cohesive soils or granular cohesive soils with shear strength measured using ASTM D 2166 or ASTM D 2573 of less than 500 psf or sands with penetration resistance measured using ASTM D 1586 of less than 8 blows per foot are unsuitable.

Where the trench is excavated in shale or rock, or broken concrete occurs, excavate six inches below grade. No rock, shale or broken concrete shall be within 6 inches of the pipe.

XI. Tunneling:

Tunneling will be allowed under water, gas or other pipe when approved.

The width of the excavation, tunnels and subgrade preparation shall be the same as that specified for open trench excavation.

XII. Utilization of Excavated Material:

Suitable material removed from the excavations shall be used, as practical, in the backfill and at other places as directed.

XIII. Disposal of Surplus and/or Waste Material:

Dispose of surplus and waste material where designated.

Grade areas for draining and a uniform appearance, blending into the surrounding grade.

7. BACKFILL:

I. General:

Do not place brush, sod, frozen material or other perishable or unsuitable materials in the fill. Distribute the material to avoid lenses differing substantially from the surrounding material.

Place the material to achieve a well and uniformly compacted fill.

II. Inspection and Approval:

Do not backfill until tests and inspections have been made on work to be covered and approved. Clear areas to receive backfill of rubbish and debris.

III. Imported Backfill:

Notify the Project Manager when imported material is to be used and indicate where material is to be placed. Do not place imported fill until approved by the Project Manager. Provide laboratory tests for the material.

IV. Moisture Control:

During compaction operations the material being placed shall be maintained within the moisture content range required to permit proper compaction to the specified density.

V. Placement and Methods:

A. General:

Because of varying trench conditions, the materials used and methods applied may vary. Individual trench requirements are specified as follows or shown on the drawings. Backfill only after approval. Maximum depth of lifts shall be 8 inches unless otherwise specified.

B. Foundation:

Where the trench bottom is unsuitable for pipe foundation, remove and replace material with select material. Compact to a minimum of 85% of maximum dry density.

C. Pipe Embedment:

1. Bedding: Place select material from the bottom of the trench to a minimum of 4 inches or the depth shown on the drawings. Mechanically tamp to a minimum of 85% of maximum dry density. Provide density tests for every 50' of trench, minimum 2.

2. Haunching: Shape the trench bottom to provide firm, stable and uniform support for the full length of the pipe and joints. Dig bell holes to provide a minimum of 1 inch clearance between the bell and the material. Adjust pipe for line and grade and make the joint. Place material carefully and tamp under the haunches of the pipe and in bell holes and sling holes. Place select material from the bottom of the trench to the springline by hand. Tamp thoroughly and equally along each side of the pipe to avoid displacement or damage to the pipe. Compact to a minimum of 85% of maximum dry density. Provide density tests for every 50' of trench, minimum 2.

Backfill methods shall be approved.

Haunching material shall be the same material as that used for bedding where Class I or Class II select material is used.

3. Initial Backfill: Compact select material to a minimum (85%) of maximum dry density. Do not drop material or perform compaction

directly over the top of the pipe. Place initial backfill from the springline to a minimum depth of 6 inches over the pipe.

4. Compacted Final Backfill: Mechanically compact lifts to a minimum of 95 percent of maximum dry density. Perform in roadways, dikes, or where otherwise shown on the drawings.

VI. Settlement:

Within one year after final acceptance of the project, utilities or other improvements adversely affected by settlement, repair the settled areas to proper grade and condition at no expense to the Owner.

VII. Surface Restoration:

Unsurfaced Areas: All surface cuts shall be, as a minimum, restored to a condition equal to that prior to construction.

VIII. Grading:

Perform finish grading for smooth transitions between lines. Grades shall be free of abrupt or irregular changes.

Grade between existing and final grades not otherwise shown to a uniform slope. Round abrupt change in slopes.

End of Section

SECTION 02545 - AGGREGATE BASE COURSE

1. SCOPE OF WORK:

Furnish all labor, materials and equipment required to complete the work of the noted Sections of this Division described herein and on the drawings.

2. WORK INCLUDED:

The work shall include, but is not necessarily limited to, placement of compacted aggregate upon the previously prepared surface.

3. SUBMITTALS:

Refer to Section 01300 - Submittals, for requirements.

4. QUALITY ASSURANCE:

Work covered in this Section shall be in accordance with these Specifications and applicable sections of the Colorado Department of Transportation Standard Specifications specified herein.

I. Density for Sands and Gravels: Relative Density Method ASTM D 4253 and ASTM D 4254.

II. In-place Density Determination: Nuclear Method ASTM D 2922

5. MATERIALS:

Aggregates for base courses shall be crushed stone, crushed slag, crushed gravel or natural gravel conforming to AASHTO M 147 except that the requirements for the ratio of minus No. 200 sieve fraction to the minus No. 40 sieve fraction shall not apply. Aggregates for base material shall meet the grading requirements of the following table and shall also be for material identification.

The liquid limit shall not be greater than 30 and the plasticity index shall not exceed 6 when the aggregate is tested in accordance with AASHTO T 89 and AASHTO T 90 respectively.

The grading requirements of the material, Colorado Department of Transportation, Section 703.03, Aggregate Base Course, are as follows:

I. Class 5:

Sieve size or designation	Percentage by Weight passing square mesh sieve sizes
1 in.	95-100
No. 4	30-70
No. 200	3-15

Quality control for earthwork shall be provided by the contractor. The Project Manager may, at any time, access the work area to perform quality control testing. Contractor shall allow access for such testing. No payment or claim will be granted for lost production during testing activities.

I. A qualified soil testing lab shall be retained to perform density testing, with field technicians working under the supervision of a Colorado registered professional engineer.

II. Denisty and moisture content testing shall be performed for every 50 tons of in place fill, and at least (4) tests under the interior concrete slab, (2) tests under the apron, and (2) tests on the gravel driveway.

III. Tests which fail density specification shall be reported verbally to the Project Manager within four (4) hours, either in person or via telephone.

IV. Base course within the failed area shall be subjected to additional compaction, moisture conditioning with additional compaction, or other corrective measures, and shall be retested. Implementation of corrective measures and retesting shall continue until the affected base coursel meets specification.

V. All test results, description of corrective measures, and retest results shall be provided to the Project Manager in writing within 48 hours of testing. Facsimile or electronic mail are acceptable forms of providing this information.

VI. Any failed areas for which corrective measures and retesting do not document that the material meets specification shall be removed and replaced to specification at the contractors expense.

6. EXECUTION:

I. Preparation:

Grade and compact the subgrade surface to receive aggregate base course to the elevations staked on the site.

Subgrade for all gravel shall be previously prepared to lines, grades and elevations shown on the drawing or as adjusted by the Project Manager, and compacted to a minimum of 95% of maximum dry density in accordance with AASHTO T 99 prior to placing gravel.

Do not place material when the prepared grade is wet, frozen, or in the Project Manager 's opinion, the prevailing conditions are not favorable.

The prepared surface coarse shall be in a plane, pitched and sloped as shown on the drawings.

II. Placement:

Place all aggregate in a single lift for the compacted thickness.

III. Mixing:

When the material used is acquired from two or more sources, the materials shall be mixed while at optimum moisture by approved equipment until the mixture is uniform throughout.

IV. Shaping and Compacting:

Continue compaction until a density of not less than 95 percent of the maximum density determined in accordance with AASHTO T 99 has been achieved. Maintain the surface during the compaction operations such that a uniform texture is produced and the aggregates firmly keyed. Water shall be uniformly applied during compaction in the amount necessary for proper consolidation.

Back dragging of a bucket is not an acceptable method of preparing the surface for compaction and is not allowed. Wheel rolling or the use of passes of loaded equipment is not an acceptable method of compaction.

End of Section

SECTION 02610 - PIPE AND FITTINGS

1. SCOPE OF WORK:

   Furnish all labor, materials and equipment required to complete the work of the noted Sections of this Division described herein and on the drawings.

2. WORK INCLUDED:

   The work shall include, but is not necessarily limited to, the furnishing and installation of all components required for a complete installation.

3. SUBMITTALS:

   Refer to Section 01300 - Submittals, for requirements.

4. PIPE INSPECTION AND INSTALLATION:

   I. Alignment:

      Alignment of pipe shall be maintained to the staked lines and grades.

   II. Placement:

      Lay pipe with spigot ends directed down-grade unless otherwise directed. Lay pipe, fittings and accessories with proper equipment and in a manner to prevent damage.

      Any defective pipe materials found during the inspection, prior to placing within the trench, shall be replaced.

      All foreign matter or dirt shall be removed from the interior of the pipe before lowering into position in the trench. Pipe shall be kept clean during and after completion of laying.

      Clean the sealing surfaces of the pipe immediately before assembly, and assembly shall be made as recommended by the manufacturer. Check the completed piping to assure joints are intact.

      Prior to the placement of earthfill or other material around the pipe, observe pipe for leakage. Repair any leaks. Repeat the procedure until the pipe is watertight (The pipe joints shall show no leakage).

      When pipe laying is not in progress, seal the open ends of installed pipe to prevent entrance of water into the line. Whenever water is excluded from the interior of the pipe, place enough backfill on the pipe to prevent floating. Remove any pipe that has floated from the trench and restore the bedding. No pipe shall be laid when the trench conditions or the weather are unsuitable for proper installation as determined by the Project Manager.

III. Handling:

Haul and handle the pipe in a manner that will avoid damage.

Remove any damaged pipe from the project site and replace. Pipe shall not be repaired for installation unless approved.

IV. Pressure Testing (Air Test):

A. Perform testing in the presence of the Project Manager prior to backfilling. Furnish water for testing.

B. Place sufficient backfill prior to filling with water and testing to prevent lifting of the pipe. If it is necessary to partially backfill the line prior to testing to hold the line in place, the initial backfill shall cover only the body of the pipe with joints and connections left uncovered for inspection. When local conditions require that the trenches be backfilled immediately after the pipe has been laid, the testing may be carried out after backfilling has been completed, but before placement of permanent surface.

C. Plug or cap the ends and cleanouts of the line with inflatable stoppers or other suitable test plugs.

D. Add air slowly to the test section until the pressure inside the pipe reaches 4.0 psig. Allow the pressure to stabilize such that a pressure between 4.0 and 3.5 psig is maintained. The pressure will normally drop slightly after install pressurization, allow the pressure to stabilize and re-pressurize as needed so that a minimum starting pressure of 3.5 psig is obtained prior to the start of the test.

E. Disconnect air supply and decrease pressure to 3.5 psig before starting the test.

F. Monitor the pressure for 5 minutes. The pressure should not drop by more than 1 psig for every 1000 ft of the line in the 5 minute period.

G. Should the line fail the pressure test, the source of the failure shall be determined and corrected at the Contractor's expense.

H. Once the source has been fixed the pipe shall be retested.

5. MATERIALS:

I. PVC Pipe:

A. General:

PVC pipe shall be manufactured by North American Specialty Products, Diamond Plastics Corp., J-M Manufacturing, Ipex Inc., or approved equal.

B. PVC Pressure Pipe:

1. Supply Pipe: Supply pipe shall be Schedule 80 PVC and shall be rated to a minimum 150 psi.

2. Drain Pipe: Drain pipe shall be Schedule 40 PVC and shall be rated to a minimum 150 psi.

C. Bell and Spigot Joints: Pipe joints, complying with ASTM D 3139, shall be made using an integral bell with an elastomeric gasket push-on type joint or using machined couplings of a sleeve type with rubber ring gaskets and machined pipe ends to form a push-on type joint. Rubber ring gaskets shall conform to ASTM F 477. Adequate gasket lubricant shall be furnished for all of the pipe and fittings connections.

D. Unions: Unions shall be rated for Schedule 80 PVC materials and fittings and comply with ASTM D 1784 for PVC Type 1, Grade 1. Threaded fittings shall conform to ASTM D 2464.

D. Schedule PVC Pipe: Schedule pipe requirements shall meet ASTM D 1785 using PVC 1120, 1220 or 2120. Socket type fittings for solvent welded joints shall conform to ASTM D 2467 for Schedule 80, ASTM D 2466 for Schedule 40 and ASTM D 2464 for the threaded type. The solvent cement shall comply with ASTM D 2564.

II. Steel Pipe: (General Use)

A. Pipe:

Steel pipe approved for water service shall comply with ASTM A 53 (Schedule 40) and AWWA C 200 (mill pipe) standards.

B. Flanges:

All required flanges shall be manufactured in compliance with the requirements of ASTM A 234 for seamless steel fittings. The Class 150 flanges of forged steel shall comply with the requirements of ASTM A 105, ready for welding to pipe or fittings.

Flange gaskets shall comply with ANSI A21.10 and AWWA requirements. The 1/8 inches thick gaskets shall be of SBR or neoprene rubber complying with ANSI requirements.

Flange bolts and nuts of high carbon, heat treated steel shall comply with ANSI B18.2.1 standard and be zinc chromate plated or galvanized.

C. Joints and Fittings:

The threaded fittings shall comply with ANSI B16.3 and AWWA C 208.

Pipe and fittings shall be hot-dipped galvanized.

Make all pipe joints carefully and neatly. All threaded joints shall comply with ANSI B2.1 NPT. Use joint compound or "teflon" thread tape on male threads only in making joints.

III. Modular Water Seals: "Link Seal" LS or approved equivalent.

IV. Associated Fittings and Adapters:

A. Compression Couplings: APAC, Dresser, Romac compression coupling, or approved equal. The coupling shall be of the type necessary for connecting the type and diameters of pipe required.

B. PVC Fittings: Unless otherwise noted on drawings or in the specifications, fittings for PVC pipe shall be PVC and certified for the pressure rating of the associated pipe. Elbow fittings shall be standard angles, a combination of standard angles, or angles fabricated to the nearest one degree for PIP, IPS, and sewer pipes.

6. EXECUTION:

I. Material Delivery, Storage, and Protection:

A. All piping materials, fittings, valves, and accessories shall be delivered in a clean and undamaged condition and stored off the ground for protection against oxidation caused by ground contact. All defective or damaged materials shall be replaced with new materials.

II. General:

A. Cleanup: After completion of the work, all remaining pipe cuttings, joining and wrapping materials, and other scattered debris, shall be removed from the site. The entire piping system shall be handed over in a clean and functional condition.

B. General Locations and Arrangements: Drawing plans indicate general location and arrangement of piping systems. Install piping as indicated, unless deviations to layout are approved on coordination drawings.

C. Install piping free of sags and bends.

D. Install exposed interior and exterior piping at right angles or parallel to building walls. Diagonal runs are prohibited, unless otherwise indicated.

E. Install piping tight to slabs, beams, joists, columns, walls and other building elements. Allow sufficient space above removable ceiling panels to allow for ceiling panel removal.

F. Pipe Penetrations: Install sleeves for pipes passing through concrete foundation walls and PVC panneling partitions.

1. Cut sleeves to length for mounting flush with both surfaces.

2. Build sleeves into new walls and slabs as work progresses.

3. Install sleeves large enough to provide 1/4" annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:

   a. PVC Pipe Sleeves: For pipes penetrating PVC panneling partitions

4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using elastomeric joint sealants.

5. Use Type S, Grade NS, Class 25, Use O, neutral-curing silicone sealant, unless otherwise indicated.

G. Underground, Exterior-Wall, Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Size sleeve for 1" annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Assemble and install mechanical sleeve seals according to manufacturer's written instructions. Tighten bolts that cause rubber sealing elements to expand and make watertight seal.

H. Piping Joint Construction: Join pipe and fittings as follows and as specifically required in individual piping specification sections:

1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

2. Remove scale, slag, dirt and debris from inside and outside of pipe and fittings before assembly.

3. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

   a. Note internal length of threads in fittings or valve ends and proximity of internal seat or wall to determine how far pipe should be threaded into joint.

   b. Apply appropriate tape or thread compound to external pipe threads, unless dry seal threading is specified.

   c. Align threads at point of assembly.

   d. Tighten joint with wrench. Apply wrench to valve end into which pipe is being threaded.

   e. Damaged Threads: Do not use pipe or pipe fittings with threads

that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

4. Flanged Joints: Align flange surfaces parallel. Select appropriate gasket material, size, type and thickness for service application. Install gasket concentrically positioned. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly using torque wrench.

5. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join pipe and fittings according to the following:

   a. Comply with ASTM F 402 for safe-handling practice of cleaners, primers and solvent cements.

   b. PVC Pressure Piping: ASTM D 2672.

I. Piping Connections: Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping 2" NPS and smaller, adjacent to each valve and at final connection to each piece of equipment with 2" NPS or smaller threaded pipe connection.

2. Install flanges, in piping 2-1/2" NPS and larger, adjacent to flanged valves and at final connection to each piece of equipment with flanged pipe connection.

3. Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

III. Erection Of Metal Supports And Anchorage:

A. Cut, fit and place miscellaneous metal supports accurately in location, alignment and elevation to support and anchor mechanical materials and equipment.

End of Section

02640 – VALVES AND GATES

1. SCOPE OF WORK:

   Furnish all labor, materials and equipment required to complete the work of the noted Sections of this Division described herein and on the drawings.

2. WORK INCLUDED:

   The work shall include, but is not necessarily limited to the furnishing and installation of specified items.

3. MEASUREMENTS:

   Valves shall not be measured separately for each installation but shall be included in the related portion of construction as noted in the Bid Schedule. Additional quantities shall not be measured for attachments, connecting hardware or required earthwork, but also included in related construction.

4. SUBMITTALS:

   Refer to Section 01300 - Submittals, for requirements.

5. MATERIALS AND INSTALLATION:

   I. Gate Valves:

      A. General:

         Gate valves shall be resilient seated, manufactured to meet or exceed the requirements of AWWA C 509 of the latest revision and in accordance and shall be manufactured by American Darling, M&H, Clow, U.S. Pipe, Mueller, or approved equivalent.

      B. Materials:

         The valve body, bonnet, and bonnet cover shall be ductile iron or cast iron, ASTM A126, Class B, fully coated with fusion bonded epoxy. The sealing mechanism shall consist of a cast or ductile iron wedge gate fully encapsulated in synthetic rubber or urethane. The resilient sealing mechanism shall provide zero leakage at 175 psi working pressure when installed.

   II. Ball Valves:

      A. General:

         Ball valves shall be of the non-lubricating, eccentric type and shall be designed for a working pressure of 175 psi. Valves shall provide tight shut-off at rated pressure.

B. Manufacturer:

Ball valves shall be 1" Socket PVC Ball Valve by True Union or approved equivalent.

Contractor to provide valve with valve key where applicable.

C. Curb Box:

Curb box shall be "Telescoping Plastic Curb Box" by Orbit or approved equivalent.

III. Plug Valves:

A. General:

Plug valves shall be of the non-lubricating, eccentric type and shall be designed for a working pressure of 175 psi. Valves shall provide tight shut-off at rated pressure.

B. Materials:

Valve body shall be constructed of ASTM A126 Class B cast iron. Valve plugs shall be constructed of ASTM A 126 Class B cast iron or ASTM A 536 Grade 65-45-12 ductile iron. Bearings shall be constructed of self-lubricating Type 316 stainless steel.

IV. Backwater Valves:

A. General:

Backwater valves shall be manufactured to meet or exceed requirements of ASME/ANSI A112.14.1 for Backwater Valves. Valves shall be fitted with extension kits as necessary. Valves shall be manufactured by Spears or approved equivalent.

B. Materials:

All thermoplastic valves shall be Backwater type constructed from PVC Type I, ASTM D 1784 Cell Classification 12454. All Valve Seats shall be EPDM. All valves shall have external Arrow Flow Indicator.

End of Section

SECTION 02934 - SEEDING AND MULCHING

1. SCOPE OF WORK:

   Furnish all labor, materials, and equipment required to complete the work of the noted Sections described herein and on the drawings.

2. WORK INCLUDED:

   The work shall include, but is not necessarily limited to, soil preparation, seeding, and mulching.

3. JOB CONDITIONS:

   Materials shall not be applied during high winds (defined as windy enough to blow materials around or off site) or when the ground is excessively wet, frozen, or not tillable.

4. SUBMITTALS:

   Refer to Section 01300 - Submittals, for requirements.

5. DEFINITIONS:

   Cultivar: A cultivated variety of a native plant, with intentional selection for agronomically desirable traits such as drought tolerance, rust resistance, even stand production, high germination rates, etc.

   Ecotype: A genetically distinct plant population adapted to specific environmental conditions (elevation, geography, soils, precipitation, etc.). Ecotypic plant material is not selected for desirable traits.

   NPF: Native Perennial Forb.

   NPG-L: Native Perennial Grass-Like (grasses, sedges, or rushes).

   PLS: Pure Live Seed. The amount of viable seed in a seed mix, which remains after one accounts for the chaff, unviable seed, inert material, crop seeds, weed seeds, and other material that is not part of the pure live seed listed in the desired seed mix.

   VNS: Variety Not Stated. The designation “VNS” is typically used when a local ecotype is being sold, and may also be termed “yellow label” or Source Identified Seed, though there are subtle differences between these designations according to the Colorado Seed Growers Association.

6. PRODUCTS:

   I. TOPSOIL - EXISTING:

      Use existing on-site material in areas to be seeded as shown on the drawings. Where applicable, topsoil should be stripped and placed in an area designated by the Project Manager.

II. SEED:

Seed shall meet the requirements of Federal Specification JJJ-S-181.

Seed shall be furnished separately or in mixture in standard containers with:

A. Seed name.
B. Lot number.
C. Net weight.
D. Percentage of purity and germination (in case of legumes, percentage of germination to include hard seed).
E. Percentage of maximum weed seed content clearly marked for each kind of seed.

Unless otherwise stated, the Contractor shall furnish the Project Manager duplicate signed copies of a statement by the vendor, certifying that each lot of seed has been tested by a recognized laboratory for seed testing within 6 months of date of delivery. This statement shall include:

A. Name and address of laboratory.
B. Date of test.
C. Lot number for each kind of seed.
D. Results of tests as to name, percentages of purity and germination, and percentage of weed content for each kind of seed furnished, and in case of a mixture, the proportions of each kind of seed.

Legume seed shall be inoculated with approved cultures in accordance with the manufacturer's instructions.

Note: All seeding rates provided are for broadcast seeding. If drill seeding is performed, reduce seeding rates by ½.

RIPARIAN SEED MIX:

Seed shall be applied at a rate of 9.4 pounds of PLS (pure live seed) per acre and have the following mix:

Species:	Variety:	Percentage Species in Mix:
Green Needlegrass	Lodom	15
Switchgrass	Blackwell, Grenville	20
Western Wheatgrass	Arriba	25
Tufted Hairgrass		15
Streambank Wheatgrass	Sodar	15
Bluebunch Wheatgrass	Goldar	10

Contact the local Natural Resources Conservation Services (NRCS) office (Glenwood Springs, 970-945-5494) for approved alternate mixes/substitutions.

UPLAND SEED MIX:

Seed shall be applied at a rate of 11.4 pounds of PLS (pure live seed) per acre and have the following mix:

Species:	Variety:	Percentage Species in Mix:
Indian Ricegrass	Paloma	15
Bottlebrush Squirreltail		15
Western Wheatgrass	Arriba	20
Sandberg Bluegrass		10
Streambank Wheatgrass	Sodar	20
Bluebunch Wheatgrass	Goldar	20

Contact the local Natural Resources Conservation Services (NRCS) office (Glenwood Springs, 970-945-5494) for approved alternate mixes/substitutions.

III. EROSION CONTROL NET AND BLANKET MATERIAL:

All erosion control materials shall be made of new material, clean, sound, and free of rips or tears.

A. Erosion control blankets should be considered for use in the entire project area. Erosion control blankets will be used on all slopes equal or steeper than 3:1 and those that will readily carry water downhill.

B. Erosion control blankets should be used whenever possible, as they help to retain moisture, reduce/eliminate seed predation by birds, and reduce weed infestations post soil disturbance.

C. Erosion control blanket shall be made of natural materials, biodegradable, non-toxic to vegetation or germination of seed, and shall not be toxic or injurious to humans or wildlife.

D. Erosion contonl netting shall be Nedia S400B or approved equal.

E. Landscape fabric staples should be used to secure erosion control blankets. Edges should be tucked into grooves dug into the soil and buried to ensure wind does not get under the blankets. Staples shall be U-shaped metal, 11-gauge minimum, 12” long.

IV. EROSION CONTROL LOGS:

A. Erosion control logs must be used in all unvegetated swales and drainage areas within the project area to reduce soil and seed loss. Wood stakes should be used to secure straw wattles and consist of 18x1x2-inch stakes cut diagonally.

B. Straw wattles must be used on downhill borders of all disturbed areas.

7. EXECUTION:

I. GENERAL SEEDING:

A. Seeding equipment, including disks, drag harrows, and hoppers, shall be cleaned and inspected prior to entering State Property. No remnant seed (from a previous project) should remain in the hoppers, seeding tubes, augers, or any other part of the seeding equipment.

B. Decompact soils.

C. Prepare the seedbed.

D. Apply soil amendments.

E. Apply and cover seed.

F. Apply soil surface protection treatments. If compost is being incorporated into the soil, it should be incorporated during decompaction or seedbed preparation steps.

G. Hydroseeding is not allowed. Seed should not be applied in hydromulch.

H. The optimal seeding timing is September or May.

II. DRILL SEEDING:

A. Use the application rate as listed. If drill seeding is being used, use half as much seed as what is called for in the broadcast seed mix. Drill seed density shall be a minimum of 50 seeds per square foot.

B. Keep in mind that smaller seeds sink to the bottom with larger seeds rising to the top. Mixing seed prior to pouring into the seed hopper will help to ensure an even application of species across your project area. All native grass drills should have a chaffy seed box if seed has not been de-bearded.

C. Seed at a depth of ¼ - ½".

D. Use half the seed on the entire area, then seed in a different direction with the second half of the seed. (This helps alleviate the effects of settling of small seeds and provides even distribution of plants and species)

III. BROADCAST SEEDING:

A. The rate of application will be doubled for all broadcast seeding. Do not broadcast seed in high winds. Broadcast seed density shall be a minimum of 100 seeds per square foot.

B. Preparatory to seeding, the topsoil should be loosened or tilled into an even and loose seedbed.

C. Loosen the seed bed soil to a depth of 4 inches. Seeded area shall be free of all clods in excess of 2 inches in diameter, and brought to the desired line and grade prior to placing any additional topsoil.

1. Keep disturbance to a minimum in order to reduce weed competition.
2. Prior to seeding, a person standing on the seed bed should sink no more than ¾" into the soil.
3. Foot prints deeper than ¾" mean that the seed bed is too loose and seeds risk being planted too deep. If this is the case, wait and let soil settle, or use a roller or foot traffic to reduce loose soil in the planting area.

D. Mix seed prior to application to ensure an even application of species across the project area.

E. Broadcast half the seed on the entire area, then broadcast the second half of the seed in the same area but in a direction perpendicular to the original direction.

F. All seed sown by broadcast seeding shall be "raked in" or covered with soil to a depth of ¼ - ½ inches. Bouncing a grass rake upside down across the seeded area can help to achieve this effect. Soil to seed contact is critical for success.

G. Post seeding, a packer should be utilized to create soil to seed contact in the seedbed to maximize seed to soil contact. If no packer is available, foot traffic across the seeded area can help achieve this effect.

IV. MULCH:

A. Straw and Native Grass Hay: Straw and native grass hay shall be applied at a rate of 4,000 lbs. per acre of air-dry material. At least 50 percent (50%) of the mulch, by weight, shall be ten inches (10") or more in length. The mulch shall be crimped four inches (4") into the soil immediately after mulching. Can be used on slopes less then 4:1.

Either straw or hay can be distributed uniformly over the soil surface after seeding and held in place by crimping or punching it into the surface soil with either a mulch tiller or crimper, a modified sheeps-foot roller, or a weighted agricultural type disc. Anchoring the mulch will adequately cover the seed, so it is not necessary to cover the seed prior to mulching.

Hydromulch: Natural wood fiber mulch shall be produced from clean, whole-wood chips and have the property of dispersing readily in water. Mulch shall be applied at the rate of:

2,000 lbs/acre for slopes 4:1 or less

2,500 lbs/acre for slopes 2:1 to 4:1

3,000 lbs/acre for critical areas, slopes 2:1 or more

A tackifier shall be incorporated in the mix at a rate of 150 lbs/per acre (Guar gum for dry soils; starch-based absorbent for wet soils.)

The material shall contain no weed seed. The material shall have no toxic effect when combined with seed or other materials. A continuous agitator action that keeps the materials in uniform suspension must be maintained throughout the distribution cycle. The discharge line shall provide an even distribution of the solution to the seedbed.

The material shall readily blend with water and other additives to form a homogenous slurry or mixture capable of application with power spray equipment. A colored dye that is noninjurious to plant growth and that fades rapidly with exposure to light may be used. Wood cellulose fiber shall be packaged in new, labeled containers in an air-dry condition.

Mulching shall not be done in the presence of free surface water.

B. Hydraulic Blanket Mulch

A bonded fiber matrix consisting of 85-90% natural wood fiber, 5-10% crosslinked tackifier and 5% locking fibers. Mulch shall be applied at the rate of 3,500 lbs. per acre. To be used of slopes steeper than 2:1, and can be used on shallower slopes.

The material shall contain no weed seed. The material shall have no toxic effect when combined with seed or other materials. A continuous agitator action that keeps the materials in uniform suspension must be maintained throughout the distribution cycle. The discharge line shall provide an even distribution of the solution to the seedbed.

The material shall readily blend with water and other additives to form a homogenous slurry or mixture capable of application with power spray equipment. A colored dye that is noninjurious to plant growth and that fades rapidly with exposure to light may be used. Wood cellulose fiber shall be packaged in new, labeled containers in an air-dry condition.

Mulching shall not be done in the presence of free surface water.

8. CARE DURING CONSTRUCTION:

The Contractor shall be responsible for protecting and caring for seeded areas until final acceptance of the work. The Contractor shall repair all damage to seeded areas caused by his construction operation without additional compensation.

9. ACCEPTANCE OF SUBSTANTIAL COMPLETION:

I. SUBSTANTIAL COMPLETION:

Upon completion of all seeding operations the Contractor shall notify the Project Manager. If all work is acceptable, the Project Manager shall record that date and issue a Substantial Completion memorandum stating that the Contractor has

completed seeding operations. The seed establishment period shall begin upon issue of Substantial Completion by the Project Manager.

II. ESTABLISHMENT AND FINAL ACCEPTANCE:

A. Seeding Areas: The Contractor shall maintain seeded areas, including all areas disturbed by Contractor equipment during the seeding operation (i.e., staging areas, access routes, etc.) until date of Final Acceptance. During the establishment period, the Contractor is responsible for keeping the seeding areas free of weeds and debris. Weed control will be accomplished by mowing the site at any point where weed species start to set flowers and before the seed heads develop, or when weeds reach 6" in height in dryland seeding areas. Areas seeded and so maintained shall be protected against damage by construction activity and pedestrian traffic by the use of barriers and appropriate warning signs.

B. Seed Germination Inspection: When germination is complete and seedlings are visible, the Contractor shall notify the Project Manager and request a "Germination Inspection" for final acceptance of the seeded areas. Any areas deemed by the Project Manager at this time to be thin, weak or dead shall be reseeded at this time.

C. Areas shall be reseeded and managed for weeds until they meet the following criteria:

1. Seeded areas contain no more than ten percent (10%) absolute weed cover;
2. No bare patches (i.e., no germination of sown species) greater than 20 square feet exist; and
3. Seeded areas contain, on average, more than 6 desirable seedlings per square foot.

D. Contractor shall continue to maintain areas until they successfully pass inspection.

10. WARRANTY:

I. As determined by the Project Manager, the Contractor shall restore and re-seed eroded areas and areas lacking a satisfactory stand of grasses at the end of 12 months following seeding. A satisfactory stand is defined as a minimal coverage of 6 healthy seeded plants per square foot, with bare patches (not including weeds) less than 20 square feet in size. Re-seeding and repair shall occur during the next earliest seeding season following notice from the Project Manager that seeded areas require reseeding and repair, and shall follow guidelines and specifications described herein.

II. Re-seeding and repair, if required, shall be at contractor’s expense.

End of Section

SECTION 03100 - STRUCTURAL CONCRETE FORMWORK

1. SCOPE OF WORK:

   Furnish all labor, materials and equipment required to complete the work of the noted Sections of this Division described herein and on the drawings.

2. WORK INCLUDED:

   The work shall include, but is not necessarily limited to, the construction of formwork for concrete structures.

3. SUBMITTALS:

   Refer to Section 01300 - Submittals, for requirements.

4. QUALITY ASSURANCE:

   I. Standards:

      A. “Recommended Practice for Concrete Formwork", ACI 347

      B. “Building Code Requirements for Structural Concrete”, ACI 318

      C. "Chapter 19", International Building Code.

      D. U.S. Product Standard PS 1-74 for Plywood.

      E. Standard Grading and Dressing Rules No. 167 of the West Coast Lumber Inspection Bureau.

5. MATERIALS:

   I. Plywood:

      Plywood shall be new or in new condition "B-B Plyform Class 1 Exterior" grade plywood, 5/8 inch minimum thickness.

   II. Steel Panels:

      Steel panels shall be flat steel sheet or plate of sufficient thickness, or braced sufficiently, to prevent noticeable deflection from pressure of concrete. Steel forms shall be galvanized and/or coated to prevent rust and staining.

   III. Framing, Studding, and Bracing:

      Framing, studding and bracing shall be "Standard" or "Construction" grade West Coast Species lumber.

IV. Form Ties:

A. Form ties shall be of a cone-type snap-tie configuration type or as approved by the Project Manager. They shall have a minimum working strength when fully assembled of 3,000 pounds. Ties shall be adjustable in length permitting complete tightening of forms and of a type that leaves no metal closer than 1 inch to the surface. Wire ties will not be permitted.

B. Ties used in structures designed to contain water shall be Superior Concrete Specialties, Inc., 3M Waterseal Snap Tie or approval equal.

V. Form Coatings:

Coat surfaces of formwork prior to each pour with "Symons Magic Kote" form coating, by Symons Manufacturing Company, Des Plaines, Illinois, or approved equal, compatible with the forming system. Do not place concrete in forms until inspected and approved.

VI. Chamfer Strips:

Chamfer strips shall be (for all exposed edges) ¾ inch, 45° bevel wood strips or reusable plastic triangular strips.

6. FORM CONSTRUCTION:

I. Construct forms to slopes, lines and dimensions shown, plumb, straight and sufficiently tight to prevent leakage, ACI 347, Chapter 2, Construction.

II. Securely brace, frame and shore forms to prevent displacement and to safely support construction loads, APA Form V 345.

III. Provide temporary openings in formwork, when needed, for concrete placement.

IV. All exposed external corners shall have chamfers of ¾ inch.

7. EXECUTION:

I. Defective Work:

Any form movement or deflection during construction or finished surface variations in excess of the tolerances specified will be basis for rejection of cast-in-place product and requirement for replacement of same.

II. Removal of Forms:

A. Do not remove forms and supports until concrete has attained sufficient strength to support anticipated loads.

B. The listing below serves only as a guide in determining the minimum length of time required before removal of forms and is based on the use of Type II Portland Cement. When high early strength Portland Cement is used, the length of time listed below may be reduced to not less than one-third time

listed, but not less than 1 day. Unless otherwise indicated the minimum length of time prior to removal of forms shall be 48 hours.

C. Use methods of form removal which will not cause overstressing of the concrete. Remove supports to permit the concrete to uniformly and gradually take the stress due to its own weight. Do not use high impact methods to remove supports.

D. Break back ties after concrete has cured sufficiently to maintain unbroken bond with steel rod.

III. Reuse of Forms:

A. Reused forms for exposed concrete work shall be reconditioned to "like new" condition. Reused forms shall be cleaned, repaired, and recoated before each reuse.

IV. Blockouts:

A. Where pipes, castings, or conduits pass through the walls, place such pipes or castings in the forms before pouring the concrete, or in special cases, with the express consent of the Project Manager or as specified, build accepted boxes in the forms to make cored openings for subsequent insertion of such pipes, castings or conduits. Provide boxes or cores with continuous keyways and waterstop all the way around, and with slight flare to facilitate grouting and the escape of entrapped air during grouting.

End of Section

SECTION 03200 - CONCRETE REINFORCEMENT

1. SCOPE OF WORK:

   Furnish all labor, materials and equipment required to complete the work of the noted Sections of this Division described herein and on the drawings.

2. WORK INCLUDED:

   The work shall include, but is not necessarily limited to, the furnishing and placement of reinforcing for structural concrete.

3. SUBMITTALS:

   Refer to Section 01300 - Submittals, for requirements.

4. QUALITY ASSURANCE CONTROL:

   I. Manual of Standard Practice for Detailing Reinforced Concrete Structures, ACI 315.

   II. Manual of Standard Practices, Concrete Reinforcing Steel Institute.

5. PRODUCT DELIVERY, STORAGE AND HANDLING:

   I. Deliver reinforcement to project site in bundles marked to coordinate with placement drawings.

   II. Handle and store to prevent contamination from dirt, oil and other materials which will affect bond.

   III. Store a minimum of 6" above ground and in locations where the material will not be subject to abuse.

6. PRODUCTS:

   I. Reinforcing Bars:

      Bars shall be deformed in accordance with ASTM A 615, ASTM A 616 and ASTM A 617 and formed of either intermediate or hard grades of steel unless otherwise specified. Steel shall have a 60,000 psi minimum yield point. Reinforcement shall be clean and free from loose rust, scale or other coatings that will reduce bond.

   II. Tie Wire: Steel, black, annealed, 16-gauge minimum.

   III. Metal Accessories:

      Include all spacers, chairs, bolsters, ties, and other devices necessary for properly placing, spacing, supporting and fastening reinforcement in place.

      Metal accessories shall be galvanized or plastic coated where legs will be exposed in finished concrete surfaces. Accessories shall conform to requirements of the

Concrete Reinforcing Steel Institute (CRSI) *"Manual of Standard Practice for Reinforced Concrete Construction."*

Chairs and other accessories fabricated from concrete, ceramic or plastic may be used in place of metal accessories when approved by the Project Manager.

IV. Reinforcing Fibers:

Shall be The FORTA Corporation (www.forta-ferro.com), "FORTA-FERRO" 2.25" length at a dosage rate of 7.5 lb per cubic yard of concrete or approved equivalent. Fiber-reinforcement shall be installed in all slabs in accordance with fiber manufacturer's recommendations and in other concrete locations if indicated on the drawings.

7. EXECUTION:

I. Splices:

A. Do not splice bars except at locations shown or noted on the shop drawings or as otherwise approved.

B. All effort shall be made to minimize the number of splices on the project. When splices are used, splices shall meet Type B, ACI 318 requriements.

C. Tie lap splices securely with wire to prevent displacement of splices during placement of concrete.

D. Perform welded splices in accordance with AWS 12.1.

II. Remove dirt, grease, oil, loose mill scale, excessive rust, and foreign matter that may reduce bond with concrete.

III. Keep reinforcing in proper position during concrete placement.

IV. Maintain minimum concrete cover over reinforcement as specified in ACI 318 or as noted.

End of Section

SECTION 03252 - INSERTS AND FASTENING DEVICES

1. SCOPE OF WORK:

   Furnish all labor, materials and equipment required to complete the work of the noted Sections of this Division described herein and on the drawings.

2. WORK INCLUDED:

   The work shall include, but is not necessarily limited to, the furnishing and placement of all inserts and fastening devices in structural concrete.

3. SUBMITTALS:

   Refer to Section 01300- Submittals for requirements.

4. MEASUREMENTS:

   Quantities shall not be measured separately for inserts and fastening devices, but shall be included as part of the related construction.

5. GENERAL:

   Sufficient time between erection of forms and placing of concrete shall be given to the various trades to permit the proper installation of their work. See drawings and other Sections of the Specifications for extent, location and details of items to be embedded or placed in the concrete. Inserts shall be cast into the concrete with care to avoid misalignment or damage.

   All inserts shall be maintained in position and protected until the concrete placement is completed.

6. QUALITY CONTROL ASSURANCE:

   Anchor bolts which have the threads pressed instead of cut from bar stock shall be have testing certification on the completed unit.

7. MATERIALS:

   I. Joint Filler

      Isolation joint filler shall be cellulose fibers securely bonded together with a uniform impregnation of bituminous binder and preformed into strips. The joint filler shall comply with ASTM D 8139.

   II. Anchor Bolts:

      Bolts and nuts shall comply with ASTM A 307 and ASTM A 563 for bolt and nut materials. All nuts, bolts and washers shall be galvanized.

8. EXECUTION:

I. Embedded Materials:

A. Coordinate the location and placement of all items to be embedded in concrete.

B. Coat any embedded aluminum with asphalt paint.

C. Cadmium or aluminum coated steel materials shall be coated with asphalt paint.

II. Drilled In Grouted Anchors and Dowels:

In lieu of embedding anchor bolts and when approved, drill holes in hardened concrete and install the anchor bolts and other items with special mortars. Drill with diamond boring or coring bits. Adhesive shall be Sika AnchorFix-3030 or approved equivalent, and shall be installed according to the manufacturer's requirements. Studs of equal size and length may be substituted for anchor bolts if nut fasteners are used. Drilled in studs or anchors utilizing mechanical expansion locking in any process areas shall not be used.

End of Section

SECTION 03300 - CAST-IN-PLACE STRUCTURAL CONCRETE

1. SCOPE OF WORK:

Furnish all labor, materials and equipment required to complete the work of the noted Sections of this Division described herein and on the drawings.

2. WORK INCLUDED:

The work shall include, but is not necessarily limited to, the construction of concrete structures.

3. SUBMITTALS:

Refer to Section 01300 - Submittals, for requirements.

4. COMPLIANCE WITH STANDARD AND INDUSTRY SPECIFICATIONS:

Concrete work shall conform to all requirements of ACI 301, Specifications for Structural Concrete for Buildings, except as modified below.

5. QUALITY ASSURANCES:

I. Allowable Tolerances:

A. Variations from the plumb in lines and surfaces of columns, piers and walls for a height of up to 10 feet shall not be greater than ¼ inch per location and a cummulative of one inch maximum for entire length.

B. Variation from the level and grades of floors and slabs in any 10 foot of length shall not be greater than ¼ inch and cummulative of ¾ inch maximum for entire length.

Variation in thickness of slabs:

Minus	¼ inch
Plus	½ inch

II. Control Tests:

A. Testing Laboratory: Retain the services of a testing laboratory under the direction of a professional engineer and pay all costs to take samples, make tests. The testing laboratory shall be independent of both the contractor and the supplier.

Field technicians shall be ACI certified as a Concrete Field Testing Technician. Laboratory technicians shall be ACI certified as either Concrete Strength Testing Technician or Concrete Laboratory Testing Technician.

B. Extent of Tests: Take samples and make tests for each 25 cubic yards of fresh concrete or fractional amount placed, but not less than one set for each day's concreting. Take air entrainment and slump tests for each batch or truck of concrete delivered.

1. Compression and Strength Tests: Each test shall consist of four standard cylinders (either 6"x12" or 4"x8"). Cylinder diameter shall be at least three (3) times the nominal maximum size of the coarse aggregate. One cylinder to be tested at the age of 7 days and two cylinders at the age of 28 days. Test one cylinder at 56 days if the other two 28 day cylinders do not meet the required strength. Secure samples for compression test specimens in accordance with ASTM C 172. Cure specimens in accordance with ASTM C 31. Additional test of specimens cured entirely under field conditions may be utilized to check the adequacy of curing and protection of the concrete as directed. Strength tests shall be made in accordance with ASTM C 39. Core tests may be required in the event that compression tests fail to meet the specifications. Core testing shall be in accordance with ASTM C 42 and evaluated in accordance with ACI 301, Chapter 17.

2. Slump Tests: Tests shall be made in accordance with ASTM C 143.

3. Air Entrainment Tests: Tests shall be in accordance with ASTM C 231, ASTM C 173, or ASTM C 138 for normal weight concrete.

4. Temperature: Determine temperature for each set of slump and air entrainment tests.

5. Unit Weight Tests: Tests shall be in accordance with ASTM C 138.

C. Acceptance of Concrete:

1. Cylinders: The average of all sets of three consecutive strength tests shall equal or exceed the specified strength f_c', and no individual strength test result shall be less than the specified strength f_c' by more than 500 psi.

2. Core Tests: The average compressive strength must be equal to or greater than 85 percent of specified strength f_c' and no single core shall be less than 75 percent of the specified strength f_c'.

D. Enforcement of Strength Requirements: When the compressive strength of cylinder falls below the specified strength, the Project Manager may order additional curing for that portion of the structure where the concrete has been placed.

If such additional curing does not give the strength required, the defective parts shall be removed and replaced.

Submit ready-mix delivery tickets per ASTM C 94 if requested.

III. Environmental Requirements:

A. Concrete when deposited shall have a temperature not below 40°F. and not above 90°F. During periods not defined as cold weather but when freezing temperatures are foreseen or occur provide suitable means for protecting the concrete from freezing the first 24 hours after placing.

B. The methods and recommended practice as described in Standard Specification for Cold Weather Concreting, ACI 306.1 and ACI Report 306R shall be followed for cold weather concreting.

C. Cold weather is a period when for more than 3 successive days the average daily outdoor temperature drops below 40°F. The average daily temperature is the average of the highest and lowest temperature during the period from midnight to midnight. When temperatures above 50°F occur during more than half of any 24 hour duration, the period shall no longer be regarded as cold weather.

D. The methods and recommended practice as described in ACI Report 305R shall be followed for hot weather concreting.

E. Hot weather is defined as any combination of high air temperature, low relative humidity, and wind velocity at which the evaporation rate exceeds 0.2 lb/ft²/hr. In excess of this rate, precautions against plastic shrinkage cracking are required. Minimum precautions require the application of an evaporation retardant.

F. The use of salt, chemicals or other foreign materials shall not be mixed with the concrete without approval.

G. Prevent the discharge of wet concrete into any stream or lake.

IV. Delivery and Placement:

A. Concrete that is completely mixed in a truck mixer shall receive 70 to 100 revolutions at the mixing speed prior to placement.

B. Discharge of the concrete shall be completed within 1½ hours, or before the drum has revolved 300 revolutions, whichever comes first, after the introduction of the mixing water to the cement and aggregates or the introduction of the cement to the aggregates. These limitations may be waived by the Project Manager if the concrete is of such slump after the 1½ hours or 300-revolution limit has been reached that it can be placed, without the addition of water, to the batch.

C. Concrete delivered in cold weather shall have the following minimum temperature as placed and maintained during the protection period. The period shall be for a minimum of 3 days.

	Section Size, Min. Dimension (inches)			
	12 or less	12 to 36	36 to 72	72 and greater
Min. Temp.	55°F	50°F	45°F	40°F

D. Termination of Protection: At the end of the protection period, the concrete shall be allowed to cool gradually. The maximum decrease in temperature measured at the surface of the concrete in a 24 hour period shall be as follows:

	Section Size, Min. Dimension (inches)			
	12 or less	12 to 36	36 to 72	72 and greater
Max. Temp. Drop	50°F	40°F	30°F	20°F

6. INSPECTION:

   I. Assure that excavations and form work are completed, and that ice and excess water are removed from all surfaces.

   II. Check that reinforcement is secured in place and forms are thoroughly wetted or oiled.

   III. Verify that anchors and other embedded items are secured in position.

   IV. Inspection and approval shall be attained before any concrete is placed.

7. PRODUCTS:

   Concrete materials shall conform to the requirements of Section 700 of the latest version of the Colorado Department of Transportation Standard Specifications for Road and Bridge Construction, and subsequent revisions thereto.

   I. Portland Cement:

      Type II, low to moderate alkali, shall conform to CDOT 701.01 (ASTM C 150).

      Low to moderate alkali cement will not be required upon approval of submittals certifying the use of non-reactive aggregate.

   II. Blended Hydraulic Cement:

      Type IL, (MS and HS), Portland-Limestone Cement, shall conform to CDOT 701.01 (ASTM C 595).

   III. Admixtures:

      A. Air-entraining admixture shall meet CDOT section 711.02 (AASHTO M 154).

      B. Water reducing admixtures shall meet CDOT section 711.03 (AASHTO M 194).

      C. Permeability reducing admixture for hydrostatic conditions shall meet CDOT section 711.03 (AASHTO M 194) and ACI 212.3.

      D. Approved fly ash may be substituted for portland cement up to a maximum of 20 percent Class C or 30 percent Class F by weight. Fly ash shall conform to ASTM C 618. Fly ash must be a pre-approved product from a source listed on the Colorado Department of Transportation's Approved Products List.

IV. Aggregate:

A. Fine Aggregate:

Shall conform to CDOT 703.01 (AASHTO M 6).

B. Coarse Aggregate:

Shall conform to CDOT 703.02 (AASHTO M 80), except crushed hydraulic-cement concrete shall not be allowed.

Regular, CDOT Class D, concrete shall be made with ¾ inch nominal sized course aggregate.

V. Mix Proportioning:

Concrete materials shall conform to the requirements of the Section 600 of the latest version of the Colorado Department of Transportation (CDOT) Standard Specifications for Road and Bridge Construction, and subsequent revisions thereto.

Concrete shall meet all of the following:

A. Regular Concrete:

1. CDOT Class D - Except as otherwise specified, concrete shall have a 28 day compressive strength of 4,500 psi, minimum.

2. Minimum cement content: 550 to 600 pounds of cement per cubic yard.

3. Maximum water to cement ratio, including aggregate surface moisture but excluding water of absorption of aggregate: 0.44.

4. Air entrainment content: 5 to 8 percent. Air content of trowel-finished interior concrete floors shall not exceed 3.0 percent

5. Slump: The maximum slump of the delivered concrete shall be the slump of the approved concrete mix design plus 1.5 inches.

B. Patching Mixture:

The patching mixture shall be made of the same materials and of approximately the same proportions as used for the concrete, except that the coarse aggregate shall be omitted and the mortar shall consist of not more than 1 part cement to 2½ parts sand by damp, loose volume. The quantity of mixing water shall be no more than necessary for handling and placing. The patching mortar shall be mixed in advance and allowed to stand with frequent manipulation with a trowel, without addition of water, until it has reached the stiffest consistency that will permit placing.

VI. Water Quality:

Mixing water shall be clean and free of oil, acid and injurious amounts of vegetable matter, alkalies and other impurities.

VII. Joint Sealant:

The material shall be Sikaflex 1-A, Mameco weatherproofing sealant Vulkem 116 or approved equivalent. The material shall be a one-part moisture curing, gun-grade polyurethane sealant suitable for continual immersion in water of a limestone color conforming to ASTM C 920. Vulkem primer 171 or Sikaflex primer 429 shall be applied to the concrete when joint will be immersed in water.

VIII. Joint Backer: extruded closed-cell polyethylene foam by Hercules, or approved equivalent.

IX. Evaporation Retardant:

SikaFilm, "ConFilm", or approved equivalent.

X. Isolation Joint:

Isolation joint expansion filler shall be closed cell superior grade polyethylene or non-extruding PVC such as "Foamjoint" or "Conflex" available from Sweeney Materials, Inc. or approved equivalent.

Joint Spacing (feet)	10-20	20-30	30-50	50-70	70-100
Filler Thickness (inches)	½	3/8	½	¾	1

8. INSTALLATION:

I. Placing Concrete:

A. Place concrete only in the presence of the Project Manager. Remove and replace concrete placed in his absence unless otherwise accepted.

B. Convey concrete from mixer to final position by method which will prevent separation or loss of material.

C. Maximum height of concrete free fall 5 feet unless otherwise allowed.

D. Regulate rate of placement so concrete remains plastic and flows into position.

E. Deposit concrete in continuous operation until section is completed.

F. Place concrete in horizontal layers 18 inches maximum thickness.

G. Do not retemper or use set concrete.

H. Water shall not be added to concrete after test samples have been taken.

I. Prevent the discharge of wet concrete into any stream or lake.

II. Consolidating Concrete:

A. Use mechanical vibrating equipment for consolidation. Contractor is

encouraged to have a spare vibrator in case of failure.

B. Do not use vibrators to transport concrete in forms.

C. Insert vibrators vertically and quickly. Withdraw slowly to remove entrapped air pockets.

D. Vibration spacing shall be such that the radius of action overlaps that of previously vibrated concrete.

E. Special attention and effort shall be used next to hardened concrete, embedded items and corners.

F. Unreinforced slabs less then 8-inches thick do not require consolidation.

III. Repairing Formed Surfaces of New Concrete:

A. After removal of forms inspect all concrete surfaces, repair any joints, voids, stone pockets, tie holes or other defective areas before the concrete is thoroughly dry. Defective areas shall be chipped away to a depth of not less than one inch with the edges undercut to the surface. The area to be repair and a space at least 6 ins. wide entirely surrounding it shall be wetted to prevent absorption of water from the patching mortar. Do not repair any concrete in freezing weather.

B. Unexposed formed surfaces of concrete shall be repair as directed.

C. Where approved, the bonding of the patching mortar to the acceptable concrete after necessary cutting and removal of porous or otherwise unacceptable concrete is completed may be done by the use of an approved bonding agent applied in accordance with the printed directions of the manufacturer. Filling and finishing of the patch shall be completed as herein specified.

IV. Slabs On Subgrade:

Place the concrete slab over material compacted to a minimum of 95% of maximum dry density as determined by ASTM or AASHTO T 99 (Standard Proctor). Place concrete of the required thickness and strike off at the proper levels.

V. Control Joints:

Control joints shall be provided at spacing as noted on the drawings.

Floor joints shall be a maximum ¼ inch wide. Wall joints can use chamfer strips with a maximum width of ¾ inch. Depth shall be ¼ the thickness of the wall or slab.

Timing of joint creation is critical and depends on the method used. Conventional saw-cut joints should be made as soon as possible without raveling the concrete -- 4 to 12 hours after placement is common, but never more than 24-hours after placement. Soft-cut joints are normally made one to four hours after completion of finishing operations. Tooled joints should be run early in the finishing process

and repeated later to provide esthetically-pleasing joints and eliminate any possibility of groove bond.

All joints shall be filled with flexible liquid joint filler within 7 days of concrete placement. Refer to Section 07900 – Sealants and Joint Fillers for additional information.

9. CONCRETE FINISHES AND TOLERANCE:

I. General Finish:

A. Finish surfaces to conform with the following table unless otherwise noted on the drawings.

B. Formed Surfaces: System:

1. Exterior - Below Grade F1

2. Exterior - Exposed, Rough.....F2

C. Unformed Surfaces: System:

1. Top of Forms U1

2. Interior Slabs.....U2

3. Driving and Exterior Walking Surface U7

II. Formed Surfaces:

Finishes for formed surfaces shall be as designated below:

A. Finishing for F1 and F2 finishes consists of concrete repairing within 48 hours after forms are removed.

B. Finish F1: Rough formed surface with defective concrete repaired and form tie holes and other holes over ½ inch deep filled. Forms may be built with a minimum of refinement and form sheathing may be any material that will not leak mortar or yield beyond specified tolerances when the concrete is vibrated.

C. Finish F2: Smooth, formed concrete surface with all fins, projections and loose material removed, and defective concrete, form tie holes, air bubble holes, surface pits, holes from defective forms, nail head holes and similar surface defects repaired and filled. Forms in contact with concrete shall be plywood or steel.

III. Unformed Surfaces:

A. Working on unformed surfaces in various finishing operations shall be held to the minimum required to produce the desired finish. Use of any finishing tool in areas where water has accumulated will not be allowed. Work in these areas shall be delayed until the water has been absorbed, evaporated, or removed by draining, mopping, dragging off with a loop of

hose, or other means. In no case, shall cement or mixture of cement and sand be spread on the surface to absorb excess moisture or shall such materials or water be added to facilitate troweling. Joints and edges, unless specified otherwise, shall be carefully finished with edging tools.

Finishes for unformed surface shall be as designated below:

B. Finish U1: Even, uniform finish. Consolidate, level, screed, and bull-float (darby) concrete for an even, uniform surface. Concrete shall be removed immediately after consolidated by striking with a sawing motion of a straightedge or template across wood or metal strips, set as guides. When the surface is curved, use screed strips at approved intervals. For long, narrow stretches of curved surfaces such as on invert paving, a heavy slip form may be used. In the case of extensive flat paving, a paving and finishing machine is preferred. Use the bull-float or darby to fill in voids and eliminate ridges. Use magnesium or aluminum on air-entrained concrete. Bull-float immediately after screeding and before bleed water appears on the surface. Do not perform any finish operation while there is bleed water or excess water on the surface.

C. Finish U2: Steel Trowel finish. Follow treatment for U1 by steel troweling by hand, or power driven equipment. Troweling to be started after some stiffening has taken place in the surface concrete and the bleed water, excess moisture and "shine" has disappeared. Work the concrete no more than necessary to produce a surface known as "Steel Trowel Finish" that is uniform in texture and free of screed marks. Do any necessary cutting and filling during the floating operations. Use a magnesium or aluminum float on air-entrained concrete.

D. Finish U7: Drive and Exterior Walking Surface. Immediately after the concrete has been placed and consolidated, strike off the surface with a finishing machine or hand-operated screed until the required surface is obtained. The use of "jitterbugs" or similar devices is not permitted. The strike-off method and equipment shall be approved. Approval shall be withdrawn for unsatisfactory performance. The equipment shall be capable of finishing within the specified surface tolerances. Improper adjustment and operation that results in unsatisfactory consolidated and smoothness shall be corrected immediately. Unsatisfactory performance may be cause for rejection of the equipment and removal of the concrete.

Following completion of the strike-off, float the slab surface to a smooth, uniform surface using floats 10 feet or longer. Use adequate floats to remove roughness and minor irregularities left by the strike board or finishing machine and to seal the concrete surface. Excessive working of the concrete surface will not be permitted. All floats shall be used so that each transverse pass overlaps the previous pass by at least one-half the length of the float.

When hand-operated float boards are used they shall be from 12 feet to 16 feet long, ribbed and trussed as necessary to provide a rigid float, with adjustable handles at each end. The float shall be wood at least 1 inch thick and 8 inches wide. Provide adjusting screws between the float and

the rib no more than 24 inches apart. Maintain the float board free of twist and true.

Operate hand-operated float boards from transverse finishing bridges. The finishing bridges shall completely span the area being floated, and a sufficient number of finishing bridges shall be provided to permit operation of the floats without undue delay. Not less than two transverse finishing bridges shall be provided when hand-operated float boards are used. When a finishing machine is used for longitudinal floating, one finishing bridge equivalent to the transverse finishing bridge specified herein shall be furnished for use by the Project Manager.

All finishing bridges shall be of rigid construction, free of wobble and spring when used by the operators of longitudinal floats, and easily moved.

After floating is complete, but while the concrete is still plastic, test the surface of the concrete for trueness with a 10-foot straightedge. The straightedge shall be held in contact with the surface in successive positions parallel to the slab centerline and the whole area gone over from one side of the slab to the other. Advancement along the slab shall be in successive stages of not more than one-half of the length of the straightedge. Any depressions found shall be filled immediately with freshly mixed concrete, and any high areas shall be cut down. The surface shall be struck off, consolidated, and refinished. Special attention shall be given to ensure that the surface across joints fully meets the requirements for smoothness. The straightedge testing and refloating shall continue until the entire surface is found to be free from observable departures from the straightedge and the slab has the required grade and crown.

As soon as the concrete has hardened sufficiently, the surfaces shall be given a further test for trueness using a 10-foot straightedge or other specified device. Areas showing high spots of more than 1/8 inch shall be marked and immediately ground down with a diamond-faced, saw-type cutting machine, capable of cutting through mortar and aggregate without breaking or dislodging the aggregate or causing spalls, to an elevation where the area or spot will not show surface deviations in excess of 1/8 inch when tested with a 10-foot straightedge.

Provide the 10-foot straightedge and perform the straightedge testing while the Project Manager is present.

IV. Tolerances:

A. Unless otherwise required, allowable tolerances for concrete surfaces shall be in accordance with the following table. Surface irregularities are classified as either "abrupt" or "gradual".

Offsets caused by displaced or misplaced form sheathing, lining, or form section or by defective form lumber shall be considered as abrupt irregularities. All others are classed as gradual irregularities. Gradual irregularities shall be measured with a template consisting of a straight edge for plane surfaces and its equivalent for curved surfaces.

B. The length of the template for testing formed surfaces is 5 feet. The length of the template for unformed surfaces is 10 feet. Maintain a 5-foot length and 10-foot length steel template on the site.

C. Maximum allowable irregularities in concrete:

Finish Designation	Irregularity in Inches	
	Gradual	Abrupt
F1	1	½
F2	½	¼
U1 through U7	1/8	1/8

10. CURING:

I. Apply curing and sealing compound, BASF "Kure-N-Seal" or approved equivalent, to the concrete by spraying. Apply one coat for curing (apply a second coat for sealing and dustproofing). For vertical surfaces application shall be made as soon as the forms have been stripped, the surfaces have been rubbed and patched, if applicable. Store and handle the curing compound and apply in recommended surface coverages in compliance with the Manufacturer's printed instructions. Curing compound shall be a liquid membrane and meet ASTM C 309, Type I-D and applied at a rate of not greater than 200 square feet per gallon for the first coat unless otherwise approved. Coating shall be kept undamaged or repaired for 7 consecutive days.

If curing compound will interfere with any sealers, grouts or other materials to be placed on the concrete, obtain approval of another curing method from the Project Manager.

11. FOUNDATION DAMPPROOFING

I. Materials:

A. Cold Solvent Mastic:

Karnak 83, Sonneborn, Hydrocide Semi-Mastic, W.R. Meadows Semi-Mastic, or approved equal asphaltic compound reinforced with mineral fibers. Roller or spray application on dry or cured concrete foundation walls.

B. Cold Emulsion Mastic:

Karnak 220 AF, Sonneborn Hydrocide 700, W.R. Meadows Sealmastic Type 2, or approved equal asphalt emulsion compound reinforced with mineral fibers for brush, roller, or spray application on damp or green concrete foundation walls.

II. Installation:

Remove fins and loose material from surfaces, fill holes and cracks with mortar, clean all surfaces free of dirt, oil, and grease. Apply mastic in 2 coats at a minimum rate of 25 square feet per gallon each coat in strict accordance with manufacturer's printed instructions. Apply to exterior face of exterior foundation walls from outside face of footing to 2" below finish grade.

12. CONCRETE PATCHING:

Patching Mortar:

The mortar mixture shall be composed of a two component system polymer-modified Portland cement appropriate to the thickness required. The mortar shall be Sika "MonoTop 611", BASF "ALL-CRETE 5", or approved equivalent.

Sand shall be clean and graded with 100 percent passing a No. 8 standard sieve; not more than 5 percent retained on a No. 16 standard sieve; from 10 to 30 percent passing a No. 100 standard sieve; and not more than 5 percent passing a No. 200 standard sieve.

End of Section

SECTION 03600 - GROUT

1. SCOPE OF WORK:

   Furnish all labor, materials and equipment required to complete the work of the noted Sections of this Division described herein and on the drawings.

2. WORK INCLUDED:

   The work shall include, but is not necessarily limited to, the placement of nonshrink grout beneath building columns and anchor bolt installation as approved by the Project Manager.

3. INSPECTION:

   Assure that all of the items have been leveled, plumbed, centered and that all the nuts have been completely tightened.

   Inspection and approval by the Project Manager shall be obtained before the grouting begins.

4. SUBMITTALS:

   Refer to Section 01300 - Submittals, for requirements.

5. DELIVERY, STORAGE AND HANDLING:

   Deliver the material in the original unopened containers and store under cover.

6. PRODUCTS:

   I. Anchor Bolts:

      A. The two-component liquid epoxy grout shall be BASF Building Systems, or approved equal.

      B. Design Strength:

         Minimum design strength shall be determined by Professional Engineer responsible for the foundation and anchor bolt design and shall be included as part of the design submittal.

7. INSTALLATION:

   I. General:

      Non-shrink grout shall be placed between building column base plates and concrete foundations once building installation is complete. Non-shrink grout shall be placed such that is completely fills the void between baseplate and concrete foundation.

II. Preparation:

Locate all tools and materials as close as possible to the area to be grouted. All surfaces in contact with the grout shall be entirely free of oil, grease, laitance, and other foreign substances. Roughen the concrete surfaces to insure good bond of grout to the existing concrete. Clean thoroughly with liberal quantities of water, leaving the surface wet but free of excess water.

III. Mixing and Placing:

Mix the grout according to the manufacturer's recommendations.

Place the grout from one side of a base plate only, to avoid entrapping air.

IV. Protection and Curing:

Protect the placed cementitious grout from rapid drying. Spray apply a curing compound to the exposed surfaces complying with ASTM C 309, Type I, such as Master Builders MB-429 curing and sealing compound, or approved equal.

End of Section

SECTION 06100 - CARPENTRY

1. SCOPE OF WORK:

   Furnish all labor, materials and equipment required to complete the work of the noted Sections of this Division described herein and on the drawings.

2. WORK INCLUDED:

   The work shall include, but is not necessarily limited to framing and finish carpentry.

3. SUBMITTALS:

   Refer to Section 01300 - Submittals, for requirements.

4. QUALITY ASSURANCE:

   I. Product Handling:

      Store materials in such a manner as to insure proper ventilation and drainage and to protect against damage and the weather with tarpaulin.

      Keep all material clearly identified with all grade marks legible; keep all damaged material clearly identified as damaged and separately store to prevent its inadvertent use.

      Do not allow installation of damaged or otherwise noncomplying material.

      Use all means necessary to protect the installed work and materials of all other trades.

      Do such work as is necessary to cover and protect all carpentry work or materials from damage of any kind.

5. MATERIALS:

   I. General:

      All materials to be used shall be consistent with grade specified. Lumber shall be protected from weather until actually used. All lumber shall be of a quality equal to or superior to the minimum required for the specified grade.

   II. Standards:

      A. General:

         All pieces shall bear the official manufacturer's association grade mark. For rough sawn lumber, lot grading certifications are acceptable. All lumber for finish millwork, trim, etc., to be properly kiln-dried to a maximum of seven (7) percent moisture content. For rough sawn lumber greater than two inches thick, "S-Grn" accepted. For 2 inch thick rough sawn and S4S lumber, the

moisture content shall be a maximum of nineteen (19) percent, (S-Dry) unless otherwise noted.

B. Western Wood Products Association (WWPA)

C. Standard Grading Rules, California Redwood Association (CRA)

D. Standard Grading Rules and the American Plywood Association (APA)

III. Wood Types:

A. Structural Framing:

Structural framing includes studs, posts, beams, joists, purlins, rafters, etc.

B. General Framing:

1. Stud Wall Framing (2" to 4" thick, 2" to 4" wide)
   Douglas Fir-Larch @24" O.C.
   Grade: #2 or better
   F_b = 900 psi
   F_c = 1350 psi

2. Structural Light Framing (2" to 4" thick, 2" to 4" wide)
   Douglas Fir-Larch
   Grade: No. 2 or better
   F_b = 900 psi
   F_c = 1350 psi

3. Structural Joists and Planks (2" to 4" thick, 5" and wider)
   Douglas Fir-Larch or Hem-Fir
   Grade No. 2 or better
   F_b = 850 psi

4. Trusses, Top and Bottom Chords
   Douglas Fir - Larch
   MSR 1650f

C. Exposed to Moisture:

1. Structural Light Framing, (2" to 4" thick, 2" to 4" wide)
   Redwood, Heart Structural
   Construction Grade
   F_b = 825 psi

2. Structural Joists and Planks, (2" to 4" thick, 5" and wider)
   Redwood, Heart Structural
   Construction Grade
   F_b = 825 psi

D. General Purpose Boards:

Common boards shall be WWPA, all species, (1" and thicker), Grade 3 Common or better.

E. Oriented Strand Board (OSB):

Shall be "inner-seal OSB" sheathing as manufactured by Louisiana-Pacific, or approved equivalent. The sheathing shall be back stamped with American Plywood Association Performance Rating Standard PRP108 or HUD/FHA Material Release 1060 Structural Requirements. Structural 1 rated sheathing shall conform to National Evaluation Report NERQA397. Installation shall conform to the manufacturer's instructions and to A.P.A. procedures.

F. Trim and Mouldings:

Western Woods producers. Finger-jointed (painted trim applications).

IV. Preservative Pressure Treatment:

All pressure treatment shall be in accordance with American Wood Preservers' Association (AWPA) Standards, unless otherwise noted.

Ammoniacal Copper Quat (AQC), Copper Boron Azole (CBA), Copper Azole (CA-B) are allowed. Preservative products shall be applied according to AWPA standards for the selected use.

"Wolman" salts CCA (chromated copper arsenate, Type C) are allowed where AWPA allows their use. CCA shall not be used in residential applications.

A. No earthen or fresh water contact: 0.25 lb./cu. ft. (ACQ & CCA)
0.20 lb./cu. Ft. (CBA)
0.10 lb./cu. Ft. (CA-B)

B. In contact with earth and/or fresh water: 0.40 lb./cu. ft. (ACQ & CCA).
0.41 lb./cu. Ft. (CBA)
0.21 lb./cu. Ft. (CA-B)

6. TRUSSES:

Design shall be for the loading indicated in the project drawings. All trusses shall be stamped to identify the fabricator. The gusset plates shall be 20 gauge minimum and galvanized.

Shop drawings and engineering design shall be submitted for approval prior to fabrication. Lateral bracing shall be reviewed for the conditions shown on the drawings. Drawings shall be stamped by a registered professional engineer.

7. TEMPORARY BRACING:

Provide and maintain all temporary bracing for door frames. Furnish and maintain all necessary scaffolding, ladders, etc.

8. METAL FRAMING CONNECTORS:

Metal framing connectors shall be furnished and installed where specified or as necessary for completion of work to anchor carpentry and millwork to adjoining construction.

I. Products:

Structural framing connectors shall be by Simpson Strong-Tie., or approved equivalent.

Install in accordance with the manufacturer's recommendations.

Connectors used with treated wood shall be hot dipped galvanized according to ASTM A653, A123 or A153. Simpson Strong-Tie "ZMAX" or "HDG" or approved equivalent. Stainless steel is also acceptable. Do not use galvanized materials with stainless steel materials.

II. Fasteners:

Fasteners shall be provided and of the type recommended by the manufacturer,

A. Column cap and base bolts, complying with ASTM A 307 for bolt and nut materials. All hardware shall be galvanized or plated with another acceptable corrosion resistant material.

B. Nails shall have a corrosion resistant coating.

C. Fasteners for treated lumber shall be hot dipped galvanized, ASTM 153, or stainless steel, Type 316L. Electro-platted fasteners shall not be used. Use only hot dipped galvanized or stainless steel connectors and fasteners. Do not use hot dipped galvanized with stainless steel.

9. WORKMANSHIP AND INSTALLATION:

Woodwork shall be properly framed, closely fitted and accurately set to required lines and levels and shall be rigidly secured in place. Panels shall be set loose and so secured as to prevent checks and warps.

Caulk the perimeter of moldings.

No carpentry work shall be covered until inspection has been made.

10. EXECUTION:

I. Selection of Lumber Pieces:

A. Carefully select all members; select individual pieces so that knots and obvious defects will not interfere with placing bolts or proper nailing or making proper connections.

B. Cut out and discard all defects which will render a piece unable to serve its intended function, lumber may be rejected whether or not it has been

installed, for excessive warp, twist, bow, crook, mildew, fungus, or mold, as well as for improper cutting and fitting.

II. General Framing:

A. At a minimum all framing shall be done in accordance with the 2015 International Building Code.

B. Top plates shall be doubled on all stud walls.

C. Cripples under headers shall be continuous to sill plate.

D. Block all stud walls as required for sheathing.

E. Beams, girders, and joists supporting bearing walls or other concentrated loads, shall not be notched. Joists, except as above, may be notched no deeper than ¼ the depth, at top edge only, provided such notch is located within $^1/_8$ to ¼ of span from face of support. Sawcuts for notches shall not overrun depth of notch. Holes in joists, beams and girders shall not be larger in diameter than 1/10 the depth of member and shall be located within center half of the span. All holes shall be centered within depth of member. Holes and notches in studs shall be located within 1/3 of height from either top or bottom but no closer than 3″ form plates. Holes and notches in studs shall not exceed 1″ in diameter or depth. Studs in exterior walls shall not be notched.

F. Joists, rafters, and decking shall not be cut and headed or displaced to provide for openings in roofs or floors, except as detailed on drawings.

G. Install all horizontal members with crown up.

H. All members in bearing shall be accurately cut and aligned so that full bearing is provided without use of shims. Bearing posts shall have full blocking or support under.

I. All rafters shall be notched for full bearing at all supports.

J. All joists shall have a minimum of 1½″ bearing on wood or metal supports. Lapping joints shall have 6″ laps centered over interior supports.

K. Stud wall foundation sill plates shall be bolted to concrete with anchor bolts of size and minimum spacing as shown on drawings. At least two bolts shall be provided for each piece with one bolt within 12″ of each end.

L. All wall sheathing shall be applied as follows: Center vertical joints over studs and center horizontal joints over 2″ blocking or plate. nail top of panels to double top plate, and nail bottom of panels to anchored sill plate.

M. Roof sheathing: Install with face grain at right angles to supports, continuous over two (2) or more spans. Allow minimum space 1/16-inch between end joints and $^1/_8$ inch at edge joints for expansion and

contraction of panels.

III. Fasteners:

A. General:

All structural timber connections using bolts, lag screws, nails, spikes and wood screws shall have a pilot hole bored into the timber joint prior to the connector insertion in accordance with the National Design Specification for Wood Construction. Nails and spikes may not be pre-bored unless the integrity of the joint is not damaged in any way. All fasteners exposed to weather shall be noncorrosive.

B. Nailing:

1. Rough Framing: Use only common nails or spikes as required to properly fasten members. Avoid nailing into end grain of wood and use toe nailing whenever possible.

2. Treated Lumber: All fasteners used with Treated Lumber shall be hot dipped galvanized.

3. Wood Stops and Trim: Nail with appropriate size non-corrosive finish nails.

4. OSB: Use only non-corrosive coated common nails to properly fasten panels. Nail 6 inches o.c. along panel edges and 12 inches at the intermediate supports, except that when supports are spaced at 48 inches o.c. or more, space nails 6 inches o.c. at all supports.

C. Bolts:

Bolts shall be ASTM A 307. Bolt threads must not bear on wood; use washer under head and nut where both bear on wood; use washers under all nuts. All bolts and associated hardware shall be galvanized.

D. Screws:

Lag screws shall be ASTM A 307 and wood screws shall be of sufficient strength to cause failure in the wood rather than in the screw. Screw, do not drive, all lag screw and wood screws.

IV. Powder Actuated Fasteners:

For masonry or concrete, powder actuated fasteners shall be Ramset or approved equivalent.

End of Section

SECTION 06600 – PVC WALL AND CEILING PANELING

1. SCOPE OF WORK:

Furnish all labor, materials and equipment required to complete the work of the noted Sections of this Division described herein and on the drawings.

2. WORK INCLUDED:

The work shall include, but is not necessarily limited to, the furnishing and installation of PVC paneling within selected areas.

3. SUBMITTALS:

Refer to Section 01300 - Submittals, for requirements.

4. REFERENCES:

I. American Society for Testing and Materials: Standard Specifications (ASTM)

II. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

III. ASTM D4226 – Standard Test Method for Impact Resistance.

IV. ASTM G21 – Standard Test Method Standard Practice for Determining Resistance of Synthetic Polymetric Materials to Fungi.

5. GENERAL PROVISIONS:

I. Product Delivery and Storage:

A. Deliver materials to the project site in manufacturer's original, unopened containers with labels indicating brand names, colors and patterns, and quality designations legible and intact.

B. Do not open containers or remove markings until materials are inspected and accepted.

C. Store and protect accepted materials in accordance with manufacturer's directions and recommendations.

D. Store wall and ceiling panels flat.

II. Environmental Requirements:

A. Installing Wall and Ceiling Panels:

1. Cold Temperatures: When installing wall and ceiling panels in temperatures below 40 degrees F, warm to a minimum of 60 degrees F overnight and leave space between panels to allow for expansion in

accordance with manufacturer's instructions.

2. Warm Temperatures: When installing wall and ceiling panels in temperatures above 70 degrees F, warm panels to a minimum of 60 degrees F in accordance with manufacturer's instructions.

B. Cutting Wall and Ceiling Panels:

1. Cold Temperatures: Before field-cutting wall and ceiling panels in temperatures below 40 degrees F, warm panels to a minimum of 60 degrees F overnight.

6. PRODUCTS:

I. PVC Wall and Ceiling Panels:

A. PVC tongue-and-groove, rib-reinforced wall and ceiling panels with nailing fins shall be DURAMAX Building Products, “Wall and Ceiling Panel” or approved equivalent.

B. Material: 100 percent virgin, exterior-grade PVC. Nonporous, waterproof and corosion proof.

C. Width: 16 inches.

D. Thickness: 1/2 inch.

E. Weight 0.95 pound per square foot.

F. Surface Burning Characteristics, ASTM E 84:

1. Flame Spread Index: 10.

2. Smoke Developed Index: 400.

G. Color: White, glossy finish.

H. Acceptance: FDA (U.S. Food and Drug Administration) & USDA.

II. Trim:

A. 100 percent virgin, exterior-grade PVC. Color to match wall and ceiling panels.

B. Trim shall be applied around the perimeter of the area receiving PVC paneling.

III. Acessories:

A. Provide all necessary accessories (i.e. sealants, fasteners, etc.) for the complete installation of the FRP system in accordance with the manufacturer’s recommendations.

B. Construction Adhesive: PL400 or Liquid Nails, as recommended by wall and ceiling panel manufacturer.

C. Fastening into Wood: Stainless steel,1 to 1-1/2-inch, No.10 pancake-head metal screws. Staples are not permitted.

7. EXECUTION:

I. Inspection of Surfaces:

A. Examine the substrate for unevenness which would prevent proper execution and impair the quality of the panel installation.

B. Do not proceed with the panel installation until the defects have been corrected except where correction is indicated under Preparation in this Section.

II. Preparation:

A. Prepare wall and ceiling panels for installation in accordance with manufacturer's instructions.

B. Remove dirt, oil, grease, or other foreign matter from surfaces to receive FRP covering materials.

III. Installation:

A. Install wall and ceiling panels in accordance with manufacturer's instructions at locations indicated on the Drawings.

B. Install wall and ceiling panels plumb, level, square, flat, and in proper alignment.

C. Install trim in accordance with manufacturer's instructions.

D. Ceiling Panels: Anchor ceiling panels with fasteners in accordance with manufacturer's instructions.

E. Wall Panels: Anchor wall panels with construction adhesive and fasteners in accordance with manufacturer's instructions.

F. Fasteners:

1. Install fasteners 16 inches to 24 inches on center into nailing fins.

2. Keep top of screw head 1/16 inch above top of nailing fins, allowing panels to move slightly.

3. Do not recess screw heads into nailing fins.

4. Ensure nailing fins lay flat against surface, not deformed around screw heads.

5. Ensure fasteners are not exposed.

G. Cutting Wall and Ceiling Panels:

1. Field-cut panels as necessary in accordance with manufacturer's instructions.

2. Ensure cuts are straight, square, and do not damage panels.

3. Apply joint sealants as specificed in Section 07900.

IV. Adjusting:

A. Repair minor damages to finish in accordance with manufacturer's instructions and as approved by the Project Manager.

B. Remove and replace damaged wall and ceiling panels in accordance with manufacturer's instructions.

V. Cleaning:

A. Upon completion of the installation of floor covering, adjacent work, and after materials have set, clean surfaces with a neutral cleaner as recommended by the manufacturer for the type of floor covering material installed.

B. Do not use harsh cleaning materials or methods that could damage finish.

C. Protect installed wall and ceiling panels from damage during construction.

End of Section

SECTION 07200 - INSULATION

1. SCOPE OF WORK:

   Furnish all labor, materials and equipment required to complete the work of the noted Sections of this Division described herein and on the drawings.

2. WORK INCLUDED:

   The work shall include, but is not necessarily limited to furnishing, installation and application of insulation materials.

3. SUBMITTALS:

   Refer to Section 01300 - Submittals, for requirements.

4. PRODUCT DELIVERY, STORAGE AND HANDLING:

   I. Delivery:

      Deliver material to the site in unopened packages, with identification labels intact. Identify contents, manufacturer, brand name, thermal values and applicable standards. Use all means necessary to protect insulation before, during, and after installation and to protect the installed work and materials of all other trades.

   II. Storage:

      Insulation must be stored under water resistant cover, protected from weather and direct sunlight or sparks and stacked on pallets. Material not stored in this manner will be immediately removed from job site at the Contractor's expense and not used.

5. QUALITY CONTROL:

   All work of this Section shall be done in accordance with manufacturer’s recommendations and in such a manner as to avoid gaps or voids at the insulation plane.

6. PRODUCTS:

   I. Fiberglass Wool (Overhead Spaces):

      Provide a fiberglass type of insulation, complying with Federal Specification (FS) HH-I-1030, Type I, Class B for pneumatically placed installations. Material shall be Owens-Corning "Therma-Cube", Johns-Manville blowing wool or approved equivalent.

   II. Fibrous Insulation (Walls):

      Provide fibrous glass insulation batts complying with ASTM C 665, Type II, Class C, (Kraft-faced), "Flexible Fibrous Glass Insulation", by Owens Corning, Johns-Manville, Certainteed, or approved equivalent. Thermal resistance shall be of the thickness or R-value shown on the drawings.

III. Closed-Cell Polyiso Insulation Board (Foundations):

Material shall be SIKA "RMAX Pro Select R-Matte Plus-3" polyisocyanurate (polyiso) foam insulation board or approved equivalent meeting ASTM C1289 Type I with a compressive strength of 20 psi.

Material shall be fastened with DOW "GREAT STUFF PRO" FOR WALL APPLICATIONS as specified below, or shall be mechanically fastened as per the manufacturer's recommendation.

7. INSPECTION:

I. Before Installation:

Assure that surfaces to receive insulation are uniform and free of debris, mortar sags and smears, grease, oil or other contaminants detrimental to the installation.

II. During Installation:

Verify that materials are undamaged when installed.

Examine areas to receive insulation to insure protection against inclement weather and other hazards until work of preceding trades is completed.

Examine space for insulation for proper depth to receive material.

Check that insulation is closely fitted around obstructions and openings.

8. EXECUTION:

I. Loose Fill Insulation:

Drill installation holes of the size and spacing required by the product manufacturer.

As the fiberglass wool is blown into all the required wall areas, allow the insulation to assume its natural density.

I. Fibrous Insulation:

Fit the insulation batts snugly between framing members per the manufacturer's specification.

Maintain integrity of insulation over entire area to be insulated.

Insulate small areas between closely spaced framing members.

Carefully cut and fit insulation around pipes, conduits and other obstructions.

Do not install insulation on top of or within 3 inches of recessed light fixtures, unless the fixtures are approved for such use.

II. Closed-Cell Polyiso Insulation Board:

1. Do not install foam insulation on concrete building surfaces with a cementitious adhesive when out-door temperatures are 32°F or below.

2. Fins and projections left after removal of concrete forms shall be removed to provide an even surface.

3. Waxes, oily films and other residue left on poured concrete surfaces from form release agents must be removed.

9. CLEANUP:

I. Remove adhesive splatters and smears.

II. Remove and dispose of excess materials, litter, and debris; leaving work areas in a clean condition.

End of Section

SECTION 07250 – WEATHER BARRIER

1. SCOPE OF WORK:

Furnish all labor, materials and equipment required to complete the work of the noted Sections of this Division described herein and on the drawings.

2. WORK INCLUDED:

The work shall include, but is not necessarily limited to furnishing, installation and application of weather barrier membrane, seam tape, flashing and fasteners.

3. SUBMITTALS:

Refer to Section 01300 - Submittals, for requirements.

4. PRODUCT DELIVERY, STORAGE AND HANDLING:

I. Delivery:

Deliver material to the site in unopened packages, with identification labels intact. Identify contents, manufacturer, brand name and applicable standards. Use all means necessary to protect weather barrier before, during, and after installation and to protect the installed work and materials of all other trades.

II. Storage:

Store weather barrier materials as recommended by system manufacturer.

5. QUALITY CONTROL:

All work of this Section shall be done in accordance with manufacturer's recommendations and in such a manner as to avoid gaps or voids.

6. MATERIALS:

I. Weather Barrier Membrane:

A. Air Penetration: <.004 cfm/ft^2 at 1.57 psf, when tested in accordance with ASTM E2178. Type I per ASTM E1677.

B. Water Vapor Transmission: 56 perms, when tested in accordance with ASTM E96-05, Method A.

C. Water Penetration Resistance: 250 cm when tested in accordance with AATCC Test Method 127.

D. Basis Weight: 1.8 oz/yd^2, when tested in accordance with TAPPI Test Method T-410.

E. Air Resistance: 1200 seconds, when tested in accordance with TAPPI Test

Method T-460.

F. Tensile Strength: 30/30 lbs/in., when tested in accordance with ASTM D882.

G. Tear Resistance: 8/6 lbs, when tested in accordance with ASTM D1117.

H. Surface Burning Characteristics: Class A, when tested in accordance with ASTM E84. Flame Spread: 15, Smoke Developed: 15.

II. Fasteners:

DuPont™ Tyvek® Wrap Cap staples as manufactured by DuPont Building Innovations. (Cap staples are only recommended for residential construction).

III. Sealants:

Refer to Section 07900 – SEALANTS AND JOINT FILLERS, Section 5.III.

IV. Adhesive:

Provide Liquid Nails "LN-910" adhesive or as recommended by the weather barrier manufacturer.

V. Flashing:

Provide DuPont "FlexWrap," as manufactured by DuPont Building Innovations or approved equivalent.

7. INSPECTION:

I. Before Installation:

Assure that surfaces to receive weather barrier are in accordance with the manufacturers recommended tolerances prior to installation of weather barrier and accessories.

II. During Installation:

Verify that materials are undamaged when installed.

Examine areas to receive insulation to insure protection against inclement weather and other hazards until work of preceding trades is completed.

Examine space for insulation for proper depth to receive material.

Check that insulation is closely fitted around obstructions and openings.

8. EXECUTION:

I. Install weather barrier over exterior face of exterior wall substrate in accordance

with manufacturer recommendations.

II. Start weather barrier installation at a building corner, leaving 6-12 inches of weather barrier extended beyond corner to overlap.

III. Install weather barrier in a horizontal manner starting at the lower portion of the wall surface. Maintain weather barrier plumb and level.

IV. Extend bottom roll edge over sill plate interface 2" to 3" minimum. Seal weather barrier with sealant or tape. Shingle weather barrier over back edge of thru-wall flashings and seal weather barrier with sealant or tape. Ensure weeps are not blocked.

V. Subsequent layers shall overlap lower layers a minimum of 6 inches horizontally in a shingling manner.

Window and Door Openings: Extend weather barrier completely over openings.

VI. Weather Barrier Attachment: Attach weather barrier to studs through exterior sheathing. Secure using weather barrier manufacturer recommended fasteners, spaced 12 -18 inches vertically on center along stud line, and 24 inch on center, maximum horizontally.

VII. Seaming:

A. Seal seams of weather barrier with seam tape at all vertical and horizontal overlapping seams.

B. Seal any tears or cuts as recommended by weather barrier manufacturer.

VIII. Opening Preparation:

A. Cut weather barrier membrane in a modified "I-cut" pattern.

B. Cut weather barrier horizontally along the bottom of the header.

C. Cut weather barrier vertically 2/3 of the way down from top center of window opening.

D. Cut weather barrier diagonally from bottom of center vertical cut to the left and right corners of the opening.

E. Fold side and bottom weather barrier flaps into window opening and fasten.

F. Cut a head flap at 45-degree angle in the weather barrier membrane at window head to expose 8 inches of sheathing. Temporarily secure weather barrier membrane flap away from sheathing with tape.

IX. Flashing:

A. Cut 7-inch wide flashing a minimum of 12 inches longer than width of sill

rough opening. Apply primer as recommended by the manufacturer.

B. Cover horizontal sill by aligning flashing edge with inside edge of sill. Adhere to rough opening across sill and up jambs a minimum of 6 inches. Secure flashing tightly into corners by working in along the sill before adhering up the jambs.

C. Fan flashing at bottom corners onto face of wall. Firmly press in place. Mechanically fasten fanned edges.

D. On exterior, apply continuous bead of sealant to wall or backside of window mounting flange across jambs and head. Do not apply sealant across sill.

E. Install window according to manufacturer's instructions.

F. Apply 4-inch wide strips of flashing at jambs overlapping entire mounting flange. Extend jamb flashing 1-inch above top of rough opening and below bottom edge of sill flashing.

G. Apply 4-inch wide strip of flashing as head flashing overlapping the mounting flange. Head flashing should extend beyond outside edges of both jamb flashings.

H. Position weather barrier head flap across head flashing. Adhere using 4-inch wide flashing over the 45-degree seams.

I. Tape head flap in accordance with manufacturer recommendations.

J. On interior, install backer rod in joint between frame of window and flashed rough framing. Apply sealant around entire window to create air seal. Apply sealant in accordance with sealant manufacturer's instructions and ASTM C1193.

9. CLEANUP:

Remove and dispose of excess materials, litter, and debris; leaving work areas in a clean condition.

End of Section

SECTION 07410 - METAL ROOFING AND SIDING

1. SCOPE OF WORK:

   Furnish all labor, materials and equipment required to complete the work of the noted Sections of this Division described herein and on the drawings.

2. WORK INCLUDED:

   The work shall include, but is not necessarily limited to, furnishing, fabrication and erection of steel metal siding and roofing from a manufacturer's prefabricated component parts.

3. SUBMITTALS:

   Refer to Section 01300 - Submittals, for requirements.

4. QUALITY ASSURANCE:

   I. Acceptable Manufacturers:

      A. Architectural Roofing and Siding:

         Metal Sales, “R-panel” or “PBR-Panel” or approved equivalent.

   II. Erector Qualifications: Minimum of 5 years experience on comparable projects.

   III. Compliance with Standard and Industry Specifications: Any material or operation specified by reference to the published specifications of a manufacturer, The American Society for Testing and Materials (ASTM), The American Iron and Steel Institute (AISI), The American Institute of Steel Construction (AISC), The American Hot Dip Galvanizers Association (AHDGA), The American Welding Society (AWS), The Metal Building Manufacturers Association (MBMA), the Steel Deck Institute (SDI) or other published standard shall comply with the requirements of the current specifications of standard listed. In case of conflict between the referenced specification and the project specifications, the project specifications shall govern unless written approval is obtained from the Engineer.

5. PRODUCT DELIVERY, STORAGE AND HANDLING:

   I. Do not bend or mar roof and siding panels.

   II. Store off ground with one end elevated for drainage.

   III. Cover materials with waterproof material.

6. PRODUCTS:

   Architectural Roofing and Siding:

   A. Painted materials shall be 26 gauge steel unless noted otherwise in the Drawings. Materials shall conform to ASTM A792 (50,000 psi minimum yield).

B. Standard paint system shall be a siliconized polyester meeting the following specifications:

1. The primer coat shall be pigmented with corrosion inhibiting pigments. It shall have a dry film thickness of .20 mils on both sides of the sheet.

2. The exterior finish coats shall have a dry film thickness of .80 mils over the primer.

3. Colors shall be selected from manufacturer's standard color chart.

4. Exterior finish shall have a 20 year written warranty.

C. Fasteners:

1. For fastening into wood structure use wood screws with neoprene washers, of the size and length recommended by the metal siding manufacturer. Screw heads and washers shall be painted to match the color of the siding or roofing.

2. For fastening into steel structures, use self-drilling tek screws with neoprene washers of the size and length recommended by the panel manufacturer. Screw heads and washers shall be painted to match the color of the siding or roofing.

3. Provide stitching screws for lapping the ribs in between the purlins.

D. Formed Closures Strips:

1. Material: Closed cell, laminated, semi-rigid, cross-linked, polyethylene foam.

2. Size and shape shall match panel configuration.

E. Trim and Accessories:

Trim items and accessories shall be per manufacturer's standards.

F. Sealants and Sealant Tape:

Sealants and sealant tape shall be as recommended by panel manufacturer.

7. EXECUTION:

I. Inspection:

A. Check that supporting structural elements have been completed.

B. Check supporting members for correct layout and alignment.

C. Correct noted deficiencies before beginning installation and erection.

II. Erection and Installation:

A. Install roof and wall panels and accessories in accordance with manufacturer's recommendations and shop drawings.

B. Placing Roofing and Siding Panels:

1. Panels should be started vertically at the end of the building, opposite from the direction of the prevailing wind.

2. Position panels on supporting framework and adjust to final position with ends bearing on supporting members and accurately aligned end to end before permanently fastened.

3. End laps shall be of the length recommended by panel manufacturer. No end lap should be less than 6".

4. Do not stretch or contract the side lap interlocks.

5. Place panel units flat and square, and secure to adjacent framing without warp or deflection.

C. Attaching and Fastening:

Architectural Roofing and Siding:

Secure roofing and siding panel units to supporting members with screws, and other fastenings. Place screw fasteners in the flat area of the sheet at 9 inches on center. Do not overdrive so as to dimple or distort. Use stitching screws on the lapping ribs in between the purlins at 9 inches on center.

D. Joint Sealing:

1. Remove dust, dirt, and moisture from joint surfaces.

2. Apply sealant in accordance with manufacturer's instructions.

E. Cutting and Fitting:

1. Cut and fit panel units and trim accessories as required.

2. Make cuts neat, square and trim.

F. Cover Plates and Mouldings:

Install sheet metal cover plates and mouldings at all open uncovered ends, edges of roof decking and in voids between decking and other construction.

G. Touch-Up Painting:

1. Wire brush, clean, and paint scarred areas, and rust spots on surfaces

of panel units.

2. Touch-up galvanized surfaces with galvanizing repair paint applied in accordance with manufacturer's instructions.

3. Touch-up paint to match existing paint in exposed areas.

8. CLEANUP:

Upon completion of the installation of the roof and related items, the site shall be cleaned of all roofing materials and debris and disposed of off State property.

End of Section

SECTION 07620 - FLASHING

1. SCOPE OF WORK:

   Furnish all labor, materials and equipment required to complete the work of the noted Sections of this Division described herein and on the drawings.

2. WORK INCLUDED:

   The work shall include, but is not necessarily limited to, flashings and flashing cement to provide a weather-tight installation.

3. SUBMITTALS:

   Refer to Section 01300 - Submittals, for requirements.

4. MATERIALS AND INSTALLATION:

   I. Sheet Metal Flashing and Counter Flashing:

      A. Strip Flashing: The galvanized steel sheeting shall be Armco, "Zinc Grip", or approved equivalent complying with ASTM A 526, commercial quality.

         All fabrication shall be strong, rigid and neat in appearance.

         Moulded surface, crickets, curbs, etc., shall be clean cut, straight and true. Mitered corners shall be well formed, neat and in true alignment.

         Plain surfaces shall be free of warping and buckles.

         All sheet metal shall be formed with a sheet metal break press or roll formed to configurations as shown on the drawings, or as approved on shop drawings.

      B. Gauge: Flashings for base course, vertical and horizontal surfaces and edge strips shall be 26 gauge minimum. Flashings for roof edges, ridges, hips, roof penetrations, crickets, and valleys shall be 24 gauge minimum.

         All sheet metal work shall be (24) gauge minimum.

      C. Fasteners:

         Screws, drive pins, or expansion type anchors shall be subject to approval by the Engineer and shall be submitted as a part of the shop drawing package. Samples may be requested.

      D. Flashing Cement: Cement shall be of premium quality complying with ASTM D 2822 (asphaltic cement) by Celotex, Flintkote, G.A.F., Johns-Manville or approved equivalent.

      E. Screws: Shall be self-tapping binder head type and are to be concealed wherever possible (all non-corrosive coatings).

II. Prefabricated Reglet and Counter Flashing:

Reglet and Counter Flashing:

Surface mounted prefabricated reglet and counter flashing system shall be Fry Reglet Corporation, "Type SM" or approved equivalent. The reglet and flashing shall be end lapped as per manufacturer's recommendations. Reglet is factory punched with slots at 16″ o.c.

Fasteners shall be of the type recommended by the manufacturer for the application. Damage caused by fastener on setting or by any other construction activity shall be repaired at the contractor's expense.

5. CLEANUP:

Upon completion of the flashing installation, the site shall be cleaned of all construction materials, nails and other related debris and disposed of off state property.

End of Section

SECTION 07900 - SEALANTS AND JOINT FILLERS

1. SCOPE OF WORK:

   Furnish all labor, materials and equipment required to complete the work of the noted Sections of this Division described herein and on the drawings.

2. WORK INCLUDED:

   The work shall include, but is not necessarily limited to furnishing, installation and application of construction sealants and joint fillers.

3. SUBMITTALS:

   Refer to Section 01300 - Submittals, for requirements.

4. GENERAL:

   The color shall closely match that of the material being caulked where it is not to be painted. Seal around all wall, ceiling and roof penetrations.

5. MATERIALS:

   I. Water Repellent Sealer:

      Thin coat, liquid applied, hydrophobic, water-repellent clear sealer consisting of an aqueous emulsion designed for use on concrete substrates with 0.5% maximum water absorption with 48 hrs exposure as tested in accordance with ASTM C642; Ghostshield Lithi-Tek® 9500 as manufactured by KreteTek Industries, Inc. or approved equivalent.

   II. Concrete Construction Joints:

      Provide self-leveling, 1-part polyurethane sealant such as Sika “Sikaflex-1c SL” or approved equal.

   III. Silicone Caulking (Waterproofing):

      Provide a waterproof silicone caulking General Electric "Silicone II Gutter and Flashing Caulk” or approved equal. The material shall meet ASTM C 920.

   IV. Acrylic Latex:

      Provide an acrylic latex caulk Pecora AC-20 or approved equal for general purpose interior and exterior applications where slight to moderate movement may be expected. The caulk shall be suitable for latex paint and meet ASTM C 834.

6. INSTALLATION:

   The surfaces receiving the sealant (joint filler) shall be thoroughly cleaned before the application of the sealant.

For control joints concrete shall have cured a minimum of 14 days prior to application. All joints shall be clean using compressed air and no water shall remain in the joint prior to application.

Apply the sealant with a caulking gun or air pressure equipment. There shall be no voids throughout the entire joint cross section. Remove the excess sealant from the surfaces and clean off all smears and streaks before the material sets.

End of Section

SECTION 08100 - METAL DOORS AND FRAMES

1. SCOPE OF WORK:

   Furnish all labor, materials and equipment required to complete the work of the noted Sections of this Division described herein and on the drawings.

2. WORK INCLUDED:

   The work shall include, but is not necessarily limited to the furnishing and installation of flush metal doors and metal door frame for the building.

3. SUBMITTALS:

   Refer to Section 01300 - Submittals, for requirements.

4. FLUSH METAL DOORS AND FRAMES:

   I. Materials:

      Framing members, adapters and mountings shall be steel. All screws, miscellaneous fastening devices and internal components shall be corrosion-resistant materials of sufficient strength to perform the functions for which they are used.

      The door shall be reinforced, stiffened, sound-deadened and insulated with a polyurethane or kraft honeycomb core completely filling the inside.

   II. Manufacturer:

      Shall be Steelcraft, Model F-16 (16 gauge) steel frames or approved equal and Model L-18 (18 gauge), galvanealed, 1-¾" flush exterior steel door (Doors to exterior shall have polyurethane insulation).

      The door frame shall have unitized weather stripping of synthetic rubber.

   III. Steel Frame Performance Under Uniform Loading:

      When tested in accordance with ASTM E 330, the maximum deflection of the head member shall not exceed 1/175 of its span and when the load is removed, there shall be no evidence of permanent deformation or damage when tested under a load of 30 psf.

   IV. Hardware:

      Provide and install hardware and accessories as specified in the Drawings. Alternative products may be approved by the Project Manager.

A. Installation:

Installation shall be in compliance with manufacturer's instructions to insure proper operation. Center line of door pulls shall be installed 3'-2" above finished floor.

B. Protection:

Trim plates and door stops shall not be installed until after painting is completed. Other hardware shall be loosened prior to painting and retightened after painting is completed. All hardware shall be masked or otherwise protected during painting operations.

V. Finish:

Shall be painted. All exposed framing members shall be free of scratches and other surface blemishes. Submit paint color and product for approval by Project Manager. All door frames shall be trimmed using metal trim (provided by building manufacturer) on exterior.

VI. Erection:

The door shall be set in its correct locations as shown in details and shall be level, square, plumb and at proper elevations and in alignment with other work.

All joints shall be tightly caulked in order to ensure a watertight job. All materials shall be screwed in placed using backfilling, masonry plugs, or anchor straps as required. When frame members are joined, they shall be accurately cut and fitted to result in a tightly closed joint.

After erection adequately protect exposed portions of framing from damage by plaster, lime, acid, cement, or other harmful compounds.

VII. Cleaning:

Remove protective materials and clean with plain water, or water with soap or household detergent. The area shall be cleaned of all debris and left in an acceptable condition as determined by the Project Manager.

End of Section

SECTION 08530 - VINYL (PVC) WINDOWS

1. SCOPE OF WORK

Furnish all labor, materials and equipment required to complete the work of the noted Divisions of this Section described herein and on the drawings.

2. WORK INCLUDED

This item shall include all work and materials necessary for the installation of vinyl windows in accordance with the building manufacturer's standard details and those details contained within this design package. The work shall include but is not necessarily limited to the following: furnishing and installing of new framed vinyl windows, screens, sealants, fasteners, blocking, interior trim and painting.

3. CODES, REGULATIONS, STANDARDS AND PERMITS:

I. AAMA 101/I.S.2/A440 - North American Fenestration Standard/Specification for windows, doors, and skylights

II. NFRC 100 - Thermal Properties; National Fenestration Rating Council.

III. NFRC 200 - Solar Heat Gain; National Fenestration Rating Council.

IV. ASTM D 3656 - Standard Specification for Insect Screening and Louver Cloth Woven from Vinyl-Coated Glass Fiber Yarn.

V. ASTM D 3678 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Interior Profile Extrusions.

VI. ASTM D 4028 - Standard Specification for Solar Screening Woven from Vinyl-Coated Fiber Glass Yarn.

VII. ASTM E 774 - Standard Specification for Sealed Insulating Glass.

VIII. IGCC - Classification of Insulating Glass Units; Insulated Glass Certification Council.

IX. U.S. Department of Energy - Energy Star Windows Program.

4. SUBMITTALS:

Refer to Section 01300 - Submittals, for requirements.

5. DELIVERY, STORAGE AND HANDLING:

I. Deliver windows to project site in undamaged condition; handle windows to prevent damage to components and to finishes.

II. Store windows out of contact with ground; protect windows from weather and construction traffic in well-ventilated area.

6. WARRANTY:

Furnish manufacturer's standard warranty against deficiencies in materials or fabrication. Warranties shall be for a minimum ten (10) years on commercial installations.

7. PRODUCTS:

I. Manufacturers:

A. Acceptable Manufacturers:

1. Alside / Windows, Web: www.alside.com

2. Jeld-Wen Windows and Doors, Web: www.jeld-wen.com

3. Pella Windows, Web: www.pella.com

4. Approved Equal

B. Window Product Requirements:

1. Grade: Shall conform to AAMA 101/I.S.2/A440; exceeding grade requirements as follows:

a. Thermal performance (U-Value), in accordance with NFRC 100, shall not exceed 0.38.

b. Solar Heat Gain Coefficient, in accordance with NFRC 200, shall not exceed 0.48.

2. Glazing: Low-E sealed insulating glass unit, ¾ inch unit thickness; U.S. Department of Energy, Energy Star conformance labeled for Northern Climate Zone.

3. Sealed Insulating Glass Units: Conform to ASTM E 774, Level CBA.

4. Color: White.

II. Fabrication: Window/Door Units: Assemble units completely in factory, including operating hardware and glazing.

8. EXECUTION:

I. Examination:

A. Verification of Conditions: Openings are in correct location, and of correct size, in accordance with approved shop drawings and manufacturer's installation instructions.

B. Installer's Examination: Have installer of this section examine conditions under which construction activities of this section are to be performed, then submit written notification if such conditions are unacceptable.

C. Beginning construction activities of this section before unacceptable conditions have been corrected is prohibited.

II. Installation:

A. Install products specified in this section square, plumb and level, in accordance with approved shop drawings and manufacturer's installation instructions.

B. Installation of joint sealers is specified in Section 07900.

III. Adjusting:

A. Adjust operating hardware for correct operation in accordance with manufacturer's installation instructions.

IV. Cleaning:

A. Clean interior and exterior surfaces free of labels, mortar, plaster, paint, joint sealers, and other foreign matter to prevent damage to weatherstrip, and to prevent interference with operation of hardware.

V. Protection:

A. Protect ventilators and operating parts from dirt and damage caused by subsequent construction activities.

B. Replace units damaged by subsequent construction activities.

End of Section

SECTION 09900 - PAINTING

1. SCOPE OF WORK:

   Furnish all labor, materials and equipment required to complete the work of the noted Sections of this Division described herein and on the drawings.

2. WORK INCLUDED:

   Complete painting of unfinished metal or other surfaces as specified.

3. SUBMITTALS:

   Refer to Section 01300 - Submittals, for requirements.

4. GENERAL:

   I. Related Work Described Elsewhere:

      Section 07900 - Sealants and Joint Fillers.

   II. Product Handling:

      A. Delivery:

         Deliver all paint materials to the job site in their original unopened containers with all labels intact and legible at the time of their use.

      B. Protection:

         1. Store only the approved materials at the job site, and store only in a suitable and designated area restricted to the storage of paint materials and related equipment. Protect floor with drop cloths or building paper during execution of the work.

         2. Use all means necessary to insure the safe storage and use of paint materials and the prompt and safe disposal of waste.

   III. Extra Stock:

      Upon completion of this portion of the work, deliver to the Project Manager an extra stock of paint equaling approximately 10% of each color used and each coating material used, with all such extra stock tightly sealed in clearly labeled containers.

   IV. Equipment:

      Furnish tools, ladders, scaffolding, other equipment necessary for work completion.

V. Specifications:

Examine specifications for various other trades; become familiar with their provisions regarding their painting; paint or finish surfaces that are left unfinished by requirements of other Sections.

VI. Methods:

If woodwork, metal or any other surface to be finished cannot be put in proper condition for finishing by customary cleaning, sanding, puttying operations, notify the Project Manager in writing; or assume responsibility for and rectify the unsatisfactory finish resulting.

5. MATERIALS:

I. Manufacturer's Standards:

All application and finish criteria shall conform to the manufacturer's specifications and recommendations.

II. Compatibility:

All paint materials and equipment shall be compatible in use: finish coats shall be compatible with prime coats; prime coats shall be compatible with the surface to be coated; all tools and equipment shall be compatible with the coating to be applied. Thinners, when used, shall be only those thinners recommended for that purpose by the manufacturer of the material to be thinned.

III. Paint Material:

Paint finishing materials shall be as specified for the different applications and of the highest quality for the appropriate use as recommended by the manufacturer. The application of second and third coats shall be made at the time intervals recommended by the manufacturer. The paint, unthinned, shall not be applied in excess of the rate specified on the label.

6. EXECUTION:

I. Surface Conditions:

Prior to all work of this Section, carefully inspect the installed work of all other trades and verify that such work is complete to the point where this installation may properly commence.

II. Preparation of Surfaces:

A. Protection:

Prior to all surface preparation and painting operations, completely mask, remove or otherwise adequately protect all hardware, accessories, machined surfaces, plates, lighting fixtures, and similar items that may

come in contact with painted surfaces or may be subject to overspray, but not scheduled to receive paint.

B. Metal:

For steel surfaces, all surfaces must be free of dirt, rust, oil, grease, water, mill scale or other observed contamination. Make certain that the substrate is dry.

Rusted or new metal surfaces must be cleaned and primed properly.

Follow Steel Structures Painting Council Specifications SSPC SP 2-63 for hand cleaning (especially wire brushing, scraping, chipping, and sanding).

III. Painting, Interior and Exterior Steel:

A. Prime Coating:

Apply 1 coat of Pittsburgh Inhibitive Metal Primer, an epoxy ester resin film type.

B. Finish Coatings and Application:

Apply 2 coats of Pittsburgh, "Speedhide" Alkyd Gloss Enamel a modified alkyd resin.

IV. Paint Touch-Up:

Upon completion of all work and before occupancy, touch up paint surfaces that are marred or damaged.

7. COMPLETION:

I. Atmospheric Conditions:

Paints other than water-thinned coatings shall be applied only to surfaces that are completely free of surface moisture as determined by sight or touch. While painting is being done, the temperature of the surfaces to be painted and of the atmosphere in contact therewith shall be maintained at or above 50°F for water-thinned coatings and 45°F for other coatings or as permitted by the Project Manager.

II. Cleanup:

Cleaning cloths and other waste that might constitute a fire hazard shall be placed in closed metal containers or destroyed at the end of each day. Upon completion of the work, staging, scaffolding, and containers shall be removed from the site or destroyed in an approved manner. Paint spots, oil, or other stains on adjacent surfaces shall be removed and the entire job left clean and acceptable.

End of Section

SECTION 10200 - LOUVERS AND VENTS

1. SCOPE OF WORK:

   Furnish all labor, materials and equipment required to complete the work of the noted Sections of this Division described herein and on the drawings.

2. WORK INCLUDED:

   The work shall include, but is not necessarily limited to, the furnishing and installation of the items specified below and shown on the drawings.

3. SUBMITTALS:

   Refer to Section 01300 - Submittals, for requirements.

4. MATERIALS AND INSTALLATION:

   I. Exhaust Fan (EF-1)

   Exhaust fan shall be Dayton “60KU30” or approved equivalent having a minimum capacity of 195 cfm. Install according to manufacturer requirements.

   II. Wall Louver (IL-1):

   Wall louver shall be 17.5”H x 17.5”W Dayton “5NKJ2” or approved equivalent with a maximum air intake of 744 cfm minimum. Louver shall be designed to have drainable blades that will prevent wind driven rain from entering the system and an internal insect screen. Paint louvers to match building. Install according to manufacturer requirements.

   III. Exhaust Duct Vent Cover:

   Vent cover shall be stainless steel 7” x 7” with 4” diameter duct connection. Vent cover shall have fully automatic flaps with drip edge and screen filter mesh. Install according to manufacturer requirements.

End of Section

SECTION 11265 - ULTRAVIOLET WATER STERILIZER EQUIPMENT

1. SCOPE OF WORK:

   Furnish all labor, materials and equipment required to complete the work of the noted Sections of this Division described herein and on the drawings.

2. WORK INCLUDED:

   The work shall include, but is not necessarily limited to, supplying and installing an ultraviolet water sterilizer and associated accessories.

3. SUBMITTALS:

   Refer to Section 01300 - Submittals, for requirements.

4. MATERIALS AND INSTALLATION:

   I. General:

   The Contractor shall furnish and install a complete low pressure disinfection system as described herein. The system shall include but is not limited to a stainless steel disinfection chamber, low pressure UV lamps and quartz sleeves with manual wiper mechanisms and complete monitoring and electrical equipment. Power source, electrical conduits and equipment base supports will be provided. The Contractor will physically install the treatment chamber and control modules as per the Manufacturer's directions and the Drawings. The Manufacturer shall be responsible for verification of installation including conductors, hook up of equipment, start-up, testing and operational instruction of the Owner's personnel.

   II. Acceptable Manufacturers: Only companies with a minimum of five years of experience and a history of successful installations of low pressure UV systems will be considered. Preference will be given to those systems that can clearly demonstrate applied experience for comparable fish hatchery applications. Acceptable manufacturers include RK2 Systems, Aquafine, Atlantic Ultraviolet, Ideal Horizons and Infilco-Degremont or approved equals.

   III. Operating Perameters:

   Fluid Composition: Water
   Maximum Flow Rate: 300 gpm
   Fluid Evaluation: 90 % Transmission in a 1 cm quartz cell at 254 nm
   Minimum Water Temperature: 42° F
   Maximum Allowable Head Loss Through Chamber: 1 foot (at 300 gpm)
   Minimum UV dose: 40,000 $\mu w/cm^2$ at end of lamp life

   End of lamp life shall be defined to be when the lamp output level has reduced by 30%. Minimum lamp life shall be 8000 hours.

IV. Disinfection Chamber:

A. Chamber:

1. The wetted metal parts shall be constructed of stainless steel. No metal parts in direct contact with the water shall be cadmium, brass, bronze, zinc, chromate, red lead, coal tar or other compounds injurious to fish shall be allowed in direct contact with the water.

2. The wetted metal parts shall have fusion welds with full penetration, purged with inert argon gas and radii ground smooth, or welds of similar strength and durability. The interior and exterior of the chamber shall be pickled, passivated and electropolished to Mil Spec S-5002.

3. The design operating pressure for the chamber shall be 150 psig. The inlet and outlet connections shall have 150 pound ANSI raised-face, slip-on flanges. The inlet and outlet flange risers shall have 1/4-inch tapped sample valve ports. The chamber shall have a 3/4-inch NPT drain plug at its lowest point to allow complete draining of the chamber.

B. Lamps: Ultraviolet lamps shall be of the low pressure mercury vapor type with hard glass enclosure. The lamp etch shall specify the UV wavelength output. Lamp bases shall be ceramic. Lamp sockets shall be watertight, vibration-resistant, and UV and ozone resistant. Lamp output shall not be altered at temperatures between 35° F and 100º F.

C. Quartz Sleeves: The lamps shall be protected by polished, high purity, ozone free quartz sleeves. The sleeve material for lamp housing shall be fused at the ends and shall have the capability of allowing 95% transmittance of UV wavelengths less than 290 nm. The sleeves shall be installed so that the lamps can be removed without breaking the water seal.

D. Cleaning System: A manual mechanical quartz sleeve cleaning system shall be provided to periodically clean the quartz sleeves and monitor windows to remove deposits.

V. UV Intensity Monitor:

A. Provide a UV intensity monitor to register on a relative percentage meter the transmission of the 254 nm wavelength as it passes from the UV lamp through the fluid to the photo sensor in the chamber wall.

B. The UV intensity monitor shall feed a module in the electrical enclosure with a 4-20 ma output signal.

C. The monitor shall include the ability to provide automatic alarm indication of low ultraviolet intensity. Dry contacts shall be provided for this purpose.

VI. Electrical Enclosures:

A. Electrical enclosures shall be weathertight and dust-tight, NEMA 4 or better. Fan-cooled ventilation shall be provided.

B. Each electrical enclosure shall contain the following controls and displays:

1. Lamp current indicator to verify each lamp "ON".

2. UV module to provide an intensity readout in percent.

3. Elapsed time indicator showing total number of hours run.

4. Fuse protection of incoming power circuits.

C. Dry contacts shall be provided to signal alarm conditions including lamp out or low UV dosage.

D. The lamps shall be protected by a ground fault circuit interrupter.

E. All wiring within the enclosure shall be done in accordance with the applicable codes and be done in a neat workmanship manner. All wiring shall be harnessed or enclosed in wireways. Electronic components shall be of standard manufacture and plug in or screw in for modular replacement.

5. WARRANTIES:

The Manufacturer shall provide written warranties that provide for:

I. For full replacement of all defective lamps within first 1000 hours of operation.

II. For full replacement of equipment for a period of two years of operation against defects in materials and workmanship. Replacement of defective equipment shall include installation, calibration and adjustment of new equipment.

III. Response time for required on site warrantee work shall not exceed 48 hours. Repairs or problems that can be resolved by telephone or shipment of minor replacement parts will not require a Manufacturer's representative to report to the Owner provided the Owner's personnel can perform the direct repairs under the Manufacturer's direction.

IV. Warrantee periods shall start upon final acceptance of all equipment and contract requirements.

6. EXECUTION:

I. Installation:

A. The Contractor will obtain written verification from the Project Manager and the Manufacturer prior to installation to ensure adequate site

preparation. The system equipment will be fully covered and protected at all times during installation and construction.

B. The Contractor shall be responsible for installation of the UV disinfection equipment per the instructions of the Manufacturer and the Drawings. The Contractor shall install electrical enclosures units per Manufacturer's recommendations and the Drawings.

II. Start-Up and Training:

A. The Contractor shall provide the services of a manufacturer's representative for a period of two days to facilitate system start-up trip and training of the Owner's personnel.

B. Training shall cover system background, operation and maintenance.

III. Testing:

A. After the UV Disinfection System has been installed, the Contractor shall perform an operational test. The Contractor shall monitor head loss and UV intensity under rated flow. The Contractor shall provide all test equipment and labor for the test. Any damage resulting from or caused by the test shall be repaired at the Contractor's expense.

B. The Project Manager shall be present at the test and approve test results prior to acceptance. The Contractor shall repair, adjust and retest equipment at his expense if called for by the Project Manager.

End of Section

SECTION 15010 - GENERAL PROVISIONS

1. SCOPE OF WORK:

   Furnish all labor, materials and equipment required to complete the work of the noted Sections of this Division described herein and on the drawings.

2. GENERAL:

   The drawings indicate the general arrangement of the proposed work. Details of departures due to actual field conditions or other causes shall be provided for by the Contractor as no extras will be paid for correcting faulty or poorly arranged and coordinated work.

3. COMPLETE INSTALLATION:

   Furnish and install all incidental parts and wiring required for the proper function of all component parts. The complete installation shall function smoothly and noiselessly to the full extent of the specifications and drawings. Complete the installation as rapidly as general construction permits. All safety devices shall be properly installed before starting equipment.

4. ORDINANCES AND CODES:

   All work shall be executed and inspected in accordance with all Underwriter's, Public Utililties, local and state codes and regulations applicable to the trade affected. Recommendations of ASTM, NFPA and ASHRAE shall be rigidly followed.

   Arrange and pay for all permits in connection with the work hereinafter specified and at completion of the work, furnish the Owner with the final certificate of inspection.

5. PERMITS AND INSPECTIONS:

   The contractor shall get a Colorado State Plumbing Permit prior to beginning the work. The work shall be inspected and approved. Make all changes, if any, directed to be made by the State Plumbing Inspector and accept and incur all expenses within the scope of the project to attain permanent approval.

6. COORDINATION:

   Before any equipment is purchased or fabricated and before running and/or fabricating any lines or piping, mechanical contractor or his subcontractors shall assure themselves that they can be run as contemplated.

   Because of the small scale of the drawings, it is not possible to indicate all offsets, fittings, and accessories that may be required. The mechanical contractor and his subcontractors shall carefully investigate all other mechanical and electrical drawings and the structural and finish conditions affecting all their work accordingly. Furnish such fittings, valves, offsets and accessories as may be required to meet such conditions, at no additional cost.

End of Section

SECTION 15050 - BASIC MATERIALS AND METHODS

1. SCOPE OF WORK:

   Furnish all labor, materials and equipment required to complete the work of the noted Sections of this Division described herein and on the drawings.

2. MATERIALS:

   Materials shall be new and of the best grades specified. Receive and be responsible for all owner-furnished equipment and provide rough-in and final connections for all mechanical equipment furnished under this Contract or by others.

3. WORKMANSHIP:

   Work throughout shall be performed by persons skilled in the installation of the various parts of the work herein specified.

4. CURBS, BASES, SUPPORTS:

   Major curbs, openings, and equipment supports will be provided under the General Section of this Contract only where shown on the drawings. All other supports, anchors, and bases shall be provided by the mechanical contractor for all mechanical equipment. Equipment shall be supported per manufacturer's written recommendations for noise-free operations.

5. ANCHORS, HANGERS AND SLEEVES:

   Provide and arrange for installation of required bolts, anchors, hangers, inserts, sleeves, etc., properly located for the work. Tape or wire hangers are not acceptable.

6. ELECTRICAL WIRING:

   All line voltage wiring including switches, disconnects, conduits and starters will be as scheduled herein.

   Automatic control wiring and interlock wiring for Mechanical Equipment shall be as scheduled herein, and shall be inserted into conduit.

7. FINAL APPROVAL:

   Before final acceptance, all mechanical equipment shall operate without objectionable noise or vibration. All equipment shall be adjusted to capacities shown on drawings. Make all corrections for above conditions to provide a completely acceptable system.

End of Section

SECTION 15440 - PLUMBING FIXTURES AND TRIM

1. SCOPE OF WORK:

   Furnish all labor, materials and equipment required to complete the work of the noted Sections of this Division described herein and on the drawings.

2. WORK INCLUDED:

   The work within this Section consists of furnishing materials, equipment and labor necessary to satisfactorily complete the installation of plumbing fixtures.

3. SUBMITTALS:

   Refer to Section 01300 - Submittals, for requirements.

4. GENERAL PROVISIONS:

   Secure wall mounted fixtures in accordance with manufacturer's rough-in and setting requirements. Make proper provisions for hanging fixtures during building construction. Steel backing plates shall be used to rigidly secure the fixtures. Set all metal fixtures' frames in putty or waterproof mastic.

   After fixtures have been set, they shall be carefully protected until the building has been finally accepted. Any damage or defect developing before acceptance shall be replaced or situation resolved at the Contractor's expense. All metal trimmings on fixtures and exposed piping to fixtures shall be chrome plated, with chrome plated escutcheons.

5. PRODUCTS AND EXECUTION:

   I. Fiberglass Tanks:

      A. The tanks shall be 1 piece round fiberglass with a smooth polished gel coat interior, 48”D x 30”H Gemini RCT-235S or approved equivalent

      B. Hardware: Include leveling legs and drain connections.

   II. Vertical Incubators:

      A. Incubator cabinet constructed of a one-piece welded aluminum frame. 8-Tray Vertical Incubator by MariSource, Fish Farm Supply Co. or approved equivalent.

      B. Hardware: Include manufacturer’s egg trays and screens.

   III. Service Sinks:

      A. The sinks shall be a stainless steel one-compartement utility sink with galvanized tubular legs and adjustable bullet feet. Sani-Lav 21” x 20” Wall Mounted Hand Sink Model #525FL or approved equivalent.

      B. Hardware: Include manufacturer’s manual low-flow 0.5 GPM faucet.

End of Section

SECTION 15453 - TANKLESS WATER HEATERS

1. SCOPE OF WORK:

   Furnish all labor, materials and equipment required to complete the work of the noted Sections of this Division described herein and on the drawings.

2. WORK INCLUDED

   The work within this Section consists of furnishing materials, equipment and labor necessary to satisfactorily complete the installation of a tankless water heater.

3. SUBMITTALS:

   Refer to Section 01300 – Submittals, for requirements.

4. QUALITY ASSURANCE:

   The water heater must be UL listed, and shall meet efficiency performance criteria set by state performance codes when tested according to D.O.E. procedures.

5. DELIVERY, STORAGE AND HANDLING:

   Deliver, store, and handle the equipment to prevent damage and disfigurement. Protect all items from damage during transit and installation.

6. MATERIALS AND INSTALLATION:

   Electric Tankless Water Heaters

   The tankless water heaters shall be a BOSCH, Tronic 3000 US3-2R, or approved equivalent.

   I. Voltage: 110-120

   II. Loading (watts): 1513-1800 low, 3025-3600 high

   III. Activation Water Flow: 0.3 gallons per minute maximum

   IV. Temperature Rise: Must raise the ambient temperature of the water 49 degrees Fahrenheit minimum at 0.5 gallons per minute flow rate.

7. INSPECTION

   I. Upon Delivery: Check for damage that may have occurred in shipment. Reject equipment that will not satisfactorily function.

   II. During Installation: Check for the proper location of the unit. Check that the water heater unit is installed plumb and level.

End of Section

SECTION 15500 - HEATING

1. SCOPE OF WORK:

   Furnish all labor, materials and equipment required to complete the work of the noted Sections of this Division described herein and on the drawings.

2. WORK INCLUDED:

   Work within this Section consists of furnishing materials, equipment and labor necessary to satisfactorily complete the installation of heating systems, and associated equipment.

3. SUBMITTALS:

   Refer to Section 01300 - Submittals, for requirements.

4. QUALITY ASSURANCE:

   I. Regulatory Agency Requirements:

      The units shall be Underwriter Laboratories (UL) design certified, and shall be rated and tested in accordance with U.S. Department of Energy test procedures and Federal Trade Commission labeling regulations.

   II. Reference Standards:

      Except as modified by governing codes and by the Contract, comply with the applicable provisions and recommendations of the following:

      A. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE).

      B. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA).

      C. National Fire Protection Association (NFPA).

5. DELIVERY, STORAGE AND HANDLING:

   Deliver, store, and handle the equipment to prevent damage and disfigurement. Protect all items from damage during transit and installation.

6. GUARANTEE:

   Promptly repair or replace any defective material or faulty workmanship that becomes apparent prior to the final inspection.

7. MATERIALS AND INSTALLATION

   I. Electric Unit Heaters:

      A. Furnish and install unit heaters as specified in the Drawings. Alternative products may be approved by the Project Manager.

B. Installation: Follow manufacturer guidelines for wall and ceiling mount installation.

C. Disconnect Means: Provide factory-installed safety disconnect switch with "off" position marking on the face plate.

D. Finish: All steel casing sections shall be factory powder coated.

E. Accessories and Trim: All accessories shall match the lines of the enclosure and shall be built to fit precisely. Front covers of end caps shall be hinged to avoid loss or damage, to permit easy access to vents and to facilitate periodic cleaning.

II. Commercial Thermostat:

Thermostat shall be compatible with the unit heater and be a weekday/weekend programmable thermostat with a minimum of four time periods per day. The thermostat shall have a minimum heat set point of 40°F. Install isolation relay as recommended by unit heater manufacturer.

8. INSPECTION:

I. Upon Delivery:

Check for damage that may have occurred in shipment. Reject equipment that will not satisfactorily function.

II. During Installation:

Check for the proper location of the units. Check that the furnace unit is installed plumb and level.

III. After Installation:

Check the operation of all components and each component's correct function during its period of operation within the operating sequence.

9. ADJUST AND CLEAN:

Adjust and lubricate moving parts for smooth, quiet operation. As work progresses, remove the crating and packing materials from the premises.

End of Section

SECTION 15890 - DUCTWORK

1. SCOPE OF WORK:

Furnish all labor, materials and equipment required to complete the work of the noted Sections of this Division described herein and on the drawings.

2. WORK INCLUDED:

The work within this Section consists of furnishing materials, equipment, and labor necessary to satisfactorily complete the installation of all ductwork for the complete air handling transport system.

3. SUBMITTALS:

Refer to Section 01300 - Submittals, for requirements.

4. QUALITY ASSURANCE:

Reference Standards: Except as modified by governing codes and by the Contract, comply with the applicable provisions and recommendations of the following:

I. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE).

II. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA).

III. National Fire Protection Association (NFPA).

5. MATERIALS AND INSTALLATION:

I. Metal and Gauge:

Galvanized iron shall be used throughout, fabricated, and installed so that no vibration or noise results. It shall be made from the best grade of mild steel sheets of the U.S. Standard Gauge, as recommended in the latest edition of ASHRAE Guide, with joint tabulated at the Contractor's option.

II. Round Rigid Ductwork:

A. All ductwork shall be constructed and erected in a workmanlike manner. Ducts shall be straight and smooth on the inside with neatly finished joints, air tight, and shall be free from vibration under all conditions in direction of air flow. Ducts shall be securely attached to building construction in an approved manner. Change in dimensions and shape of ducts shall be gradual. All duct sizes fall within limiting dimensions indicated on drawings, unless otherwise approved.

B. Duct Turns: All 90° rectangular elbows up to 18" wide and all 45° elbows shall consist of an inside radius of not less than one-half the width of the duct, or shall be furnished with single blade duct vanes with 2¼" blade spacing. 90° elbows larger than 18" shall be equipped with air foil type

duct vanes having an inside radius of 4½", and an outside radius of 2¼", and shall be Tuttle & Bailey Type D, Elgen Manufacturing Corp., Vane Runners, or approved equal.

Curved elbows in round ducts shall have a center line radius equal to 1½ times the duct width. Square elbows shall have turning vanes similar to Tuttle-Bailey Ducturn. Job fabricated turning vanes will not be accepted without prior approval.

C. Flexible Connections: Furnish and install sound isolating flexible connections on the inlet and outlet of each fan and unit to which duct connectors are made. Flexible connections shall be made from Ventglas, neoprene coated glass fabric. At least 1" slack shall be allowed in these connections to insure that no vibration is transmitted from fan to ductwork. Fabric shall either be folded in with the metal or attached with metal collar frames at each end to prevent air leakage.

D. Joints and openings in ducts and around equipment with excessive leakage shall be sealed air tight.

E. Seams: All exposed ducts with a maximum width and/or depth of 24" shall have flat seams.

F. Collars: Wherever exposed ducts pass through walls, floors, or ceilings, a 2" sheet metal collar fitting close around ducts shall be slipped along duct until flange is tight against finished surface covering edges of openings and presenting a neat appearance. Lock collar to duct.

G. All concealed and lined ductwork shall be a fiberglass duct system, Type II taping system ½" thick with vapor seal. Installation as recommended by Manufacturer. Ductwork to be reinforced to ½" static pressure class as a minimum. All ducts in equipment rooms or otherwise exposed must be metal ductwork with liner.

H. At all places where inside of duct will be visible through return air grille louvers, etc., paint normally visible inside portion of duct with flat black paint.

6. COMPLETION:

At the completion of this Division's work, clean the area of all debris, building and packing materials, leaving it in an acceptable condition as determined by the Project Manager.

End of Section

SECTION 16010 - GENERAL PROVISIONS

1. SCOPE OF WORK:

Furnish all labor, materials and equipment required to complete the work of the noted Sections of this Division described herein and on the drawings.

2. GENERAL:

I. The drawings show only the general location of conductors and the approximate location of fixtures, panels, outlets, switches, and other equipment. They are understood to be subject to such revision as may be found necessary or desirable at the time the work is installed. Report significant changes in feature location or conductor locations to the Project Manager for approval prior to alteration. The contractor shall be responsible for all other drawings necessary for permitting.

II. Obtain from the Project Manager in the field the location of such outlets or equipment not definitely located on the drawings.

III. Examine and compare the electrical drawings and specifications with the drawings and specifications of other trades. Report any discrepancies to the Project Manager and obtain from him written instructions for changes necessary in the electrical work.

IV. The drawings generally do not indicate the number of wires for the branch circuit wiring of fixtures and outlets or the actual circuiting. Provide the correct wire size and quantity as required by the requirements of the NEC.

3. MEASUREMENTS:

I. The contractor will be responsible for all work related to the installation of the complete electrical system as described in the drawings and specifications.

II. All payments will be made in accordance with the bid schedule and bid item descriptions.

4. SUBMITTALS:

Refer to Section 01300 - Submittals, for requirements.

5. CODES, REGULATIONS, STANDARDS AND PERMITS:

I. The electrical installation shall be in compliance with the latest requirements of the NEC, O.S.H.A. and the rules and regulations and requirements of the power company supplying power to the buildings. Comply with ASHRAE 90-75A energy conservation code.

II. The electrical installation and the Contractor shall comply fully with all city, county and state laws, ordinances and regulations applicable to electrical installations.

III. Notify the Project Manager of conflicts between these specifications, drawings,

codes and ordinances.

IV. All local fees and permits and services of inspection authorities shall be obtained and paid for by the Contractor. The Contractor shall cooperate fully with local utility companies with respect to their services. The Contractor shall include in his bid, any costs to be incurred relative to power service (primary and/or secondary).

6. COORDINATION OF WORK:

I. Coordinate with Division personnel the dates and times of installation.

II. Certain materials will be provided by other trades. Examine the Contract to ascertain these requirements.

III. Carefully check space requirements with other trades to insure that all material can be installed in the spaces allotted thereto.

IV. Wherever work interconnects with work of other trades, coordinate with other trades to insure that all trades have the information necessary so that they may properly install all the necessary connections and equipment. Identify all items to work that require access so that the ceiling trade will know where to install access doors and panels. Before installation, make proper provisions to avoid interferences in a manner approved by the Project Manager.

V. Due to the type of the installation, a fixed sequence of operation is required to properly install the complete systems. Coordinate projects and schedule work with other trades in accordance with the construction sequence.

7. CERTIFICATION:

Upon completion of the electrical service installation the Colorado State Electrical Board will be contacted by the Contractor and arrange to have the new construction inspected and certified. Make all changes, if any, directed to be made by the State Electrical Board and accept and incur all expenses within the scope of the project to attain permanent service certification for the electrical service installations.

8. INSPECTION TESTS AND GUARANTEES:

After the electrical installation is completed and at such times as the Project Manager may direct, the Contractor shall conduct an operating test for approval. The installation shall be demonstrated to be in accordance with the requirements of this specification. Any defects revealed shall be corrected promptly at the Contractor's expense and the tests reconducted.

9. PRODUCTS:

I. If products and materials are specified or indicated on the drawings for a specific item or system, use those products or materials. If products and materials are not listed in either of the above, use first class products and materials, subject to approval of shop drawings.

II. All equipment capacities, etc., are listed for job site operating conditions. All equipment sensitive to altitude is to be derated and method of derating shown on shop drawing. Where operating conditions shown differ from the laboratory test conditions, the equipment to be derated and the method of derating is to be shown on shop drawings.

III. All products and materials to be new, clean, free of defects and free of damage and corrosion, excluding temporary power and lighting.

IV. Delivery of Products and Materials:

Ship and store all products and materials in a manner which will protect them from damages, weather and entry of debris. If items are damaged, do not install, but take immediate steps to obtain replacement or repair. Deliver materials (except bulk materials) in manufacturer's unopened container fully identified with manufacturer's name, trade name, type, class, grade, size and color.

V. Storage of Products and Materials:

Store materials suitably sheltered from the elements, but readily accessible for inspection by the Project Manager until installed. Store all items subject to moisture damage in dry, heated spaces.

VI. Identification:

Furnish a nameplate for each panel, feeder switch, etc. Unless otherwise noted, use lamacoid or aluminum with a black enamel background with etched or engraved upper case letters, enclosed by natural aluminum border, or black and white laminated bakelite plate with beveled edges. Inscribe name and number of equipment as shown on the drawings.

10. EXECUTION:

I. Follow manufacturer's instructions for installing, connecting, and adjusting all equipment. Provide one copy of such instructions to the Project Manager before installing any equipment. Provide a copy of such instructions at the equipment during any work on the equipment. Provide all special valves, piping, wiring and accessories.

II. Use mechanics skilled in their trade for all work.

III. Keep all items protected before and after installation. Cleanup all debris.

IV. Perform all tests required by local authorities in addition to tests specified herein, such as life safety systems.

V. Applicable equipment and materials are to be listed by Underwriters' Laboratories and manufactured in accordance with ASME, NEMA, ANSI or IEEE standards and as approved by local authorities having jurisdiction.

VI. Before commencing work, examine all adjoining work on which this work is in any way dependent for perfect workmanship and report any condition which prevents

performance of first class work. Become thoroughly familiar with actual existing conditions to which connections must be made or which must be changed or altered. Adjust location of conduits, panels, equipment, pull boxes, fixtures, etc., to accommodate the work to prevent interferences, both anticipated and encountered. Determine the exact route and location of each pipe and duct prior to fabrication.

VII. Right of Way: Lines which pitch to have the right-of-way over those which do not pitch. For example: steam, condensate, and plumbing drains normally have right-of-way. Lines whose elevations cannot be changed to have right-of-way over lines whose elevations can be changed.

VIII. Make offsets, transitions and changes in direction in conduits as required to maintain proper head room in pitch of sloping lines whether or not indicated on the drawings.

IX. Miscellaneous Repair:

A. The work shall be carefully laid out in advance to avoid damage to surrounding elements. Where cutting, channeling, chasing or drilling is necessary for proper installation, the work shall be carefully done. Any damage shall be repaired or replaced by skilled mechanics of the trades involved at no additional cost to the Owner.

B. Slots, chases, openings and recesses through floors, walls, ceilings and roofs will be provided by the various trades in their respective materials. The trade requiring them to properly locate such openings shall be responsible for any cutting and patching caused by the neglect to do so.

C. The Contractor shall not do cutting, channeling, chasing, or drilling of unfinished masonry, structural steel, wood members, tile, etc., unless he first obtains permission from the Project Manager. If permission is granted, the Contractor shall perform this work in a manner approved by the Project Manager.

D. Where conduits, outlet, junction, or pull boxes are mounted on a painted surface, or a surface to be painted, they shall be painted to match the surface unless otherwise specified. Whenever support channels are cut, the bare metal shall be cold galvanized.

X. Deliver to the Owner's representative all special tools needed for proper operation, adjustment and maintenance of equipment.

End of Section

SECTION 16050 - BASIC MATERIALS AND METHODS

1. SCOPE OF WORK:

Furnish all labor, materials and equipment required to complete the work of the noted Sections of this Division described herein and on the drawings.

2. WORK INCLUDED:

The work shall include, but is not necessarily limited to, the furnishing and installation of all components required for a complete installation of the electrical system.

3. SUBMITTALS:

Refer to Section 01300 - Submittals, for requirements.

4. GENERAL:

I. Materials shall be new, first quality and approved by Underwriters' Laboratories, Inc. or National Electrical Manufacturers Association.

II. Material damaged during course of installation shall be replaced and paid for by the Contractor. Alternates must be approved by the Project Manager.

III. All materials and products will not be permitted to contain asbestos.

5. MATERIALS:

I. Raceways:

A. General:

1. Provide raceways for wiring systems.

2. Where nonmetallic raceways are utilized, provide the proper sized grounding conductor within the raceway.

3. A minimum size ½" raceway is to be used.

B. Concrete Encased Raceways:

Provide electrical metallic underfloor distribution system manufactured of steel, galvanized on the outside and coated on the inside with a smooth hard finish of lacquer, varnish or enamel. Steel "Walkerduct" or approved equal screw type service fittings shall be used. Where installed in slab or fill, provide concrete tight fittings.

C. Non-Encased Raceways:

Unless specifically noted on the drawings or for concrete encasement, provide one of the following raceway systems:

1. Thinwall Conduit:

   Electrical Metal Tubing (EMT) with couplings and connectors for terminating conduit at outlet boxes, pull boxes, cabinets, gutters, etc.

2. Rigid Conduit:

   a. Rigid, heavywall, Schedule 40, PVC conduit, suitable for direct burial and Underwriters' Laboratories listed by Borg Warner, Carlon, Ethyl, Karloy, Triangle or approved equal. PVC may be utilized to exterior luminaries where ground wire is employed.

   b. Rigid, heavy wall galvanized steel conduit with double lockouts and bushings on conduits terminating at outlet boxes, cabinets, gutters, etc.

3. Flexible Electrical Conduit:

   Flexible interlocked double-wrapped steel, galvanized inside and outside forming smooth internal wiring channel, by National Electrical Products, Triangle, Clifton Conduit or approved equal. Each section of raceway must contain a bonding wire bonded at each end and sized as required, except for lighting fixtures. Provide connectors with insulating bushings.

4. Liquid-Tight Flexible Electrical Conduit:

   a. Maximum length 6 feet, single strip, continuous, flexible interlocked double-wrapped steel galvanized inside and outside forming a smooth internal wiring channel, by National Electric Products, Triangle, Clifton Conduit or approved equal. Each section of raceway must contain a bonding wire bonded at each end and sized as required, except for lighting fixtures. Conduit is to be covered with a tough, inert watertight plastic outer jacket, "Seal-Tite" Type U.S. (American Brass Company), "Flex-Seal Type LX" (Columbia Cable and Electric Corporation), "Electric-Flex" (International Metal Hose) or approved equal.

   b. Fittings: Cast malleable iron body and gland nut, cadmium plated with one-piece brass grounding bushings which threads to interior of conduit. Spiral molded vinyl sealing ring between gland nut and bushing and nylon insulated throat, by Gedney, Appleton, Thomas & Betts or approved equal.

D. Surface-mounted Raceways:

1. Surface Metal:

   a. Surface metal raceways shall be used to provide power services as shown on drawings.

b. The electrical contractor shall provide and install all surface metal raceways and appropriate fittings to provide a safe and complete installation "wiremold", two-piece, surface metal raceway.

c. The surface metal raceway and fittings shall be the G-3000 series as manufactured by The Wiremold Company, West Hartford, CT or approved equal.

d. The two piece surface metal raceway shall consist of a base section having ½" and ¾" trade size knockouts for electrical fittings.

e. The base and cover sections shall be manufactured of cold rolled steel, and painted with ANSI 61 gray finish which is capable of being overpainted in the field.

f. A full complement of fittings for the surface metal raceway shall be used including but not limited to elbows, (90°, internal and external), tees, couplings for joining raceway sections, wire clips for holding wires or cables in place, blank end fittings for closing open ends of the raceway, boxes to allow inclusion of devices like System 3000 Duplex Receptacles, transition connectors to other surface metal raceways and tradesize conduit or armored cable.

g. The surface metal raceway and fittings shall meet all requirements of the National Electrical Code Article 352A and shall be listed by Underwriters' Laboratories, Inc. in full compliance with their standard for surface metal raceways and fittings (UL-5).

II. Boxes:

A. Outlet, Junction and Pull Boxes

Provide zinc-coated or cadmium-plated sheet steel outlet boxes not less than 4 inches octagonal or square, unless otherwise noted. Equip fixture outlet boxes with 3/8 inch no-bolt fixture studs where required. Where fixtures are mounted on or in an accessible type ceiling, provide a junction box and extend flexible conduit to each fixture. Fit outlet boxes in finished ceilings or walls with appropriate covers, set flush with the finished surface. Where more than one switch or device is located at one point, use gang boxes and covers unless otherwise indicated. Sectional switch boxes or utility boxes will not be permitted. Where drywall material is utilized provide plaster ring. Provide outlet boxes of the type and size suitable for the specific application.

B. Provide pullboxes, Type "SC" surface mounted with screw covers exposed to outside. Each pullbox shall have knockouts. Each box shall be galvanized and U.S. labeled.

C. Plug any open knockouts not utilized.

D. Outdoor and Wet Location Boxes:

Weatherproof boxes to have built-in, reinforced, threaded international hubs and grounded terminals. Plugs to be nylon taped prior to installation. Connectors to be water tight and gasketed. Box to be affixed to surface with exterior tie.

III. Wire and Cable:

A. General:

Actual (secondary) service cable size shall be determined by the Contractor based upon the amperage required for the designated total installation.

B. Conductor:

Electrical grade, annealed copper, tinned or rubber insulated, and fabricated in accordance with ASTM standards. Minimum size number 12 for branch circuits; number 14 for control wiring.

C. Stranding and Number of Conductors:

1. Number 12 and number 10 solid.

2. Cables larger than number 10, stranded in accordance with Class B, ASTM flexibility standards.

3. Control wires stranded in accordance with Class B, ASTM flexibility standards.

4. Cables, multi-conductor unless otherwise noted for low tension systems.

D. Insulation:

1. Provide wire with a minimum insulating rating of 600 volts, except for wire used in low voltage (below 50 volts) control of signal systems use 300 volt minimum or 600 volt where permitted to be incorporated with other wiring systems.

2. Jacketed:

a. Type THW: Thermoplastic insulation suitable for use in wet locations up to 75°C. Use for lighting, outlet, and motor circuits and for panel and equipment feeders.

b. Type USE: Two and three conductor Type RHW insulated with neoprene jacket suitable for operation in wet or dry locations at a maximum temperature of 75°C. Underground service

entrance cable for direct earth burial, duct, or aerial applications.

c. Type TC: Control Wire, multiconductor THHN-THWN conductors rated for 90°C in dry locations and 75°C in wet locations. Cables may be installed in open air, ducts, conduits, in tray and trough, and are suitable for direct burial.

3. Single Conductor:

a. Type THHN: Heat-resistant thermoplastic insulation, nylon jacket rated for 90°C operation. Use for lighting branch circuit wiring installed and passing through the ballast channels of fluorescent fixtures, wiring in metal or wood roof decks in or near roof insulation, in attic or joist spaces, or in raceways exposed to the sun.

b. Type TFFN or TFN: Fixture wire with PVC insulation and nylon jacket, suitable for use on lighting fixtures and other applications where temperatures do not exceed 90°C.

4. Aerial Cable: Three conductor crosslinked polyethylene insulated cable with 30% EHS copper-clad steel messenger.

5. Color-code wiring for control systems installed in conjunction with mechanical and/or miscellaneous equipment in accordance with the wiring diagrams furnished with the equipment. Factor color code wire number 2 and smaller. Wire number 1 and larger may be color coded by color taping of the entire length of the exposed ends.

E. Connectors:

1. Make connections, splices, taps and joints with solderless devices mechanically and electrically secure. Protect exposed wires and connecting devices with electrical tape or insulation.

2. Branch circuit wires (No. 10 and smaller): Use any of the following types of terminals and connecting devices:

a. Hand Applied: Coiled tapered spring wound devices with a conducting corrosion-resistant coating over the spring steel and a plastic cover and skirt providing full insulation for splice and wired ends. Screw connector on by hand. Manufacturer: "Wing Nut" (Ideal Industries), "Piggy" (Thomas & Betts), "Scotchlok" (3M Company) or approved equal.

b. Tool Applied: Steel cap, with conduction and corrosion resistant metallic plating, open at both ends, fitted around the twisted ends of the wire and compressed or crimped by means of a special die designed for the purpose. Specifically fitted plastic or rubber insulating cover wrap over each connector.

Manufacturer: "Stakon" (Thomas & Betts), "Number 410 Crimp Connector" (Ideal Industries), "Wrap-Cap" (Buchanan) or approved equal.

F. Electrical Tape:

1. Specifically designed for use as insulating tape.

2. Manufacturer: Johns-Manville, Minnesota Mining or approved equal.

G. Lubricant: Use lubricant only where the possibility of damage to conductors exists. Use only a lubricant designed by the cable manufacturer and one which is inert to cable raceways.

IV. Switch and Wiring Devices:

A. Wall Switches:

1. Provide specification grade, flush mounting, quiet-operating AC type, with toggle operator and heat-resistant plastic housing. Silver alloy contact rated 20A at 277V and capable of full capacity on tungsten or fluorescent lamp load. Design for side or back wiring with up to Number 10 wire verified by U.L. to meet or exceed Federal specifications WS-896E.

2. Use single-pole, double-pole, 3-way, 4-way, pilot or keyed type, as indicated on drawings or required.

3. Switches controlling lighting by way of low voltage lighting control relays shall be 3-position, momentary-contact, center-off type to match the other switches.

4. Manufacturers: "1990 Series" (Arrow-Hart), "1220 Series" (Hubbell), "5600 Series" (Leviton) or approved equal. Color as selected by the Project Manager.

B. Duplex Convenience Outlets:

1. Unless otherwise noted, mount receptacle vertically with U-shaped ground position at bottom.

2. Provide 3-pole NEMA and American National Standards Institute standard type, with bronze contacts that accept plug with 2 parallel blades and 1 grounding blade, heat-resistant plastic enclosure with nylon face, two grounding screws, break-off terminals for 2-circuit wiring, rated for 20 amps at 125 volt AC. Comply with National Electrical Manufacturers' Association Standard W D-1, 3.02 through 3.10 and Underwriters' Laboratories Standard 498.

3. Manufacturers: "Catalog Number 5362" (Hubbell), Arrow Hart, Leviton or approved equal. Color as selected by the Project Manager.

C. Cover Plates:

Wall plates and cover plates shall be ivory plastic.

Screws to be of the same color and suitable for this application.

When two or more switches or devices are shown in one location, mount under a common plate.

D. Outdoor Locations:

1. Protect receptacles located outdoors or where indicated to be weatherproof by a GFI receptacle or circuit breaker.

2. Protect exterior receptacles by a cast aluminum metal plate with a stainless steel spring-loaded, gasketed lift cover to remain locked in either open or closed.

E. Switch and Pilot Light: "Number 1261" (Hubbell) switch with "Number 1375" (Hubbell) or approved equal flush neon pilot light with red jewel.

F. Smoke & Carbon Monoxide Alarm:

Provide and install smoke & carbon monoxide detection/alarm unit by Universal Security Systems, Model No. CD-9795 or approved equal.

G. Buried Detection Tape:

The electrical detection tape shall be a underground warning tape by Empire Level Manufacturer, Inc., available from Hamilton Associates, Inc., 800 W. Louisiana Ave, Denver, CO 80223, (303) 722-6882, or approved equal. The tape shall consist of a flexible plastic sheath, permanently color coded (impregnated) APWA "Safety Red" containing a solid aluminum foil core. The tape legend shall read "Caution Buried Electric Line Below" upon the 6 inch wide material.

6. EXECUTION:

I. Raceway Systems

A. Install capped bushings on conduits as soon as installed and remove only when wires are pulled. Securely tie embedded raceway in place prior to embedment. Conduits installed below or in floor slabs must extend a minimum of 6 inches above the finished slab to the first connector. Lay out the work in advance to avoid excessive concentrations of multiple raceway runs. Locate raceways so that the strength of structural members is unaffected and they do not conflict with the services of other trades. Install 1 inch or larger raceways in or through structural members (beams, slabs, etc.) only when and in the manner accepted by the Project Manager. Draw up couplings and fittings full and tight. Protect threads from corrosion with one (1) coat red lead or zinc chromate after installation.

B. Above Grade - Defined as the area above finished grade for a building exterior and above top surface or any slabs (or other concrete work) on grade for a building interior. Above-grade raceways to comply with the following:

1. Install raceways concealed except at surface cabinets and for motor and equipment connection in electrical and mechanical rooms. Install a minimum of 6 inches from flues, steam pipes, or other heated lines. Provide flashing and counter-flashing for waterproofing of raceways, outlets, fittings, etc., which penetrate the roof. Route exposed raceways parallel or perpendicular to building lines with right-angle turns and symmetrical bends. Run concealed raceways in a direct line and, where possible, with long sweep bends and offsets.

2. Provide raceway expansion joints with necessary bonding conductor at building expansion joints and where required to compensate for raceway or building thermal expansion and contraction. Terminate raceways 1¼ inches and larger with insulated bushings or rain-tight connections with insulated throats.

3. In all remaining areas where permitted by Code, Electric Metallic Tubing (EMT) may be used.

4. Provide flexible metal conduit in sufficient lengths not exceeding 6 feet for the makeup of motor, transformer or equipment, and/or raceway connections where isolation of sound and vibration transmission is required. For connections in locations exposed to weather and in interior locations to moisture, use watertight flexible conduit.

5. Provide separate code-size ground conductor in all plastic conduits.

6. Where conduits pass between levels provide seal fittings to maintain fire rating of level passing through.

II. Outlet, Junction and Pullboxes:

A. Provide outlets, junction and pullboxes as indicated on the drawings and as required for the complete installation of the various electrical systems and to facilitate proper pulling of wires and cables. J-boxes and pullboxes shall be sized per N.E.C. minimum.

B. The exact location of outlets and equipment is governed by structural conditions and obstructions, or other equipment items. When necessary, relocate outlets so that when fixtures or equipment are installed, they will be symmetrically located according to the room layout and will not interfere with other work or equipment. Verify final location of outlets, panels, equipment, etc., with the Project Manager and indicate on as-built drawings.

C. Back to back outlets in the same wall, or through-wall type boxes are not permitted. Provide 12 inch (minimum) spacing for outlets shown on

opposite sides of a common wall to minimize sound transmission.

III. Wiring Devices:

A. Plates:

1. Plates to be attached correctly and firmly without cracking.

2. Blind plates to be located at all boxes that are to be abandoned.

B. Mounting Heights:

Heights listed are from finished floor to center of device. Verify exact locations with the Project Manager before installation.

1. Convenience and Signal Outlets: 12" unless otherwise noted.

2. Lighting Switches: 4 feet

3. Disconnect Switches and Motor Controllers: 5 feet

4. Wall-mounted Fixtures: 7 feet 6 inches) or 1 foot below ceilings lower than 8 feet.

5. Mount switches vertically with the "on" position on top, unless noted or specified otherwise.

6. Where switches are indicated to be installed near doors, corner walls, etc., mount same not less than 2 inches and not more than 12" from trim. Verify exact location with the Project Manager.

7. Carefully coordinate the location of switches to insure locations at the strike side of doors.

8. Furnish and install an engraved legend for each switch that controls motors, equipment systems, etc., not located within sight of the controlling switch.

IV. Wire and Cable:

A. Provide a complete system of conductors in raceway system. Mount wiring through a specified raceway, regardless of voltage application.

B. Drawings do not indicate size of branch circuit wiring. For branch circuits whose length from panel to furthest outlet exceeds 150 feet for 120 volt circuits use number 10 or larger.

C. Do not install wire in incomplete conduit runs or until after the concrete work and plastering is completed and moisture is swabbed from conduits. Eliminate splices wherever possible. Where necessary, splice in readily accessible pull, junction or outlet box.

D. Provide cable supports for all vertical risers where required by code.

E. Flashover or insulation value of joints to be equal to that of the conductor. Provide Underwriters' Laboratories listed connectors rated at 600 volts for general use and 1,000 volts for use between ballasts and lamps or gaseous discharge fixtures.

F. Use terminating fittings, connectors, etc., of a type suitable for the specific cable furnished. Make bends in cable at termination prior to installing compression device. Make fittings tight. Recheck splices and termination and make mechanically and electrically tight during a 15 day period immediately prior to final acceptance of the work.

G. Apply an anti-oxide inhibitor equivalent to "Penetrox" (Burnday), "Noalox" (Ideal) or approved equal to aluminum terminations.

H. Install wire in raceways and make up terminations in accordance with manufacturer's recommendations using special washers, nuts, etc., as required. Use an accepted wire-pulling lubricant equivalent to "Yellow" (Ideal) or approved equal for all wire number 4 and larger. Strip insulation so as to avoid nicking of wire.

I. Extend wire sizing for the entire length of a circuit unless otherwise noted.

V. Grounding

A. Provide a separate grounding conductor, securely grounded on each end of the sections of plastic, fiber, or flexible raceways.

B. Provide grounding type bushings for conduits that originate at the service panels and individually bond this raceway to the ground bus in the service panels.

End of Section

SECTION 16400 - SERVICE AND DISTRIBUTION

1. SCOPE OF WORK:

   Furnish all labor, materials and equipment required to complete the work of the noted Sections of this Division described herein and on the drawings.

2. WORK INCLUDED:

   The work shall include, but is not necessarily limited to, electrical service and distribution systems.

3. SUBMITTALS:

   Refer to Section 01300 - Submittals, for requirements.

4. QUALITY ASSURANCE:

   Except as modified by governing codes and by the Contract, comply with the applicable provisions and recommendations of the following:

   I. Panelboards: Comply with Underwriters' Laboratories Standards UL 50 and UL 67, Federal Standard W-P-115A, Amendment Number 2, and National Electrical Manufacturers' Association Standard PB-1.

   II. Circuit Breakers: Comply with Underwriters' Laboratories Standard UL 489, Federal Standard W-C-375a, Amendment Number 4, and National Electrical Manufacturers' Association Standard AB-1.

   III. Ground Fault Circuit Interrupt (G.F.C.I.): Underwriters' Laboratories Standards

   IV. Except as modified by governing codes and by this specification, comply with the applicable provisions and recommendations of the following: Institute of Electrical and Electronics Engineering, National Electrical Manufacturers Association, Underwriters' Laboratories, Utility Company Standards, ASA, AIEE.

5. PRIMARY SERVICE:

   I. The power company will provide final connection to the pole mounted transformer as shown on the drawings. The Contractor will be responsible for installing the feed from the building to the base of the electrical pole including and extra 35’ of wire for Xcel to use to connect up the pole to the transformer. Contractor to coordinate with Xcel.

   II. Contractor will provide Meter Housing as required by Xcel and located as shown on the drawings. Contractor to coordinate with Xcel for all inspections and meter installation.

6. PRODUCTS:

I. Service Panel:

A. Provide panelboard consisting of an assembly of branch circuit switching and protective devices mounted inside a dead front enclosure. Provide the number and size of these branch circuit devices as required to serve the building. The panel shall have the following specifications.

1. Amperage - 200 amps.

2. Voltage – 110/240 volts.

3. Phase - single.

4. Blank spaces - 20.

B. Panelboard:

1. Rigid removable assembly of aluminum or copper bus bars and interchangeable bolted branch circuit devices.

2. Bus bars drilled to permit branch circuit devices of all sizes and number of poles to be interchangeable and installed in any spare space of sufficient size, without disturbing adjacent units; without removing main bus or branch circuit connectors; and without machining, drilling or tapping.

3. Arrange bus in sequence or distributed phasing so that multipole circuit breaker can replace any group of single circuit breakers of the same size.

4. Provide ground bus in each lighting and appliance branch circuit panelboard.

C. Enclosure:

1. Code gauge steel box galvanized.

2. Provide a bolt-on connector inside box for service entrance conduit.

3. Flush mounted in finished areas and where indicated. Surface mount elsewhere.

D. Front:

1. Heavy code gauge steel as required to maintain panel face flat.

2. Locate main lugs properly at top or bottom, depending on where main feeder enters.

E. Circuit Breaker Branch Circuit Devices:

1. Completely sealed enclosure; toggle type operating handle; trip ampere rating and ON/OFF indication clearly visible.

2. Thermal-magnetic trip-free, trip-indicating, quick-make, quick-break, with inverse time delay characteristics. Single-handle and common tripping multipole breakers. Silver alloy contacts with auxiliary arc-quenching devices.

3. Commercial grade plug-in or bolt-on type.

F. Provide main breakers in panels in sections of multi-section panels and when 2 or more panels are served by a common conductor or overcurrent device.

G. Ground Fault Interrupt (G.F.C.I.):

Furnish and install UL listed devices as required by code or as shown on the drawings.

7. EXECUTION:

I. Grounding:

A. Connect grounding wire to building foundation reinforcement in accordance with NEC requirements.

B. Ground service equipment, conduit systems, supports, cabinets, transformers, poles, fixtures, etc., and the grounding circuit conductors.

C. Provide bonding jumpers and wire, grounding bushings, clamps, etc., as required for complete grounding. Route ground conductors to provide the shortest and most direct path to the ground electrode system. Provide ground connections with clean contact surfaces, tinned and sweated while bolting. Install ground conductors in conduit. Make readily accessible connections to the underground in the vicinity of the switchgear. Make connections to the water pipe with "Series 3900" Thomas & Betts or approved equal ground clamp, grounding the conduit enclosing as well as the conductor. Bond cold water pipe system to separate grounding electrode.

D. Provide a separate grounding conductor, securely grounded on each end of sections of plastic, fiber, or flexible raceways. Route inside raceway.

E. Provide grounding type bushings for feeder conduits which originate from the service switchboards and individually bond this raceway to the ground bus in the main switchboards.

F. Connect the neutral bus in the main service switchboards to the ground bus by means of removable link.

G. Provide grounding of conduits entering motor control starters and panelboards as specified elsewhere.

II. Panelboards:

A. Installation:

1. Mount panel 4 feet to panel center but with maximum height of 6 feet 6 inches to handle of topmost switching device.

2. Neatly arrange branch circuit wires and tie together in each gutter with Thomas & Betts nylon "Ty-Raps," or approved equal at minimum intervals.

3. Plug all knockouts removed and not utilized.

B. Indexing and Identification

1. After installations are complete, provide and mount under sturdy transparent shield in the directory frame of each panel door, a neat, accurate and carefully typed directory properly identifying the lighting, receptacles, outlets, and equipment each branch circuit breaker controls.

2. Include on directory the panel identification, the cable and conduit size of panel feeder.

End of Section

SECTION 16410 – ENCLOSED SWITCHES AND CIRCUIT BREAKERS

1. SCOPE OF WORK:

Furnish all labor, materials and equipment required to complete the work of the noted Sections of this Division described herein and on the drawings.

2. WORK INCLUDED:

This Section includes individually mounted enclosed switches and circuit breakers used for equipment disconnecting means.

3. SUBMITTALS:

Refer to Section 01300 - Submittals, for requirements.

4. QUALITY ASSURANCE:

I. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by UL or by a testing agency acceptable to Authorities having Jurisdiction, and marked for intended use.

II. Comply with NEMA AB 1 and NEMA KS 1.

III. Comply with NFPA 70.

5. COORDINATION:

I. Coordinate layout and installation of switches, circuit breakers, and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

6. EXTRA MATERIALS:

Enclosure Keys: Furnish two each to owner. All keys shall be keyed alike or keyed as directed by the Project Manager.

7. PRODUCTS:

I. Manufacturers:

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Corp.; Cutler-Hammer Products.

2. General Electric Co.; Electrical Distribution & Control Division.

3. Siemens Energy & Automation, Inc.

4. Square D Co.

II. Enclosed switches:

A. Enclosed, Nonfusible Switch: NEMA KS 1, Type GD or HD to suit voltage, quick make, quick-break, load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position. Handle lockable in OFF position.

B. Enclosed, Fusible Switch, 800-A and Smaller: NEMA KS 1, Type GD or HD to suit voltage quick-make, quick-break, and load interrupter enclosed knife switch with externally operable handle. Provide interlock to prevent opening front cover with switch in ON position. Handle lockable in OFF position. Fuse Clips: Designed to accommodate specified fuses.

C. Enclosed switches shall be provided with an equipment ground kit, and if required an insulated, groundable, bondable neutral kit.

III. Enclosed circuit breakers:

A. Molded-Case Circuit Breaker: NEMA AB 1, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250A and larger.

2. GFCI Circuit Breakers: Single-and two-pole configurations with 30-mA trip sensitivity.

B. Molded-Case Circuit-Breaker Features and Accessories: Standard frame sizes, trip ratings, and number of poles.

1. Lugs: Mechanical style suitable for number, size, trip ratings, and material of conductors.

2. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.

3. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground fault indicator.

IV. Enclosures:

A. NEMA AB 1 and NEMA KS 1 to meet environmental conditions of installed location.

V. Factory finishes:

A. Finish for Outdoor Units: Factory-applied finish in manufacturer's standard

color or as specified, including undersurfaces treated with corrosion-resistant undercoating.

B. Finish for Indoor Units: Factory-applied finish in manufacturer's standard gray finish over a rust-inhibiting primer on treated metal surface.

8. EXECUTION:

I. Examination:

A. Examine areas and surfaces to receive enclosed switches and circuit breakers for compliance with requirements, installation tolerances, code compliance clearances, and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

II. Installation:

A. Install enclosures so they are rigidly supported and squarely aligned.

III. Identification:

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 16 Section "Electrical Identification."

B. Enclosure Nameplates: Label each enclosure with engraved metal or laminated plastic nameplate mounted with corrosion-resistant screws.

IV. Connections:

A. Install equipment grounding connections for switches and circuit breakers with ground continuity to main electrical ground bus.

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

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

D. Do not use switch or circuit breaker enclosure as pull box. All conductors entering enclosure must terminate on lugs within enclosure.

V. Field quality control:

A. Prepare for acceptance tests as follows:

1. Test insulation resistance for each enclosed switch, circuit breaker, component, and control circuit.

2. Test continuity of each line-and load-side circuit.

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

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

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

VI. Cleaning:

A. On completion of installation, inspect interior and exterior of enclosures. Remove paint splatters and other spots, dirt, and debris. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Touch up scratches and marred finish to match original finish.

End of Section

SECTION 16500 - LIGHTING FIXTURES

1. SCOPE OF WORK:

   Furnish all labor, materials and equipment required to complete the work of the noted Sections of this Division described herein and on the drawings.

2. WORK INCLUDED:

   The work shall include, but is not necessarily limited to, the installation of lighting fixtures.

3. GENERAL:

   I. Provide lighting fixtures in accordance with the Contract.

   II. Fixtures to be complete with light bulbs as specified.

4. QUALITY ASSURANCE:

   Provide three year manufacturer warranty for all LED luminaires, including drivers. Conform to requirements of NFPA 70.

5. SUBMITTALS:

   Refer to Section 01300 - Submittals, for requirements.

6. MATERIALS:

   I. Plastic Lenses and Diffusers: Virgin methyl methacylate unless otherwise permitted. Destaticize after cleaning. Install and leave with no finger or dirt marks on the lense or diffuser. Use white gloves if necessary.

   II. Parabolic Fixture Care: Parabolic fixtures to be installed with mylar cover over louvers. Upon completion of work, remove mylar cover with white gloves and blow clean reflectors.

   III. Finish: Porcelain or baked enamel finish matte white on interiors with minimum tested reflectance of 90 percent matte white finish or as specified in visible exterior. Thoroughly clean base metal and bonderize after fabrication.

   IV. LED Fixtures:

      A. LED Linear Strip (ID. 1&2):

         Nicor, LS1 4’ LED High Output Linear Strip. Provide the models specified in the drawings or an approved equivalent.

      B. LED Wall Pack (ID. 3):

         Nicor, “Corvus - OWG” LED Wall Pack with photocontrol. Color – bronze. Provide the models specified in the drawings or an approved equivalent.

7. EXECUTION:

I. Fabrication:

Provide fixtures, completely factory assembled and wired and equipped with necessary sockets, ballasts, wiring, shielding, reflectors, channels, lenses, etc., and deliver to job ready for installation.

II. Installation:

Install fixtures in mechanical areas after ductwork and piping installation. Locate fixtures above floor, as shown, or at suitable locations within space on walls or ceilings.

End of Section