Montana Fish, Wildlife & Parks

SPECIFICATIONS FOR WORK SPECIAL PROVISIONS

Contents:

1.01 PROJECT DESCRIPTION

A. The Project involves construction work associated with:

Bluewater Springs Trout Hatchery Artesian Well Head Development
Fish, Wildlife & Parks (FWP) project #7113112
Located in Carbon County, MT

B. The project includes construction of a well house, foundation, piping, equipment, and appurtenances as well as minor site work (excavation/grading) for an artesian well at the Bluewater Springs Fish Hatchery. Note that a portion of the equipment installed in the well house will be furnished by the Owner. See Section 11245 of the specifications for a complete list of the Owner-furnished equipment.

The project includes the following components:

- Well House building, precast concrete sump, and cast in place concrete floors
- Automatic strainer assembly, purge line, and bypass piping
- Flow control valve and pressure reducing valve
- Jib crane installation
- 217-foot 10” O.D. PVC pipeline and connection
- Miscellaneous piping, control panels, electrical connections and other appurtenances to provide a complete, in-place system.

2.01 PROJECT RELATED CONTACTS

Project contacts are designated as follows:

Owner:	Montana FWP 1522 Ninth Ave. PO Box 200701 Helena, MT 59620-0701
FWP Project Representative:	Tom Mannatt, Project Manager Civil Engineer Specialist 1522 Ninth Avenue Helena, MT 59620 406-841-4006

3.01 SITE INSPECTION

A. All Bidders should satisfy themselves as to the construction conditions by personal examination of the site described in this document. Bidders are encouraged to make any investigations necessary to assess the nature of the construction and the difficulties to be encountered, see General Conditions, Article 3.

4.01 SOILS INFORMATION

A. Geotechnical investigation work has not been done for this Project. It is the responsibility of the Bidders to conduct all investigations and determine the soil type and digging conditions that may be encountered with this Project prior to bid preparation, see General Conditions, Article 3.

5.01 PROJECT REPRESENTATIVE, INSPECTIONS, AND TESTING

A. The Contractor's work will be periodically tested and observed to ensure compliance with the Contract Documents. Complete payment will not be made until the Contractor has demonstrated that the work is complete and has been performed as required. If the Project Representative detects a discrepancy between the work and the requirements of the Contract Documents at any time, up to and including final inspection, such work will not be completely paid for until the Contractor has corrected the deficiency, see General Conditions, Article 9.

B. The Project Representative will periodically monitor the construction of work to determine if the work is being performed in accordance with the contract requirements. The Project Representative does not have the authority or means to control the Contractor's methods of construction. It is, therefore, the Contractor's responsibility to utilize all methods, equipment, personnel, and other means necessary to assure that the work is installed in compliance with the Drawings and Specifications, and laws and regulations applicable to the work. Any discrepancies noted shall be brought to the Contractor's attention, who shall immediately correct the discrepancy. Failure of the Project Representative to detect a discrepancy will not relieve the Contractor of his ultimate responsibility to perform the work as required, see General Conditions, Article 3.

C. The Contractor shall inspect the work as it is being performed. Any deviation from the Contract requirements shall be immediately corrected. Prior to any scheduled observation by the Project Representative, the Contractor shall again inspect the work and certify to the Project Representative that he has inspected the work and it meets the requirements of the Contract Documents. The Project Representative may require uncovering of work to verify the work was installed according to the contract documents, see General Conditions, Article 12.

D. The work will be subject to review by the Project Representative. The results of all such observations, and all contract administration, shall be directed to the Contractor only through the Project Representative.

5.01.1 Services Required by the Contractor. The Contractor shall provide the following services:

A. Any field surveys to establish locations, elevations, and alignments as stipulated on the Contract Documents. FWP reserves the right to set preliminary construction staking for the project. The Contractor is responsible to notify FWP for any construction staking discrepancies.

B. Preparation and certification of all required shop drawings and submittals as described in the General Conditions, Article 3.

C. All testing requiring the services of a laboratory to determine compliance with the Contract Documents shall be performed by an independent commercial testing laboratory acceptable to the Project Representative. The laboratory shall be staffed with experienced technicians properly equipped, and fully qualified to perform the tests in accordance with the specified standards.

D. Preparation and submittal of a construction schedule, including submittals, see General Conditions, Article 3. The schedule shall be updated as required, as defined in the Contract Documents.

E. All Quality Control testing as required by the Contractor's internal policies.

F. All Quality Assurance testing and/or re-testing as stated in the Contract Documents, see General Conditions, Article 13.

5.01.2 Services Provided by the Owner. The Owner shall provide the following services at no cost to the Contractor except as required for retests as defined in the Contract Documents.

A. The Project Representative may check compaction of backfill and surfacing courses using laboratory testing submittal information supplied by the Contractor. These tests are to determine if compaction requirements are being fulfilled in accordance with the Contract Documents. It is ultimately the responsibility of the Contractor to ensure that this level of compaction is constant and met in all locations.

B. Any additional Quality Assurance testing deemed appropriate by the Owner, at the Owner's expense.

6.01 ENGINEERING INTERPRETATIONS

A. Timely Engineering decisions on construction activities or results have an important bearing on the Contractor's schedule. When engineering interpretation affects a plan design or specifications change, it should be realized that more than 24 hours may be required to gain the necessary Owner participation in the decision process including time for formal work directive or change order preparation as required.

7.01 REJECTED WORK

A. Any defective work or nonconforming materials or equipment that may be discovered at any time prior to the expiration of the warranty period, shall be removed and replaced with work or materials conforming to the provisions of the Contract Documents, see General Conditions, Article 12. Failure on the part of the Project Representative to condemn or reject bad or inferior work, or to note nonconforming materials or equipment on the Contractors submittals, shall not be construed to imply acceptance of such work. The Owner shall reserve and retain all its rights and remedies at law against the Contractor and its Surety for correction of any and all latent defects discovered after the guarantee period (MCA 27-2-208).

B. Only the Project Representative will have the authority to reject work which does not conform to the Contract Documents.

8.01 UTILITIES

A. The exact locations of existing utilities that may conflict with the work are not precisely known. It shall be the Contractor's responsibility to contact the owners of the respective utilities and arrange for field location services. **One Call Locators, 1-800-424-5555**

B. The Contract Documents may show utility locations based on limited field observation and information provided to the Project Representative by others. **The Project Representative cannot guarantee their accuracy.** The Contractor shall immediately notify the Project Representative of any discrepancies with utility locations as shown on the Contract Drawings and/or bury depths that may in any way affect the intent of construction as scoped in these specifications.

C. There will be no separate payment for exploratory excavation required to locate underground utilities.

8.01.1 Notification. The Contractor shall contact, in writing, all public and private utility companies that may have utilities encountered during excavation. The notification includes the following information:

a. The nature of the work that the Contractor will be performing.

b. The time, date, and location that the Contractor will be performing work that may conflict with the utility.

c. The nature of work that the utility will be required to perform such as moving a power pole, supporting a pole or underground cable, etc.

d. Requests for field location and identification of utilities.

A copy of the letter of notification shall be provided to the Project Representative. During the course of construction, the Contractor shall keep the utility companies notified of any change in schedule, or nature of work that differs from the original notification.

8.01.2 Identification. All utilities that may conflict with the work shall be the Contractor's responsibility to locate before any excavation is performed. Field markings provided by the utility companies shall be preserved by the Contractor until actual excavation commences. All utility locations on the Drawings should be considered approximate and should be verified in the field by the Contractor. The Contractor shall also be responsible for locating all utilities that are not located on the Drawings.

The design survey did not include a comprehensive survey of existing utilities. It is the Contractor’s responsibility to properly identify any existing utilities.

8.01.3 Removal or Relocation of Utilities. All electric power, street lighting, gas, telephone, and television utilities that require relocation will be the responsibility of the utility owner. A request for extending the specified contract time will be considered if utility owners cause delays.

8.01.4 Public Utilities. Water, sewer, storm drainage, and other utilities owned and operated by the public entities shall, unless otherwise specifically requested by the utility owner, be removed, relocated, supported, or adjusted as required by the Contractor at the Contractor's expense. All such work shall be in accordance with these Contract Documents, or the Owner's Standard Specifications or written instructions when the work involved is not covered by these Specifications.

8.01.5 Other Utilities. Utilities owned and operated by private individuals, railroads, school districts, associations, or other entities not covered in these Special Provisions shall, unless otherwise specifically requested by the utility owner, be removed, relocated, supported or adjusted as required by the Contractor at the Contractor's expense. All work shall be in accordance with the utility owner's directions, or by methods recognized as being the standard of the industry when directions are not given by the owner of the utility.

8.01.6 Damage to Utilities and Private Property. The Contractor shall protect all utilities and private property and shall be solely responsible for any damage resulting from his construction activities. The Contractor shall hold the Owner and Project Representative harmless from all actions resulting from his failure to properly protect utilities and private property. All damage to utilities shall be repaired at the Contractor's expense to the full satisfaction of the owner of the damaged utility or property. The Contractor shall provide the Owner with a letter from the owner of the damaged utility or property stating that it has been repaired to the utility owner's full satisfaction.

8.01.7 Structures. The Contractor shall exercise every precaution to prevent damage to existing buildings or structures in the vicinity of his work. In the event of such damages, he shall repair them to the satisfaction of the owner of the damaged structure at no cost to the Owner.

8.01.8 Overhead Utilities. The Contractor shall use extreme caution to avoid a conflict, contact, or damage to overhead utilities, such as power lines, streetlights, telephone lines, television lines, poles, or other appurtenances during the course of construction of this project.

8.01.9 Buried Gas Lines. The Contractor shall provide some means of overhead support for buried gas lines exposed during trenching to prevent rupture in case of trench caving.

8.01.10 Pavement Removal. Where trench excavation or structure excavation requires the removal of curb and gutter, concrete sidewalks, or asphalt or concrete pavement, the pavement or concrete shall be cut in a straight line parallel to the edge of the excavation by use of a spade- bitted air hammer, concrete saw, colter wheel, or similar approved equipment to obtain a straight, square clean break. Pavement cuts shall be 2 feet wider than the actual trench opening.

8.01.11 Survey Markers and Monuments. The Contractor shall use every care and precaution to protect and not disturb any survey marker or monuments, such as those that might be located at lot or block corners, property pins, intersection of street monuments or addition line demarcation. Such protection includes markings with flagged high lath and close supervision. No monuments shall be disturbed without prior approval of the Project Representative. Any survey marker or monument disturbed by the Contractor during the construction of the project shall be replaced at no cost to the Owner by a licensed land surveyor.

8.01.12 Temporary Utilities. The Contractor shall provide all temporary electrical, lighting, telephone, heating, cooling, ventilating, water, sanitary, fire protection, and other utilities and services necessary for the performance of the work. All fees, charges, and other costs associated therewith shall be paid for by the Contractor.

9.01 CONSTRUCTION SAFETY

A. The Contractor shall be solely and completely responsible for conditions of the jobsite, including safety of all persons (including employees and subcontractors) and property during performance of the work. This requirement shall apply continuously and not be limited to normal working hours. Safety provisions shall conform to U.S. Department of Labor (OSHA), and all other applicable federal, state, county, and local laws, ordinances, codes, and regulations. Where any of these are in conflict, the more stringent requirement shall be followed. The Contractor's failure to thoroughly familiarize himself with the aforementioned safety provisions shall not relieve them from compliance with the obligations and penalties set forth therein, see General Conditions, Article 10.

10.01 CONSTRUCTION LIMITS AND AREAS OF DISTURBANCE

A. Construction Limits. Where defined limits of disturbance, construction easements or property lines, are not specifically called out on the Contract Documents, limit the construction disturbance to ten (10) feet, when measured from the edge of the slope stake grading, or to the adjacent property line, whichever is less. Disturbance and equipment access beyond this limit is not allowed without the written approval of both the Owner and the Owner of the affected property. If so approved, disturbance beyond construction limits shall meet all requirements imposed by the landowner; this includes existing roads used and/or improved as well as the construction of new access roads. Special construction, reclamation, or post-construction reclamation or other closure provisions required by the landowner on access roads beyond the construction limits shall be performed by the Contractor at no additional cost to the Owner.

B. Areas of Disturbances. Approved areas of disturbance are those areas disturbed by construction activities within the construction limits and along designated or approved access routes. Such areas may require reclamation and revegetation operations, including grading to the original contours, top soiling with salvaged or imported topsoil, seeding, fertilizing, and mulching as specified herein. Other areas that are disturbed by the Contractor's activities outside of the limits noted above will be considered as site damage or unapproved areas of disturbance, see General Conditions, Article 3.

C. This includes areas selected by the Contractor outside the defined construction limits for mobilization, offices, equipment, or material storage.

11.01 DECONTAMINATE CONSTRUCTION EQUIPMENT

A. Power wash all construction equipment entering the project site to prevent the spread of noxious weeds and aquatic invasive species. This applies to all FWP projects, whether individual construction permits specifically address cleaning of equipment.

12.01 TREE PROTECTION AND PRESERVATION

A. The Contractor and the Owner shall individually inspect all trees within the project construction limits prior to construction. The Owner shall determine which trees are to be removed and which trees are to be preserved. Construction of the grading, utilities and various roadway facilities must not significantly damage the tree's root system or hinder its chances for survival. Reasonable variations from the Contract Documents, as directed by the Project Representative, may be employed to ensure the survival of trees.

13.01 CONSTRUCTION SURVEYS

A. The Owner shall provide one-time construction staking at the beginning of work to establish reference points and lines as necessary. Owner's construction staking will include:

   1. Slope stakes located at critical points as determined by the Project Representative.
   2. Location and grade stakes for well house and foundation.
   3. Location and grade stakes for well house pad grading.
   4. Centerline staking for water and drain lines.
   5. Location stakes for roadside safety items, permanent and temporary traffic control, and misc. items as determined by the Project Representative.

B. The Contractor will be responsible for providing all required staking necessary to complete the work that is not provided by the Owner.

C. Existing survey control (horizontal and vertical) has been set for use in the design and ultimately the construction of these improvements. A listing of the coordinates and vertical elevation for each of these control points are included in the project drawings.

D. The Contractor will be responsible for preserving and protecting the survey control and staking until proper referencing by the Contractor has been completed. Any survey control or staking obliterated, removed, or otherwise lost during construction will be replaced at the Contractor's expense.

E. Contractor shall be aware of property pins and survey monuments. Damage to these pins will require replacement of such by a registered land surveyor at no cost to the Owner.

F. The Contractor is responsible for pre and post topographic surveys for the purpose of quantity and progress surveys. Original field notes, computations and other records taken by the Contractor shall be furnished promptly to the Project Representative and shall be used to the extent necessary in determining the proper amount of payment due to the Contractor.

14.01 MATERIAL SOURCES AND CONSTRUCTION WATER

A. The Contractor shall be responsible for locating all necessary material sources, including aggregates, earthen borrow and water necessary to complete the work. The Contractor shall be responsible for meeting all transportation and environmental regulations as well as paying any royalties. The Contractor shall provide the Project Representative with written approvals of landowners from whom materials are to be obtained, prior to approval.

B. The Contractor may use materials from any source, providing the materials have been tested through representative samples and will meet the Specifications.

15.01 MATERIALS SALVAGE AND DISPOSAL

A. Notify the Owner for any material salvaged from the project site not identified in the Contract Documents. The Owner reserves the right to maintain salvaged material at the project site, compensate the Contractor for relocation of salvaged material, or agreed compensation to Owner for material salvaged by the Contractor.

B. Haul and waste all waste material to a legal site and obey all state, county, and local disposal restrictions and regulations.

16.01 STORED MATERIALS

A. Contractor shall use an approved storage area for materials. Materials and/or equipment purchased by the Contractor may be compensated on a monthly basis. For compensation, provide the Project Representative invoices for said materials, shop drawings and/or submittals for approval, and applicable insurance coverage, see General Conditions, Article 9.

17.01 STAGING AND STOCKPILING AREA

A. Contractor shall use staging and stockpiling sites for to facilitate the project as approved by the Owner. Contract Documents may show approved staging and stockpiling locations. Notify Owner within 24 hours for approval of staging and stockpiling sites not shown on the Contract Drawings.

18.01 SECURITY

A. The Contractor shall provide all security measures necessary to assure the protection of equipment, materials in storage, completed work, and the project in general.

19.01 CLEANUP

A. Cleanup for each item of work shall be fully completed and accepted before the item is considered final. If the Contractor fails to perform cleanup within a timely manner the Owner reserves the right to withhold final payment.

B. Review these Contract Documents for additional Final Cleanup specifications for specific measures, associated with Contractor responsibilities and final payment.

20.01 ACCESS DURING CONSTRUCTION

A. Provide access to all public and private roadways and approaches within the project throughout the construction period. Coordinate with Bluewater Springs Hatchery's Manager for any access issues.

21.01 CONSTRUCTION TRAFFIC CONTROL

A. The Contractor is responsible for providing safe construction and work zones within the project limits by implementing the rules, regulations, and practices of the Manual on Uniform Traffic Control Devices, current edition.

22.01 SANITARY FACILITIES

A. Provide on-site toilet facilities for employees of Contractor and Sub-Contractors and maintain in a sanitary condition.

23.01 SEEDING

A. This work also includes conserving, placing, and finishing topsoil placement at designated areas on the project drawings or as directed by the Engineer.

B. The Contractor is responsible for providing the seed mixture and application rate that shall be determined and mixed by a local seed supplier or plant ecologist and approved by the Engineer.

C. Fertilizer shall not be used.

D. Utilize all salvaged topsoil conserved from clearing and grubbing operations to cover excavation and embankment slopes prior to fertilizing, seeding, or mulching.

24.01 CONTRACT CLOSEOUT

A. The Contractor's Superintendent shall maintain at the project site, a "Record Set of Drawings" showing field changes, as-built elevations, unusual conditions encountered during construction, and such other data as required to provide the Owner with an accurate "as constructed" set of record drawings. The Contractor shall furnish the "Record Set" to the Project Representative following the Final Inspection of the Project.

   The Contractor's final payment will not be processed until the "Record Set" of drawings are received and approved by the Project Representative.

25.01 MEASUREMENT AND PAYMENT

A. This section describes the method of measurement and basis of payment for all work shown on the drawings and required by the Contract documents.

   a. The bid price for each item of the Contract in the Bid Proposal shall cover all work shown on the drawings and defined in the specifications and other Contract Documents. All costs required by the work including furnishing materials, equipment, and performing all necessary labor and supervision to complete the work shall be included in the lump sum or unit price bid items.

      No item that is required by the Contract Documents for the successful completion of the work will be paid for outside of or in addition to the prices submitted in the Bid Proposal. All work not specifically set forth as a pay item in the Bid Proposal shall be considered a subsidiary obligation of the Contractor and all costs in connection therewith shall be included in the prices submitted.

   b. Unit Price quantities and measurements shown on the Bid Proposal are for bidding and contract purpose only. Quantities and measurements supplied, completed for the project, and verified by the Project Representative shall determine payment. Each unit price will be deemed to include an amount considered by the Contractor to be adequate to cover Contractor's overhead and profit for each bid item.

c. The Owner or Contractor may make a Claim for an adjustment in Contract Unit Price if the quantity of any item of Unit Price Work performed by the Contractor differs materially and/or significantly (increase or decrease by 50%) from the estimated quantity indicated on the Bid Proposal.

d. Lump sum bid item quantities will not be measured. Payment for the lump sum bid proposal items will be paid in full amount listed on the Bid Proposal when accepted by the Project Representative, unless specified otherwise.

B. Method of Measurement and Basis of Payment

1. Mobilization, Insurance, and Bonding

Measurement for this item shall be as a percentage of the contract amount completed and shall be paid as a Lump Sum (LS), with the payment percentage based on the table provided below. Payment shall be made for mobilization to cover the costs of preparatory work and operations, including but not limited to those necessary for the movement of personnel, equipment, supplies, materials and incidentals to the project site; for the establishment of all offices, buildings and other facilities necessary for the Work on the project; for Contractor overhead relating to the project; and for all other work and operations which must be performed or cost incurred including project closeout, final cleanup and moving off of project site upon completion of Work.

Also to be included in Mobilization are costs relating to insurance, contract bonds and permits which the Contractor is to obtain or pay, to perform work. Also included are all submittals required that are not paid for under other items.

Mobilization Payments

Percentage of Contract Amount Paid	**Amount Paid (whichever is less)**	
	Percentage of Mobilization Bid Amount[1]	**Percentage of Original Contract Amount**
First estimate after Notice to Proceed	99	1
5	25	3
10	50	6
25	60	8
50	90	10
70 or Conditional Final Acceptance, whichever occurs first	99	
Final Estimate	100	

2. Quality Control Testing

Measurement for this item shall be as a percentage of the contract amount completed and shall be paid as a Lump Sum (LS), with the percentage based on the amount of work complete to date. All testing shall follow the Montana Public Works Standard Specifications (MPWSS). Contractor is responsible for and shall employ at his expense a testing laboratory acceptable to the Engineer to perform any testing to determine product quality and characteristics, job mix formulas or any other internal quality control testing as needed to ensure delivery and installation of an acceptable product at the job site, per these Contract Documents. Contractor is also responsible for all materials testing during construction for quality control including, by not limited to, compaction density tests of backfill, subgrade, crushed base, and Portland cement concrete testing.

3. Construction Surveying

Measurement for this item shall be as a percentage of the item completed and shall be paid as a Lump Sum (LS), with the percentage based on the total construction completed to date.

4. SWPPP Administration

Measurement for this item shall be paid as a Lump Sum (LS), 25% on the initial pay application and subsequent payments shall be as a percentage based on the total construction completed to date. Contractor is responsible for all permit, monitoring, and reporting fees, adherence to SWPPP water quality requirements associated with all construction activities, including dewatering.

5. Miscellaneous Force Account

Measurement for this item shall be based on approved Engineer's Field Order – Force Account prepared by the Engineer in accordance with changes to the Contract.

6. Seeding

Measurement for this item shall be made in the field with the quantity to be paid determined by the actual number of Cubic Yards (CY) revegetated based upon the neat lines defined in the drawings or as defined by a comparison of pre and post topographic surveys. The price shall be full compensation for stripping, topsoil salvage and/or importing, topsoil placement, seedbed preparation, and seeding as well as materials, labor, equipment, tools and incidentals to complete the work in accordance with the Contract Documents.

7. Well House, Piping, and Appurtenances

Measurement for this item shall be as a percentage of the item completed and shall be paid as a Lump Sum (LS), with the percentage based on the complete in place well house installed to date. Price shall include all excavation, backfill, compaction, crushed base, dewatering, precast concrete box, concrete landing, cast in place concrete floors, well house building, guardrail, access stairs, automatic strainer, flow control and pressure reducing valves, flow meters, jib crane, piping, valves, fittings, couplers, restraints, pressure gauges, floor drains, heaters, and all appurtenances necessary to install and complete the construction within the footprint of the well house perimeter as shown on the drawings. The concrete landing pad shall constitute all sealant and curing of concrete, for all premolded mastic material for expansion joints, contraction joints and all saw cuts required to install expansion joints. Price shall also include all costs to cover materials, labor, equipment, tools, and incidentals to complete the work in accordance with the Contract Documents.

8. 10-Inch C900 DR18 PVC

This bid item will include the 10-inch PVC water line from the well house to the existing PVC water line and the 10-inch PVC discharge line. Measurement for this item shall be made in the field with the quantity to be paid determined by Linear Feet (LF) of water line installed outside of the perimeter of the well house building. No measurement or payment under this bit item will be made for water line, fittings or appurtenances installed within the perimeter of the building footprint. Payment shall include trench excavation and furnishing and installing the water line, pipe bedding, end treatment, tracer wire, discharge pipe riprap, erosion control, backfill, compaction, dewatering, and other necessary materials, fittings, thrust restraints, shoring, testing, haul, placing and all other work for completion of the item. Price shall also include all costs to cover materials, labor, equipment, tools, and incidentals to complete the work in accordance with the Contract Documents.

9. 6-Inch C900 DR18 PVC

This bid item will include the 6-inch PVC drain line from the well house sump. Measurement for this item shall be made in the field with the quantity to be paid determined by Linear Feet (LF) of drain line installed outside of the perimeter of the well house building. No measurement or payment under this bit item will be made for drain line, fittings, or appurtenances installed within the perimeter of the building footprint. Payment shall include trench excavation and furnishing and installing the drain line, pipe bedding, end treatment, tracer wire, discharge pipe riprap, erosion control, backfill, compaction, dewatering, and other necessary materials, fittings, thrust restraints, shoring, testing, haul, placing and all other work for completion of the item. Price shall also include all costs to cover materials, labor, equipment, tools, and incidentals to complete the work in accordance with the Contract Documents.

10. Connect to Existing Water Main

Measurement for this item shall be made in the field with the quantity to be paid determined by the actual number of Each (EA) connection to existing water main to the lines and grades shown on the drawings. Connect to existing water main shall be measured as one per connection to the existing mainline system. A connection may be made through connection to an existing fitting, replacement of an existing fitting or installation of a new fitting within an existing water line or as directed by the Engineer. The price shall be full compensation for all excavation, backfill, dewatering, coordination of operation of existing valves and mainline system, special sleeves or couplings, 10-inch wye, cathodic protection, cleaning, testing, haul, placing, and appurtenances. Price shall also include all costs to cover materials, labor, equipment, tools, quality control testing and incidentals to complete the work in accordance with the Contract Documents.

11. Embankment

Measurement for this item shall be made in the field with the quantity to be paid determined by the actual number of Cubic Yards (CY) imported, placed, and compacted, based upon the neat lines defined in the drawings or as defined by a comparison of pre and post topographic surveys. The price shall be full compensation for backfill and compaction including importing, hauling, placing, permits, water, compaction, pit reclamation required, materials, labor, equipment, tools and incidentals to complete the work in accordance with the Contract Documents. Backfill and compaction for water line trenching is not included in this item.

12. 1-Inch Drain

Measurement for this item shall be made in the field with the quantity to be paid determined by the actual number of Each (EA) 1-inch drain to be installed shown on the drawings. The price shall be full compensation for excavation, backfill, compaction, connection to watermain, saddle, corporation stop, service line, connection to service line, curb stop and box, rod and pin, drain rock and other necessary materials, fittings, thrust restraints, shoring, testing, haul, placing and all other work for completion of the item. Price shall also include all costs to cover materials, labor, equipment, tools, and incidentals to complete the work in accordance with the Contract Documents.

13. Electrical

Measurement for this item shall be as a percentage of the item completed and shall be paid as a Lump Sum (LS), with the percentage based on the amount of work complete to date. Price shall also include all costs to cover materials, labor, equipment, tools, and incidentals to complete the work in accordance with the Contract Documents and the Electrical drawings.

END OF SPECIAL PROVISIONS

MONTANA FISH, WILDLIFE, & PARKS

BLUEWATER SPRINGS TROUT HATCHERY
ARTESIAN WELL HEAD DEVELOPMENT

SPECIFICATIONS FOR WORK
TECHNICAL PROVISIONS

Incorporation of Montana Public Works Technical Specifications.

The Technical Specifications as found in Montana Public Works Standard Specifications (MPWSS), Seventh Edition, April 2021 and/or current Addendums or Revisions; are hereby incorporated by reference and made a part of this Contract:

Incorporation of Montana Fish, Wildlife & Parks Technical Specifications and Modifications to MPWSS Technical Specifications.

In addition to the MPWSS Technical Specifications are the following Montana Fish, Wildlife & Parks Technical Specifications (modifications to MPWSS Technical Specifications).

TABLE OF CONTENTS

SECTION 01100 - SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Access to site.
4. Coordination with occupants.
5. Work restrictions.
6. Specification and drawing conventions.
7. Miscellaneous provisions.

B. Related Requirements

1. Division 01 Section “Temporary Facilities and Controls” for limitations and procedures governing temporary use of Owner’s facilities

1.2 PROJECT INFORMATION

A. Project Identification: Bluewater Springs Trout Hatchery Artesian Well Head Development #7113112

1. Project Location:

Bluewater Springs Hatchery
Carbon County, MT
Latitude/Longitude: (45.33015 -108.79951)

B. Owner: State of Montana Fish Wildlife & Parks

1. Owner's Representative:

Tom Mannatt, Project Manager
State of Montana Fish,
Wildlife and Parks Design & Construction Bureau
1522 Ninth Avenue Helena, Montana
Phone: (406) 841-4006
Cell: 406-431-4031

1.3 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and consists of the following:

1. The work consists of construction of a well house, foundation, piping, equipment, and minor site work for an existing artesian well. Work also includes the construction of a PVC pipeline and connection to the existing water main line.

2. It is the contractor's responsibility to confirm dimensions and layout for quantifying materials.

B. Type of Contract.

1. Project will be constructed under a single prime contract.

1.4 ACCESS TO SITE

A. General: Contractor shall have limited use of project site for construction operations as indicated by requirements of this Section.

B. Staging Area: Designated area for Contractor parking and material storage will be approved by Bluewater Springs Hatchery Management.

C. Use of Site: Limit use of Project site to work in areas of the well head and pipelines. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1. Keep driveway entrances and parking areas clear and available to Owner, Owner's employees, the public, and emergency vehicles at all times.

a. Do not drive vehicles or equipment on the grounds around the buildings or off established roads unless approved by the Bluewater Springs Hatchery Manager. Any damage to the ground outside of the work area shall be repaired by the Contractor at no cost to the Owner.

1.5 COORDINATION WITH OCCUPANTS

A. Owner Occupancy: Owner or Project Representative will occupy site throughout construction period.

1.6 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations.

B. On-Site Work Hours: Project work will be limited to the hours of 7:00 a.m. to 6:00 p.m., Monday through Friday excluding legal holidays. Additional hours or working days are subject to Owner approval with prior notice. Contractor must give Owner a minimum of two (2) days' notice for working hours outside of those indicated above.

C. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.

1. Notify Owner not less than two days in advance of proposed disruptive operations.

2. Undesirable language and other such devices such as excessively loud radios and conversation are hereby specifically prohibited on the project site.

D. Smoking is not permitted on the site due to fragile wildfire conditions in and around Bluewater Springs Hatchery. Workers may smoke in their vehicles.

1.7 MISCELLANEOUS PROVISIONS

1.7.1 See Special Provisions.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01500 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

B. Related Requirements:

1. Division 01 Section "Summary" for work restrictions.

C. All work not specifically described in this technical specification of this bid document shall be performed in compliance with the applicable technical specification sections found in the current version of Montana Public Works Standard Specifications (MPWSS).

1.2 USE CHARGES

A. General: Installation and removal of any necessary temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to Owner and authorities having jurisdiction.

B. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service.

PART 2 – PRODUCTS

2.1 TEMPORARY FACILITIES

A. Field Offices, General: Prefabricated or mobile units. Contractor’s option- Field office not required at project site.

B. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations. Contractor’s option – Storage shed not required at project site.

C. Toilet Facility: Locate in designated staging area, or as otherwise approved by Bluewater Springs Hatchery Management.

2.2 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures. Due to fragile nature of the structures and location, the contractor must have fire extinguishers on the site daily.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work.

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed.

3.2 TEMPORARY UTILITY INSTALLATION

A. General: Connect to existing service.

B. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

C. Electric Power Service: Contractor supplied portable generators if necessary.

3.3 SUPPORT FACILITIES INSTALLATION

A. Parking: Use area(s) designated by Owner for construction personnel.

B. Waste Disposal Facilities: Provide covered waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. The Owner’s waste receptacles shall not be used by the Contractor.

C. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.

1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

3.4 SECURITY AND PROTECTION

A. Contractor is solely responsible for security and protection of all temporary facilities, equipment and materials stored on site.

B. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities caused by Contractor.

C. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

D. Tree and Plant Protection: Protect vegetation from damage from construction operations. Replace vegetation damaged from work in this Contract. Replace damaged trees and plants as directed by the Owner.

E. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses.

3.5 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Termination and Removal: Remove each temporary facility when need for its service has ended. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

END OF SECTION

SECTION 01660 - EQUIPMENT TESTING AND START-UP

PART 1 - GENERAL

1.1 GENERAL

A. Equipment testing is requisite to satisfactory completion of the contract and, therefore, shall be completed within the contract time. The CONTRACTOR shall demonstrate that all equipment operates satisfactorily throughout the entire operating range.

B. The CONTRACTOR shall require that each manufacturer's representative furnish to the ENGINEER a written report addressed to the OWNER certifying that the equipment has been properly installed and lubricated, is in accurate alignment, is free from any undue stress imposed by connecting piping or anchor bolts, and has been operated satisfactorily under full-load conditions.

C. The CONTRACTOR shall be responsible for scheduling all operations testing. The CONTRACTOR is advised that the ENGINEER and the OWNER's operating personnel will witness the Verification Operation Phase.

D. The CONTRACTOR shall notify the ENGINEER at least 3 days in advance of each equipment test.

E. The CONTRACTOR shall furnish all personnel, power, water, heat, chemicals, fuel, oil, grease, and all other necessary equipment, facilities, and services required for conducting the tests.

F. Prior to scheduling any operations testing, the CONTRACTOR shall have previously furnished the Owner's Manuals required under Submittals.

G. Temporary gauges, meters and instruments shall be provided by the CONTRACTOR, as required to supplement the permanent gauges, meters and instruments provided under this contract, to demonstrate that all equipment satisfies the requirements of the Contract Documents. All instruments shall have been recently calibrated and the CONTRACTOR shall be prepared to demonstrate the accuracy of all instruments used for testing. Calibration procedures shall be in accordance with applicable standards.

1.2 RELATED WORK

A. Refer to specific requirements listed in the following Divisions;

Division 15 Mechanical
Division 16 Electrical

1.3 PRE-OPERATIONAL CHECKOUT

A. The CONTRACTOR shall provide the services of an authorized representative of the manufacturer of each item of major equipment who shall visit the site of the WORK and inspect, check, fill fluids, adjust if necessary, and approve the equipment installation. In each case, the CONTRACTOR shall arrange to have the manufacturer's representative revisit the job site as often as necessary until any and all trouble is corrected and the equipment installation and operation are satisfactory.

1.4 INITIAL OPERATION

A. The initial operation phase shall be the trouble shooting phase during which the Contractor shall operate the equipment to confirm that all equipment will operate in accordance with contract requirements.

B. The Contractor shall notify the Engineer and Owner in writing when the initial operation will take place. The Engineer and Owner may be present during this phase but they are not required to do so.

C. Coordinate with the OWNER for instruction for the handling of water produced by the operation of pumps. Water may be allowed to enter the distribution piping system only after testing has shown it to be safe for potable water systems.

1.5 OPERATION DEMONSTRATION

A. The operation demonstration phase takes place after the Contractor has operated the equipment. The purpose of the operation demonstration phase is for the ENGINEER and OWNER to witness the operation of the equipment.

B. The CONTRACTOR shall provide the effective coordination of all parties necessary for the successful operation demonstration.

C. The CONTRACTOR shall provide operating personnel for the duration of the demonstration. Additionally, the CONTRACTOR shall provide all water, power, chemicals, and other consumables required for the test.

D. The operation demonstration shall not be commenced until all required leakage tests and initial operation have been completed.

E. All defects in materials or workmanship which appear during this test period shall be immediately corrected by the CONTRACTOR.

F. During the operation demonstration, the CONTRACTOR shall provide the services of authorized representatives of the manufacturers, in addition to those services required under operations testing, as necessary, to correct faulty equipment operation.

G. During the operation demonstration, the CONTRACTOR shall keep records of the operations, in accordance with the instructions of the ENGINEER. This information will serve as base line information to be used for comparison if problems are detected in the future.

1.6 TRAINING

A. The CONTRACTOR shall make available experienced factory trained representatives of the manufacturer who shall instruct the OWNER'S personnel in the operation and maintenance of the equipment. Such instruction shall be scheduled at a time arranged with the OWNER at least 2 weeks in advance and shall be provided while the respective manufacturer's equipment is fully operational. On-site instruction shall be given by qualified persons who have been made familiar in advance with the equipment.

END OF SECTION

SECTION 02220 – CLEARING/GRUBBING, TOPSOIL SALVAGING/PLACING

PART 1 – GENERAL

1.1 SUMMARY

A. Section consists of clearing, grubbing, excavating and depositing topsoil in accordance with these specifications and in conformity with the lines, grades, thicknesses, and typical cross sections shown on the Drawings or established by the Owner.

B. The Contractor will provide all necessary erosion control and protective measures necessary to ensure the integrity of the project area.

C. All work not specifically described in this technical specification of this bid document shall be performed in compliance with the applicable technical specification sections found in the current version of Montana Public Works Standard Specifications (MPWSS).

PART 2 – PRODUCTS

2.1 MATERIALS

A. Clearing and Grubbing shall consist of felling trees, disposal of stumps, brush, logs, limbs, vegetation, and other matter within the clearing limits or other areas that interfere with the excavation and embankment limits.

B. Topsoil salvaging and placing shall consist of that material which is considered suitable for the growth of grass or other cover crops, reasonably free of hard dirt, clay, rocks, or other materials which would inhibit the germination of seeds or the growth of the cover crop.

C. Topsoil removal shall be to a depth of 6-inches of material in all areas unless otherwise specified or directly by the Owner. Classification of soils suitable for topsoil will be at the discretion of the Owner.

PART 3 – EXECUTION

3.1 PROCEDURES

A. Clearing and Grubbing will be performed when there are trees, stumps, brush, and other matter that are within the boundaries of disturbance activities.

B. Topsoil shall be removed in areas within the boundaries of disturbance activities. If topsoil removal depths exceed the 6-inches specified, the Contractor will cease all topsoil removal operations until the quantity of overstripping can be determined by a method approved by the Owner.

C. Topsoil which is not stripped from its original position and placed directly in its final position shall be stockpiled for later incorporation into the work. Stockpiles shall be placed at locations selected by the Contractor and approved by the Owner.

D. All topsoil will be replaced along cut and fill slopes and over pipeline trenches.

E. The Contractor will be responsible for hauling excess topsoil to approved location by the Owner.

END SECTION

SECTION 02221 – TRENCH EXCAVATION AND BACKFILL FOR PIPELINES

PART 1 - GENERAL

1.1 SUMMARY

A. Work shall consist of trench excavation and backfill for pipelines and appurtenances within the limits of the Work necessary for the construction of the well bypass line, floor drain line, and water line.

B. All excavation work shall be constructed to the neat lines and elevations as shown in the Drawings.

C. All work not specifically described in this technical specification of this bid document shall be performed in compliance with the applicable technical specification sections found in the current version of Montana Public Works Standard Specifications (MPWSS).

D. Related Requirements

1. Division 02 Section “Excavation, Backfill and Compaction” for requirements for trench backfill and compaction.

1.2 SUBMITTALS

A. Submittals of material quality testing for Type 1 pipe bedding gradation and plasticity index and Type 2 pipe bedding gradation.

PART 2 – PRODUCTS (Not used)

2.1 PIPE BEDDING MATERIALS

A. Type 1 Pipe Bedding

1. Type 1 pipe bedding includes the material placed from 4 inches below the bottom of the pipe to 6 inches over the pipe.

2. Provide imported granular material with a gradation as specified in Section 02221 2.1(A)(3) of the MPWSS.

B. Type 2 Pipe Bedding

1. Type 2 pipe bedding is to be used as directed by the Engineer to replace unsuitable material encountered in the trench bottom

2. Place Type 2 pipe bedding from the bottom of the Type 1 pipe bedding to the depth required to adequately support the pipe.

3. Provide Type 2 pipe bedding with a gradation as specified in Section 02221 2.1(B)(3) of the MPWSS.

2.2 TRENCH BACKFILL MATERIAL

A. Backfill material obtained from trench excavations must be free of cinders, ash, refuse, organic or frozen material, boulders, or other deleterious materials.

2.3 DETECTABLE BUIRED WARNING TAPE

A. Detectable warning tape is to have a minimum 6-inch width and 5-mil thickness and a solid aluminum core running the full length and width of the tape enclosed in a color-coded inert plastic jacket, impervious to alkalis, chemical reagents and solvents in the soil. The tape is to meet APWA/ULCC Color Code requirements and is to have a maximum 36-inch imprint.

PART 3 – EXECUTION

3.1 TRENCH EXCAVATION

A. General Trench Excavation

1. Excavate as necessary at the locations shown on the Drawings, staked in the field or otherwise specified for the installation of pipelines as required.

2. Excavate to the depth required for the invert grade shown on the drawings.

3. Do not excavate below required depths unless directed by the Engineer in the field.

B. Pile excavated materials that are suitable for backfilling in an orderly manner on the side of the trench at a sufficient distance from the banks of the trench to avoid overloading and to prevent slides or cave-ins.

1. Place suitable cut material on one side of the trench only.

2. Do not allow surface runoff to flow into excavations and promptly remove all water that accumulates in trench excavations.

3. Do not obstruct surface drainage of adjoining areas.

C. Enforce safety and maintain safe working conditions in all trenching and shoring to conform to OSHA regulations

1. Employ qualified, properly trained personnel to design shoring, perform safety inspections of the trenches, and supervise other operations involving safety procedures, as prescribed by OSHA.

2. Protect all open trenches by safety fencing that meets the approval of the Owner during all times when Work is not taking place in the trench.

3.2 TRENCH FILLING AND BACKFILLING

A. General

1. Backfill all trenches as specified immediately after grade, alignment, and pipe jointing has been inspected and approved by the Engineer. Conduct any pipe testing as specified in these Contract Documents and correct all defects discovered by tests prior to backfilling.

2. Storage of all imported backfill materials, including protecting said materials from adverse conditions that would disqualify them from use under these specifications, is the responsibility of the Contractor.

B. Pipe Bedding Placement

1. Type 1 Bedding

a. Place type 1 Bedding material 4 inches under, around the pipe, and to a point 6 inches above the top of the pipe in 6-inch lift, using hand or other compaction methods without damaging or disturbing the pipe and all appurtenances.

b. Place bedding material in equal lifts on both sides of the pipe for the full trench width. Thoroughly compact each lift of pipe bedding by tamping, vibration, slicing with a shovel, rodding, or by a combination of these methods. Take special care to assure complete compaction under the haunches of the pipe.

2. Type 2 Bedding

a. Use Type 2 Pipe Bedding as directed by the Engineer to replace unsuitable material encountered in the trench bottom, placing it from the bottom of the Type 1 Bedding material to the depth required to adequately support the pipe.

C. Trench Backfill

1. After the pipe bedding materials are placed and compacted as specified, backfill the trench.

   a. Use backfill material free of cinders, ash, refuse, organic or frozen material, boulders, or other deleterious material.

   b. From the top of the Type 1 Bedding to 6 inches (15 cm) below the ground surface, or the subgrade elevation, material containing stone up to 8 inches (20 cm) in the greatest dimension may be used.

   c. Cost of screening, drying, or moistening excavated backfill to comply with specifications will be considered incidental to the Contractor's bid price per linear foot of pipe and service lines and unit prices for appurtenances, and no additional payment will be made for such work.

2. Meet the backfill and compaction requirements for all of the backfill types described in the Contract Documents.

END OF SECTION

SECTION 02229 – STRUCTURE EXCAVATION

PART 1 - GENERAL

1.1 SUMMARY

A. Work shall consist of structure excavation for the well house foundation within the limits of the Work necessary for the installation of the precast concrete box and cast in place concrete floor.

B. All excavation work shall be constructed to the neat lines and elevations as shown in the Drawings.

C. All work not specifically described in this technical specification of this bid document shall be performed in compliance with the applicable technical specification sections found in the current version of Montana Public Works Standard Specifications (MPWSS).

D. Related Requirements

1. Division 02 Section “Excavation, Backfill and Compaction” for requirements for trench backfill and compaction.

PART 2 – PRODUCTS (Not used)

PART 3 – EXECUTION

3.1 STRUCTURE EXCAVATION

A. General Structure Excavation

1. Excavate as necessary at the locations shown on the Drawings, staked in the field or otherwise specified for the installation of the well house as required.

2. Excavate to the depth required for the grade shown on the drawings.

3. Do not excavate below required depths unless directed by the Engineer in the field.

4. When the excavation reaches the designated depth, de-water, clean, and maintain the excavation until the foundation bed is inspected.

5. Pile excavated materials that are suitable for backfilling in an orderly manner at a sufficient distance from the excavation to avoid overloading and to prevent slides or cave-ins.

B. Enforce safety and maintain safe working conditions in all excavations and shoring to conform to OSHA regulations

1. Employ qualified, properly trained personnel to design shoring, perform safety inspections of the excavations, and supervise other operations involving safety procedures, as prescribed by OSHA.

2. Protect all open excavations by safety fencing that meets the approval of the Owner during all times when Work is not taking place in the excavation.

END OF SECTION

SECTION 02230 – EXCAVATION, BACKFILL AND COMPACTION

PART 1 - GENERAL

1.1 SUMMARY

A. Work shall consist of excavation and backfill within the limits of the Work necessary for the construction of the well house foundation, pad, and landing.

B. All excavation and backfill work shall be constructed to the neat lines and elevations as shown in the Drawings.

C. All work not specifically described in this technical specification of this bid document shall be performed in compliance with the applicable technical specification sections found in the current version of Montana Public Works Standard Specifications (MPWSS).

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION

3.1 EXCAVATION, BACKFILL AND COMPACTION

A. Refer to Drawings to ensure conformity to grade thickness, cross sectional area and grading.

B. The areas to be covered by the compacted fill shall be prepared by scarifying to a minimum depth of 8 inches, smoothing, watering or aerating as necessary to bring the moisture content to within plus four (4) or minus two (2) percentage points of the optimum moisture content, and then compacted to a density not less than 95 percent of the maximum density as determined by ASTM D-698 (Standard Proctor).

C. Immediately prior to placing the first layer of compacted fill, all earthen surfaces upon or against which compacted fill is to be placed shall be cleaned of all loose rocks and organic material.

D. When placing compacted earthfill materials, the materials shall be deposited in continuous horizontal layers and compacted as specified below. The excavation, placing, moistening, and compacting operations shall be such that the material will be uniformly compacted throughout. No compacted earthfill shall be placed on or consist of frozen materials.

E. The thickness of each horizontal layer after compaction shall be not more than 6 (six) inches.

END OF SECTION

SECTION 02235 - AGGREGATES

PART 1 – GENERAL

1.1 SUMMARY

A. This work consists of placing crushed base, screened drainage rock, and riprap as indicated on the Drawings for installation of the well house foundation, water line, and drain line erosion control.

B. This Work consists of all equipment and labor to install the aggregates in accordance with these specifications and in conformity with the lines, grades, thicknesses, and typical cross sections shown on the Drawings.

C. All work not specifically described in this technical specification of this bid document shall be performed in compliance with the applicable technical specification sections found in the current version of Montana Public Works Standard Specifications (MPWSS).

1.2 SUBMITTALS

A. Submittals of gradation, moisture density curves, and other test results for sources for crushed base material shall be provided to the Engineer for approval.

PART 2 – PRODUCTS

2.1 CRUSHED BASE

A. Use crushed stone or gravel consisting of hard, durable particles of fragments of stone, free of excess flat, elongated, soft or disintegrated pieces, dirt, or other deleterious matter, having a percent of wear not exceeding 50 at 500 revolutions when tested under AASHTO T96.

B. Furnish 1 ½" minus crushed base in accordance with the specifications shown in Table 1.

Table 1. Crushed Base Course Gradation

Sieve Size	Percent Passing
1 ½"	100
¾"	–
½"	–
No. 4	25 – 60
No. 10	–
No. 200	0 – 8

2.2 SCREENED DRAINAGE ROCK

A. Furnish screened drainage rock in accordance with the specifications for Type 1 Pipe Bedding in Section 02221 2.1(A)(3) of the MPWSS. The aggregate must not contain deleterious material, such as shale, alkali, mica, or soft flaky particles.

PART 3 – EXECUTION

3.1 PLACEMENT AND SPREADING

A. Crushed Base Course

1. Mix and place the material in maximum 8 inches (20 centimeters) compacted layers unless otherwise approved. Deposit and spread each load of material on the prepared subgrade, or on a completed sub-base or base course layer continuously without interruption. Discontinue operating haul units over subgrade, or over any sub-base or base course completed if the haul units damage the subgrade, sub-base or base course.

2. Deposit and spread the material in a uniform layer, without segregation, to a loose depth so that when compacted, and making allowance for any filler to be blended on the road, the layer has the specified thickness.

3. Spread material using dump boards, spreader boxes, or vehicles equipped to distribute the material in a uniform layer. The material may be deposited in windrows mixed and spread as described below.

4. Construct each layer meeting these requirements. Blade smooth and thoroughly compact each layer as specified before placing the succeeding layer.
5. If segregation or moisture problems exist, or if the material was placed in windrows, thoroughly mix the material of the affected.

6. Uniformly add water, when required, on site and place in amounts required to compact the material as necessary to aid in densification and to limit segregation. Maintain an adequate water supply during the work. Assure the equipment used for watering is of the capacity and design to provide uniform water application.

7. Apply water during the work to control dust and to maintain the base course in a damp condition.

B. Riprap

1. Place riprap as shown on the drawings and as specified herein.

2. Minimize drop height when placing riprap.

3. Repair all tears and punctures to geosynthetic separation fabric which occur during placing riprap on separation fabric.

3.2 FIELD DENSITY REQUIREMENTS

A. Crushed Base Course

1. Compact placed material the full width by rolling with suitable tamping equipment or power rollers. Correct all irregularities or depressions that develop during rolling by loosening the material in these places and adding or removing material, as required.

2. Perform blading and compacting alternately as required or directed, to maintain a smooth, even, uniformly compacted surface until the final inspection. Along curbs, headers, manholes, and similar structures, and at all places not accessible to the roller, compact the base course material with suitable mechanical tampers or hand tampers to reach the compaction requirements.

3. Provide the watering and rolling required to obtain a minimum field density of 95% of maximum dry density as determined by AASHTO T99. No separate compensation is made for rolling and watering the base course.

END OF SECTION

SECTION 03200 – REINFORCING STEEL

PART 1 – GENERAL

1.1 SUMMARY

A. This work is furnishing and placing reinforcing steel or wire fabric meeting the quality, type and size specified in the contract.

B. All work not specifically described in this technical specification of this bid document shall be performed in compliance with the applicable technical specification sections found in the current version of Montana Public Works Standard Specifications (MPWSS).

1.2 REFERENCES

ASTM A615	Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM A705	Age-Hardening Stainless-Steel Forgings
AASHTO M31	Deformed and Plain Carbon and Low-Alloy Steel Bars for Concrete Reinforcement
AASHTO M32	Steel Wire, Plain, for Concrete Reinforcement
AASHTO M55	Steel Welded Wire, Plain, for Concrete Reinforcement
AASHTO M54	Deformed Steel Bar Mats for Concrete Reinforcement

PART 2 – PRODUCT

2.1 Furnish all new material meeting the following requirements.

A. Bar Reinforcement

1. Furnish deformed reinforcement steel meeting ASTM A615, (AASHTO M31) or ASTM A705, Grade 60. Use only epoxy-coated reinforcement steel supplied by a CRSI certified epoxy-coated reinforcement steel manufacturer.

B. Wire and Wire Mesh

1. Furnish wire meeting cold-drawn steel wire AASHTO M32 (ASTM A82) requirements.

2. Furnish wire mesh for concrete reinforcement meeting AASHTO M 55 (ASTMA A 185).

3. Furnish bar mats meeting AASHTO M54 (ASTM A 184).

PART 3 – EXECUTION

3.1 PROTECTION

A. Protect steel reinforcement from damage at all times. Place steel free from dirt, detrimental scale, paint, oil and other foreign substance. Clean steel reinforcement having easily removed rust, loose scale, and dust using an approved method.

3.2 FABRICATION

A. Furnish four copies of shop details and placing drawings for all reinforcing steel to the Engineer for approval. Once checked, the Engineer will return two marked- up sets of prints or drawings for correction. The Engineer's review is only for general conformity with the plans. Checking the detailed dimensions is the Contractor's responsibility. The Engineer's review does not relieve the Contractor's responsibility to furnish all material meeting the Contract requirements. Detail Reinforcing, steel meeting the ACI "Standard Details and Detailing of Concrete Structures" and the "Manual of Engineering and Placing Drawings for Reinforced Concrete Structures" published by the American Concrete Institute (ACI 315).

B. Assure all bars are bent cold. Do not field bend any bar partially imbedded in concrete except as specified on the plans.

C. Ship bar reinforcement in standard bundles, tagged and marked meeting the "Details and Detailing of Concrete Structures" (ACI 315) requirements.

D. Concrete reinforcement and accessory details, not covered herein or on the drawings, must meet "Details and Detailing of Concrete Structures" and the "Manual of Engineering and Placing Drawings for Reinforced Concrete Structures" (ACI 315 and 315R) requirements.

3.3 PLACING AND FASTENING

A. Accurately place and hold firm all steel reinforcement in the plan locations, or as directed by Engineer, as concrete is being placed. Thrusting dowels into freshly poured concrete is prohibited.

B. Support and fasten together all reinforcement to prevent displacement due to construction loads. It is permissible to use on ground, where necessary, concrete support blocks having a minimum 4 square inches (2580 MM2) bearing area and having a compressive strength equal to the concrete being placed. Use approved bar chairs and spacers over form work. For concrete surfaces exposed to the weather in the finished structure, assure the portions of all accessories within ½-inch (12.7 mm) of the concrete surface are noncorrosive or protected against corrosion.

C. Overlap welded wire fabric for successive mats or rolls providing an overlap measured between outermost cross wires of each fabric sheet not less than the greatest spacing of the cross wires plus 2 inches (50 mm) but not less than 6 inches (150 mm), whichever is greater. Extend the fabric across supporting beams and walls to within 4 inches (100 mm) of concrete edges. It may extend through contraction joints. Adequately support the fabric during concrete placement to maintain its position in the slab using the methods previously described or by laying the fabric on a concrete layer of the required depth before placing the upper slab layer.

D. Offset vertical bars in columns at least one bar diameter at lap splices. Furnish templates for all column dowels.

E. Obtain Engineer approval for all splices not shown on the plans. Mechanical connectors for reinforcing bars may be used if approved.

F. Do not use pebbles, pieces of broken stone, concrete rubble, broken brick or building blocks, metal pipe, or wooden block to position the fabric.

G. Follow the minimum concrete protective covering for reinforcement below, unless noted otherwise on the drawings.

1. Concrete deposited against ground: 76.2 mm (3 inches)

2. Formed surfaces exposed to weather or in contact with the ground:

    a. #6 bars or larger 50.8 mm (2 inches)

    b. Smaller than #6 bars 38.1 mm (1-1/2 inches)

3. Interior Surfaces:

    a. Beams, girders and columns 38.1 mm (1-1/2 inches)

    b. Slabs, walls and joists:

        1) #11 bars or smaller 19.05 mm (3/4-inch)

        2) #14 and #18 bars 38.1 mm (1-1/2 inches)

H. For corrosive atmospheres or fire protection, see special provisions for minimum covering requirements.

I. Obtain Engineer approval of reinforcement placement before placing concrete. Remove and replace concrete placed without Engineer approval of reinforcing.

J. Straighten fabric reinforcement shipped in rolls into flat sheets before placing it.

END OF SECTION

SECTION 03310 – STRUCTURAL CONCRETE

PART 1 – GENERAL

1.1 SUMMARY

A. Work shall consist of ready-mixed and precast structural concrete meeting all specified requirements that is composed of Portland cement, aggregates, water, and admixtures as specified. Furnish ready-mixed concrete meeting ASTM C94 unless otherwise specified.

B. All work not specifically described in this technical specification of this bid document shall be performed in compliance with the applicable technical specification sections found in the current version of Montana Public Works Standard Specifications (MPWSS).

1.2 REFERENCES

ASTM C-94	Standard Specification for Ready-Mixed Concrete
ASTM C-150	Specification for Portland Cement
ASTM C-618	Specification for Coal Flyash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete
ASTM C-989	Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars
ASTM C-595	Specification for Blended Hydraulic Cements
ASTM C-157	Performance Specification for Hydraulic Cements
ASTM C-33	Specification for Concrete Aggregates
ASTM C-260	Specification for Air-Entraining Admixtures for Concrete
ASTM C-494	Specification for Chemical Admixtures for Concrete
ASTM C-1017	Specification for Chemical Admixtures for Use in producing Flowing Concrete
ASTM C-138	Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete
ASTM C-173	Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
ASTM C-231	Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C-31	Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C-39	Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C-172	Practice for Sampling Freshly Mixed Concrete
ACI 301	Standard Specification for Structural Concrete for Buildings
ACI 305	Hot Weather Concrete
ACI 306	Cold Weather Concrete

ACI 318 Building Code Requirements for Reinforced Concrete

1.3 QUALITY ASSURANCE

A. Codes and Standards: The codes and standards referred to in this section are declared to be part of this specification as if fully set forth herein. In addition, the following ACI Standards are incorporated in their entirety, unless specifically required otherwise:

1. ACI Standard 301, "Specifications for Structural Concrete for Buildings," American Concrete Institute, Edition.

2. ACI Standard 318, "Building Code Requirements for Reinforced Concrete", American Concrete Institute, current edition.

3. Concrete Reinforcing Steel Institute, "Manual of Standard Practice".

4. International Building Code of I.C.B.O.

B. Concrete Testing: The Contractor shall employ at his expense a testing laboratory acceptable to the Engineer to perform material evaluation tests and/or perform the mix design prior to placing any concrete. Retesting or additional testing of concrete or materials failing to meet the requirements of these specifications shall be done by the Contractor at no additional cost to the

1.4 SUBMITTALS

A. Source Submittals

1. Complete concrete mix design meeting all specification requirements. Meet the mix proportions specified in ACI 301. Submittals will include the following:

Mix Proportions	
- cement in lbs	Type and source of supply
- coarse aggregate	Size and source of supply
- fine aggregate	Source of supply
- water, gallons	City or well
- admixtures	Brand and description

B. Material Submittals

1. Specific gravity (bulk s.s.d. Basis) of coarse and fine aggregate and 1% absorption coarse aggregate unit weight (dry-rodded)-ASTM C33 quality tests including the following:

a. Fine Aggregate

1) gradation AASHTO, T27 and T11 deleterious substances soundness (AASHTO T104) organic impurities (AASHTO T21) mortar-making properties (AASHTO T71)

b. Coarse Aggregate

1) Deleterious substances gradation (AASHTO T27 and T11) soundness (AASHTO T104) percentage of wear (AASHTO T96)

c. Current chemical analysis of mixing water (if well)

d. Current cement and fly ash mill analysis

2. Concrete Mix Data

a. Slump

b. % air content

c. Unit weight

d. 7 day and 28-day compressive strength

3. Variations

a. The following variations will be cause for a new mix design

1) Change of aggregate source

2) Change of cement source

3) Addition or exclusion of certain admixtures including, but not limited to, pozzolans, accelerators, retarders and water reducers

4) Change in aggregate size

5) Change in type of cement

6) Failure to attain the strength requirements as outlined in ACI 301 or ASTM C94

b. A variation in any of the following will require informing the Engineer and Owner.

1) Change of cement supplier

2) Change of admixture brands or dosages (not types)

3) Minor adjustments of aggregate proportions accompanying material changes to accommodate placement conditions (same w/c ratio)

C. Certification of Ready Mixed Concrete Production Facilities

1. Concrete producers are to allow access to their facilities by Engineer or the Owner representatives for inspecting their facilities and/or sampling materials. All facilities should meet the requirements of the "National Ready-Mix Concrete Association" check list for concrete production facilities.

2. Items directly affecting a facility's ability to properly proportion, transport and deliver concrete may be reason for disqualifying that facility as a source of supply until such deficiencies are corrected. Examples would include cement and aggregate scales that will not accurately weigh materials or mixer units that will not thoroughly mix concrete materials.

PART 2 – PRODUCT

2.1 CLASSIFICATION

A. Concrete is classified as set forth by aggregates size referenced in ASTM C33, sizes 4 and 467 for Class C concrete and 56, 57, and 6 for Class M concrete. Place the specified class of concrete for each structure element as specified.

1. Use M-4500 (f'c=4,500 psi) concrete. The maximum allowable water cement (w/c) for this concrete is 0.45.

A. If concrete strength or durability requirements established by design exceed the above strength classifications, the Engineer may specify additional concrete classifications to meet those requirements, contractor shall verify this on the structural general notes found in the Drawings.

2.2 COMPOSITION OF CONCRETE

B. Upon receipt of the notice of award of the contract, furnish the Engineer with names of suppliers and locations of sources of materials proposed for use.

2. Materials

a. Cementitious Material: Cementitious material consists of Portland cement meeting ASTM C 150, with or without the addition of cementitious or pozzolanic mineral admixtures meeting, ASTM C618 or ASTM C989, or blended hydraulic cement meeting ASTM C595 or hydraulic cement meeting ASTM 1157. Unless otherwise specified, assure cementitious

material meets ASTM C 150 Type I or Type II. Assure cementitious material used in concrete is the same brand and type and from the same plant of manufacture as the cementitious material used in the concrete represented by the submitted field test date or used in the trial mixtures.

b. Aggregates: Assure aggregates meet ASTM C33.When a single size or a combination of two or more sizes of coarse aggregates are used, assure the final gradation meets the grading requirements of ASTM C33. Obtain concrete aggregates from the same source and use the same size ranges as the aggregates used in the concrete represented by submitted historical data, or used in trial mixtures.

c. Water and Ice: Use concrete mixing water and water to make ice meeting requirements of ASTM C94.

d. Admixtures: Use admixtures meeting the following requirements:

1) Air entraining, admixtures - ASTM C260

2) Chemical admixtures - ASTM C494

3) Chemical admixtures for use in producing flowing concrete - ASTM C1017

4) Calcium Chloride - ASTM D98

5) Use admixtures in the concrete that are the same as those used in the concrete represented by submitted field test data or in trial mixtures.

3. Change of Materials

a. When brand, type, size, or source of cementitious materials, aggregates, water, ice or admixtures are requested to be changed, submit new field data or data from new trial mixtures or furnish evidence that indicates that the change will not adversely affect the relevant properties of the concrete for acceptance before using the concrete.

B. Performance and Design Requirements

1. Assure the cementitious material content is adequate to meet the specified requirements for strength, water-cement ratio and finishing requirements. For concrete used in floors, assure the cement content is at least that indicated in Table 1. For concrete exposed to freezing and thawing or concrete exposed to deicers, assure a maximum water-cement ration of 0.45.

Table 1. Minimum Cement Content Requirements

Nominal Maximum Size of Aggregate (in)	Minimum Cement Content lb/yd^3
1 ½	470*
1	520
¾	540
3/8	641

* Minimum cement content is 520 lb/yd^3 and maximum H2O/cement ratio of 0.45 if concrete will be exposed to freezing and thawing and/or in the presence of deicing chemicals.

2. Furnish concrete at the point of delivery having a slump of 4 inches (max) determined by ASTM C 143.Meet slump tolerances in ACI 117. When a plasticizing admixture is used meeting ASTM C 10 17 or when a Type F or G high range water reducing admixture meeting ASTM C494 is approved to increase the concrete slump, assure the concrete has a slump of 2 to 4 inches before the admixture is added and a maximum slump of 8 inches at the point of delivery after the admixture is added.

3. Assure the nominal maximum size of coarse aggregate does not exceed three-fourths of the minimum clear spacing between reinforcing bars, one-fifth of the narrowest dimension between sided of forms or one-third of the thickness of slabs or toppings.

4. Concrete must be air entrained. Measure air content under ASTM C 138, C 173 or C231. Unless otherwise specified, ASTM C231 shall be used.

Table 2. Total Air Content of Concrete for Various Sizes of Course Aggregate

Nominal Maximum Size of Aggregate (in)	Total Air Content %
Less than 3/8	9
3/8	7.5
½	7
¾	6
1	6
1 ½	5.5
2	5
3	4.5
6	4

a. When admixtures are specified in the Contract Documents for particular parts of the Work, use type specified. Use of calcium chloride is not allowed.

b. When the average of the highest and lowest temperature during the period from midnight to midnight is expected to drop below 40°F for more than three successive days, deliver concrete in accordance with ASTM C-94.

2.3 PROPORTIONING AND DESIGN OF MIXES

A. Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301. If trial batch method used, use an independent testing facility acceptable to the Engineer for preparing and reporting proposed mix designs.

B. Submit written reports of each proposed mix for each class of concrete at least 15 days prior to start of work. Do not begin concrete production until mixes have been reviewed and approved.

PART 3 – EXECUTION

3.1 CONCRETE MIXES

A. Job-Site Mixing: Mix materials for concrete in appropriate drum type batch match mixer. For mixers of 1 cu. yd., or small capacity, continue mixing at least 1-½ minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released. For mixers of capacity larger than one cu. yd., increase minimum 1-½ minutes of mixing time by 2.5 minutes for each additional cu. yd., or fraction thereof. Aggregates or bags of cement containing lumps or crusts shall not be used.

B. Provide batch ticket in compliance with ASTM C94 for each batch discharged and used in work.

C. When air temperature is between 85°F and 90°F, reduce mixing and delivery time from 1-½ hours to 75 minutes, and when air temperature is above 90°F, reduce mixing and delivery time to 60 minutes, unless a hot weather concreting plan has been approved.

D. The mix may be designed for delayed set time to allow for long haul or other project conditions. Information pertaining to the delayed set admixture needs to be included on the Batch Ticket. Include with the mix design submittal information on the delayed set provisions of the design and specific time to final placement requirements.

3.2 MIXING

A. Thoroughly mix concrete to assure a uniform distribution of the materials throughout the mass. Mix concrete only in quantities required for immediate use and place it within the time limits specified. Waste all concrete which initial set has begun. Retempering of concrete is prohibited. Mix concrete in an approved truck mixer meeting the requirements of ASTM C94 herein.

1. WATER:

a. Do not exceed the approved w/c ratio.

b. The addition of water is allowed only one time and a minimum of 30 revolutions at mixing speed are required before discharge of concrete.

c. Do not add water if part of the batch has been discharged as a w/c ratio has not been determined.

d. Do not add water if the slump is within the specified range.

2. ADMIXTURE

a. Do not exceed manufacturer’s recommended dosage rates unless approved in the mix design stage.

b. Only admixtures included in the approved mix design may be dosed on-site.

c. A minimum of 30 revolutions at mixing speed are required before discharging concrete.

d. Do not add admixtures if any concrete has been discharged from the mixer other than the minimal amount for initial testing.

e. When measured plastic air content or slump exceeds the upper test limit and there is time available within the discharge time limit specified, rotate the load at agitation speed and re-test the air content and/or slump

f. Do not use admixtures to reduce the air content and/or slump.

B. The capacity of the plant and the transportation equipment must ensure delivery at a rate that will permit proper handling, placement and finishing at the point of delivery. Maintain the concrete delivery rate to provide for the continuous operation of placing, handling and finishing concrete as is practical. Maintain the interval between delivery of loads so that layers or lifts of concrete in place do not harden before succeeding layers or lifts are placed. In general, no lift or layer of concrete can remain exposed for more than 20 minutes before being covered by fresh concrete.

C. The volume of mixed concrete in the mixing drum shall not exceed the manufacturer's rating on the capacity plate.

D. A recording water metering device is always required at the primary point in the batching operation.

E. Do not add water to concrete in transit. Water may be introduced into the mixer at the job site, one time only, at the discretion of the Engineer, if the specified water-cement ratio is not exceeded. Water must be added in accordance with ASTM C94, assuring that the drum revolves continuously after introduction of the cement and water until the concrete is discharged.

F. Begin mixing immediately after introduction of the cement and water and continue for at least 70 revolutions of the drum at mixing speed. This minimum revolution count will be waived when the concrete is produced at a central mixing plant. Not more than 100 drum revolutions can exceed 6 revolutions per minute. All other revolutions must be at agitating speed of not less than 2 or more than 6 revolutions per minute.

G. Provide a revolution counter on each truck that registers the number of revolutions of the drum.

3.3 PLACING CONCRETE

A. Thoroughly consolidate concrete into its final position. Assure it is thoroughly consolidated around fittings and embedded items. Assure all reinforcement and embedded items are accurately placed as shown on the plans and are clean and free from coatings of dried mortar, detrimental rust, scale, oil or foreign matter. Place concrete meeting the applicable requirements of Sections 02529.

3.4 CURING CONCRETE

A. Protect freshly placed concrete from freezing, high temperature, large temperature differentials, premature drying, excessive moisture, and moisture loss for a period of time necessary to develop the desired concrete properties.

B. Thoroughly cure concrete surfaces by covering as soon as possible with canvas, plastic sheets with sealed joints, burlap and sand or other satisfactory materials and keep concrete moist. If the concrete surfaces are not covered, keep them moist by flushing or sprinkling. Continue curing for at least 7 days after placing the concrete. Concrete surfaces placed against forms may be cured by leaving the forms in place for at least 7 days, when approved.

C. Protect concrete against freezing or other conditions detrimental to strength development meeting the applicable requirements of this specification.

D. To aid finishing, side forms on ornamental work, curbs and sidewalks, railing and parapets may be removed after 12 hours, not to exceed 48 hours, depending on weather conditions. Continue moist curing during the concrete finishing operation.

E. Untreated forms and existing concrete must be kept continuously wet for at least 1 hour before any concrete is placed. Keep wet until covered with concrete except

that adequately treated forms must be thoroughly washed with a water spray immediately before placing the concrete.

F. The curing of concrete, by either water curing or membrane curing, must be as follows unless otherwise approved by the Engineer.

1. Water Curing

a. Keep all concrete top surfaces continuously moist after finishing, with a fine water spray, until the concrete has set. Cover the moist concrete with water or an approved curing covering.

b. Cure concrete deck slabs and concrete floors for at least 7 days. Cure by placing burlap, cotton mats or other absorptive material as close behind the finishing operation as possible without marring the finished surface. Keep the absorptive material continuously moist for the full time it is used. The absorptive material may be kept in place for the entire curing period or it may be removed as soon as practical and the entire surface covered with approximately 1-1/2 inches (38.1 mm) of sand, kept continuously moist for the entire curing period.

c. Remove forms and repair surface irregularities without interfering with any of the curing requirements. As soon as the vertical forms have been removed and the surface irregularities repaired, cover the concrete with absorptive material, kept continuously wet for the balance of the curing period.

2. Impervious Membrane Curing

a. Assure membrane curing compounds are delivered to the job in the manufacturer’s original container, clearly labeled to show the name of the manufacturer and the contents. The clear curing compound must be sufficiently transparent and free from permanent color that would change the color of the natural concrete. Use clear compound containing a fugitive dye having color sufficient to render the film visible on the concrete for at least 4 hours after application. The concrete surface must maintain its natural color after curing.

b. Use a compound ready for use as shipped by the manufacturer. Dilute following the manufacturer's recommendations. Use curing compound only with written approval. Sampling will not be required if manufacturer's certification is available. Apply the curing compound under pressure with a spray nozzle to cover the entire exposed surface thoroughly and completely with a uniform film not exceeding manufacturer's specifications. Maintain the required pressure in the spray machine to force the material to leave the nozzle in a fine mist. Keep all concrete surfaces moist with a fine water

spray or with wetted burlap until the sealing compound is applied. Keep the curing compound application close to the finishers of the top surface of concrete at all times. Seal the concrete immediately after the finishing operations have been completed, to the satisfaction of the Engineer.

c. If it is necessary to allow workers or equipment on the surface before the 7-day curing period is completed, protect the concrete from damage and maintain the curing environment.

d. Keep concrete, which has not completed its curing period, continuously moist during the stripping and surface repair operations. Remove all surface irregularities, repair all depressions, voids or holes, including those formed by trapped air, to the satisfaction of the Engineer. Immediately apply the curing compound before the surface has had an opportunity to dry out. Keep concrete, from which forms have been stripped, continuously moist until surface repair and finishing are completed and the impervious membrane curing has been applied.

3.5 WEATHER AND NIGHT LIMITATIONS

A. General

1. Stop concreting operations when darkness prevents obtaining the specified placing and finishing work. Night operations may be conducted with written approval and when approved artificial lighting is provided.

2. Cold weather concreting is governed by ACI 306.1 unless otherwise specified herein. Cold weather exists when the ambient air temperature has fallen, or is expected to fall below 40°F during the protections and curing period. The protection and curing period is defined as the time required to prevent concrete from being affected by exposure to cold weather.

3. When cold weather conditions are expected, all concreting operations will be suspended unless authorized by the Engineer. Contractor may receive authorization from concrete placement in cold weather by submitting a cold weather concreting plan for review and approval. The plan shall include detailed procedures to protect the fresh concrete from freezing during placement and maintaining the concrete surface temperature at a minimum of 55°F during the curing period.

4. Assume all risk of placing concrete in cold weather. Placing concrete during cold weather does not relieve the Contractor of the responsibility for obtaining the specified results. Remove and replace all concrete injured by frost at Contractor expense.

5. Before any concrete is placed, remove all ice, snow and frost completely from the formwork receiving the concrete. The subgrade must be frost free and above freezing before any concrete can be placed. Increase the temperature of formwork, reinforcement, subgrade, and base gravel to a minimum of 35°F.

6. Protection of Concrete

    a. Unless otherwise approved, Maintain the surface temperature of the concrete in place between 55° F and 75° F for a minimum of 7 days using approved heating devices or enclosures during the protection and cure period. The minimum 7-day protection and cure period is intended only to protect the concrete from the effects of cold. A longer protection period may be needed for the concrete to gain additional strength to support the loads it will experience when in service. Contractor may, bearing all expenses, field cure concrete test cylinders with the in-place concrete and discontinue protection and curing when the field test cylinders reach 3500 psi. Contractor shall monitor the concrete temperature daily throughout the protection and cure period and make adjustments as needed to maintain the temperature between 55° F and 75° F. Forms shall be kept in place for the duration of the protection and cure period. When the protection and cure period has ended reduce the heat gradually so the concrete surface temperature does not decrease faster than 15° per hour until the concrete temperature is the same as the outside temperature. Modifications may be allowed if approved by Engineer and in conformance with ACI 306.1.

    b. A Contractor may, at their expense, determine the in-place strength of the concrete using appropriate test methods and discontinue protection when those test methods indicate the concrete has reached 3500 psi.

3.6 TESTING

A. All concrete quality assurance testing must be performed by an ACI Grade I certified testing technician. Unless otherwise specified, the Engineer shall be responsible for all quality assurance testing during the on-site placement of the concrete.

1. Materials

    a. The Engineer or their representative must have access to the ready mix production facility for sampling constituent materials during production to assure the materials meet these specifications and represent those stated on the approved mix design.

2. Standard Slump Tests

a. The Engineer shall, during each day's placement, check the consistency of the concrete by slump test. A slump test will also be made each time that strength specimens are made. Slump tests are performed meeting ASTM C143 "Method of Test for the Slump of Portland Cement Concrete".

3. Air Content Tests

   a. The Engineer shall during each strength test, check the air content by either the "Method of Test for Air Content of Freshly Mixed Concrete by the Pressure Method" (ASTM C231), "Method of Test for Air Content of Freshly Mixed Concrete by the Volumetric Method" (ASTM C173) or "Method of Test for Unit Weight, Yield and Air Content (Gravimetric) of Concrete" (ASTM C138).

4. Compressive Strength Tests

   a. A minimum of three specimens, 6 inch (150 mm) in diameter or 4 inch (100 mm), shall be made and tested for every concrete placement. Mold and test one set of test cylinders for every 100 yards (76.5 cubic meters) of concrete or fraction thereof placed each day. On a given project, if the total volume of concrete is such that frequency of testing required above would generate less than 5 strength tests for a given class of concrete, make tests from at least 5 randomly selected batches or from each batch if fewer than 5 batches are used. Cure these cylinders under laboratory conditions except that additional test cylinders cured entirely under field conditions may be required by the Engineer to check the adequacy of curing and protection of the concrete.

   b. Take samples for strength tests in accordance with ASTM C172.

   c. Mold test cylinders and laboratory-cure in accordance with ASTM C31. Test cylinders in accordance with ASTM C39, entitled " "Method of Test for Compressive Strength of Cylindrical Concrete Specimens", ASTM C39, using an independent testing laboratory, as approved by the Engineer.

   d. Of each of the 3 cylinders take for a pour, test 1 for information strength at 7 days and test 2 for acceptance strength at 28 days. To meet this specification, average strength of two cylinders from the same sample, tested at 28 days or the specified earlier age, is required for each strength test. Strength level of an individual class of concrete is considered satisfactory if both of the following requirements are met:

      1) The average of all sets of 3 consecutive tests equal or exceed the specified strength.

2) No individual strength test (average of two cylinders) falls below specified strength by more than 500 psi (3400 kPa).

e. Cure field cured cylinders under field conditions meeting Section 7.4 of "Method of Making and Curing Concrete Test Specimens in the Field" (ASTM C31).

f. Mold field cured test cylinders at the same time and from the same samples as laboratory cured test cylinders. Improve procedures for protecting and curing concrete when strength of field cured cylinders at the test age designated for measuring specified strength is less than 85 percent of that of companion laboratory cured cylinders. When laboratory cured cylinder strengths are appreciably higher than the specified strength, field cured cylinder strengths need not exceed the specified strength by more than 500 psi (3400 kPa) even though the 85 percent criterion is met.

g. The strengths of any specimens cured on the job are to indicate the adequacy of protection and curing of the concrete and may be used to determine when the forms may be stripped, shoring removed or the structure placed in service. When the strengths of the job cured specimens are below those specified above, the Contractor must improve the procedures for protecting and curing the concrete.

h. When concrete fails to meet the requirements above or when tests of field cured cylinders indicate deficiencies in protection and curing, the Owner's representative may order tests on the hardened concrete under Chapter 17.3 of ACI-301-84 or order load tests in Chapter 20 of the ACI Building Code (ACI 318-83) for that portion of the structure where the questionable concrete has been placed. In the event the load or core tests indicate that the structure is unsatisfactory, make all modifications as directed by the Engineer to make the structure sound. If the load or core tests indicate the concrete is satisfactory, all cost of testing shall be paid by Owner.

5. Temperature

a. Test hourly when air temperature is 40°F (4°C) and below, and when 80°F (27°C) and above; and each time a set of compression test specimens is made.

3.7 Reinforcing Steel

A. Support and fasten together all reinforcement to prevent displacement due to construction loads. It is permissible to use on ground, where necessary, concrete

support blocks having a minimum 4 square inches (2580 MM2) bearing area and having a compressive strength equal to the concrete being placed. Use approved bar chairs and spacers over form work. For concrete surfaces exposed to the weather in the finished structure, assure the portions of all accessories within ½-inch (12.7 mm) of the concrete surface are noncorrosive or protected against corrosion.

B. Overlap welded wire fabric for successive mats or rolls providing an overlap measured between outermost cross wires of each fabric sheet not less than the greatest spacing of the cross wires plus 2 inches (50 mm) but not less than 6 inches (150 mm), whichever is greater. Extend the fabric across supporting beams and walls to within 4 inches (100 mm) of concrete edges. It may extend through contraction joints. Adequately support the fabric during concrete placement to maintain its position in the slab using the methods previously described or by laying the fabric on a concrete layer of the required depth before placing the upper slab layer.

C. Offset vertical bars in columns at least one bar diameter at lap splices. Furnish templates for all column dowels.

D. Obtain Engineer approval for all splices not shown on the plans. Mechanical connectors for reinforcing bars may be used if approved.

E. Do not use pebbles, pieces of broken stone, concrete rubble, broken brick or building blocks, metal pipe, or wooden block to position the fabric.

F. Follow the minimum concrete protective covering for reinforcement below, unless noted otherwise on the drawings.

1. Concrete deposited against ground: 76.2 mm (3 inches)

2. Formed surfaces exposed to weather or in contact with the ground:

    a. #6 bars or larger 50.8 mm (2 inches)

    b. Smaller than #6 bars 38.1 mm (1-1/2 inches)

3. Interior Surfaces:

    a. Beams, girders and columns 38.1 mm (1-1/2 inches)

    b. Slabs, walls and joists:

        1) #11 bars or smaller 19.05 mm (3/4-inch)

        2) #14 and #18 bars 38.1 mm (1-1/2 inches)

H. For corrosive atmospheres or fire protection, see special provisions for minimum covering requirements.

I. Obtain Engineer approval of reinforcement placement before placing concrete. Remove and replace concrete placed without Engineer approval of reinforcing.

J. Straighten fabric reinforcement shipped in rolls into flat sheets before placing it.

END OF SECTION

SECTION 07900 - JOINT SEALANTS

PART 1 - GENERAL

1.1 GENERAL

A. All work shall be performed in accordance with manufacturer's printed recommendations, specifications, and installation instructions.

1.2 GUARANTEE

A. The Contractor shall furnish a Guarantee-Warranty that the sealants and moisture systems are free from defects in materials and workmanship and that the areas treated will remain weathertight against the penetration of water and retain all the other properties inherent in the product for a period of 2 years after acceptance.

1.3 SUBMITTALS

A. Manufacturer's literature, specifications, installation instructions, material samples and color samples for each type of material shall be submitted to the Engineer for approval.

PART 2 - PRODUCTS

2.1 SEALANT

A. Sealant for exterior or interior use shall be polyurethane, exterior grade.

B. Caulking and sealant colors will be selected by the Owner.

C. Filler material shall be resilient closed-cell polyethylene foam and/or bond breakers of proper size for joint widths, compatible with sealant manufacturer's product.

D. Cleaning and cleanup solvents shall be as recommended by the caulking and sealant manufacturers.

PART 3 - EXECUTION

3.1 SEALANT

A. Installation shall be in accordance with sealant manufacturer's printed recommendations.

B. Joints and spaces to be sealed shall be clean, dry, and free of dust, loose mortar, and other foreign materials. Ferrous metal surfaces shall be cleaned of all rust, mill scale, and coatings by wire brush, grinding, or sandblasting. Oil and grease shall be removed by cleaning in accordance with sealant manufacturer's printed

recommendations. Bituminous or resinous materials shall be removed from surfaces to receive caulking or sealants.

C. Sealant depth in joints shall be 1/2 width of joint; minimum 1/8-inch deep, 1/4-inch wide; maximum 1/2-inch deep, 1-inch wide. All joints shall have filler material installed to proper depth prior to application of sealant.

D. Sides of joints of porous materials shall be primed where required by manufacturer immediately prior to caulking or sealing.

E. Installation shall be in accordance with sealant manufacturer's printed recommendations.

F. Joints and spaces to be sealed shall be clean, dry, and free of dust, loose mortar, and other foreign materials. Ferrous metal surfaces shall be cleaned of all rust, mill scale, and coatings by wire brush, grinding, or sandblasting. Oil and grease shall be removed by cleaning in accordance with sealant manufacturer's printed recommendations. Bituminous or resinous materials shall be removed from surfaces to receive caulking or sealants.

G. Sealant depth in joints shall be 1/2 width of joint; minimum 1/8-inch deep, 1/4-inch wide; maximum 1/2-inch deep, 1-inch wide. All joints shall have filler material installed to proper depth prior to application of sealant.

H. Sides of joints of porous materials shall be primed where required by manufacturer immediately prior to caulking or sealing.

E. A full bead of sealant shall be applied into the joint, under sufficient pressure, with nozzle drawing across sealant to leave a slightly concave surface. Sealants shall be tooled immediately after exposure with caulking tool or soft bristled brush moistened with solvent.

F. After application of sealant and caulking, adjacent materials which have been soiled shall be cleaned and left in a neat clean undamaged or discolored condition. On porous surfaces, excess sealant shall be removed per sealant and caulking manufacturer's printed instructions.

END OF SECTION

SECTION 08710 - FINISH HARDWARE

PART 1 - GENERAL

1.1 GENERAL

A. The Contractor shall provide all architectural hardware as specified and shown, together with any additional items necessary to ensure the proper operation of all doors, windows and other architectural installations. Items not specifically mentioned but necessary to complete the work shall be provided of a type and quality suitable to the service required and comparable to other hardware.

B. Finish hardware shall be coordinated with all other work requiring builder's hardware or attaching to it. Copies of schedules, templates, etc., shall be furnished in ample time to avoid fabrication and construction delays. Each item of hardware shall be identified according to the approved list and schedule. All hardware shall be made to template. Hardware shall be delivered to the job in unopened packages, complete with fastenings and accessories, bearing the manufacturer's labels.

C. Hand of lock shall be as shown. If door hand is changed during construction, make necessary changes at no extra cost.

D. Exit doors shall be openable at all times from the inside without the use of key or any special knowledge or effort.

1.2 KEYING

A. All locks and cylinders shall be master keyed to match the Owner's existing buildings.

B. All lock cylinders shall be construction master keyed or construction cylinders construction keyed.

C. All locks shall be furnished with 5 keys per cylinder keying combination. All keys along with five master keys shall be delivered to the Engineer at the completion of the job.

1.3 SUBMITTALS

A. The Contractor shall submit a complete detailed hardware list and a schedule along with manufacturer's literature on each item for approval. No hardware shall be delivered until the hardware schedule has been approved by the Engineer. The samples of all items requested shall be furnished by the hardware supplier no later than 10 days after said request is received.

PART 2 - PRODUCTS

2.1 FASTENERS

A. The Contractor shall provide all necessary screws, bolts and other fasteners of suitable size and type to secure the hardware into position. The fasteners shall match the hardware in material and finish.

B. The hardware provided, such as expansion bolts, hex bolts, toggle bolts and other approved anchorages, shall be coordinated with the job and to each setting condition.

C. Phillips head screws shall be used at exposed conditions. Machine screws shall be used at metal doors and frames.

2.2 MANUFACTURERS, DESIGN, FINISH

A. Hardware numbers listed in the Hardware schedule are from the catalogs of the manufacturer underlined and the item shall be furnished in the design and finish indicated. Other manufacturers listed are approved manufacturers providing all other characteristics are equal to the specified item.

1 LOCKSETS, LATCHSETS: Schlage "D Series" Rhodes Design or equivalent, finish: 626

2. CLOSERS: LCN, Smoothie 4040 series exterior doors, 4030 series interior doors or equivalent, sprayed enamel aluminum finish.

3. STOPS: Ives, Concave rubber, wrought wall bumpers (B26D), Glynn Johnson, Sargent or equivalent

4. DEADBOLT: Schlage B600 Series or equivalent, finish 626.

B. Locksets and Latchsets - Backset: 2-3/4". Strikes: Standard A.S.A. 4-7/8" for hollow metal frames, except for special strikes dictated by the Hardware specified or required.

C. Closers - It shall be the hardware supplier's responsibility to furnish door closers to comply with the manufacturer's recommendations for size and installed condition. Full rack and pinion type with dual adjustable closing controls. Provide adjustable back-check feature. Supply arm types, brackets, plates and all other required accessories and fasteners for their proper installation. Corner brackets shall be avoided wherever possible. Closers shall not be exposed on the exterior. Where wall conditions permit, interior doors shall swing 180 degrees.

D. Stops - It shall be the hardware supplier's responsibility to furnish door stops in accordance with the installed conditions as follows:

Use concave rubber bumpers in all areas.
Use machine screw and expansion shield at all masonry partitions (Ives 408-1/2 or equivalent).

E. Door Silencers - Provide whether scheduled or not. Glynn Johnson Type #64 or equivalent for all frames. Three for each leaf of single openings. One for each leaf of double openings in head.

2.3 WEATHERSTRIPPING

A. Weatherstripping shall be manufactured by Pemko Manufacturing Co., Zero Weatherstripping Co., or equivalent. All exterior doors (except roll-up and entrance doors) shall be weatherstripped with neoprene sponge rubber and bottom sweeps unless specified otherwise.

2.4 HARDWARE SCHEDULE

A. All component parts of locksets shall be the product of one manufacturer. The following hardware groups shall be furnished as indicated on the door schedule.

Door No. 101 shall have:
1 - Deadbolt (B662P) - (Inactive leaf)
1 - Lockset - (Active leaf) D50PD
2 - Stop
1 - Removable mullion hardware.
1 - Thresholds 424
1 - Weatherstripping 1010C
2 - Closer

PART 3 - EXECUTION

3.1 EXECUTION

A. All locks, exit devices, hinges, thresholds and other similar items shall be individually packed in separate, suitable original containers as furnished by the hardware manufacturers. Each container shall be clearly marked with item numbers, article numbers and names, corresponding to that listed in the hardware schedule.

B. Small miscellaneous items, such as door stops that would not require specific location identifications, may be quantity packed if properly labeled with item numbers, and other identification.

C. Contractor shall check the hardware upon delivery. The Contractor shall be responsible for the proper storage of all hardware until ready for application.

D. All required items of hardware, including cylinders for locks, and fitting, adjusting and securing each item neatly and firmly in place, shall be in perfect working order. Any work less than this shall form a basis for corrective measures.

E. All finish hardware shall be fitted and dismantled and rehung where required for finish painting work.

F. All hinges shall be installed so as not to bind.

G. Strippable coating or removable tape protection or other means to prevent any damage or staining of hardware during construction shall be used. Such protective measures shall be removed prior to final cleaning for Owner's acceptance of project.

END OF SECTION

SECTION 09800 - COATINGS

PART 1 - GENERAL

1.1 SUMMARY

A. General: This section covers surface preparation, furnishing, and application of industrial and architectural paint and special protective coatings.

B. The intention of these Specifications is for new interior and exterior wood, masonry, concrete, and metal, and submerged metal surfaces to be painted, whether specifically mentioned or not, except as specified otherwise. Prime and coat structural steel surfaces as specified. Exterior concrete surfaces will not be painted unless specifically indicated.

1.2 RELATED WORK

A. Section 13900: Corrosion Protection.

B. Section 15062: Interior Pipe, Ductile Iron Pipe and Fittings.

1.3 REFERENCE STANDARDS

A. General: The latest revision of the following standards shall apply, at a minimum, to the coating materials, testing, and installation except where more stringent standards are applicable. In case of conflict, the most stringent requirements shall apply.

B. American National Standards Institute (ANSI):

1. 359-A-85, Standard Colors for Color Identification and Coding.

2. A13.1-81, Scheme for the Identification of Piping Systems.

3. ANSI/NSF Standard 60 Drinking Water Treatment Chemicals - Health Effects.

4. ANSI/NSF Standard 61 Drinking Water System Components - Health Effects.

C. SSPC (The Society for Protective Coatings)

1. SSPC Surface Preparation Standards.

1.4 SUBMITTALS

A. Provide catalog cuts and other information for all products proposed for use, that show compliance of those materials with these Specifications.

PART 2 - PRODUCTS

2.1 PRODUCT MANUFACTURERS

A. Each coating system provided herein shall be the end product of one manufacturer in order to achieve standardization for appearance, maintenance, and replacement.

B. The use of a manufacturer's name and model or catalog number is solely for the purpose of establishing the standard of quality and general configuration desired. Products of other manufacturers of equal standard and quality will be considered in accordance with the General Conditions.

2.2 MATERIALS

A. General:

1. Materials Including Primer and Finish Coats: Produced by same manufacturer.

2. Thinners, Cleaners, Driers, and Other Additives: As recommended by manufacturer of the particular coating. Where coatings are required to meet ANSI/NSF Standard 60 and 61, addition of thinners, driers, and other paint additives not approved under the submitted ANSI/NSF certification letter will not be permitted without written approval from the coating manufacturer.

2.3 PAINT DELIVERY, STORAGE, AND HANDLING

A. Deliver new coating materials to project site in unopened containers and cartons that plainly show, at time of use, designated name, date of manufacture, color, and manufacturer. Store materials in original packaging until time of use.

B. Coating material provided shall be within manufacture's product stated shelf life. Coating shall be fresh with smooth consistency and easy application properties. Utilize coating before shelf life has expired.

C. Store products in a covered and protected area that is heated or cooled to maintain temperatures within the range recommended by paint manufacturer.

2.4 COLORS

A. General

1. Colors to be used are to be selected by Owner from color samples to be supplied by the coating manufacturer.

2. Where more than one coat of a material is applied within a given system, alternate color to provide a visual reference that the required numbers of coats

have been applied. Blending of two colors for visual color reference in multiple coat system will not be permitted.

3. Proprietary identification of colors is for identification only. Selected authorized manufacturer may supply matches.

B. Pipe Identification Painting:

1. Each coating system provided herein shall be the end product of one manufacturer in order to achieve standardization for appearance, maintenance, and replacement. Color code nonsubmerged metal piping except electrical conduit. Paint fittings and valves the same color as pipe, except equipment isolation valves.

C. Equipment Colors:

1. Each coating system provided herein shall be the end product of one manufacturer in order to achieve standardization for appearance, maintenance, and replacement. Equipment includes the machinery or vessel itself plus the structural supports and fasteners and attached electrical conduits.

2. Paint equipment and piping one color as selected.

3. Paint nonsubmerged portions of equipment the same color as the piping it serves, except as itemized below:

4. Dangerous Parts of Equipment and Machinery: OSHA Orange.

5. Fire Protection Equipment and Apparatus: OSHA Red.

6. Radiation Hazards: OSHA Purple.

7. Physical hazards in normal operating area and energy lockout devices, including, but not limited to, electrical disconnects for equipment and equipment isolation valves in air and liquid lines under pressure: OSHA Yellow.

8. Fiberglass reinforced plastic (FRP) equipment with an integral colored gel coat does not require painting, provided the color is as selected.

PART 3 - EXECUTION

3.1 WORKMANSHIP

A. All work shall be in accordance with these Specifications and the printed directions and recommendations of paint manufacturer whose product is to be applied. The more stringent requirements shall apply. Where a better grade of material or a higher standard of workmanship is required, the most stringent requirement shall apply.

3.2 ENVIRONMENTAL REQUIREMENTS

A. Do not apply paint in temperatures outside of manufacturer's recommended maximum or minimum allowable, or in dust, smoke-laden atmosphere, damp or humid weather.

B. Perform abrasive blast cleaning or apply coating only when relative humidity is below 85-percent and when structure surface temperature is more than 5 degrees F. above dew point and rising unless approved by coating manufacturer.

C. Stop surface preparation and/or coating operations when environmental (weather) conditions are outside allowable parameters.

3.3 SURFACES NOT REQUIRING PAINTING

A. Unless otherwise stated or shown, the following areas or items will not require painting or coating:

1. Concrete surfaces. Concrete floors and exterior slabs.

2. Reinforcing steel.

3. Nonferrous and corrosion-resistant ferrous alloys such as copper, bronze, monel, aluminum, chromium plate, atmospherically exposed weathering steel, and stainless steel, except where:

   a) Required for electrical insulation between dissimilar metals.

   b) Aluminum and stainless steel are embedded in concrete or masonry, or aluminum is in contact with concrete or masonry.

   c) Color coding of equipment and piping is required.

4. Nonmetallic materials such as glass, PVC, wood, porcelain, and plastic (FRP) except as required for architectural painting or color-coding.

5. Prefinished electrical and architectural items such as motor control centers, switchboards, switchgear, panelboards, transformers, disconnect switches (if prefinished in OSHA yellow), acoustical tile, cabinets, elevators, building louvers, and wall panels; color coding of equipment is required.

6. Nonsubmerged electrical conduits attached to unpainted concrete surfaces.

7. Cathodic protection anodes.

8. Items specified to be galvanized after fabrication, unless specified elsewhere or subject to immersion.

9. Exposed electrical conduit, except where the conduit is attached to a painted surface, it shall be painted the same color.

10. PVC Pipe

3.4 SURFACE CLEANING METHODS

A. Solvent Cleaning:

1. Consists of removal of foreign matter such as oil, grease, soil, drawing and cutting compounds, and any other surface contaminants by using solvents, emulsions, cleaning compounds, steam cleaning, or similar materials and methods which involve a solvent or cleaning action.

2. Meets requirements of SSPC-SP-1.

B. Blast Cleaning

1. Minimum surface preparation is as specified herein and takes precedence over coating manufacturer's recommendations.

2. Do not perform surface preparation blast prior to submission and approval of samples.

3. Provide materials, equipment, procedures, and safety equipment for personnel in accordance with current SSPC specifications as follows:

a) Solvent Cleaning: SP-1.

b) Hand Tool Cleaning: SP-2.

c) Power Tool Cleaning: SP-3.

d) White Metal Blast Cleaning: SP-5.

e) Commercial Blast Cleaning: SP-6.

f) Brush-Off Blast Cleaning: SP-7.

g) Pickling SP-8.

h) Near-White Blast Cleaning: SP-10.

i) Power Tool Cleaning to Bare Metal: SP-11.

j) High Pressure Water Jetting: SP-12

3.5 PREPARATION OF SURFACES

A. Metal Surfaces

1. Equipment, procedure, and degree of cleaning shall meet minimum specified requirements per SSPC.

2. Welds and Surface Defects:

   a) Prepare such that there is:

      (1) No undercutting or reverse ridges on weld bead.

      (2) No weld spatter on or adjacent to weld or any other area to be painted.

      (3) No sharp peaks or ridges along weld bead.

   b) Grind embedded pieces of electrode or wire flush with adjacent surface of weld bead.

   c) Provide grinding where structure surface is not smooth or resultant weld surface is not a smooth ripple.

   d) Round or chamfer sharp edges and grind smooth burrs, jagged edges, and surface defects.

3. Preblast Cleaning Requirements:

   a) Remove oil, grease, welding fluxes, and other surface contaminants prior to blast cleaning per SSPC SP-1

   b) Cleaning Methods: Steam, open flame, high pressure (3,000 psi or greater) hot water or cold water with appropriate detergent additives followed with clean water rinsing.

   c) Clean small isolated areas as above or solvent clean with suitable solvents and clean cloths.

4. Post-Blast Cleaning and Other Cleaning Requirements:

   a) Clean surfaces of dust and residual particles from cleaning operations by dry (no oil or water vapor) air blast cleaning or other method prior to painting. Vacuum clean enclosed areas and other areas where dust settling is a problem and wipe with a tack cloth.

   b) Paint surfaces the same day they are blasted, unless dehumidification equipment is provided and properly operated on a continuous basis during

surface preparation and coating application. Reblast surfaces that have started to rust before they are painted.

c) Horizontal surfaces subject to contamination by dust settlement, such as welds, floors, and flanges on rafters and girders shall be recleaned immediately preceding coating application by dry air blasting, vacuuming, or by wiping down.

B. Cast and Ductile Iron Pipe and Fittings:

1. Cast and Ductile Iron Pipe and Fittings shall be prepared at the factory by abrasive blast and epoxy primer application.

2. For Topcoating with Conventional Coatings.

a) For conventional coatings (alkyd), clean asphalt varnish supplied on pipe in accordance with Existing Surfaces to be Painted Section included herein.

b) Follow surface preparation recommendations of pipe and coating manufacturers.

C. Galvanized Surfaces

1. Remove soil, cement splatter, and other surface contaminants with appropriate hand or power tools.

2. Remove oil and grease by wiping or scrubbing with suitable solvents per SSPC SP-1. Use clean solvents and rags for final wiping to avoid contaminating the surface.

3. Wipe down with wash primer to prepare all galvanized surfaces for top coating.

D. Plastic Surfaces

1. Hand sand plastic surfaces to be coated with a medium grit sandpaper to provide tooth for the coating system.

2. Large areas may be power sanded or brush-off blasted, provided sufficient controls are employed so surface is roughened without removing excess material.

E. Wood Surfaces:

1. Replace damaged wood surfaces or repair in a manner acceptable to ENGINEER prior to start of surface preparation.

2. Solvent clean (mineral spirits) knots and other resinous areas and coat with shellac or other knot sealer, prior to painting. Remove pitch by scraping and

wipe clean with mineral spirits or turpentine prior to applying knot sealer.

3. Round sharp edges by light sanding prior to priming.

4. Filler:

   a) Synthetic-based wood putty approved by paint manufacturer for the paint system.

   b) For natural finishes, color of wood putty shall match color of finished wood.

   c) Fill holes, cracks, and other surface irregularities flush with surrounding surface and sand smooth.

   d) Apply putty before or after the prime coat, depending on compatibility and putty manufacturer's recommendations.

   e) Use a cellulose type putty for stained wood surfaces.

5. Ensure surfaces are clean and dry prior to painting.

3.6 PAINT MIXING

A. Multiple-Component Coatings:

1. Prepare using the contents of the container for each component as packaged by paint manufacturer.

2. No partial batches will be permitted.

3. Mix coating in manner and for length of time as recommended by coating manufacturer.

4. Allow coating to set or “sweat” for amount of time as recommended by product manufacturer.

B. Use of accelerators, thinners, or other additives is not acceptable for coatings in contact with potable water unless approved by product manufacture and provided with ANSI/NSF certification letters for the coating system.

3.7 PAINT APPLICATION

A. General:

1. Apply coatings in accordance with these specifications, the paint manufacturers' printed recommendations, and project specific details. The more stringent requirements shall apply.

2. Ensure surfaces are clean and dry prior to painting.

3. Paint surfaces the same day they are sandblasted before they start to rust. Reblast surfaces that have started to rust.

4. Provide ventilation, heating, and/or dehumidification as required to meet environmental requirements of coating being applied.

5. Allow sufficient time between coats to assure thorough drying of previously applied paint.

6. Coat previous coated surfaces within recoat window. Consult specific product data sheets for necessary cure and recoat times.

7. For noncementatious coatings subject to immersion, obtain full cure for completed system. Consult coatings manufacturer's written instructions for these requirements. Do not immerse noncementatious coatings for any purpose until completion of curing cycle.

8. Sand wood and metal lightly between coats to achieve required surface profile.

9. Vacuum clean surfaces free of loose particles. Use tack cloth just prior to applying next coat.

10. Fusion Bonded Coatings Method Application: Electrostatic, fluidized bed, or flocking. Provide liquid or stick repair kits for fusion bonded epoxy items.

11. Coat units or surfaces to be bolted together or joined closely to structures or to one another prior to assembly or installation with specified number of coats and thicknesses.

B. Film Thickness:

1. Coverage is listed as either total minimum dry film thickness in mils (MDFT) or the spreading rate in square feet per gallon (SFPG). Per coat determinations are listed as MDFTPC or SFPGPC.

2. Dry film thickness mils specified is the absolute minimum allowed.

3. Number of Coats: Minimum required irrespective of the coating thickness. Additional coats may be required to obtain minimum required paint thickness, depending on method of application, differences in manufacturers' products, and atmospheric conditions.

4. Where dry film thickness measurements are below the specified minimum, provide additional coat of paint, as necessary to meet the thickness required.

5. Maximum film build per coat or system shall not exceed coating manufacturer's recommendations.

C. Shop Primed and Factory Finished Surfaces:

1. Schedule inspection with Engineer before shop priming or topcoating factory finished items delivered to site.

2. Hand or power sand areas of chipped, peeled, or abraded coating, feathering the edges. Follow with a spot primer using specified primer.

3. For two-package or converted coatings, consult coatings manufacturer for specific procedures as relates to manufacturer's products.

4. Prior to application of finish coats, clean shop primed surfaces free of dirt, oil, and grease and apply mist coat of specified primer, 1-mil dry film thickness.

5. After welding, prepare and prime holdback areas as required for paint system. Apply primer in accordance with manufacturer's instructions.

D. Manufacturer Applied Paint Systems:

1. Repair abraded areas on factory finished items as recommended by coating manufacturer.

2. Carefully blend repaired areas into original finish.

E. Cast and Ductile Iron Pipe and Fittings:

1. For high performance (epoxy, vinyl, polyurethane, etc.) coatings, follow recommendations of pipe and coating manufacturers.

2. For conventional (alkyd) coatings, clean asphalt varnish supplied on pipe and apply one full coat of a tar stop before two full coats of the color coats specified.

F. Porous Surfaces, Such As Concrete, Masonry:

1. Filler/Surfacer: Use coating manufacturer's recommended product to fill air holes, bug holes, and other surface defects prior to additional coats.

2. Provide primer, sealer, or block filler as recommended by coating manufacturer to seal porous surfaces and prepare surfaces for top coating.

3. Prime Coat: May be thinned to provide maximum penetration and adhesion.

a) Type and Amount of Thinning: Determined by paint manufacturer and dependent on surface density and type of coating.

4. Surfaces Specified to Receive Water Base Coating: Damp, but free of running water, just prior to application of coating.

3.8 EXISTING SURFACES TO BE PAINTED

A. Surfaces Preparation

1. Detergent wash and freshwater rinse.

2. Abrade or scarify coating existing coating surface if recoat window missed or coating has glossy finish.

3. Clean loose, abraded, or damaged coatings to substrate by Hand or Power Tool, SSPC SP-2 or SP-3.

4. Feather surface preparation into surrounding intact coating.

5. Solvent wipe per SSPC SP-1

B. Asphaltic Coated Ductile or Cast Iron Pipe or Fittings

1. For ductile iron pipe with asphaltic varnish finish, apply a coat of tar stop seal coat prior to application of two complete finish coats of the color coats specified if conventional (alkyd) type coating.

2. If high performance coatings (epoxy, vinyl, polyurethane, etc.) coatings consult with coating manufacturer for additional surface preparation and barrier coating requirements.

3.9 FIELD REPAIR

A. Unsatisfactory Application

1. If item has an improper finish color, or insufficient film thickness, clean surface and topcoat with specified paint material to obtain specified color and coverage.

2. Obtain specific surface preparation and coating repair information from coating manufacturer for coatings that have exceeded the maximum recoat time (window).

3. Hand or power sand visible areas of chipped, peeled, or abraded paint, and feather the edges. Follow with primer and finish coat. Depending on extent of repair and appearance, a finish sanding and topcoat may be required.

4. Evidence of runs, bridges, shiners, laps, or other imperfections is cause for rejection.

3.10 PROTECTIVE COATING SYSTEMS APPLICATION SCHEDULE AND COATING SYSTEMS

A. Unless otherwise shown or specified, paint surfaces in accordance with the following application schedule. In the event of discrepancies or omissions in the following, request clarification from Engineer before starting work in question. The below schedule is not intended to be all-inclusive.

B. System No. 6 Exposed Metal:

1. Use on the following items or areas:

2. Exposed metal surfaces, located inside or outside of structures or exposed to weather, including metal doors and frames, vents, louvers, exterior metal ductwork, flashings, sheet metalwork and miscellaneous architectural metal trim and the following specific surfaces:

   a) All exposed surfaces of metallic piping, valves, fittings, and appurtenances located above ground or in structures.

3. Vent piping

4. Pipe supports

5. Other areas where specified or noted on the Drawings.

System No. 6 Surface Prep.	**Paint Material**	**Min. Coats, Cover**
Abrasive Blast, or Centrifugal Wheel Blast (SP 6 Commercial)	Rust-Inhibitive Primer	1 coat, 2 MDFT
	Alkyd Enamel	2 coats, 4 MDFT

C. System No. 8 Buried Metal-General:

1. Use on the following items or areas:

   a) Buried pipe fittings and valves

   b) Other areas where specified or noted on the Drawings.

System No 8 Surface Prep.	**Paint Material (One of the Following)**	**Min. Coats, Cover**
Abrasive Blast, or Centrifugal Wheel Blast (SP 10) or Acid Pickling (SP 8)	Fusion Bonded 100-percent Solids Epoxy or Polyurethane	1 or 2 coats, 12 to 16 MDFT

D. System No. 10 Galvanized Metal Conditioning:

1. Use on the following items or areas:

   a) Galvanized surfaces requiring painting.

   b) Concealed galvanized surfaces do not require painting.

2. Other areas where specified or noted on the Drawings.

System No 10 Surface Prep.	**Paint Material**	**Min. Coats, Cover**
Solvent Clean (SP 1) Followed by Hand Tool (SP 2) or Power Tool (SP 3)	Wash Primer or Coating Manufacturer's Recommendation	1 coat, 0.4 MDFT

END OF SECTION

SECTION 10522 - FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 GENERAL

A. Reference standards shall be manufacturer's published recommendations and specifications unless otherwise shown or specified.

B. All accessory and specialty items shall be factory built units unless shown otherwise and shall include all materials, anchors, equipment and labor necessary to install specified items.

PART 2 - PRODUCTS

2.1 FIRE PREVENTION EQUIPMENT

A. Manufacturers: All fire prevention equipment shall be manufactured by the same manufacturer unless noted otherwise and shall meet NFPA Pamphlet No. 10.

B. Location: Fire prevention equipment locations shall be verified with the ENGINEER before installation and shall be installed where directed per NFPA Pamphlet No. 10.

C. Fire Extinguishers: The following chemical fire extinguishers shall be furnished and installed with wall brackets, unless shown otherwise.

Location	Capacity	Fire Class	U/L Rating
Well House	10 lbs.	A, B, C	4 A, 60 B.C.

PART 3 – EXECUTION

3.1 GENERAL

A. Mount to wall at locations designated by the Engineer.

END OF SECTION

SECTION 11245
INSTALLATION OF OWNER-FURNISHED EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. This section covers the work necessary to install the Owner-furnished Equipment.

B. All piping and appurtenances not designated as Owner-furnished Equipment are the Contractor's responsibility to furnish and install. Piping and electrical systems that connect the Owner-furnished Equipment shall be provided and installed by the Contractor.

1.2 RELATED DOCUMENTS

A. The Contractor shall take particular note of the following divisions of the specifications:

1. Division 11, Equipment

2. Division 15, Mechanical

1.3 EQUIPMENT

A. The Owner-furnished Equipment specified herein has been shipped as fully assembled units.

B. The Contractor shall install all equipment according to manufacturer's instructions.

C. The Owner-furnished Equipment to be installed by the Contractor under this section shall include but shall not be limited to the following:

	Description	Quantity
1.	12 ft x 24 ft Metal Building	1
2.	8-inch gate valve	2
3.	8-inch Cla Val Pressure Reducing Valve	1
4.	8-inch Cla Val Flow Control Valve	1
5.	Electric Unit Heaters	2
6.	Jib Crane	1
7.	Valmatic air release valve	1

1.4 SUBMITTALS

A. The Owner will provide the Contractor with copies of approved shop drawings of the Owner-furnished Equipment if available.

1.5 QUALITY ASSURANCE

A. Transfer of Equipment: All Owner-furnished Equipment will be transferred from the Owner to the Contractor at the project site.

B. Job Conditions: The Contractor shall repair, replace or correct to the satisfaction of the Owner all defective equipment items caused by the Contractor's improper placement and handling of the Owner-furnished Equipment.

C. Contractor’s Acceptance: Upon delivery to the site of Owner-furnished Equipment, the Contractor shall assume responsibility for Owner-furnished Equipment. Inspect equipment to determine compliance with requirements of Contract Documents and approved submittals and that material and equipment are protected and undamaged.

D. Operation: Owner-furnished Equipment shall be operated in accordance with the instructions furnished with the equipment and by the authorized representatives of equipment manufacturers

E. Miscellaneous Items to be Furnished by Contractor: The following are items associated with the Owner-furnished Equipment which are to be provided by the Contractor.

1. Flange bolts and gaskets

2. Anchor bolts

PART 2 (Not Used)

PART 3 EXECUTION

3.1 SERVICES OF EQUIPMENT MANUFACTURERS' REPRESENTATIVES

A. Prior to start-up of the system, the Contractor will provide a field service engineer employed directly by the manufacturer of the Cla Val Control Valves to inspect the equipment, make necessary final adjustments and certify the equipment ready for operation.

3.2 FIELD TESTING

A. After installation and certification by equipment manufacturers' representatives, the Contractor shall test the equipment.

3.3 TRAINING

A. The Cla Val representative will provide training to the fish hatchery staff.

3.4 INSTALLATION OF EQUIPMENT

A. Installation includes piping, mounting, insulation, alignment, wiring, testing, and start-up of all Owner-furnished Equipment. Copies of the installation instructions are available for inspection at the Owner's offices.

END OF SECTION

SECTION 11350 - SELF-CLEANING STRAINER

PART 1 - GENERAL

1.1 SUMMARY

A. This section covers specifications for the self-cleaning strainer assembly that is to be installed in the well house.

PART 2 - PRODUCTS

2.1 AUTOMATIC SELF-CLEANING STRAINER

A. Materials of Construction

1. Body: Cast iron or steel with flanged ends, Class 125 lb flanges, rated for 200 psi working pressure

2. Automatic operation initiated by differential pressure

3. Two strainer heads with electric motor driven rotating screens

4. Automatic 4" drain valve and actuator

5. 1/8" perforated screen round opening size

6. Interior and Exterior Coating - Liquid Epoxy according to AWWA C550.

B. Model – Provide a Hellan Strainer Company 10” in-line self cleaning strainer, MPN - 1001DA250800 or equal.

2.2 AUTOMATIC STRAINER CONTROL PANEL

A. Model – Provide a Hellan Strainer Company automatic strainer control panel, MPN – SSP-C2D-P or equal.

PART 3 – EXECUTION

3.1 GENERAL

A. Strainer shall be installed in accordance with the plans and the manufacturer’s recommendations.

END OF SECTION

SECTION 13900 - CORROSION PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Provide galvanic anodes for all buried metallic pipe and fittings used in conjunction with plastic pipe sections.

1.2 SUBMITTALS

A. Provide catalog cuts and other information for all products proposed for use that show compliance of those materials with these Specifications.

B. Installation, material, and safety requirements for thermite weld wire connections.

PART 2 - PRODUCTS

2.1 GENERAL

A. Unless otherwise indicated, provide all first-quality, new materials, free from defects, in first class condition suitable for the intended use. Provide materials and equipment, which are the standard products of manufacturers regularly engaged in the production of such materials and equipment. Provide the manufacturer's latest standard design that conforms to these specifications.

B. The use of a manufacturer's name and model or catalog number is solely for the purpose of establishing the standard of quality and general configuration desired. Products of other manufacturers of equal standard and quality will be considered in accordance with the General Conditions.

2.2 WIRES

A. General: Wire shall conform to applicable requirements of NEMA WC 3-80, WC 5-73, and WC 7-88.

B. Test Wires

1. No. 12 AWG wire for prepackaged galvanic anode and test leads and No. 14 AWG reference electrode lead wires shall be single-conductor, stranded copper wire with 600-volt, TW, THWN, THHN or HMWPE insulation.

2. No. 2 AWG, N. 4 AWG and No. 8 AWG for bond and pipe lead wires shall be single-conductor, stranded copper wire with 600-volt, HMWPE insulation.

C. Wire Identification

1. Wire insulation color shall indicate the function of each wire and shall be as shown on the Drawings and as follows:

a) Pipeline test wires:

(1) Water Pipeline: Blue

(2) Foreign Pipeline: White or as requested by Foreign pipeline company

(3) Unprotected Pipe: Black

b) Casings: Orange

c) Anode lead wires: Black

d) Reference electrode wires: Yellow

e) Tracer wires: Green

2.3 THERMITE WELD MATERIALS

A. Electrical connection of copper wire or copper strap to metallic (steel, ductile iron, and cast iron) fittings and pipe shall be by the thermite weld (cadweld) method.

B. Supply the proper size and type of wire sleeves, cartridges, and welder molds as required for each type of connection and pipe material in accordance with the thermite weld manufacturer's written recommendations. Weld materials from different manufacturers shall not be interchanged.

C. Provide cast iron charges for ductile iron and cast iron materials. Provide steel charges for steel materials.

D. Welder molds shall be graphite molds. Ceramic "One-Shot" molds will not be acceptable. Special welders and materials are required for copper strap, formed joint, and flexible coupling bonds. Vertical type connections require special welders and materials as recommended by the weld manufacturer.

E. Install adapter sleeves for No. 12 AWG test wires, No. 4 AWG, and No. 2 AWG wires. Provide sleeve and die as recommended by thermite weld manufacturer. Either premade factory sleeved wires or wires with sleeves made in the field with the appropriate size sleeves and hammer die are acceptable. Field formed sleeves shall be attached with the appropriate size and type of hammer die and

method as recommended by the thermite weld manufacturer. Wire conductor for field installed adapter sleeves shall extend 1/4 inch beyond end of the sleeve.

F. Thermite weld materials are available as specified from Erico Products Inc. (Cadweld), Cleveland, OH; Continental Industries, Inc. (Thermoweld), Tulsa, OK; or equivalent.

G. Approved Materials:

1. Provide the thermite weld materials for attaching copper wires or copper straps to the pipe material using the appropriate types of materials as listed below:

Thermite Weld Materials		
Wire Type and Pipe Material	**Weld Type**	**Maximum Cartridge Size**
No. 4 AWG Wire & Smaller:		
Steel	HA, VS	25 gm
Ductile Iron	HB, VH	32 gm
Cast Iron	HB, VH	32 gm

2.4 THERMITE WELD CAPS

A. Thermite weld caps shall consist of a 4-inch by 4-inch size premade weld cap filled with elastomeric mastic coating and suitable primer, such as the Handy Cap II with Royston 747 Primer, available from Royston Laboratories, Inc.; or equivalent.

2.5 GROUND CLAMPS

A. Ground clamps for wire connections to copper service pipe shall be sized to fit the pipe and wire. All parts of the clamp shall be bronze including bolts and nuts, as manufactured by O. Z. Gedney, Burndy, Thomas and Betts, or equivalent.

2.6 GALVANIC ANODES

A. Magnesium Anode

1. High-Potential Magnesium Composition for buried soil applications shall be:

ELEMENT	CONTENT
Aluminum (Al)	0.010% maximum
Manganese (Mn)	0.500% to 1.300%
Zinc (Zn)	0.002% maximum
Silicon (Si)	0.002% maximum
Copper (Cu)	0.020% maximum
Nickel (Ni)	0.001% maximum
Iron (Fe)	0.030% maximum
Total Others	0.050% each or 0.300% maximum, total
Magnesium (Mg)	Remainder

Prepackaged Magnesium Anode Dimensions:

BARE ANODE SIZE	5 POUND ANODE	17 POUND ANODE
Bare Anode Nominal Dimensions	3 inches by 7 inches long minimum	3 inches by 25 inches long minimum
Packaged Weight	14 pounds minimum	42 pounds minimum
Nominal Package Size	5 inch diameter by 13 inches long minimum	6 inch diameter by 29 inches long minimum

2. Acceptable High Potential Magnesium Anodes: Dow Galvomag, Magcorp (formerly Amax) Maxmag, or equivalent.

B. Prepackaged Galvanic Anode General Requirements:

1. Anode Wire: Supply each anode with No. 12 AWG stranded copper wire with THWN insulation, 10 feet long minimum. Provide longer anode leads as required for test stations. Lead wire shall be coiled and bound.

2. Wire-to-Anode Connection: Manufacturer's standard. The anode connection shall be stronger than the wire. Connection of lead wire to anode shall be electrically insulated with manufacturer's standard insulation.

3. Prepackaged Anode Backfill: Backfill shall have a grain size so that 100 percent is capable of passing through a 20-mesh screen and 50-percent will be retained by a 100-mesh screen. The backfill mixture shall be thoroughly mixed and firmly packaged around the galvanic anode within the cloth bag or cardboard tube by means of adequate vibration. The complete packaged galvanic anode

shall weigh a minimum of 2.0 times the bare anode weight. The quantity of backfill shall be sufficient to cover all surfaces of the anode to a depth of 1-inch.

4. Packaging and Shipping: Provide electrode packaged in a plastic or heavy paper bag of sufficient thickness to protect the anode, wire, backfill, and cloth bag during normal shipping and handling.

5. Prepackaged Galvanic Anode Backfill Composition:

ELEMENT	**CONTENT**
Ground Hydrated Gypsum	75 Percent
Powdered Wyoming Bentonite	20 Percent
Anhydrous Sodium Sulfate	5 Percent

2.7 CONDUIT, LOCKNUTS, AND STRAPS

A. The minimum conduit size shall be 1-inch diameter unless otherwise indicated on Drawings or specified.

B. Use intermediate metal conduit, including couplings, elbows, nipples, and other fittings, hot-dipped galvanized and meeting the requirements of UL and the NEC. Do not use set screw type couplings, elbows, and nipples unless approved by the Owner.

C. Heavy wall rigid PVC conduit shall be Schedule 40, UL listed for concrete-encasement, underground direct burial, concealed and direct sunlight exposed use. Use conduits, couplings, elbows, nipples, and other fittings meeting the requirements of NEMA TC and TC 3, Federal Specification W-C-1094, UL, NEC, and ASTM specified tests for the intended use.

2.8 WIRE CONNECTIONS AND SPLICE MATERIALS

A. Shunts: Shunts for junction box and test stations shall be Holloway Type RS 0.01-ohm manganin wire shunt with 6 amp capacity and/or Holloway Type SS 0.001 ohm shunt with 25 amp capacity as shown on Drawings, or approved equal.

B. Compression Connectors: Compression connectors for in-line, multi-splices, and tap splices shall be "C" taps made of conductive wrought copper, sized to fit the wires being spliced. Compression connectors shall be applied with the crimp tool and die recommended by the manufacturer for the wire and tap connector size. Acceptable Type "YC" wire compression connectors as manufactured by Burndy Co., or approved equal.

C. Silver Brazing Alloy: Brazing Alloy with 15 percent silver content, 1185 to 1300 degrees F melting range.

D. Electrical Splicing Tape: Tape for wire splice insulation shall be 30 mil linerless rubber high voltage splicing tape, Scotch 130C; and 7 mil vinyl electrical tape, Scotch 33+; suitable for moist or wet environments, as manufactured by 3M Products; or approved equal.

E. Wire Connector Terminals: A one-piece copper, tin-plated crimp-on lug or Lug-it connector shall be installed on the end of all stranded wire before connecting it to test station, terminal box, or junction box terminal studs. Acceptable wire connectors are manufactured by Burndy Co., Thomas and Betts, or approved equal.

F. Electrical Sealer: Provide electrical sealer Ivy-spray Type Scotch 1603, manufactured by 3M Company, or equivalent.

G. Electrical Connectors: Hardware used in electrical connections including bolts, studs, nuts, washers, and lock washers shall be tin or nickel plated copper, brass, bronze, or 300 series stainless steel for electrical conductivity and atmospheric corrosion resistance.

PART 3 - EXECUTION

3.1 GENERAL

A. All materials and equipment associated with pipe connecting wires, test stations, galvanic anodes, and insulating joints as shown and specified herein shall be furnished and installed by the Contractor.

3.2 MATERIAL STORAGE AND HANDLING

A. Store materials in secure, protected location. Store thermite weld materials, prepackaged galvanic anodes, and reference electrodes off the ground and keep them dry at all times. Protect against weather, condensation, and mechanical damage. Handle with care to prevent damage. Equipment or materials damaged in shipment or in the course of installation shall be replaced. Immediately remove from site all mechanically damaged materials. Prepackaged anodes or reference electrodes shall be handled with care to prevent loss of backfill material. Do not lift or hold anodes and reference electrodes by the lead wire.

3.3 PIPE JOINT AND FITTING BONDING

A. To form an electrically continuous associated appurtenances, the joints of all buried valves and fittings, including all bolted and restrained joints, shall be electrically bonded, except joints specified to be threaded, welded, or insulated.

B. Wire connections to pipes or fittings shall be as specified under WIRE CONNECTIONS.

C. Install one insulated joint bond wire or bond strap per joint on all pipe or fittings 10 inches in diameter or smaller. Install two insulated joint bond wires or bond straps per joint on all pipe or fittings 12 inches in diameter or larger.

D. Install No. 4 AWG insulated bonding wires between metallic fittings, valves, pipe spool pieces, etc. and metallic gland connection pieces, so as to provide electrical continuity between all buried metallic components on metallic and non-metallic pipelines. All metallic components shall be either bonded together and connected to an anode or provided with an individual galvanic anode for protection as specified under PREPACKAGED GALVANIC ANODE INSTALLATIONS.

3.4 WIRE CONNECTIONS

A. The electrical connection of copper wire or copper strap to metallic (steel, cast iron, and ductile iron) surfaces shall be by the thermite weld method. Assure that pipe or fitting wall thickness is of sufficient thickness that the thermite weld process will not damage the pipe or fitting wall's integrity or damage the lining in any way.

B. The Contractor is responsible for repair of any damage to pipe, fitting, lining, or coating as a result of the thermite weld process.

C. Make thermite weld connections at locations as directed by pipe manufacturer so as to not damage pipe gasket or internal linings exposed to liquid.

D. For tape coated joints, at joint bond wire locations, the pipeline joint shall be field coated before the thermite connection is made.

E. For lined (epoxy, polyurethane, etc) pipe where damage may occur to lining from the thermite welding process or on concrete cylinder pipe make thermite connection on the shop welded stud or thermite tab plates provided on the pipe for this purpose. Clean the steel studs or thermite tab plate to bright metal before thermite welding. If approved by pipe manufacturer, for bell and spigot joints, connections to the pipe bell end may be made directly to the pipe on the non-pressured side of joint.

F. The electrical quality and resistance of the connection is dependent on proper adhesion of the welded connection to the pipe or fitting surface. Observe proper thermite weld material selection, safety precautions, surface preparation, and welding procedures as recommended by the material manufacturer.

G. Connections to gas and petroleum piping systems shall be according to ANSI/ASME B31.8 and ANSI/ASME B31.4 codes. Maximum charge size shall be 15 grams.

H. Before the connection is made, clean the surface to bare metal by making a 2-inch by 2-inch window in the coating, and then filing or grinding the surface with a grinding wheel to produce a bright (white) metal finish.

I. All power grinding shall be with a vitrified type grinding wheel. The use of resin, rubber, or shellac-impregnated type grinding wheels is not recommended by the thermite weld manufacturer and will not be acceptable.

J. Contractor shall take appropriate actions for existing coatings with asbestos to minimize worker exposure and to contain, handle, and dispose of asbestos per regulations.

K. After the surface is cleaned to a smooth, white metal finish, lightly tap the pipe surface so as to produce dimples to improve surface profile and adhesion for the weld material. In cold weather or on cold or wet surfaces, preheating of the metal surface may be required to improve successful connections. Exothermic welding should be completed immediately following preparation of the metal surface before surface flash rusting or oxidation can occur.

L. Where specified wire sleeves shall be firmly attached to the end of the wire before thermite welding to the metal surface. Wire and sleeve shall be clean and dry. Wire shall extend 1/4-inch out of field formed sleeves. Factory formed sleeves shall be provided with end of sleeve angled so that wire is exposed to thermite weld.

M. The mold and base metal should always be clean and dry. Replace worn molds at intervals as recommended by manufacturer.

N. Place a metal disk in the bottom of the graphite mold and then pour in the weld material. Be sure to squeeze the plastic cylinder to get all of the starting powder out. Close the mold body lid. Place the graphite mold on the prepared pipe surface and install the wire in the slot at the bottom of the mold. Hold the wire and mold steady and firm on the pipeline.

O. Ignite the weld material with the spark gun. Lightly tap the mold body during the ignition fusion process. Carefully remove the graphite mold after the fusion process is completed.

P. Care should be taken during the thermite welding process, as the exothermic process is extremely hot (4,000 degrees F). Do not breathe the fumes.

Q. The graphite mold should not be touched or allowed to come in contact with the pipe coating or other flammable or meltable materials, as it is extremely hot. Carefully clean the slag out of the graphite mold body.

R. Welded area shall be allowed to cool to "warm to touch" condition prior to application of primer and field coating.

S. After the weld connection has cooled, remove slag, visually and physically test quality of connection by tapping with a hammer and lightly pulling on the wire. The completed weld should visually present a good appearance of a well-formed connection with a minimum loss of weld material or splatter. All portions of the wire and sleeve shall be covered with the weld material. Remove and replace all visually defective welds.

T. Attach copper wire to copper service lines with grounding clamp.

3.5 WIRE CONNECTION COATING

A. Clean weld area, prime, and install a prefabricated thermite weld cap per manufacturer's directions over each completed connection after testing. In cold weather, store primer and cadweld cap materials in a heated location and keep warm until installation.

B. The pipe and factory-coating surface shall be clean and dry before application of primer. Primer shall be thoroughly mixed and applied to pipe surface in an even manner to obtain a minimum dry film thickness of 1 mil. Primed area shall provide uniform coverage around cadweld area and extend a minimum of 3 inches onto coated surface. Skips or misses and runs and sags shall be reprimed or repaired to provide an even uniform coverage.

C. Primed surface shall be kept free of all contamination. Allow primer to dry for one to five minutes depending on application and weather conditions. Primer shall be dry-to-touch condition and have a non-glossy appearance, before application of cadweld cap.

D. Cadweld cap shall be applied at connection according to manufacturer's directions. The filler material shall be placed over the thermite weld connection and worked around and under the wire and connection. Apply pressure to the cadweld cap to assure good adhesion.

E. Completed cadweld cap assembly shall adhere tightly to pipe and wire connection with no voids or gaps. Inadequate adhesion is demonstrated if there are visible gaps or voids under the cap or if the cap can be easily removed from the pipe surface by pulling with fingertip pressure. At all locations where inadequate adhesion is evident, reprime and replace cap or prime and apply a 6-inch long piece of field repair tape or heat shrink repair material over existing cadweld cap. Apply per coating manufacturer’s directions.

F. All exposed metallic surfaces not covered by the thermite weld cap or heat shrink sleeve shall be repaired per PIPE AND FITTING COATING REPAIR.

3.6 PIPE AND FITTING COATING REPAIR

A. External pipe and fitting repair coatings shall consist of external coating materials and repair procedures as recommended by the pipe or fitting coating manufacturer.

1. Fusion-bonded epoxy coated items shall be repaired with liquid epoxy repair kits provided by the fusion-bonded coating manufacturer.

2. Epoxy coated items shall be repaired with repair coating from the original coating manufacturer.

3. Spot coating damage at thermite weld connections not covered by standard thermite weld cap coating repair procedure shall be repaired with a field applied 6-inch minimum piece of tape coating, 6-inch minimum size or heat shrink repair material, or a 100 percent solids epoxy coating that can cure in either wet or dry conditions.

4. Cold-applied tape repair coatings shall consist of suitable primer and minimum 35-mil thick patch/repair/joint tape with aggressive adhesive and release liner, 4 or 6-inches width. Suitable primer shall be provided with the repair coatings as recommended by the repair-coating manufacturer. Acceptable products are Tapecoat H35 Gray available from The TAPECOAT Company, Evanston, IL.; Polyken 1027 primer and Polyken 934-35 tape available from Tyco Adhesive (Polyken Kendall) Mansfield, MA.; Tek-Rap 200-23 Series primer and Tek-Rap 280 tape available from Tek-Rap, Inc., Houston, TX.; or equivalent.

5. Acceptable epoxy coatings that can cure under wet or dry conditions are "A-788 Splash Zone Compound " by Koppers, Pittsburgh, PA; "Aquata Poxy" by Raven (King Adhesive Corporation), St. Louis, MO; " Concresive No. 1438 or No. 1170 " by Adhesive Engineering Company, San Carlos, CA; or equivalent.

6. Heat shrink repair kits shall be used to repair coating damage on heat shrink sleeves and at locations where heat shirk sleeves do not completely encase wires under sleeve. Apply heat shrink sleeves and repair kits in accordance with coating manufacturer’s directions.

7. Mastic coating for application to irregular shapes by brush, trowel, or in solid form is allowed only in dry burial conditions, where excavation is left open for an adequate time to allow coating to completely cure before burial or exposure to ground water. Acceptable materials are TC Mastic (Brush Applied) as manufactured by the Tapecoat Company, Evanston, IL; Polyken Brush Applied Mastic No. 937, Polyken Trowel Applied Mastic No. 938, Polyken Solid Mastic No. 939 as manufactured by Tyco Adhesive (Kendall Polyken) Mansfield, MA.; or equivalent.

3.7 TAPE COATING FOR STEEL, DUCTILE IRON, AND/OR COPPER SERVICE PIPING

A. Field tape coat short sections of buried metallic piping such as vent pipes, blow-off assemblies, and pipe stubs to be concrete encased under buildings or tanks if not already coated with a specified coating system.

B. Field tape coat copper service or galvanized steel service piping where specified or shown on the Drawings.

C. Follow Specification Section 09800, the tape coating manufacturer's recommendations, and AWWA Standard C209 Cold-Applied Tape Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipelines.

1. Provide suitable field primer (if required) and 35-mil field applied repair tape with aggressive adhesive and release liner, 4 or 6-inches width. Acceptable products as specified under “PIPE AND FITTING COATING REPAIR”.

2. Hand tool clean surfaces. Copper service lines shall not be sandblasted.

3. Pipe shall be clean and dry prior to and during application of both primer and tape coating. Tape shall be applied in a spiral wrap with a 50 percent overlap.

3.8 PREPACKAGED GALVANIC ANODE INSTALLATION

A. General:

1. Remove plastic or paper shipping wrap from prepackaged anode prior to placement. Galvanic anodes packaged in cardboard type chip-tube shall be thoroughly perforated just prior to installation.

2. Install galvanic anodes a minimum of 1-foot below the pipe invert and 5-feet from buried metallic piping or 3-feet from metallic fittings to be protected. Space galvanic anodes equally around the fitting, pipe section, or appurtenance. Locate at bottom edge of pipe trench as shown on the Drawings or as specified. Alternate anode placement on opposite sides of the pipe. Provide a minimum anode spacing of 5-feet from other unprotected pipelines.

3. Handle prepackaged anode with care. Damage to the anode, anode to wire connection, or prepackaged backfill bag will require replacement of the entire assembly.

4. Earth backfill around each anode shall be thoroughly compacted to a point 1-foot above the anode. Backfill material around each anode shall be native soil free of roots, organic matter, trash, and rocks. Stop backfill at specified grade to allow for placing of topsoil, pavement, or concrete, when required.

5. All anode wires shall be buried a minimum of 36-inches below finish grade. Wires shall be handled with care. Splices or damage to the insulation on any wire shall be repaired in accordance with WIRE INSULATION REPAIR and be approved by Engineer.

6. Electrical connection of the anode wire to steel, cast or ductile iron metallic pipe or fittings shall either be directly to the pipe or fitting by the thermite weld method or through a test station with shunt as shown on the Drawings.

7. Electrical connection to copper services shall either be directly to the copper service by a ground clamp or through a test station with shunt as shown on the Drawings.

B. Installation:

1. Each buried metallic (steel, ductile, or cast iron) pipeline section, appurtenance, valve, or fitting shall receive a minimum of one galvanic anode unless already protected by an impressed current cathodic protection system.

2. All metallic valves, blow-offs, air valves, or fittings located in vaults, which will be continuously or intermittently under the water table shall be be protected as if buried.

3. Install a minimum of one each 17-pound galvanic anode for each concrete encased metal pipe section (stub piece) under pump stations, buildings, or tanks.

4. Where two or more metallic fittings are adjacent to each other, install joint bonds as specified in PIPE CONNECTING WIRES, and install the specified quantity of galvanic anodes for each metallic pipe section, appurtenance, valve, or fitting used in conjunction with nonmetallic pipe.

5. At the Contractor’s option, larger anodes may be used in place of multiple smaller anodes for a group of bonded metallic components on non-metallic piping provided the same total weight of galvanic anode is used.

6. Anodes shall be installed on all metallic fittings, valves and appurtenances in accordance with the following schedule:

ITEM	BARE ANODE SIZE
Metallic Fitting or Valve **with** Factory applied Fusion Bonded Coating	5 pound anode
Metallic Fitting or Valve **without** Factory applied Fusion Bonded Coating	17 pound anode
2 or 3 Bonded Metallic Fittings or Valves **with** Factory applied Fusion Bonded Coating	17 pound anode

3.9 WIRE INSULATION REPAIR

A. Minor insulation damage to test, galvanic anode, or reference electrode wires shall be repaired by spirally wrapping (minimum of 50 percent overlap) with two layers of high voltage rubber splicing tape and two layers of vinyl electrical tape. Wire splices shall be made with suitably sized compression connectors as specified, or mechanically secured and soldered with rosin cored 50/50 solder. All wire splices and wire insulation repair locations shall be approved by Engineer.

3.10 PIPE TRACING WIRE

A. Pipe tracing wire shall be taped to top of plastic pipeline every 10 feet and shall be terminated above grade in test stations, valve boxes, vaults, or at fire hydrant bases. Tracing wire shall be brought up outside of valve box to with-in a 1-foot maximum of top of valve box and a hole drilled in valve box for threading tracer wire into and terminating inside valve box. Tracing wire shall be terminated inside test stations where available on terminal separate from anode or pipe/fitting leads. Tracing wire shall be terminated at fire hydrant bases in ½-inch diameter 2-foot long plastic conduit. Terminate wire and plastic conduit approximately 6-inch above grade with a minimum of one (1) foot of excess wire.

3.11 FINAL TESTING

A. After construction is complete, the Engineer shall test the pipeline to ensure proper installation of the joint bonds, galvanic anodes, test stations, cased crossings, and insulated joints. The Engineer shall conduct longitudinal electrical continuity testing of joint bonded pipelines. Any construction defects identified during the final testing shall be located and corrected by the Contractor at his sole expense. Provide the Engineer with a minimum of 14 days' advance notice before beginning final testing repairs.

END OF SECTION

SECTION 15062 - INTERIOR PIPE, DUCTILE IRON PIPE AND FITTINGS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes interior ductile iron pipe and fittings, including: tees, bends, flanges, fittings and all appurtenances to be installed in the well house.

1.2 RELATED WORK

A. Section 09800, Coatings.

1.3 SUBMITTALS

A. Provide catalog cuts and other information for all products proposed for use that show compliance of those materials with these Specifications.

PART 2 - PRODUCTS

2.1 DUCTILE IRON PIPE

A. Ductile iron pipe and fittings shall be used for the new piping. Pipe shall be Class 53 in accordance with AWWA Standard C151.

B. The outside surface of metallic pipe and fittings shall receive a liquid epoxy coating 16 MDFT (mils dry film thickness) in accordance with AWWA C-210. Minimum surface preparation before coating shall be near white blast (SSPC 10) for external surfaces. The interior of pipe and fittings shall have a cement mortar lining conforming to AWWA C-104. Fusion bonded epoxy coating in accordance with AWWA C116 (8 mils minimum) may be substituted for liquid epoxy coating and cement mortar lining. Fusion bonded epoxy shall be NSF 61 approved for potable water service.

C. Cast iron or ductile iron fittings shall be flanged fittings, rated for 350 psi conforming to AWWA C153. The interior of fittings shall have a cement mortar lining conforming to AWWA C-104 or the same fusion bonded coating as the exterior.

D. Threaded outlets for ductile iron pipe shall be made by the direct tap method or with a tapping saddle.

2.2 AIR VALVES

A. Air valves shall be combination air valves constructed of either cast iron air or ductile iron. Valves shall be in accordance with AWWA C512. Air valves shall satisfy the following criteria;

1. Cast iron or ductile iron body for 250 psi working pressure

2. Air valves shall receive abrasive blast surface preparation, before coating, in accordance with Section 09800.

3. Air valves shall have internal coating shall be 8 mils of liquid epoxy in accordance with AWWA C550 and exterior coating shall be 8 mils of liquid epoxy in accordance with AWWA C218. 8 mils of fusion bonded coating in accordance with AWWA C213 may be substituted.

4. The appropriate durometer of the rubber seat shall be selected by the manufacturer for the following operating pressure range;
   Before pressure control valves 100 to 200 psi
   After pressure control valves 10 to 20 psi

B. All air valves shall have Schedule 40, PVC piping from the discharge as shown on the plans. Cover the end with a 24 mesh stainless steel screen.

2.3 RESTRAINED FLANGED ADAPTERS

A. Restrained Flanged Adapters shall be EBAA Iron Series 2100 ductile iron flange adapters rated for 350 psi working water pressure or approved equal. Transition gaskets shall be used with steel pipe.

2.4 PRESSURE GAUGE

A. Pressure gauges shall be accurate within 1%. Pressure gauges shall be of a bourdon-type with 4.5-inch diameter dial and shall be as manufactured by Ashcroft Gauges or equivalent. Gauges shall include an isolation ball valve.

   Gauge Operating Range
   0 to 300 psi before the pressure reducing valves
   0 to 60 psi downstream of the pressure reducing valves

2.5 SMALL DIAMETER VALVES

A. Valves 2.5-inch diameter and smaller shall be ball valves (steel or brass as stated on the plans), standard port, with Teflon seats, rated for a minimum of 200 psi working pressure, and have a steel handle. Valves 1.5-inch diameter and smaller shall have female thread connections, valves 2 and 2.5-inch diameter shall have flanged connections.

2.6 CORPORATION STOPS

A. Corporation stops shall be Mueller B-25008, or equal, 300psi

2.7 INTERIOR GATE VALVES

A. Interior gate valves shall be flanged, shall have handwheel operators, and shall be in accordance with AWWA C509. Direction of opening shall open left.

2.8 FLANGE BOLTS

A. Flange bolts, nuts and washers shall be galvanized steel or stainless steel.

2.9 PIPE SUPPORT

A. Pipe support shall be in accordance with the Plans.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Piping: All piping shall be erected accurately to line and grade in accordance with these Specifications and as shown on the Drawings. The Contractor shall furnish any temporary supports and bracing as may be required to hold the pipe sections in place and prevent distortion during welding. Installations shall be in accordance with manufacturer's recommendations and as shown on the Drawings.

Pipe shall be parallel to building lines; floor, walls, ceiling, unless shown otherwise.

B. Valves and Appurtenances: Installation shall be in accordance with manufacturer's recommendations and as shown on the Drawings.

C. All air valves shall be installed with a corporation stop for isolation.

D. Do not paint threads, nuts or heads of bolts.

3.2 PIPE SUPPORTS

A. Pipe supports shall be installed where indicated on the Drawings and as required by equipment manufacturers.

3.3 FLANGED ADAPTERS

A. Flanged adapters shown in the plans are required at the locations where they are shown.

3.4 WATER PIPE AND FITTINGS TESTING

A. Field Test: Test shall be conducted in the presence of the Engineer. The Contractor shall also perform any tests which might be recommended by the manufacturer, supplier or Engineer in addition to those specified in this Section, to

determine that equipment, materials or systems meet all requirements of these Specifications. All testing shall be performed solely at the Contractor's expense along with the replacement or repair of any equipment or materials damaged due to use of unapproved test procedures or due to improper handling of test apparatus.

3.5 HYDROSTATIC TESTING

A. The piping and fittings shall be hydrostatically tested for two hours at 250 psi. Pipe joints located under buildings shall be hydrostatically tested before the pipe is covered. Visible leakage will not be allowed.

3.6 AIR VALVE TESTING

A. Air Valve testing shall be performed according to AWWA C512. The discharge pipe shall be disconnected for testing. Demonstrate the movement of the seat downward, allowing water to discharge. Close the isolation valve and move the seat down. Open the isolation valve to demonstrate the seat will seal in a filling mode.

END OF SECTION

SECTION 15160 – MAGNETIC FLOW METERS

PART 1 - GENERAL

1.1 SUMMARY

A. Provide flow meters as indicated on the drawings.

1.2 SUBMITTALS

A. Provide catalog cuts and other information for all products proposed for use that show compliance of those materials with these Specifications.

PART 2 - PRODUCTS

2.1 GENERAL

A. Unless otherwise specified, measuring elements and transmitters shall comply with the following requirements:

1. Transmitters shall be provided with integral indicators. Indicators shall be calibrated in process units, and said units shall be engraved on the indicator scale plate.

2. Transmitters shall be two-wire type with operating power derived from source shown.

B. Transmitter output shall be galvanically isolated.

C. Transmitter output shall increase with increasing measurement.

D. Transmitter enclosures shall be rated NEMA 250, Type 4X, unless otherwise specified.

E. SCHEDULE OF MAGNETIC FLOW METERS:

Location	Size	Flow Range	Tag Number
Well House	8"	500 – 2,000 GPM	FM-1

F. MANUFACTURERS;

Endress & Hauser, Rosemount, or approved equal

2.2 TRANSMITTER SPECIFICATION SHEET

A. Flow Tube: Flow shall be 316 stainless steel full-body flanged construction with carbon steel flanges and powder-coated die-cast aluminum sensor housing. Flow tube shall have an Al/Zn protective coating. Flow tube liner shall be hard rubber or polyurethane. Flow tube shall be rated for 250 psi working pressure.

B. Electrodes: Flow tube measuring, ground, and empty pipe detection electrodes shall be of 316L stainless steel construction unless specified otherwise.

C. Transmitter: The transmitter shall contain all electronics associated with the magnetic flow meter system. Enclosure shall be NEMA 4X cast aluminum with a compartment for power, field connections and calibration adjustments separate from digital circuitry. Transmitter shall be provided with 3 optical keys to permit non-intrusive setup and calibration. The transmitter shall contain self diagnostics and shall be interchangeable with other units of the same type without special re-calibration. Transmitter shall include an integral 4 line, 16-digit illuminated LCD display. Features shall include current signal output simulation and empty pipe detection.

D. Transmitter dampening shall be programmable from 0.01 to 100 seconds. All setup parameters shall be stored in non-volatile EEPROM memory.

E. Installation: Install in accordance with manufacturer's instructions, API RP550, and the specified functional requirements.

F. Application: Application and setup shall be in accordance with manufacturer’s recommendations and as specified in Instrument Index.

G. Test and Calibration: Meter shall be provided with NBS certified or equivalent flow certification to a minimum of 3 calibration points.

H. Training: 4-hour training session covering the setup, calibration, maintenance, and troubleshooting of the flow measurement system.

I. Transmitter Function: Flow measurement

J. Transmitter Description: Magnetic flow metering system

K. Power Supply: 120 volt, 60 hertz nominal

L. Signal Input: Process

M. Signal Output: 4-20 mA and scaled pulse frequency

N. User-configurable contact closure output configured to indicate reverse flow

O. Process Connection: Flange, ANSI B16.5 Class 150, raised face

P. Product Requirements:

1. General: Magnetic flow meter shall be provided as a system consisting of a flow tube and integral converter/transmitter. Converter/transmitter shall be suitable for full-scale flow rates from 1 to 33 feet per second. System error shall not exceed the greater of 0.5 percent of rate ± 0.01 percent of maximum full scale. Flow metering system repeatability shall be ± 0.1 percent of rate ± 0.005 percent of maximum full scale. Flow metering system shall be bi-directional and shall provide a contact closure signal to indicate flow in the reverse direction.

2. Flow tubes located in lined or non-conductive pipelines shall be provided with 0.125 inch thick grounding rings. Grounding rings shall be fabricated from ASTM A312, Type 316 stainless steel. Grounding ring inside diameter shall be 1/16 inch smaller than flow tube inside diameter.

3. Excitation power requirements shall not exceed 100 volt-amperes.

4. Standard meter shall be FM approved Class 1, Div 2 Groups A-D.

PART 3 - EXECUTION

3.1 INSTALLATION OF PROCESS VARIABLE TRANSMITTERS

A. Raceway Connections: Final connections between rigid raceway systems and instruments shall be made with jacketed flexible conduit with a maximum length of 2 feet.

B. Transmitter shall be mounted on the flowmeter.

C. Install in accordance with manufacturer's instructions, API RP550, and the specified functional requirements.

3.2 FIELD TESTING

A. Testing: Transmitters shall be tested in accordance with the manufacturer’s instructions.

B. Cleaning: Touch-up scratched or marred enclosure surfaces to match original finishes. Remove all dust, debris, paint, and other foreign material from the transmitter enclosure.

C. Meter shall be provided with NBS certified or equivalent flow certification to a minimum of 3 calibration points.

3.3 TRAINING

A. The Contractor shall provide the services of a factory-trained instructor for the purpose of training the Owner's personnel in the proper operation and maintenance of process variable transmitters. Training shall address instrument theory of operation and installation and application guidelines. Instruments shall be provided for hands-on demonstration and exercises. Training instructors shall be in the direct employment of the instrument manufacturer.

END OF SECTION

SECTION 15190 - INTERIOR PIPING IDENTIFICATION

PART 1 - GENERAL

1.1 SUMMARY

A. The extent of piping identification Work required by this section includes all materials and installation of piping identification for the piping in the well house

1.2 QUALITY ASSURANCE

A. Comply with all requirements of ANSI A13.1 including; lettering size, length of color field, colors and viewing angles of identification devices.

PART 2 - PRODUCTS

2.1 PIPE MARKERS

A. Pipe markers shall be plastic as manufactured by Seton Name Plate Company or equivalent. They shall be pressure-sensitive adhesive vinyl.

B. Only flow direction arrows are required.

PART 3 - EXECUTION

3.1 GENERAL

A. Install piping identification after the pipe has been painted.

B. Install arrows to show normal direction of flow.

C. Locate arrows as follows wherever piping is exposed to view:

1. Near each branch, excluding short take-offs for fixtures and terminal units.

2. Near wall, floor and ceiling penetrations and where pipes enter non-accessible enclosures.

3. Near major equipment items and other points of origination and termination.

END OF SECTION

SECTION 15400 - PLUMBING SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section consists of furnishing and installing the floor drain system.

1.2 SUBMITTALS

A. Submit manufacturer's data for fittings, floor drains, pipe, including rough-in requirements, clearances, and anchorages.

1.3 QUALITY ASSURANCE

A. Meet requirements of the 2021 Uniform Plumbing Code.

PART 2 - PRODUCTS

2.1 PRODUCTS

A. Soil, Storm, Waste, And Vent Pipe And Fittings;

1. Pipe, Schedule 40 PVC

2. Fittings, Schedule 40 PVC

B. Floor Drains: Ductile iron frame, bottom outlet, no hub connection, sized as shown on the plans. Provide a satin finished, solid bronze alloy, 12-inch diameter grate and accessories. Nyoplast 12" Drain Basin, or approved equivalent.

PART 3 - EXECUTION

3.1 GENERAL:

A. Install materials and equipment as shown and specified in accordance with governing codes and standards.

3.2 INSTALLATION OF FLOOR DRAIN SYSTEM:

A. Pitch underground pipe within the building a minimum of 1/8 inch per foot in the direction of flow. Make changes in direction of drainage lines with 45-degree wyes, long turn wyes, or sweep bends. Use long turn fittings wherever space conditions permit. Provide waterproofing around all lines penetrating through foundation walls and floor slabs.

B. Check and verify all inverts of lines within and outside the building.

END OF SECTION