

SECTION 01010

SUMMARY OF WORK

PART 1 GENERAL

1.01 SCOPE OF WORK COVERED BY THE CONTRACT

- A. These Specifications and the accompanying Drawings describe the work to be done and materials to be furnished for the construction of Contract 519-06-02, Water System Improvements, Little Cowan, for the Letcher County Water and Sewer District.
- B. The Work is located in central Letcher County along Little Cowan Road.
- C. Major work items in this Contract include:
 - 1. Approximately 19,345 L.F. of 6-inch water line and associated accessories.
 - 2. Approximately 6,545 L.F. of 3-inch water line or smaller, and associated accessories.
 - 3. One booster pump station.
 - 4. Residential meter settings, accessories, and service lines.
 - 5. Bores/casing pipe.
 - 6. The OWNER has contracted to purchase meters directly and the CONTRACTOR will not be responsible for either their purchase or their installation.
 - 7. A 30,000 gallon ground storage tank.

1.02 WORK SEQUENCE

- A. No priorities are assigned to this work.

1.03 BOND

- A. Prior to beginning work, the CONTRACTOR shall post a bond in the OWNER'S name with the Kentucky Department of Highways for the Encroachment Permit. The bond amount to be posted will be per an addendum during the bidding phase. The cost of this bond shall be considered incidental to pipe laying activities and there will be no additional payment for posting the bond.

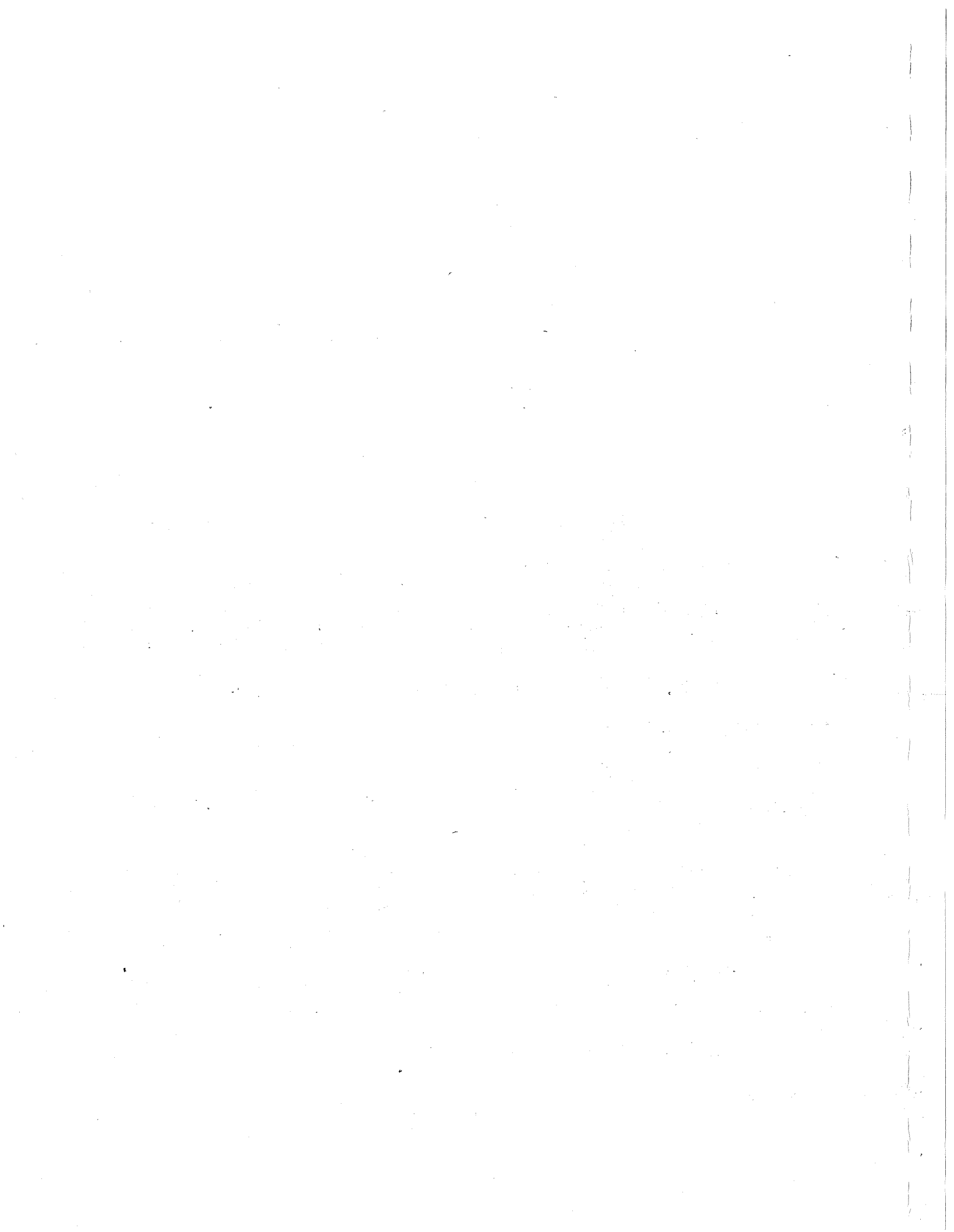
PART 2 MATERIALS

Not used.

PART 3 EXECUTION

Not used.

END OF SECTION



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SECTION 01020

ALLOWANCES

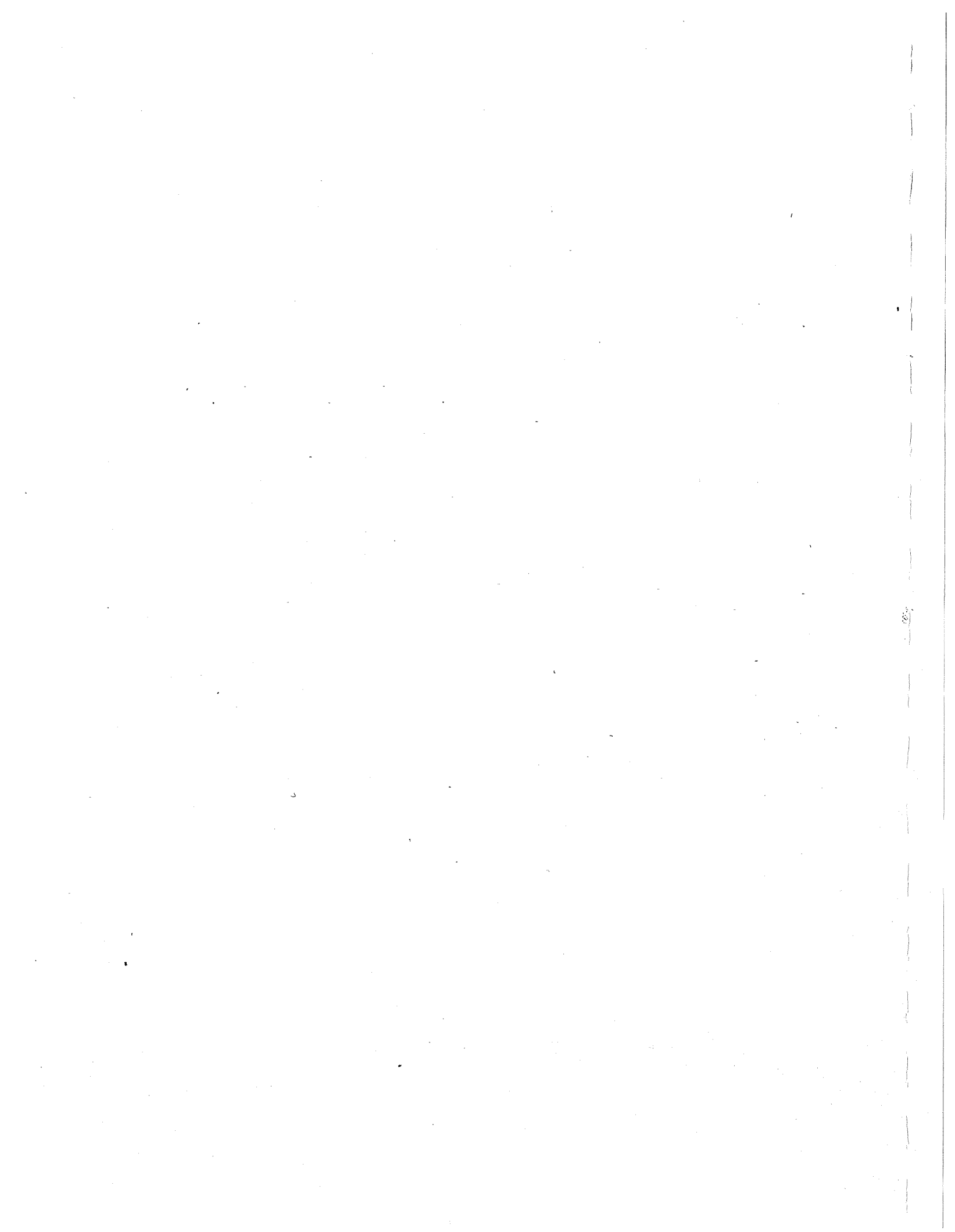
PART 1 GENERAL

1.01 CASH ALLOWANCES

- A. Cash allowance of \$20,000.00 is included for telemetry equipment. The CONTRACTOR shall be reimbursed for actual expenses incurred based on actual invoices plus 10 percent for overhead and profit. The OWNER shall select the company responsible for supply and installation of the telemetry equipment.

END OF SECTION

01020-1



SECTION 01300

SUBMITTALS

PART 1 GENERAL

1.01 DESCRIPTION OF REQUIREMENTS

- A. This section specifies the general methods and requirements of submissions applicable to the construction schedule and shop drawings, product data, and samples. Additional general submission requirements are contained in paragraphs 5.1 through 5.7 of the General Conditions. Detailed submittal requirements are specified in the technical Specifications sections.

1.02 CONSTRUCTION SCHEDULE

- A. In addition to the progress schedule requirements specified in Article 3 of the General Conditions, the CONTRACTOR shall, within 10 days after the Notice to Proceed, provide and submit to the ENGINEER for review the schedule the CONTRACTOR plans to maintain in order to successfully construct the work within the time allotted. The schedule shall account for all work of the CONTRACTOR and the Subcontractors.
- B. The CONTRACTOR shall update the schedule information monthly and submit the updated information to the ENGINEER at the same time the pay estimate is prepared. The schedule shall contain all of the items of the periodic estimate and pay schedule.
- C. The CONTRACTOR bears full responsibility for scheduling all phases and stages of the work including all Subcontractors' work to insure its successful prosecution and completion within the time specified in accordance with all provisions of the Contract Documents.

1.03 SHOP DRAWINGS, PRODUCT DATA, SAMPLES, O&M INSTRUCTIONS

- A. Submittal of these items shall comply with Section 00700, The General Conditions, in addition to the more detailed requirements listed in this section and in the technical Specifications.
- B. Shop Drawings
 - 1. Shop drawings, as defined in the General Conditions, and as specified in the technical Specifications include, but are not necessarily limited to, custom-prepared data such as fabrication and erection/installation drawings, scheduled information, setting diagrams, actual shopwork manufacturing instructions, custom templates, special wiring diagrams, coordination drawings, individual system of equipment inspection and test reports including performance curves and certifications, as applicable to the work.

2. All details on shop drawings submitted for review shall show clearly the relation of the various parts to the main members and lines of the structure, and where correct fabrication of the Work depends upon field measurements, such measurements shall be made and noted on the shop drawings before being submitted for review.

C. Product Data

1. Product data as specified in individual sections include, but are not necessarily limited to, standard prepared data for manufactured products (sometimes referred to as catalog data), such as the manufacturer's product specification and installation instructions, availability of colors and patterns, manufacturer's printed statements of compliance and applicability, roughing-in diagrams and templates, catalog cuts, product photographs, standard wiring diagrams, printed performance curves and operational-range diagrams, production or quality control inspection and test reports and certifications, mill reports, product operating and maintenance instructions and recommended spare-parts listing, and printed product warranties, as applicable to the Work.

D. Samples

1. Samples specified in individual sections include, but are not necessarily limited to, physical examples of the work such as sections of manufactured or fabricated work, small cuts or containers of materials, complete units of repetitively-used products, color/texture/pattern swatches and range sets, specimens for coordination of visual effect, graphic symbols, and units of work to be used by the ENGINEER or OWNER for independent inspection and testing, as applicable to the Work.

E. Operation and Maintenance Instructions

1. O&M instructions shall conform to Article 5 of the General Conditions (Section 00700) and the particular requirements of the individual sections.
2. Refer to Section 01600 for additional requirements for O&M instructions.

1.04 CONTRACTOR'S RESPONSIBILITY

- A. The CONTRACTOR shall review shop drawings, product data and samples prior to submission to determine and verify the following:
 1. Field measurements
 2. Field construction criteria
 3. Catalog numbers and similar data
 4. Conformance with the Specifications

- B. All shop drawings submitted by subcontractors for review shall be sent directly to the CONTRACTOR for preliminary checking. The CONTRACTOR shall be responsible for their submission at the proper time so as to prevent delays in delivery of materials.
- C. The CONTRACTOR shall check all Subcontractors' shop drawings regarding measurements, size of members, materials, and details to satisfy the CONTRACTOR that they conform to the intent of the Drawings and Specifications. Drawings found to be inaccurate or otherwise in error shall be returned to the Subcontractors for correction before submission thereof.
- D. Each shop drawing, working drawing, sample and catalog data submitted by the CONTRACTOR shall have affixed to it the following certification statement, signed (not initialed) by the CONTRACTOR: By this submittal, I hereby represent that I have determined and verified all field measurements, field construction criteria, materials, dimensions, catalog numbers and similar data; and I have checked and coordinated each item with other applicable reviewed shop drawings and all Contract requirements.
- E. The CONTRACTOR shall notify the ENGINEER and OWNER in writing, at the time of submittal, of any deviations in the submittals from the requirements of the Contract Documents.
- F. The CONTRACTOR should include the notation "Critical Path" on critical path submittals.
- G. The review of shop drawings, samples or catalog data by the ENGINEER shall not relieve the CONTRACTOR from his responsibility with regard to the fulfillment of the terms of the Contract.
- H. No portion of the work requiring a shop drawing, working drawing, sample, or catalog data shall be started nor shall any materials be fabricated or installed prior to the review or qualified review of such item. Fabrication performed, materials purchased or on-site construction accomplished which does not conform to reviewed shop drawings and data shall be at the CONTRACTOR's risk. The OWNER will not be liable for any expense or delay due to corrections or remedies required to accomplish conformity.
- I. Project work, materials, fabrication, and installation shall conform with reviewed shop drawings, working drawings, applicable samples, and catalog data.

1.05 SUBMISSION REQUIREMENTS

- A. The CONTRACTOR shall make submittals in such sequence as to cause no delay in the work or in the Work of any other Contractor.

B. Number of submittals required:

1. Shop Drawings: Submit 7 copies.
2. Product Data: Submit 7 copies.
3. Samples: Submit number stated in the respective Specification sections.
4. O&M Instructions: Submit 7 copies in accordance with Section 01600 of the Specifications.

C. Submittals shall contain:

1. The date of submission and the dates of any previous submissions.
2. The Project title, Contract number, and submittal number.
3. Contractor identification.
4. The names of:
 - a. CONTRACTOR
 - b. Supplier
 - c. Manufacturer
5. Identification of the product, with the Specification section number.
6. Field dimensions, clearly identified as such.
7. Relation to adjacent or critical features of the work or materials.
8. Applicable standards, such as ASTM or Federal Specification numbers.
9. Identification of deviations from Contract Documents.
10. Identification of revisions on resubmittals.
11. An 8-in. x 3-in. blank space for CONTRACTOR's and ENGINEER's stamps.
12. Critical path notation as required.

1.06 RESUBMISSION REQUIREMENTS

- A. The CONTRACTOR shall make any corrections or changes in the submittals required by the ENGINEER and resubmit until accepted, in accordance with the following:

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1. Shop drawings and product data:
 - a. Revise initial drawings or data, and resubmit as specified for the initial submittal.
 - b. Indicate any changes which have been made other than those requested by the ENGINEER.
2. Samples: Submit new samples as required for initial submittal.

B. The CONTRACTOR shall bear the cost for all review and processing after the second resubmittal.

1.07 GENERAL PROCEDURES FOR SUBMITTALS

- A. Coordination of Submittal Times: The CONTRACTOR shall prepare and transmit each submittal sufficiently in advance of performing the related Work or other applicable activities, or within the time specified in the individual Work section of the Specifications, so that the installation will not be delayed by processing times including disapproval and resubmittal (if required), coordination with other submittals, testing, purchasing, fabrication, delivery and similar sequenced activities.

PART 2 PRODUCTS

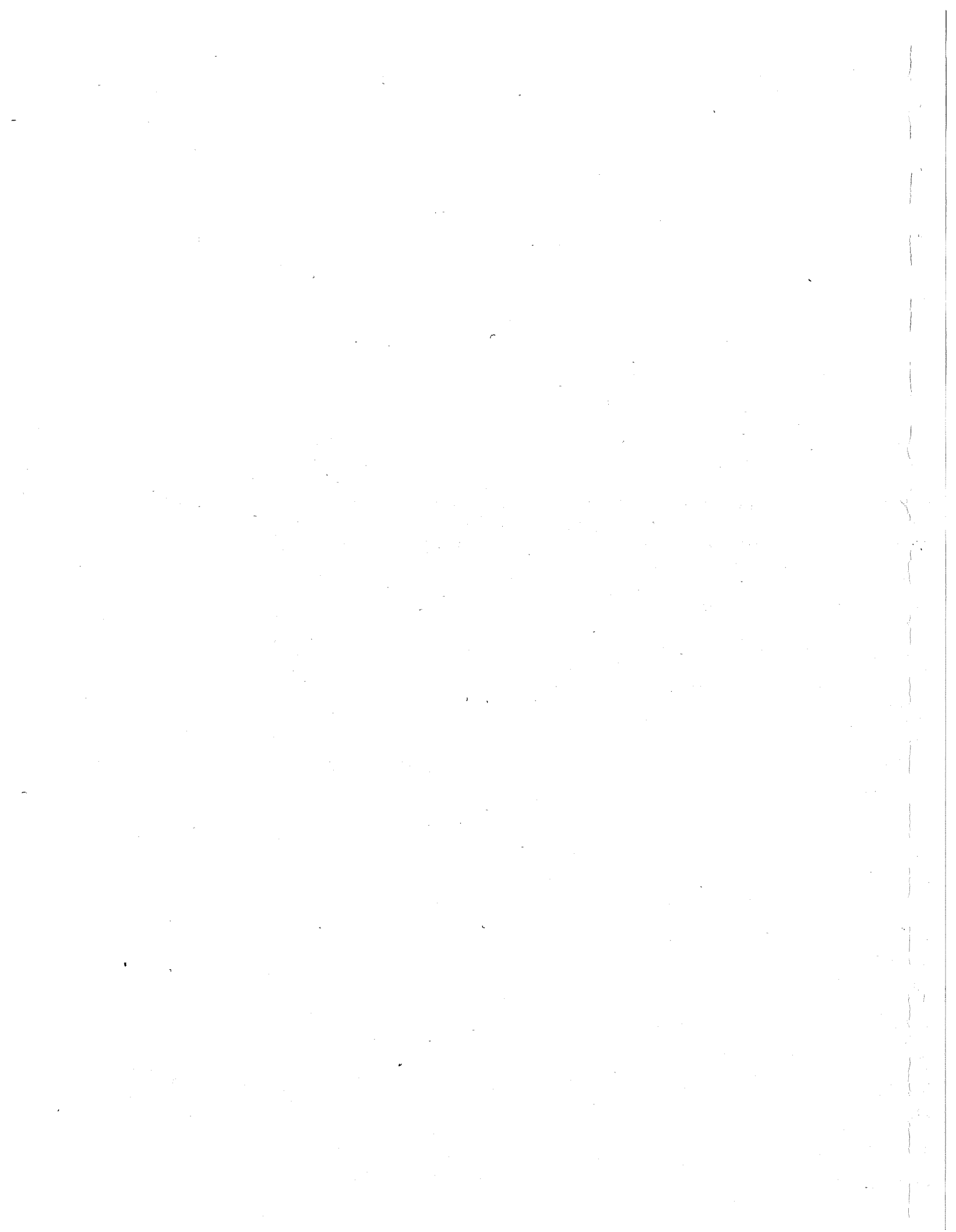
Not used.

PART 3 EXECUTION

Not used.

END OF SECTION

01300-5



SECTION 01500

CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 GENERAL

1.01 SANITARY FACILITIES

- A. The CONTRACTOR shall construct and maintain, in a sanitary condition, sanitary facilities for the CONTRACTOR'S employees and also employees of the Subcontractors. The CONTRACTOR shall, at completion of the Contract Work, properly dispose of these sanitary facilities.

1.02 UTILITIES

- A. The obtaining of all utilities for construction, including power and water, shall be the responsibility of the CONTRACTOR, and he shall bear the cost of all utilities used for construction. Cost of all connections and facilities for use of utilities shall be borne by the CONTRACTOR.

1.03 MAINTENANCE OF SERVICE IN EXISTING UTILITIES

- A. Where the existing utilities, including in-plant process piping and plant water piping, must be disturbed during construction under this Contract, their operation and function shall be maintained by the CONTRACTOR to such a degree that service to customers will be interrupted for minimum time periods only. Such disturbances and any maintenance use of these lines shall constitute no cost to the OWNER. **The OWNER shall be notified of interruptions in sufficient time to prepare for them and shall agree to the hour, date, and duration of them before they are undertaken.**
- B. Should shutdowns in service be in excess of the time of duration agreed upon, and such excessive shutdown time be due to the CONTRACTOR's negligence, faulty Work and/or inability to perform, then and in that event, the CONTRACTOR shall be held liable to the OWNER for any and all damages that may accrue to the OWNER, by reason of such excessive shutdown periods.
- C. Digging through services with trenching machines will not be permitted. Upon damage to utility services, such services shall be repaired immediately and tested to the satisfaction of the ENGINEER. The CONTRACTOR shall notify all utility users of impending interruption of service and shall be responsible for all damage resulting from same. Payment for necessary disconnection and reconnection of utility services shall be included as a part of the CONTRACTOR'S bid and no extra compensation will be made for same.
- D. The CONTRACTOR shall at all times maintain on hand an adequate supply of repair materials and tools with which to make repair to damaged water, gas and sewer lines. Should the CONTRACTOR inadvertently damage existing utilities, he shall make immediate repair thereto and in no event shall he leave the site before such repair has been made and proven to be successful.

- E. As far as possible, the locations and sizes of existing mains are indicated on the Drawings; however, exact locations, pipe materials and sizes cannot be guaranteed. It shall be the responsibility of the CONTRACTOR to locate and uncover existing lines, to which new mains are to be connected, and provide all connecting fittings of the correct size and type for each connection. Payment for the above shall be included in the unit price bid for each item used for the connection as indicated on the Drawings or as specified.

1.04 PROPERTY PROTECTION

- A. Care is to be exercised by the CONTRACTOR in all phases of construction, to prevent damage and/or injury to the OWNER's and/or other property. Payments for the repair and restoration are limited as set forth in "Conflict With or Damage to Underground Facilities" of the Supplementary General Conditions.
- B. The CONTRACTOR shall avoid unnecessary injury to trees and shall remove only those **authorized** to be removed by written consent of the OWNER. Fences, gates, and terrain damaged or disarranged by the CONTRACTOR's forces shall be immediately restored in their original condition or better.

1.05 CONSTRUCTION WARNING SIGNS

- A. The CONTRACTOR shall provide construction warning signs for each location where he is working in the State highway right-of-way or in City streets. He will further provide flagmen as required and shall abide by all Kentucky Transportation Cabinet, Department of Highways safety rules, including size, type and placement of construction signs. All signs shall be of professional quality.

1.06 RESIDENT PROJECT REPRESENTATIVE OFFICE

- A. The CONTRACTOR shall provide at the beginning of construction and remove at the completion of construction, an office with storage room for the exclusive use of the Resident Project Representative, at least 10 feet by 24 feet with at least 3 windows, inside door and outside door with lock. The storage room shall occupy a space approximately 10 feet by 5 feet within the above dimensions. This office shall be at least 100 feet from the CONTRACTOR'S offices and storage buildings.
- B. The office shall be furnished with a desk, 2 chairs, stool, plan rack, and a built-in sloped plans table at least 10 feet long and 3 feet wide with a drawer 42 inches by 27 inches by 4 inches deep inside dimensions. The office shall be equipped with a 4-drawer steel filing cabinet, printing calculator, telephone, air conditioner of adequate size, 3 electric ceiling lights, and at least 3 electric plug-in duplex receptacles.
- C. During occupancy, the office shall be supplied with telephone, electric and janitor services, and shall be supplied with adequate, safe, dependable heat.

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- D. Subject to approval of the ENGINEER, the CONTRACTOR may furnish office space in an existing building or a trailer equal to 35 feet by 8 feet "Field Office Trailer" of the Contractor's Trailer Company, Williamstown, Massachusetts.
- E. At completion of the Contract, this temporary structure and all other temporary structures erected by the CONTRACTOR shall become the property of the CONTRACTOR, and he shall remove them from the site at no expense to the OWNER. The CONTRACTOR shall restore the site to a condition equal to that which existed before placement of the office.

1.07 ACCESS ROADWAYS

- A. The CONTRACTOR shall construct all access roadways needed during construction, and the planned access roadways for the completed project. The CONTRACTOR shall maintain access roadways continuously during the construction period.
- B. The CONTRACTOR shall maintain all existing roadways within the project site which are used for any purpose by his construction operations. The degree and frequency of maintenance shall be adequate to keep existing roadways in a condition at least equal to their condition prior to construction. Road maintenance shall include dust control and grading as necessary.

1.08 RESPONSIBILITY FOR TRENCH SETTLEMENT

- A. The CONTRACTOR shall be responsible for any settlement caused by the construction, that occurs within 1 year after the final acceptance of this Contract by the OWNER. Repair of any damage caused by settlement shall meet the approval of the OWNER.

1.09 DAMAGE TO CROPS, LIVESTOCK AND VEGETATION

- A. The CONTRACTOR shall protect crops, livestock and vegetation against damage or injury from construction operations at all times. Crops damaged or equipment access obtained outside of the easements provided shall be the responsibility of the CONTRACTOR. Temporary fences shall be provided at no extra cost to the OWNER wherever necessary to keep livestock away from the construction area. Ornamental shrubbery and tree branches shall be temporarily tied back, where appropriate, to minimize damage. Damaged limbs shall be trimmed and damaged tree trunks shall be treated with wound dressing.

1.10 WASTE DISPOSAL

- A. The CONTRACTOR shall dispose of waste, including any hazardous waste, off-site in accordance with all applicable laws and regulations.

1.11 CONTRACTOR'S TRAILERS AND MATERIAL STORAGE

- A. The location of the CONTRACTOR'S and Subcontractors' office and work trailers and parking areas on the project site shall be subject to the OWNER's approval.

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- B. The location of the CONTRACTOR's and Subcontractors' material storage yards on the project site shall be subject to the OWNER's approval.

1.12 CONSTRUCTION IDENTIFICATION SIGNS

- A. The CONTRACTOR shall furnish and erect project identification signs if such are required by the funding agency.
- B. The CONTRACTOR shall obtain the OWNER'S permission before erecting any construction signs not specifically required by the Contract.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

END OF SECTION

SECTION 01600

SPECIAL PROVISIONS FOR MATERIAL AND EQUIPMENT

PART 1 GENERAL

1.01 SERVICES OF MANUFACTURERS' REPRESENTATIVE AND OPERATING MANUALS

- A. Bid prices for equipment (if applicable) furnished under Divisions 11, 13, 14, 15 and 16, shall include the cost of written operation and maintenance instructions and the cost of a competent representative of the manufacturers of all equipment to supervise the installation, adjustment, and testing of the equipment and to instruct the OWNER'S operating personnel and the ENGINEER'S representative on operation and maintenance. This supervision and instruction may be divided into two or more time periods as required by the installation program, and shall be scheduled at the convenience of the OWNER.
- B. Unless otherwise specified with the equipment, equipment manufacturers shall provide a minimum of 2 separate repeated training sessions for the OWNER'S staff. Each session shall be at least 2 hours in length, but not more than 4 hours. Manufacturer's agenda and schedule for the training shall be submitted to and approved by the OWNER prior to conducting the training. No training will be scheduled until the equipment has been installed, satisfactorily tested, and is ready for operation.
- C. The manufacturer's representative shall have complete knowledge of the proper installation, lubrication, operation and maintenance of the equipment provided and shall be capable of instructing the representatives of the OWNER and ENGINEER on proper start-up, shut-down, on-line operations, lubrication and preventive maintenance of the equipment. Outlines of lesson plans and proposed training schedule shall be submitted to the ENGINEER for review 30 days prior to the desired instructional period. Specific requirements for furnishing the services of manufacturer's representatives are indicated under detailed Specifications. This work may be conducted in conjunction with Inspection and Testing, whenever possible, as provided under Part 3 of EXECUTION of detailed specification. Should difficulties in operation of the equipment arise due to the manufacturer's design or fabrication, additional services shall be provided at no cost to the OWNER.
- D. A certificate from the manufacturer stating that the installation of the equipment is satisfactory, that the unit has been satisfactorily tested, is ready for operation, and that the operating personnel have been suitably instructed in the operation, lubrication, and care of the unit shall be submitted to the ENGINEER.
- E. For equipment furnished under other Divisions, the CONTRACTOR, unless otherwise specified, shall furnish the services of accredited representatives of the manufacturer only when some evident malfunction or over-heating makes such services necessary.

- F. Four complete sets of operation and maintenance instructions covering all equipment furnished under Divisions 11, 13, 15 and 16, shall be delivered directly to the ENGINEER.
1. The manual for each piece of equipment shall be a separate document with the following specific requirements:
 - a. Contents:
 - Table of contents and index
 - Brief description of each system and components
 - Starting and stopping procedures
 - Special operating instructions
 - Routine maintenance procedures
 - Manufacturer's printed operating and maintenance instructions, parts list, illustrations, and diagrams. These shall be specific to the material supplied under the Contract, and not a manufacturer general brochure.
 - One copy of each wiring diagram
 - One final accepted copy of each shop drawing and each CONTRACTOR'S coordination and layout drawing
 - List of spare parts, manufacturer's price, and recommended quantity
 - Manufacturer's name, address, and telephone number
 - Name, address, and telephone number of manufacturer's local representative

1.02 INSTALLATION OF EQUIPMENT

- A. Special care shall be taken to ensure proper alignment of all equipment with particular reference to the pumps, blowers and electric drives. The units shall be carefully aligned on their foundations by qualified millwrights after their sole plates have been shimmed to true alignment at the anchor bolts. The anchor bolts shall be set in place and the nuts tightened against the shims. After the foundation alignments have been reviewed by the ENGINEER, the bedplates or wing feet of the equipment shall be securely bolted in place. The alignment of equipment shall be further checked after securing to the foundations, and after conformation of all alignments, the sole plates shall be finally grouted in place. The CONTRACTOR shall be responsible for the exact alignment of equipment with associated piping, and under no circumstances, will "pipe springing" be allowed.
- B. All wedges, shims, filling pieces, keys, packing, red or white lead grout, or other materials necessary to properly align, level, and secure apparatus in place shall be furnished by the CONTRACTOR. All parts intended to be plumb or level must be proven exactly so. Any grinding necessary to bring parts to proper bearing after erection shall be done at the expense of the CONTRACTOR.

1.03 GREASE, OIL AND FUEL

- A. All grease, oil, and fuel required for testing of equipment shall be furnished with the respective equipment. The OWNER shall be furnished with a 1 year's supply of required lubricants including grease and oil of the type recommended by the manufacturer with each item of equipment supplied under Divisions 11, 13, 14, 15 and 16.
- B. All lubricants and fuels shall be properly labeled, using an indelible marker and writing on the lubricant container or drum, specifying the type and brand name of the lubricant supplied.

1.04 TOOLS AND SPARE PARTS

- A. Any special tools (including grease guns or other lubricating devices) which may be necessary for the adjustment, operation, and maintenance of any equipment shall be furnished with the respective equipment.
- B. All spare parts shall be properly protected for long periods of storage (contained in plastic bags or cardboard containers) and labeled for easy identification without opening. The labels shall be written with an indelible marker, in the following example format:

1.05 MAINTENANCE AND LUBRICATION SCHEDULES

- A. The CONTRACTOR'S attention is directed to the General Conditions and Section 01300 for all requirements relative to the submission of shop drawings for the mechanical equipment. For all mechanical and electrical equipment furnished, the CONTRACTOR shall provide a list including the equipment name, and

address and telephone number of the manufacturer's representative and service company so that service and/or spare parts can be readily obtained. In addition, a maintenance and lubrication schedule for each piece of equipment shall be submitted along with shop drawings. Submission shall be in 3 copies.

1.06 STORAGE AND HANDLING OF EQUIPMENT

A. Special attention shall be given to the storage and handling of equipment. As a minimum, the procedure outlined below shall be followed:

1. Equipment shall not be shipped until all pertinent shop drawings are reviewed by the ENGINEER.
2. All equipment having moving parts such as gears, electric motors, etc., and/or instruments shall be properly stored until such time as the equipment is to be installed.
3. All equipment shall be stored fully lubricated with oil, grease, etc. unless otherwise instructed by the manufacturer.
4. Manufacturer's storage instructions shall be carefully studied by the CONTRACTOR and reviewed with the ENGINEER. These instructions shall be followed and a written record of this kept by the CONTRACTOR.
5. Moving parts shall be rotated a minimum of once weekly to ensure proper lubrication and to avoid metal-to-metal "welding." Upon installation of the equipment, the CONTRACTOR shall start the equipment, at least half load, once weekly for an adequate period of time to ensure that the equipment does not deteriorate from lack of use.
6. Lubricants shall be changed upon completion of installation and as frequently as required thereafter during the period between installation and acceptance. New lubricants shall be put into the equipment at the time of acceptance.
7. Prior to acceptance of the equipment, the CONTRACTOR shall have the manufacturer inspect the equipment and certify in writing that its condition has not been detrimentally affected by the shipment or long storage period. Such certifications by the manufacturer shall be deemed to mean that the equipment is judged by the manufacturer to be in a condition equal to that of equipment that has been shipped, installed, tested and accepted in a minimum time period. As such, the manufacturer will guarantee the equipment equally in both instances. If such a written certification is not given, the equipment shall be judged to be defective. It shall be removed and replaced at the CONTRACTOR'S expense.

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- B. The OWNER reserves the right to withhold all payment for any foreign materials entering the equipment materials improperly stored, maintained, damaged during shipment, and equipment that does not meet or exceed contract specifications.

1.07 PARTIAL UTILIZATION

- A. During the course of construction partial occupation and utilization of completed portions of the work may be required.
- B. When deemed necessary, the OWNER or the CONTRACTOR may request use of completed work.
- C. Partial utilization shall be practiced in accordance with the Supplementary General Conditions (Section 00810).

1.08 EQUIPMENT WARRANTY

- A. The CONTRACTOR shall provide the OWNER a minimum 1 year warranty on all equipment, in accordance with the General Conditions, Section 00700, Article 29. The warranty period for each item of equipment shall be a minimum of 1 year, or as specified otherwise, from the date of the OWNER'S acceptance of the equipment item.

1.09 ADJUSTMENTS AND CORRECTIONS OF EQUIPMENT AND APPURTENANCES DURING OPERATION

- A. Some items of functional nature included in this Contract cannot be tested as to performance and quality at the time of completion of their installation. They must wait for necessary testing and proper performance until such functions are possible during later portions of this Contract. Such testing, specified performance and proper instructions to the OWNER's operators (as to their maintenance and operation) is deemed a portion of this Contract, and payment shall be retained by the OWNER for equipment delivered to the site and for Work completed to cover such service. Such service replacements and performance shall take precedence over expiration of the 1 year guarantee period.
- B. The CONTRACTOR shall expedite the completion of such service by all Suppliers and Subcontractors and shall render competent supervision of such service. The CONTRACTOR shall also expedite the replacement of defective and unaccepted parts and equipment. Unnecessary delay in delivery and installation of corrective parts and equipment may constitute additional retainage being withheld for damage to the OWNER for which the CONTRACTOR can be held liable.

END OF SECTION

SECTION 02110

SITE CLEARING AND GRUBBING

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Furnish all labor and equipment required and perform all clearing, grubbing and stripping of topsoil complete as shown on the Drawings and as specified herein.

1.02 RELATED WORK

- A. Earth and rock work are included in Section 02200.

1.03 SUBMITTALS

None required for this Section.

PART 2 PRODUCTS

None in this Section.

PART 3 EXECUTION

3.01 GENERAL

- A. The proposed building sites, paved areas, areas designated for ditches and channel changes, borrow pits, etc., (except any portions thereof that may be reserved) shall be cleared of all trees, timber, brush, stumps, rubbish and other debris. All this material, unless otherwise specified, shall be removed and disposed of away from the site.
- B. Open burning of cleared and grubbed material from this Project will not be allowed.
- C. Where clearing is to be done, stumps shall be grubbed where embankments are less than 5 feet in height, where the profile indicates excavation, in all areas designated for the construction of other facilities and in borrow areas. In all other areas the stumps may be cut off even with the ground. In areas to be grubbed, all stumps and roots must be removed.
- D. No debris will be allowed to be left under or in the embankments.
- E. In felling trees near tracks, structures and wire lines, necessary precaution must be exercised in order to prevent damage to wire lines, structures, the facilities of others or obstruct tracks.
- F. Payment for all clearing and grubbing shall be included in the bid item requiring the action.

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3.02 TREES

- A. Trees (3" caliper and larger) shall not be disturbed by construction without written permission from the property OWNER, except in those areas to be cleared. Trees disturbed by construction shall be replaced by the CONTRACTOR with same size and type at no additional cost to the OWNER.

END OF SECTION

SECTION 02140

DEWATERING

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Furnish all labor and equipment required to dewater all excavations. Dewatering of all excavations shall be the responsibility of the CONTRACTOR, and no additional compensation will be allowed for same unless specifically included as a bid item.
- B. Leaking pipes and structures are to be anticipated on this project. For this reason, no additional payment will be made for dewatering associated with leakage from any existing facility.

1.02 RELATED WORK

- A. Earthwork is included in Section 02200.
- B. Crushed stone and DGA are included in Section 02235.

1.03 SUBMITTALS

None.

PART 2 PRODUCTS

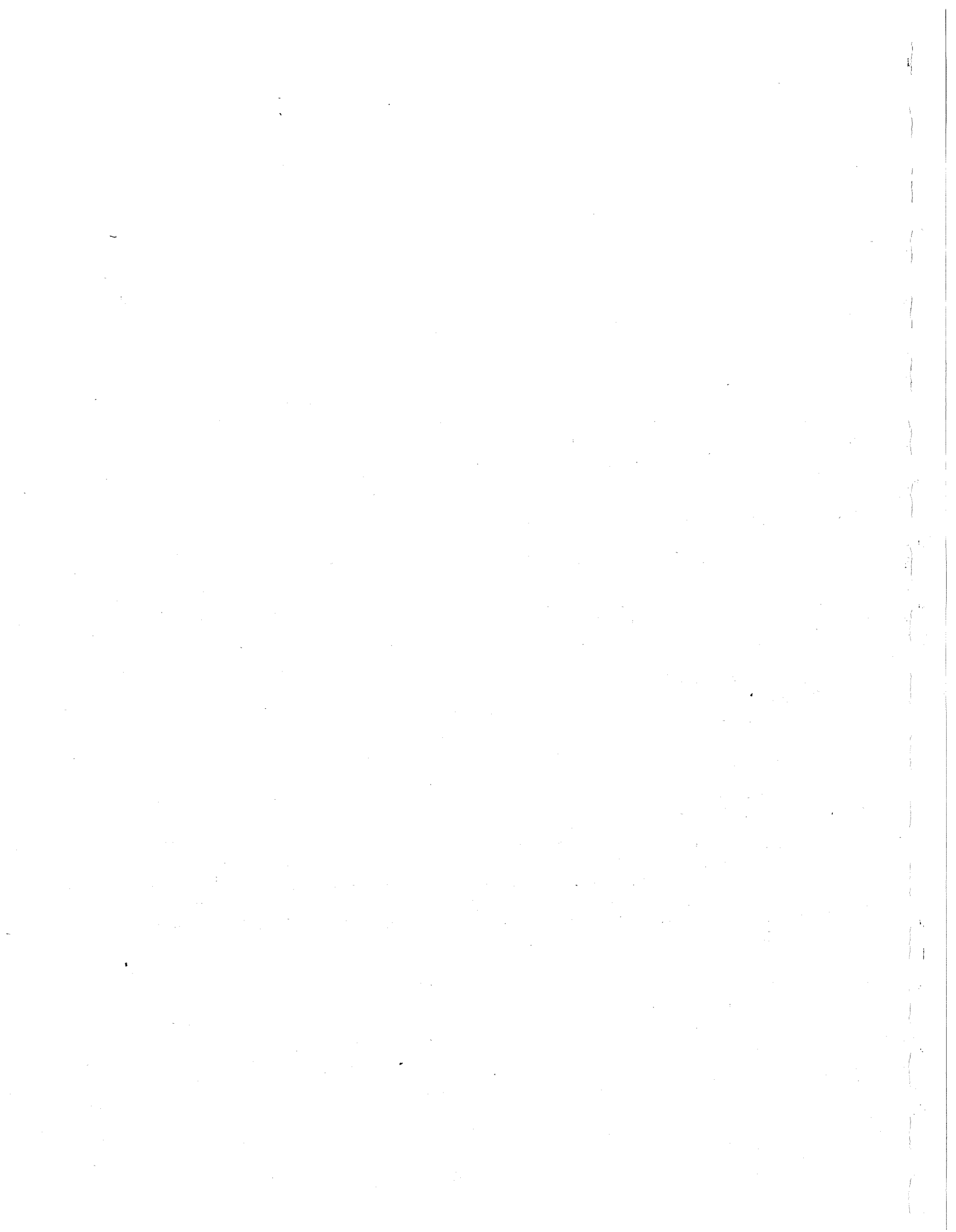
None in this Section.

PART 3 EXECUTION

1.01 GENERAL

- A. Dewatering equipment shall be of adequate size and quantity to assure maintaining proper conditions for installing pipe, concrete, backfill or other material or structure in the excavation. Dewatering shall include proper removal of any and all liquid, regardless of source, from the excavation and the use of all practical means available to prevent surface runoff from entering any excavation.

END OF SECTION



SECTION 02200
EARTH AND ROCK WORK

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Extent of earthwork is indicated on the Drawings.
 - 1. Preparation of subgrade for tanks, basins, building slabs, walks and pavements is included as part of this work.
 - 2. Engineered fill course for support of building or basin slabs is included as part of this work.
 - 3. Backfilling of tanks, basins, basements, and trenches within building lines is included as part of this work.
- B. Excavation for Mechanical/Electrical Work
 - 1. Excavation and backfill required in conjunction with underground mechanical and electrical utilities, and buried mechanical and electrical appurtenances is included as work of this Section.

1.02 RELATED WORK

- A. Dewatering is included in Section 02140.
- B. Crushed Stone and DGA is included in Section 02235.
- C. Pressure Pipe is included in Section 02610.
- D. Sodding and Seeding is included in Section 02930.

1.03 QUALITY ASSURANCE

- A. Perform excavation work in compliance with applicable requirements of governing authorities having jurisdiction.

1.04 JOB CONDITIONS

- A. Site Information
 - 1. Data on indicated subsurface conditions are not intended as representations or warranties of accuracy or continuity between soil borings. It is expressly understood that OWNER will not be responsible for interpretation or conclusions drawn therefrom by CONTRACTOR. Data are made available for convenience of CONTRACTOR.

2. Additional test borings and other exploratory operations may be made by CONTRACTOR at no cost to OWNER.

B. Existing Utilities

Prior to commencement of work, the CONTRACTOR shall locate existing underground utilities in areas of the work. If utilities are to remain in place, provide adequate means of protection during earthwork operations.

C. Use of Explosives

1. The CONTRACTOR (or any of his subcontractors) shall not bring explosives onto site or use in work without prior written permission from the OWNER. All activities involving explosives shall be in compliance with the rules and regulations of the Kentucky Department of Mines and Minerals, Division of Explosives and Blasting. CONTRACTOR is solely responsible for handling, storage, and use of explosive materials when their use is permitted.

D. Protection of Persons and Property

1. Barricade open excavations occurring as part of this work and post with warning lights.
2. Operate warning lights as recommended by authorities having jurisdiction.
3. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

PART 2 PRODUCTS

2.01 SOIL MATERIALS

A. Definitions

1. Satisfactory soil materials are defined as those complying with ASTM D2487-85 soil classification groups GW, GP, GM, SM, SW, SP, GC, SC, ML, and CL.
2. Unsatisfactory soil materials are defined as those complying with ASTM D2487-85 soil classification groups MH, CH, OL, OH and PT.
3. Subbase material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, crushed slag, natural or crushed sand.
4. Drainage fill: Washed, evenly graded mixture of crushed stone, or crushed or uncrushed gravel, with 100 percent passing a 1-1/2 inch sieve and not more than 5 percent passing a No. 4 sieve.

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5. Backfill and fill materials: Satisfactory soil materials free of debris, waste, frozen materials, vegetable, and other deleterious matter.

PART 3 EXECUTION

3.01 STRIPPING AND TOPSOILING

- A. Before excavation and grading is commenced for buildings, structures or other work described hereinafter (except pipelines and manholes) or before material is removed from borrow pits, the material meeting the topsoil specification in Section 02930 of these Specifications shall be removed from the areas affected and stockpiled.
- B. When final grading is accomplished, particularly around buildings and other structures, the topsoil shall be spread evenly over the excavated area. Rough grading above excavated areas shall have been carried approximately 6 inches below finished grade (except solid rock, where it shall be carried 12 inches below finished grade) and brought back up to grade with topsoil as set out herein.

3.02 EXCAVATION

- A. Excavation includes excavation to subgrade elevations indicated including excavation of earth, rock, bricks, wood, cinders, and other debris. All excavation of materials in the lump sum portion of the work will be unclassified and no additional payment will be made regardless of type material encountered.
- B. Differing Site Conditions
 1. Refer to Section 00700, paragraph 17.
- C. Excavation Classifications
 1. The following classifications of excavation will be made when unanticipated material is encountered in work:
 - a. Earth excavation includes excavation of pavements and other obstructions visible on ground surface; underground structures, utilities, and other items indicated to be demolished and removed; together with earth and other materials encountered that are not classified as rock or unauthorized excavation.
 - b. Rock excavation in trenches and pits includes removal and disposal of materials and obstructions encountered which cannot be excavated with a 1.0 cubic yard (heaped) capacity, 42 inch wide bucket on track-mounted power excavator equivalent to Caterpillar Model 215, rated at not less than 90 Hp flywheel power and 30,000 pound drawbar pull. Trenches in excess of 10 feet in width and pits in excess of 30 feet in either length or width are classified as open excavation.

c. Rock excavation in open excavation includes removal and disposal of materials and obstructions encountered which cannot be dislodged and excavated with modern track-mounted, heavy-duty excavating equipment without drilling, blasting, or ripping. Rock excavation equipment is defined as Caterpillar Model 973 or No. 977K, or equivalent track-mounted loader, rated at not less than 170 Hp flywheel power and developing 40,000 pound break-out force (measured in accordance with SAE J732C).

- (1) Typical of materials classified as rock are boulders $\frac{1}{2}$ cubic yard or more in volume, solid rock, rock in ledges and hard cementitious aggregate deposits. Rock material encountered will be classified as rock excavation.
- (2) Intermittent drilling, blasting, or ripping performed to increase production and not necessary to permit excavation of material encountered will be classified as earth excavation.

D. Unauthorized excavation consists of removal of materials beyond subgrade elevations or dimensions without specific direction of ENGINEER. Unauthorized excavation, as well as remedial work directed by ENGINEER, shall be at CONTRACTOR's expense.

1. Under footings, foundation bases, or retaining walls, fill unauthorized excavation by extending indicated bottom elevation of footing or base to excavation bottom, without altering required top elevation. Lean concrete fill may be used to bring elevations to proper position, when acceptable to the ENGINEER.
2. Elsewhere, backfill and compact unauthorized excavations as specified for authorized excavations of same classification.

E. Additional Excavation

1. When excavation has reached required subgrade elevations, notify the ENGINEER who will make an inspection of conditions.
 - a. If unsuitable bearing materials are encountered at required subgrade elevations, carry excavations deeper and replace excavated material as directed in writing by the ENGINEER.
 - b. Removal of unsuitable material and its replacement as directed will be paid on basis of Contract conditions relative to changes in work.

F. Stability of Excavations

1. Slope sides of excavations to comply with codes and ordinances having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated.
2. Maintain sides and slopes of excavations in safe condition until completion of backfilling.

G. Shoring and Bracing

1. Provide materials for shoring and bracing, such as sheet piling, uprights, stringers, and cross-braces, in good serviceable condition.
2. Establish requirements for trench shoring and bracing to comply with codes and authorities having jurisdiction.
3. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Carry down shoring and bracing as excavation progresses.
4. Provide permanent steel sheet piling or pressure creosoted timber sheet piling wherever subsequent removal of sheet piling might permit lateral movement of soil under adjacent structures. Cut off tops as required and leave permanently in place. In the event the OWNER directs the CONTRACTOR to leave shoring materials in place, the OWNER will reimburse the CONTRACTOR for the reasonable cost of leaving such materials in place.

H. Dewatering

1. Refer to Section 02140 for dewatering requirements.

I. Material Storage

1. Stockpile satisfactory excavated materials where directed, until required for backfill or fill. Place, grade, and shape stockpiles for proper drainage.
2. Dispose of excess soil material and waste materials as herein specified.

J. Excavation for Structures

1. Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10 feet and extending a sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services, other construction, and for inspection.

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2. In excavating for footings and foundations, take care not to disturb bottom of excavation. All loose material shall be removed from the excavation just before concrete reinforcement is placed. Trim bottoms to required lines and grades to leave solid base to receive other work.

K. Excavation for Pavements

1. Cut surface under pavements to comply with cross-sections, elevations, and grades as shown.

L. Trench Excavation

1. Refer to Section 02610 for trench excavation requirements.

M. Cold Weather Protection

1. Protect excavation bottoms against freezing when atmospheric temperature is less than 35 degrees Fahrenheit (1 degree Celsius).

3.03 COMPACTION

A. General

1. Control soil compaction during construction providing minimum percentage of density specified for each area classification indicated below:
 - a. Percentage of maximum density requirements: Compact soil to not less than the following percentages of maximum density for soils which exhibit a well-defined moisture density relationship (cohesive soils) determined in accordance with ASTM D698; and not less than the following percentages of relative density, determined in accordance with ASTM D4253 and D4254, for soils which will not exhibit a well-defined moisture-density relationship (cohesionless soils).
 - b. Structures, building slabs and steps, pavements: Compact top 12 inches of subgrade and each layer of backfill or fill material at 95 percent standard proctor density.
 - c. Lawn or unpaved areas: Compact top 6 inches of subgrade and each layer of backfill or fill material at 90 percent standard proctor density.
 - d. Walkways: Compact top 6 inches of subgrade and each layer of backfill or fill material at 95 percent standard proctor density.

B. Moisture Control

1. Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface or subgrade, or layer of soil material, to prevent free water appearing on surface during or subsequent to compaction operations.
2. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.
3. Soil material that has been removed because it is too wet to permit compaction may be stockpiled or spread and allowed to dry. Assist drying by discing, harrowing, or pulverizing until moisture content is reduced to a satisfactory value.

3.04 BACKFILL AND FILL

A. General

1. Place acceptable soil material in layers to required subgrade elevations, for each area classification listed below. Backfill material shall be no larger than the specified depth of the layer to be placed and/or compacted.
 - a. In excavations, use satisfactory excavated or borrow material.
 - b. Under grassed areas, use satisfactory excavated or borrow material.
 - c. Under walks and pavements, use subbase material, or satisfactory excavated or borrow material, or combination of both.
 - d. Under steps, use subbase material.
 - e. Under building slabs, use subbase material for a minimum depth of 6 inches.

B. Backfill excavations as promptly as work permits, but not until completion of the following:

1. Acceptance of construction below finish grade including, where applicable, dampproofing, waterproofing, and perimeter insulation.
2. Inspection, testing, approval, and recording locations of underground utilities.
3. Removal of concrete formwork.

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has to be removed and reworked, the ENGINEER shall determine if removed material can be remixed and used again for fill.

4. All compacted DGA fill shall be included in the bid item requiring the action.

END OF SECTION

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SECTION 02326

STEEL COVER PIPE

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Steel cover pipe shall be furnished and installed as shown on the Drawings and specified herein.

1.02 RELATED WORK

- A. Pressure pipe is specified in Section 02610.

PART 2 PRODUCTS

2.01 STEEL COVER PIPE

- A. Steel cover or jack pipe shall be plain end steel pipe with minimum yield strength of 35,000 psi and tensile strength of 60,000 psi per API-5L Grade B material. The steel pipe supplied shall be manufactured by the seamless, electric-weld, submerged-arc weld or gas metal-arc weld process as specified in API-5L. Certification of 35,000 psi minimum yield strength shall be furnished by the supplier through the CONTRACTOR to the ENGINEER in sufficient copies before pipe is shipped to job to permit the ENGINEER to retain three copies.
- B. Used pipe shall be acceptable if it meets the minimum requirements for size, thickness and strength for new pipe. Supplier shall furnish through the CONTRACTOR to the ENGINEER 3 copies of certification of test results of strength tests conducted on the used pipe prior to shipment to job site. Used pipe with excessive corrosion and pitting present shall not be supplied.
- C. The inside diameter of steel cover pipe shall be at least 2 inches greater than the largest outside diameter of the carrier pipe, joints or couplings, except for carrier pipe 6 inches or greater in diameter under railroads, the difference shall be 4 inches instead of 2 inches.
- D. Cover pipe shall have a **minimum** wall thickness as shown in the following table:

Nominal Diameter Inches	Nominal Thickness Inches	Nominal Diameter Inches	Nominal Thickness Inches
Under 10	0.188	24	0.438
10 & 12	0.250	26	0.438
14 & 16	0.281	28 & 30	0.500
18	0.312	32	0.500
20	0.344	34 & 36	0.562
22	0.375	38 & 42	0.562

PART 3 EXECUTION

3.01 TUNNELING, BORING OR JACKING

- A. Boring or jacking as specified herein will be allowed at locations other than those noted on the Drawings, where advantageous to lay pipe under streets, driveways, and sidewalks, without their monolithic structure being destroyed.
- B. Tunneling under paving, railroads, buildings and underground structures is included as an alternate to boring or repaving required by open cut trenching at no extra cost to the OWNER. Bore and cover pipe is also included as an alternate to tunneling. Backfilling of tunnels shall be mechanically tamped in not more than 3 inch layers and with materials rendered suitable for tamping before being placed in tunnel unless otherwise shown on the Drawings. No payment will be made for tunnels less than 3 feet long.
- C. In tunneling under buildings, the CONTRACTOR will be held responsible for all damage by his operations and methods of excavation and backfilling. No payment will be made for tunnels less than 3 feet in length.
- D. Should the CONTRACTOR elect and receive permission to tunnel or bore, other than at locations designated on the Drawings or required by the ENGINEER to be tunneled or bored, the entire compensation therefore shall be the same as the unit prices bid for installation in open trench, including paving replacement, but not including bore or tunnel unit prices.
- E. At locations where tunneling or boring or jacking is called for on the Drawings, in addition to the unit prices for permanent tunnel, tunnel liner, temporary tunnel, boring or jacking and/or cover pipe, payment will be made for furnishing and laying sewer lines inside the tunnel or cover pipe. No payment will be made for separate trench and backfill unit price items where permanent tunnel, tunnel liner, temporary tunnel, boring or jacking and/or cover pipe unit prices are paid.
- F. Boring or jacking under highways, railroads, sidewalks, pipelines, etc., shall be done at the locations shown on the Drawings. It shall be performed by mechanical means and accurate vertical and horizontal alignment must be maintained. When shown on the Drawings, cover pipe shall be used and shall be installed inside bored holes concurrently with boring, or jacking.

3.02 STEEL COVER PIPE INSTALLATION

- A. Steel cover pipe shall be of the size and wall thickness as shown on the Drawings.
- B. When cover pipe is jacked, concurrent with boring, all joints shall be solidly welded. The weld shall be such that the joint shall be of such strength to withstand the forces exerted from the boring and jacking operation as well as the vertical loading imposed on the pipe after installation. The weld shall also be such that it provides a smooth, nonobstructing joint in the interior of the

pipe which will allow easy installation of the carrier pipe without hanging or abrasion to the carrier pipe upon installation.

- C. When cover pipe is installed in open trench or permanent tunnel, it shall be bedded and backfilled per Specifications applying to sewer pipe in such locations.
- D. Cover pipe in open trench, permanent tunnel and temporary tunnel shall be joined in such manner that they will not be moved out of alignment or grade and that will prevent backfill material from entering joint. Where cover pipes are shown on the Drawings to be equipped with vent pipes, vents shall be installed as shown on the Drawings with cost of same included in the price bid for the cover pipe unless otherwise specified.

3.03 CARRIER PIPE IN COVER PIPE INSTALLATION

A. Pipeline Spacers

- 1. Pipes installed inside cover pipes shall be centered throughout the length of cover pipe. Centering shall be accomplished by the installation of bolt on style spacers with a 2 piece solid shell made from T-304 stainless steel of a minimum 14 gauge thickness. The shell shall be lined with a ribbed PVC sheet of a 0.090 inch thickness that overlaps the edges. Runners, made from UHMW polymer, shall be attached to the pipe in such a manner as to prevent the dislodgement of the spacers as the carrier pipe is pulled or pushed through the cover pipe. Risers shall be made from T-304 stainless steel of a minimum 14 gauge thickness and shall be attached to the shell by MIG welding. All welds shall be fully passivated. All fasteners shall be made from T-304 stainless steel.
- 2. Spacers shall be of such dimensions to provide 1) full supportive load capacity of the pipe and contents; 2) of such thickness to allow installation and/or removal of the pipe; and 3) to allow no greater than 1/2 inch movement of the carrier pipe within the cover pipe after the carrier pipe is installed.
- 3. Spacers shall be located immediately behind each bell and at a maximum spacing distance as shown below unless a lesser maximum spacing distance is recommended by the pipe manufacturer:

<u>Pipeline Diameter (in.)</u>	<u>Maximum Spacing (ft.)</u>
2 - 2-1/2	4
3 - 8	7
10 - 26	10

The materials and spacing to be used shall be accepted by the ENGINEER prior to installation. The pipeline spacers shall be manufactured by Cascade Waterworks Manufacturing Co., of Yorkville, Illinois, Pipeline Seal

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and Insulator, Inc., of Houston, Texas, or equal. Installation shall be in accordance with manufacturer's recommendations.

- B. Upon completion of installation of the carrier pipe, the annular space at the ends of the cover pipe shall be sealed to prevent the entrance of groundwater, silt, etc., into the cover pipe. The seal shall be a manufactured product specially made for this purpose. The seal shall be Link Seal - Model 5 with stainless steel bolts and nuts as manufactured by the Thunderline Corporation, Wayne, Michigan, or equal.

END OF SECTION

SECTION 02400

STREETS, ROADS AND PARKING AREAS

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Provide all labor, materials, equipment, and services required to construct all replacements as shown on the Contract Drawings and as specified herein.

1.02 RELATED WORK

- A. Crushed stone, DGA, paving and concrete are specified in other sections of Divisions 2 and 3.

1.03 SUBMITTALS

- A. Shop drawings, manufacturer's data and other items needed to establish compliance with the Drawings and these Specifications shall be submitted to the ENGINEER in accordance with Section 01300 - Submittals.

1.04 WARRANTY

- A. Refer to Section 00700 for general warranty requirements.

PART 2 PRODUCTS

2.01 CONSTRUCTION MATERIALS

- A. Concrete materials and methods of installation are specified in Section 03300.
- B. Crushed stone and dense graded aggregate materials are specified in Section 02235.
- C. Bituminous paving materials and methods of placement are specified in Section 02500.
- D. Concrete paving materials and methods of placement are specified in Section 02510.
- E. Fencing materials and methods of installation are specified in Section 02830.
- F. Sodding and seeding materials and methods of construction are specified in Section 02930.

PART 3 EXECUTION

3.01 DELIVERY, STORAGE AND HANDLING

A. Clearing and Grubbing

1. Clearing and grubbing requirements shall be as stated in Section 202 of KTCSSRBC except that the method of payment as stated therein shall not apply.

B. Removal of Structures and Obstructions

1. Removal of structures and obstructions requirements shall be as stated in Section 203 - KTCSSRBC.

C. Roadway and Drainage Excavation

1. The requirements for roadway and drainage excavation shall be as stated in Section 204 of KTCSSRBC.

D. Ditching and Shouldering

1. The requirements for ditching and shouldering shall be as stated in KTCSSRBC Section 210.

E. Erosion Control

1. Requirements for erosion control shall be as delineated in Section 02930 - Sodding and Seeding of these Specifications. When work is located within Department of Highways rights-of-way, the requirements for erosion control shall be as delineated in KTCSSRBC - Section 212.

F. Water Pollution Control

1. The requirements for water pollution control shall be per KTCSSRBC Section 213.

G. Aggregate Surfaces and Base Courses for Paved Surface

1. The requirements for crushed stone aggregate and base courses for paved surfaces is specified in Section 02235.

H. Paved Surfaces

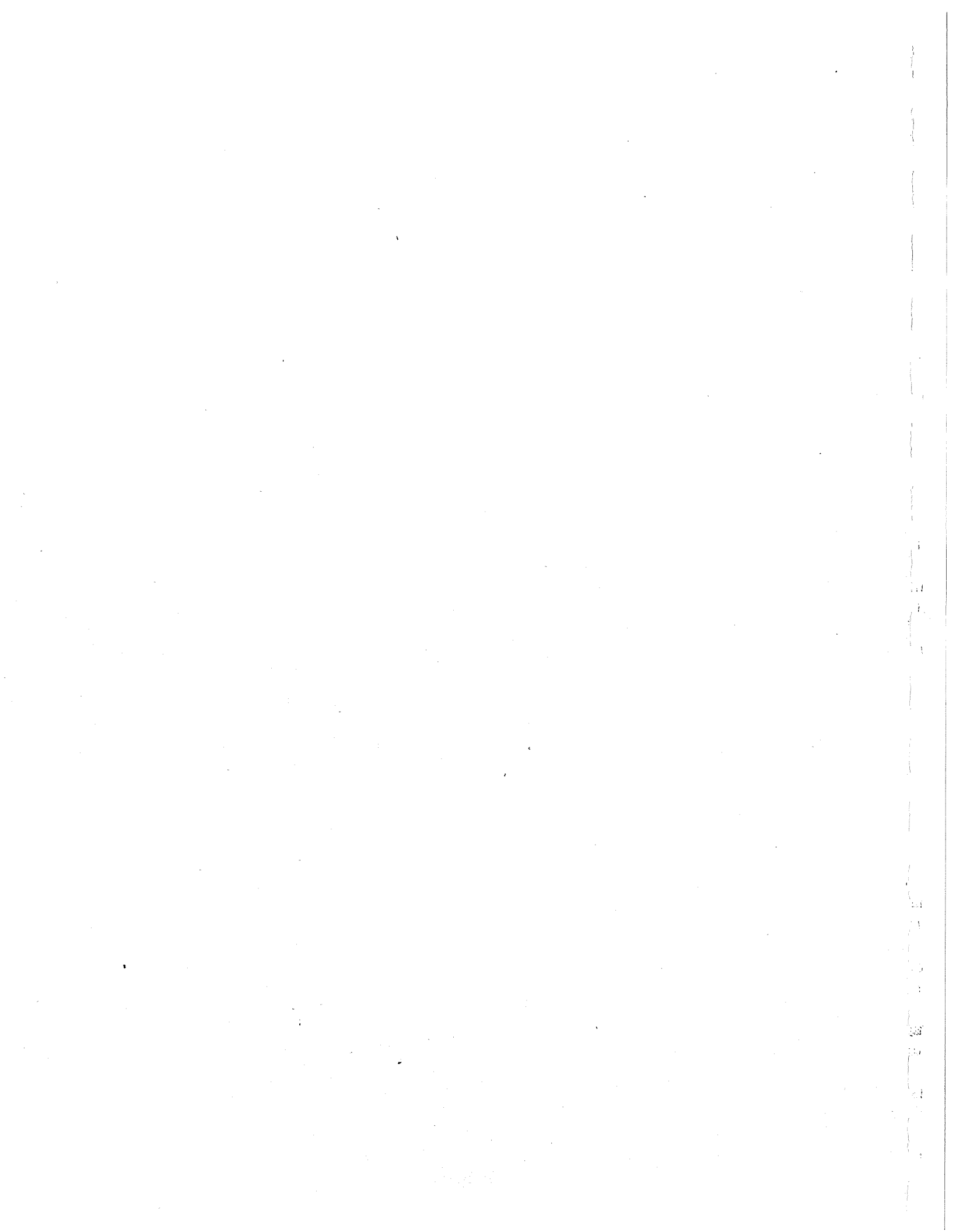
1. Bituminous Pavements
 - a. The requirements for bituminous paving are as shown in Section 02500 of these Specifications.

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2. Concrete Pavements

- a. The requirements for concrete pavements are as shown in Section 02510 of these Specifications.

END OF SECTION



SECTION 02500
BITUMINOUS PAVING

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The CONTRACTOR shall be required to supply all materials and equipment and perform all work for the placement of the base, binder, or surface course for restoring to the preconstruction condition the surface of the existing streets, roads, drives and parking areas to the depths as shown in the detailed Drawings and as specified herein.

1.02 REFERENCES

- A. Unless noted, all Specifications designations denoted KTCSSRBC refer to the Kentucky Transportation Cabinet Department of Highways Standard Specification for Road and Bridge Construction. Appropriate technical portions of the referenced sections of the Specifications shall apply, but all work shall be as described herein unless otherwise specified or shown on the Drawings.

1.03 RELATED WORK

- A. Special sequence or schedule requirements (if any) are specified in Section 01010 - Summary of Work.
- B. Special requirements for materials and equipment are given in Sections 01300 and 01600.
- C. Crushed stone surfacing requirements, temporary and permanent replacement, are specified in Section 02235 of these Specifications.
- D. Streets, roads and parking area material and construction are specified in Section 02400.

1.04 WORK DESCRIPTION

- A. Bituminous concrete shall be used for surfacing new roads and parking areas, for replacement of city streets, drives, parking areas and state highways of bituminous construction and for resurfacing existing roads and state highways at locations shown on the Drawings or specified.

1.05 QUALIFICATIONS

- A. The pavement design mixture shall be used as determined by local plant mix availability. The design mixture shall have been approved recently by the Kentucky Transportation Cabinet Department of Highways and used recently on a state paving project.

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B. The design mix shall be submitted to the ENGINEER for review and acceptance. The submittal shall include the following:

1. The last date the mixture was approved by the Kentucky Transportation Cabinet Department of Highways for use on a state road project.
2. The location where the mixture was recently used, and the name and address of the paving contractor.

1.06 SUBMITTALS

- A. Prebid submittals, when required, are specified in Section 00820 - Special Conditions of these specifications.
- B. Shop Drawings, manufacturers data and other items needed to establish compliance with the Drawings and Specifications shall be submitted to the ENGINEER in accordance with Section 01300 - Submittals.

1.07 WARRANTY

- A. Refer to Section 00700 for warranty requirements.

PART 2 PRODUCTS

2.01 BITUMINOUS CONCRETE PAVING

A. Mixture

1. Bituminous concrete mixture shall conform to the applicable requirements of KTCSSRBC Section 401, Bituminous Plant Mixed Pavements-General, and Section 402, Bituminous Concrete Surface and Binder. The pavement mixture shall meet the requirements of Sections 401.02 through 401.05 and conform to the requirements below when tested in accordance with ASTM D 1559-76:

Stability, minimum pounds	750
Flow, 0.01 inch	Min. 8; Max. 16
Percent air voids	Min. 3; Max. 5
Minimum voids in mineral	
Aggregate, percent: 3/4 in.	14
1 in.	13
Void filled, percent	Min. 75; Max. 85

- B. Fine aggregates shall meet the requirements of KTCSSRBC Section 804.
- C. Coarse aggregates shall meet the requirements of KTCSSRBC Section 805.
- D. Bituminous materials shall meet the requirements of KTCSSRBC Section 806.

- E. Bituminous materials for tack coat shall be one of the following: SS-1, SS-1h, CSS-1, CSS-1h, AE-60, RS-1, CRS-1, RC-70, or RC-250.

PART 3 EXECUTION

3.01 GENERAL

- A. Construction requirements shall conform to applicable requirements of Section 401, 402 and 407 of KTCSSRBC.
- B. A tack coat shall be required to bond new paving to the surface of concrete or brick pavements and bases or existing bituminous surfaces. It shall be applied at the rate of 0.8 pound (0.1 gallon) per square yard at the following range of application temperatures:

SS-1, SS-1h, CSS-1, CSS-1h, AE-60	21-70°C (70-160°F)
RS-1, CRS-1	21-60°C (70-140°F)

- C. When SS1, SS1h, CSS1, CSS1h, or AE60 is furnished for tack material, it shall be diluted with an equal quantity of water conforming to Section 803, shall be thoroughly mixed prior to application, and shall be applied a sufficient time in advance of the paver to ensure that all water has evaporated before the bituminous concrete mixture is placed. The application rate shall be 0.8 pound (0.1 gallon) per square yard of the diluted SS1, SS1h, CSS1, CSS1h, or AE60.
- D. Where bituminous paving is placed against vertical surfaces such as curbs, gutters, manhole frames, valve boxes, etc., the vertical face shall be tack coated in order to seal the surface. Where these surfaces are inaccessible to pressure distributor, the tack coat may be brushed or broomed into place. The tack coat shall not be allowed to spill over onto any horizontal surface outside the area to be paved.
- E. Unless otherwise indicated on the Drawings or in these Specifications, the compacted thickness of the bituminous concrete paving shall be a minimum of 2 inches and the minimum ambient temperature for placing shall be 40° Fahrenheit. Mixing and laying temperatures shall be as follows:

Aggregates	Min. 116°C (240°F) - Max. 163°C (325°F)
Asphalt Cement	Min. 107°C (225°F) - Max. 163°C (325°F)
Mixture at Plant (measured in truck)	Min. 116°C (240°F) - Max. 163°C (325°F)
Mixture When Placed (measured in truck when discharging)	Min. 107°C (225°F)

- F. Trucks for hauling bituminous mixtures shall have tight, clean, and smooth metal beds that have been sprayed with a minimum amount of soap emulsion, paraffin oil, or other approved material which is not detrimental to the mixture to prevent the mixture from adhering to the beds. All trucks shall be equipped with covers of sufficient size to completely cover the loaded material, and all covers shall be securely fastened in place before the truck leaves the plant.

Truck beds shall be insulated, when necessary, to maintain the specified temperature to the point of delivery. Any truck causing excessive segregation of material by its spring suspension or other contributing factors, shall be discharged from the work, until such conditions are corrected.

- G. The CONTRACTOR shall have an accurate thermometer on the job at all times for verifying all temperature requirements and for taking temperature measurements whenever requested by the ENGINEER or OWNER. The CONTRACTOR shall closely control temperature and compaction requirements in order to achieve quality bituminous paving and related work.
- H. Bituminous paving which fails as the result of not meeting the requirements of these Specifications shall be removed and replaced as directed by the ENGINEER at the CONTRACTOR'S expense.

3.02 FULL WIDTH PAVING OF EXISTING STREETS, U.S. HIGHWAYS, KENTUCKY STATE ROADS, COUNTY ROADS AND PARKING AREAS

- A. Where the entire width of the bituminous street damaged by construction is to be resurfaced, the existing pavement shall be cleaned and tack coated, and bituminous paving shall be hot applied as previously described.
- B. The preparation of the base shall include removal of unstable material from the trench, removal of excess crushed rock from the trench to same level as the existing bituminous pavement and addition of compacted crushed rock (DGA) to the trench where needed. No cutting of edges of existing paving will be required.
- C. The ENGINEER will determine if and where bituminous leveling courses are required before application of surface courses. The leveling course shall be hot applied and rolled similarly to the surface course.
- D. The surface course shall be 1-1/2 inches thick applied to the entire width of the street, unless otherwise directed by the ENGINEER. The surface course shall be feathered out to a thickness of 1/2 inch at the front of existing gutters. The point where feathering shall begin and the amount of feathering shall be controlled by the ENGINEER. Where there are no gutters, feathering of edges will not be done unless otherwise directed by the ENGINEER in order to conform to existing features, such as driveways.
- E. Payment for the surface course shall be by the ton of bituminous concrete actually placed, limited by a maximum allowable weight of 100 lbs. per square yard of surface area per inch of depth. Payment for the leveling course, when ordered by the ENGINEER, shall be by the ton of bituminous concrete actually placed, limited by a maximum allowance of 25 percent of the weight of the surface course.

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- F. No extra payment will be allowed for tack coat, removal of unstable material from the trench, compacted dense graded aggregate (DGA) used to replace unstable material, removal of excess crushed rock from the trench to the grade of existing bituminous pavement, and cleaning of the surface.

3.03 TRENCH WIDTH REPAVING - CITY, STATE AND COUNTY STREETS, ROADS AND PARKING AREAS

- A. The cut edges of the existing paving surface shall be trimmed a depth of at least 2 inches to straight lines for uniform appearance and clean surface at joints. The area between the cut edges of the paving shall be removed to a depth of 2 inches (minimum) or to the bottom of the existing paving. All unstable material in the trench shall be removed and replaced with compacted dense graded aggregate and dense graded aggregate added as needed to bring the base surface to the bottom of existing paving or 2 inches below the existing surface, whichever is the lower. Dense graded aggregate required for stabilizing the subgrade will be paid for as an extra, but no extra payment will be allowed for removal of unstable backfill.
- B. The paving subgrade shall be compacted under the wheel of a roller, until there is no observed settlement of the subgrade.
- C. The sides of existing pavement shall be covered with a tack coat and bituminous paving shall be hot applied as previously described. Final surface shall be finished to 1/4 inch above existing paving surface at edges and crowned to 1/2 inch above existing surface at the center.
- D. Payment for bituminous repaving shall be per linear foot of pipeline covered to any width the CONTRACTOR shall find necessary to remove plus width of cut back to secure clean straight edges, and shall include excavation to subgrade, preparation of subgrade, cleaning edges of existing paving, tack coat, and all operations and materials planned and specified for this type of repaving. The CONTRACTOR shall maintain such repaving up to grade of existing street surface until final completion and acceptance of work under his Contract. During the guarantee period of one year, the CONTRACTOR will be responsible for defective materials or workmanship, and natural settlement.
- E. In case additional bituminous paving is to be added due to settlement, surface to be built up shall have all dirt removed and such surface swept clean with a stiff wire brush or broom. A tack coat shall be applied to clean surface and additional paving placed in quantity required. Traffic shall be prevented from passing over the treated surface before the additional paving materials are placed. No payment will be allowed for this tack coat or additional paving.

3.04 TRENCH WIDTH REPAVING - STATE MAINTAINED STREETS AND HIGHWAYS

- A. Streets, roads and highways maintained by the Kentucky Transportation Cabinet Department of Highways shall be repaved in accordance with details shown on the attached Department of Highways Drawing No. TD 99-13, latest revision.

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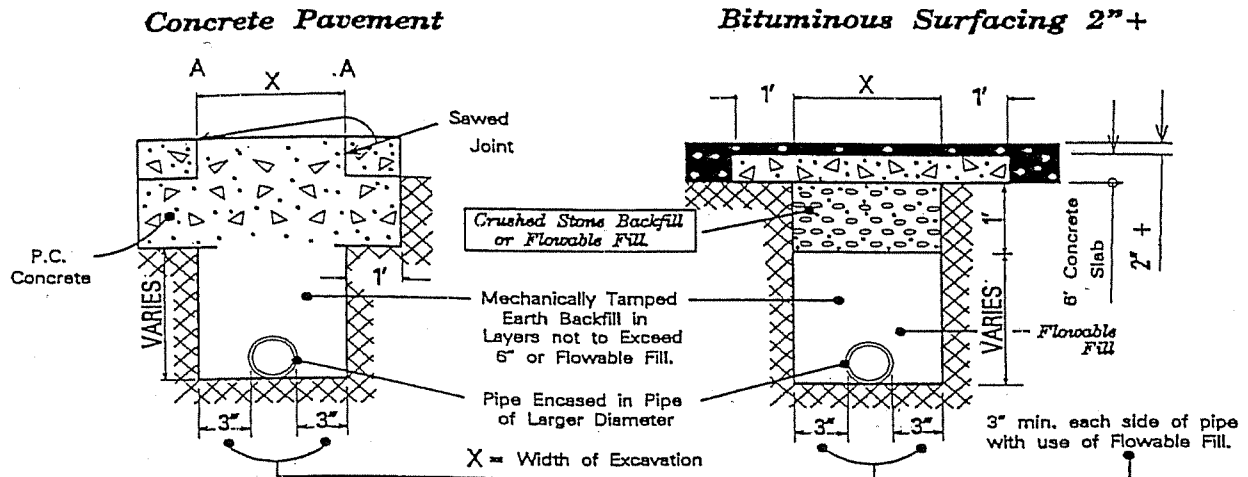
- B. Concrete base slab shall be cleaned and tack coated, and bituminous paving shall be hot applied as previously described.
- C. Payment for replacement of bituminous paving on state maintained streets and roads, where concrete base slab and bituminous surface are required, shall be per foot of pipeline covered, and shall include excavation, crushed rock backfill, base courses, concrete base slab, tack coat, and bituminous surfacing. Widths, depths, and other details and methods of application shall be as shown on attached drawing and as required by the Kentucky Transportation Cabinet Department of Highways.
- D. The CONTRACTOR shall maintain the bituminous surface of all state highways and state maintained streets to grade during the entire guarantee period of the Contract.

END OF SECTION

Attachment: Kentucky Department of Highways drawing No. TC 99-13.

02500-6

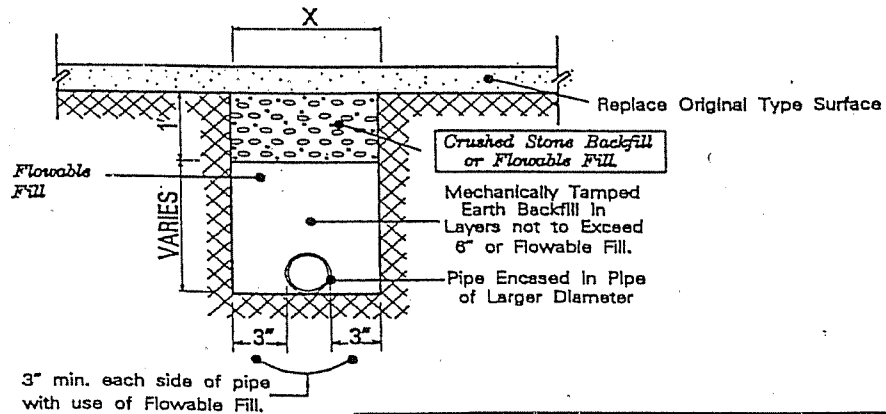
SURFACE RESTORATION METHODS



Replace Concrete Pavement with new pavement same thickness of existing pavement.

Replace Bituminous Pavement with same type and depth as existing pavement.

Bituminous Surface Less Than 2 inches & Traffic Bound Macadam

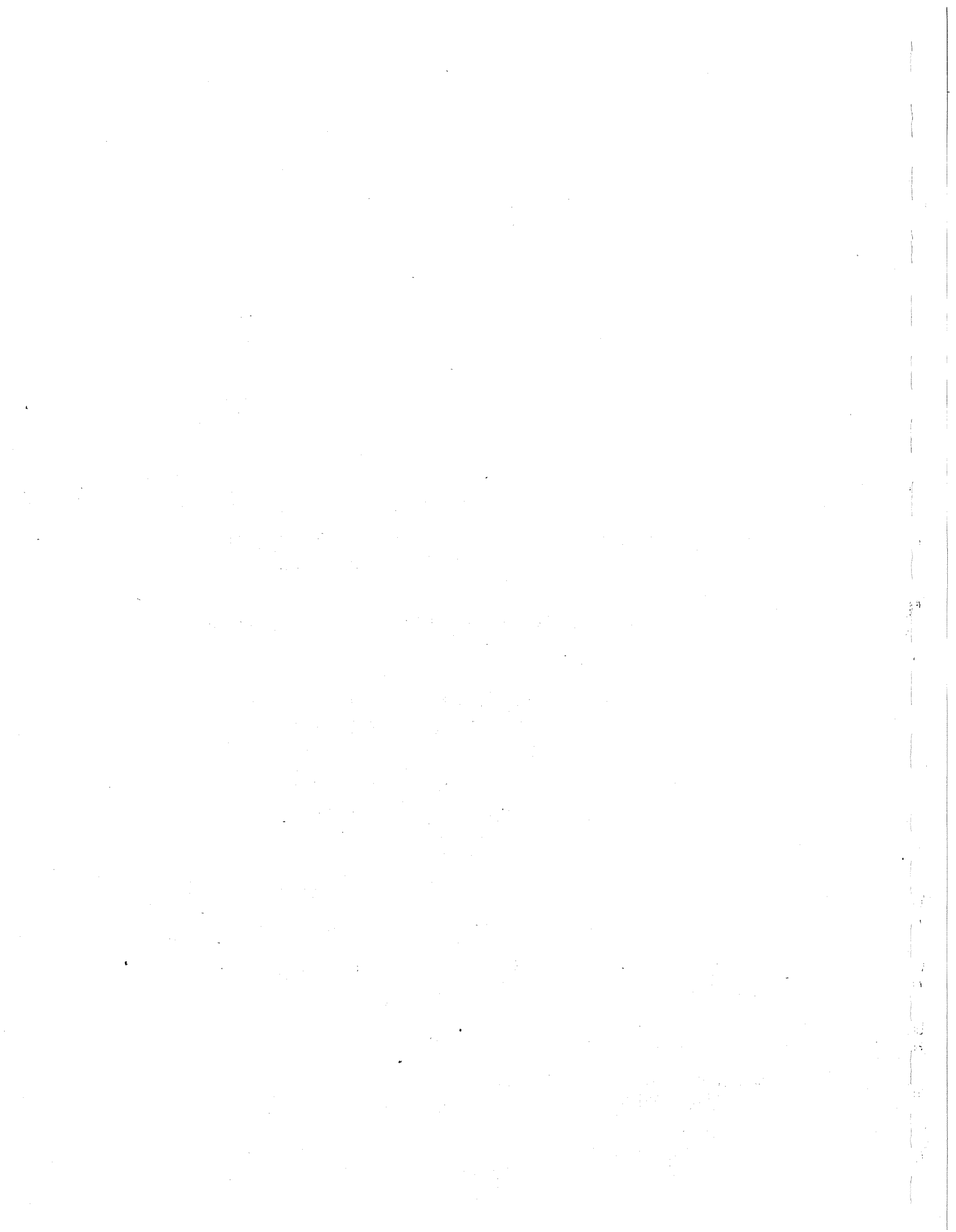


NOTE:

1. Distance From points "A" (Concrete Pavement) to nearest joint or break in pavement must be six (6) feet or more. If less than six (6) feet, remove pavement to joint or break and replace entire slab.
2. Concrete slab under Bituminous Surface to extend twelve (12) inches on each side of trench.
3. An approved joint sealer to be applied between new and existing pavement.

KENTUCKY TRANSPORTATION CABINET
Department of Highways

Methods of Surface Restoration Due to Open trench Pipe Installation



SECTION 02510
CONCRETE PAVING

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Provide all labor, materials, equipment and services required to construct concrete street pavement or concrete sidewalks as shown on the Contract Drawings and as specified herein.

1.02 RELATED WORK

- A. Special sequence or schedule requirements (if any) are specified in Section 01010 - Summary of Work.
- B. Special requirements for materials and equipment are given in Sections 01300 and 01600.
- C. Crushed stone bases, if required, are as specified in Section 02235.
- D. Castings are specified in Section 05540.

1.03 SUBMITTALS

- A. Prebid submittals, if required, are specified in Section 00820 - Special Conditions.
- B. Shop drawings and other items needed to establish compliance with the Drawings and these Specifications shall be submitted to the ENGINEER in accordance with Section 01300 - Submittals.

1.04 WARRANTY

- A. Refer to Section 00700 for warranty requirements.

PART 2 PRODUCTS

2.01 CONCRETE MATERIALS

- A. Concrete and related materials are specified in Section 03300.

PART 3 EXECUTION

3.01 CONCRETE ROADWAY PAVING

- A. Concrete surface paving shall meet the requirements of Section 501 of the Kentucky Transportation Cabinet, Department of Highways Standard Specifications for Road and Bridge Construction.

- B. Concrete base paving shall meet the requirements of Section 502 of the Kentucky Transportation Cabinet, Department of Highways Standard Specifications for Road and Bridge Construction.

3.02 CONCRETE SIDEWALKS AND STEPS

A. New Construction

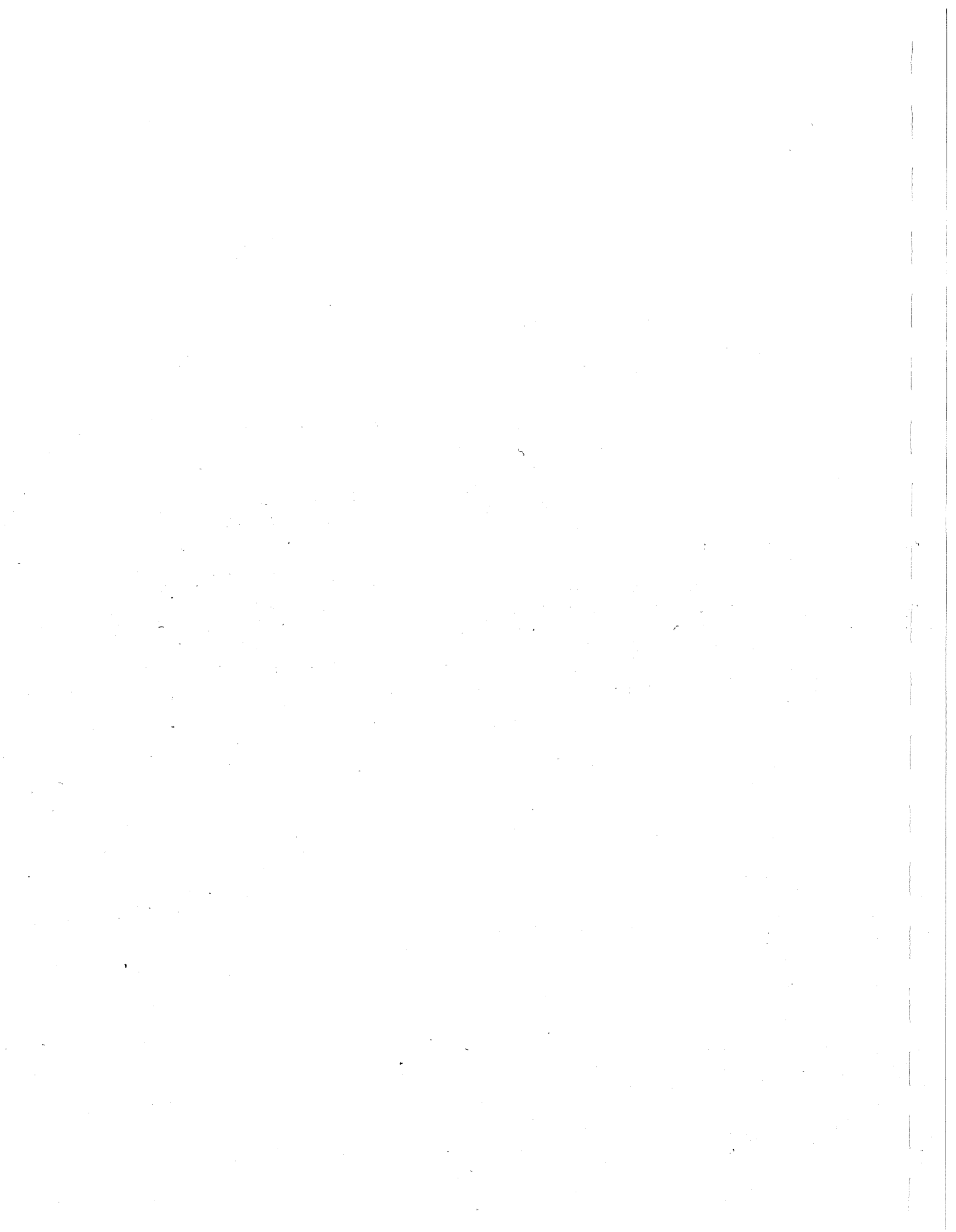
1. Concrete sidewalks and steps shall be dimensioned and reinforced as shown on the Drawings.
2. Sidewalks and steps shall be constructed on a prepared, compacted, smooth subgrade of uniform density formed by trenching or filling to the required elevation. Large boulders and ledge rock found in the subgrade shall be removed to a minimum depth of 6 inches below the subgrade elevation and the space shall be backfilled with suitable material which shall be thoroughly compacted by rolling or tamping. A 3-inch thick course of No. 68 or No. 78 coarse aggregate shall be placed on prepared subgrade prior to placing concrete walks. The CONTRACTOR shall furnish a template and shall check the finished subgrade prior to depositing concrete. The subgrade shall be moistened immediately prior to placement of concrete. Sidewalks may be placed by use of side forms or by use of an acceptable slip-form method.
3. All exposed edges and corners for sidewalks and steps shall be rounded to a 1/4 inch radius.
4. The surfaces of sidewalks shall be divided into rectangular areas by means of a jointer having a radius of 1/4 inch and forming a groove no less than 1 inch in depth for the full width of the walk, or the joints may be sawed if acceptable to the ENGINEER. The length of the rectangles formed shall not exceed the width of the sidewalk being constructed, unless otherwise directed.
5. The CONTRACTOR shall install 1/2 inch premolded expansion joints, specified in Section 03300, extending entirely through the sidewalk at intervals not to exceed 40 feet, unless the sidewalk is constructed integral with the curb, in which case the width of joints and spacing shall conform to that in the curb, or as otherwise directed. The edges of the sidewalk at all expansion joints shall be rounded with an acceptable edging tool to a 1/4 inch radius. One-half inch premolded expansion joint material shall be installed to the full depth of the sidewalk where the walk abuts any rigid structure or fixture such as curbs, columns, castings, buildings, light standard, etc.

B. Replacement Construction

1. Replacement construction shall be the same as required above for new construction except as hereinafter set forth.

2. Sidewalks shall be replaced to the same width, grade and thickness (3-1/2 inches minimum) as the original sidewalk, unless otherwise directed by the ENGINEER. In replacing concrete walks against edge of existing walks, the existing edges shall be sawed to straight edges and thoroughly cleaned. The new and existing walks shall be separated by 1/2 inch premolded expansion joint material cemented to the existing walk.
3. Concrete curb and gutter shall be protected by the CONTRACTOR and shall not be removed except in the event of solid rock excavation and/or conflict with existing utilities. Grass strips between sidewalks and curbs shall be reseeded in accordance with Section 02930 of these Specifications.
4. For unit price contracts, sidewalk replacement, including reinforcing and forms, will be paid for by the linear foot measured along the centerline of pipe so covered. The unit price bid shall include excavation to subgrade; preparation of subgrade; required base course, if any, as shown on the Drawings; expansion joints; marking and reseeded of grass strips when required; and replacing concrete to any width which the CONTRACTOR should find necessary to remove.
5. At the unit price bid for sidewalk replacement for unit price contracts, the CONTRACTOR will not be required to replace greater than 4 foot width, 4 inches thick. However, where a 4 foot or less width walk is cut longitudinally, the whole walk shall be replaced. If replacement over 4 foot width is required, the unit price per linear foot shall be increased, the increased width's proportion to 4 feet.

END OF SECTION



SECTION 02610

PRESSURE PIPE

PART 1 GENERAL

1.01 SUMMARY

- A. For Cover Pipe and Boring and/or Jacking see Section 02326.

1.02 SUBMITTALS

- A. Prior to the shipment of any pressure pipe to the project site, the CONTRACTOR shall submit to the ENGINEER a bill of materials and shop drawings for all interior and exterior piping, in the number of copies listed in Special Conditions.
- B. Supplemental Submittal Requirements
 - 1. Shop drawings are not required.
 - 2. All testing and certification requirements for descriptive literature remain as described.

PART 2 PRODUCTS

2.01 MATERIALS - PRESSURE PIPE

- A. Ductile Iron Pipe - Mechanical and Rubber Slip Joint Type

- 1. Pipe

- a. General

- (1) Ductile iron pipe shall be furnished for all piping 3 inches and over in size designated "D.I." on Drawings and shall be designed in accordance with ANSI/AWWA C150/A21.50-96 and ANSI/AWWA C151/A21.51-96 specifications and supplements thereto, and for pressures and conditions as stated in Article b.(1) below.

- b. Design Conditions

- (1) Pressure: Minimum 200 to 350 psi operating pressure, as shown in Table 50.14 below, plus 100 psi water hammer allowance.
- (2) Trench Loading: Laying Condition Type 3, depth of cover as shown on Drawings.

c. Metal Design Strength PSI (Minimum)

Tensile Strength	60,000
Yield Strength	42,000
Percent Elongation	10

d. Minimum Nominal Thickness

- (1) Minimum design thicknesses for 200 through 350 psi operating pressures, depths of cover, trench loading and other conditions per ANSI/AWWA C150/ A21.50-96 specifications shall be as shown in the following table:

TABLE OF THICKNESSES
FOR DUCTILE IRON PIPE
(TABLE 50.14)

<u>Size</u>	<u>Pressure Class (psi)</u>	<u>Nominal Thickness (in.)</u>	<u>Laying Thickness Type 3 Trench Maximum Depth of Cover (ft.)</u>
3"	350	0.25	99
4"	350	0.25	69
6"	350	0.25	37
8"	350	0.25	25
10"	350	0.26	19
12"	350	0.28	19

- (2) For depths of cover or pressures exceeding those in the above table, refer to ANSI/AWWA C150/A21.50-96 and the thickness class shown on the Drawings.

e. Lengths

- (1) Pipe may be furnished in 18 or 20 foot nominal laying lengths.

f. Marking

- (1) The net weight, class or nominal thickness, and casting period shall be shown on each pipe. The manufacturer's mark, the year in which the pipe was produced, and the letters "DI" or "DUCTILE" shall be cast or stamped on the pipe.

g. Weighing

- (1) Each pipe shall be weighed before application of lining or coating other than standard coating and the weight shown on the outside or inside of the bell or spigot end.

h. Spigot End of Pipe

- (1) The spigot end of the pipe shall be free of blemishes and defects which, in the opinion of the ENGINEER, might be responsible for a poor fit with the rubber ring gasket and result in leakage.

2. Fittings

a. General

- (1) Ductile iron and gray iron mechanical joint, locked mechanical joint and fittings shall conform to ANSI/AWWA C110/A21.10-93 Standard for Gray Iron and Ductile Iron Fittings - 3 inch through 48 inch. Mechanical joints and push on joints shall also conform in all respects to ANSI/AWWA C111/A21.11-95.
- (2) Ductile iron compact fittings, meeting the requirements of ANSI/AWWA C153/A21.53-94, will also be accepted through 16 inch diameter. Fittings larger than 16 inch diameter shall meet the requirements of ANSI/AWWA C110/A21.10-93.
- (3) Fittings shall be 250 psi pressure rating for sizes through 12" and shall be 150 psi rating for sizes above 12" unless a higher operating pressure is shown on the Drawings, and in such cases the fitting pressure rating shall be equal to or above the operating pressure.
- (4) Fittings shall be gray iron or ductile iron meeting the above requirements and shall be furnished complete with all joint accessories.

b. Lining and Coating

- (1) All fittings shall be lined and coated the same as adjacent pipe.

3. Joints

a. General

- (1) Pipe joints shall be mechanical joint, rubber ring slip joint or locked mechanical joint as shown on the Drawings.
- (2) All items used for jointing pipe shall be furnished with the pipe. The joints shall be made with tools and lubricant in strict conformity with the manufacturer's instructions. Copies of the instructions shall be delivered to the ENGINEER at start of construction in sufficient numbers that will permit the ENGINEER to retain 3 copies.

b. Mechanical Joints

- (1) Mechanical joints are to be furnished according to ANSI/AWWA C111/A21.11-95. All pipe joints must be furnished complete with all accessories. Mechanical joint bolts and nuts shall be of alloy cast iron or alloy steel (Corten type such as U.S. Alloy) or equal. Rubber gaskets shall be made of plain first grade rubber, free of imperfections and porosity. Hardness shall be 75 ± 5 durometer.

c. Rubber Ring Slip Joint (Push On)

- (1) Rubber ring slip joint shall be equal to ANSI/AWWA C111/A21.11-95. The joints shall be of the following materials and assembled in the sequence outlined below:
 - (a) Rubber ring gasket compressed in groove in bell of pipe.
 - (b) Beveled spigot end of pipe for initial centering into rubber gasket in bell.

d. Locked Mechanical Joints

- (1) Locked mechanical joints shall be equal to American Cast Iron Pipe Company's, U.S. Pipe Company's, or Clow Corporation's locked mechanical joint.

e. Restrained Joints

- (1) Restrained joints, where called for on the Drawings, shall be American's Fastite joint with Fast-Grip gasket, U.S. Pipe's Tyton Joint with Field-Lok gasket, or equal.

4. Lining and Coating

a. Water Service

- (1) All ductile iron pipe for water service shall have manufacturer's standard outside bituminous or asphaltic base coating and a cement lining and bituminous seal coat on the inside. Cement mortar lining and bituminous seal coat inside shall conform to ANSI/AWWA C104/A21.4-95.

b. Bitumastic Finish Coat

- (1) Only a coal tar outside coating, or other compatible coating, shall be applied to pipe which is to receive a bitumastic finish coat.

B. Ductile Iron Pipe - Ball and Socket Joint Type

1. Pipe

a. General

- (1) Ductile iron ball and socket joint pipe shall be designed and manufactured in accordance with ANSI/AWWA Specifications C151/A21.51-96 and C110/A21.10-93 which are applicable with the exception of joints and lengths and thickness of pipe.

b. Minimum Nominal Thickness

- (1) Thickness of pipe shall be at least the following:

3" Diameter	.34"
4" Diameter	.35"
6" Diameter	.37"
8" Diameter	.42"
10" Diameter	.44"
12" Diameter	.49"

c. Lengths

- (1) Length of pipe, except where short sections are needed to meet job conditions shall be between 15'-6" and 21'-0".

2. Joints

- a. Joints shall have deflections of at least 15 degrees and shall be "FlexLok" (American Cast Iron Pipe Company), "River Crossing Pipe" (Clow), "Usiflex" (U. S. Pipe and Foundry Company), or equal, ball and socket joints. Nuts and bolts shall be stainless steel. Rubber gaskets shall be manufacturer's standard first grade. All joint accessories shall be furnished with the pipe, including transition couplings to mechanical joint cast iron pipe.
- b. Pipe joints shall be flexible to future movement without leakage and without pulling apart in tension.

3. Lining and Coating

- a. Ball and socket joint pipe for water service shall be cement lined and bituminous coated per ANSI/AWWA C104/A21.4-95 specification.

C. Ductile Iron Pipe - Flanged, Grooved and Special Coupling

1. Pipe

a. Flanged Pipe

- (1) Flanged pipe shall be made in accordance with ANSI/AWWA C115/A21.15-88 Specifications, and shall be thickness Class 250.
- (2) Where plain ends of flanged and plain end pipe fit into mechanical joint bells, centrifugally cast pipe shall be used.

2. Fittings

a. Flanged Pipe

- (1) Flanged joint fittings shall conform to ANSI/AWWA C110/A21.10-93 Standard for Gray Iron and Ductile Iron Fittings - 3 inch through 48 inch.
- (2) Fittings shall be 250 psi pressure rating for sizes through 12" and shall be 150 psi rating for sizes above 12" unless a higher operating pressure is shown on the Drawings and in such cases the fitting pressure rating shall be equal to or above the operating pressure.
- (3) Fittings shall be gray iron or ductile iron meeting the above requirements and shall be furnished complete with all joint accessories.

3. Joints

a. General

- (1) Pipe joints shall be as shown on the Drawings.
- (2) All items used for jointing pipe shall be furnished with the pipe. The joints shall be made with tools and lubricant in strict conformity with the manufacturer's instructions. Copies of the instructions shall be delivered to the ENGINEER at start of construction in sufficient numbers that will permit the ENGINEER to retain 3 copies.

b. Flanged Pipe

- (1) All ductile iron flanged pipe shall have flanges faced and drilled, 125 pound in accordance with ANSI/AWWA C110/A21.10-93 unless otherwise specified.
- (2) Flanges may be cast integrally with the pipe or they may be screwed on specially designed long hub flanges, refaced across both face of flange and end of pipe.
- (3) Flanged joints are to be furnished according to ANSI/AWWA C115/A21.15-88 and shall be ductile iron only. Flanged joints shall have 1/8 inch rubber full face gaskets made especially for water pipe use. Bolts for ductile iron flanged pipe must be of standard sizes for pipe to be fitted, and must be black steel, machine bolts with heavy hexagon heads and nuts meeting ANSI B18.2.1 and ANSI B18.2.2, respectively. In unheated vaults, submerged and/or damp locations, bolts and nuts for ductile iron flanged pipe shall be stainless steel.
- (4) The American Toruseal Flange Gasket Manufactured by American Cast Iron Pipe Company is an acceptable alternate to the above described gasket.

4. Lining and Coating

a. Flanged Pipe

- (1) Flanged pipe for water and wastewater service shall be cement lined and bituminous coated the same as written herein for ductile iron pipe, mechanical and rubber slip joint type.

D. Copper Pipe and Fittings

1. Inside, Rigid with Solder Joint Connections
 - a. Small piping inside structures shall consist of standard copper tubing for water; Type "L" for general plumbing purposes. All fittings shall be "solder joint connection" cast or wrought bronze for water service for inside diameter of pipe sizes given. All stops, valves, hose bibbs, and unions shall be made with same joints or threaded iron pipe standard, and be of brass or copper. Use 95-5 tin-antimony solder for "solder joints."
 - b. Outside, Underground Tubing with Compression Joints
 - (1) Small piping in the ground shall be of standard soft copper tubing for water service pipe, ASTM Specifications B 88-81, Type "K," with bronze fittings, stops, and valves having compression connections for flared copper tubing.

E. Galvanized Threaded Steel Pipe and Galvanized Threaded Malleable Fittings

1. Galvanized threaded steel pipe of the schedule shown on the Drawings shall be equal to "National" standard galvanized pipe in strength, coating, chemical and physical properties, threads and thickness, as manufactured by the National Tube Company, Pittsburgh, Pennsylvania, Youngstown Sheet & Tube Company, Youngstown, Ohio, or equal.
2. Fittings shall be equal to Crane's standard malleable galvanized iron fittings in case of pressure lines and Crane's cast iron threaded drainage fittings in case of drains.
3. Ductile iron pipe may be substituted for galvanized pipe where authorized by the ENGINEER.

F. Polyvinyl Chloride (PVC) Pipe (ASTM)

1. Pipe
 - a. This Specification covers rigid polyvinyl chloride pipe and fittings, hereinafter called PVC pipe and PVC fittings, for sizes 3/4 inch through 12 inch.
 - b. PVC pipe shall be extruded from Class 12454-B polyvinyl chloride material with a hydrostatic design stress of 2000 psi for water at 73.4° F, designated as PVC 1120, meeting ASTM Specifications D 1784-81 for material. Three-fourths inch through 1-1/2 inch water service piping shall be PVC Schedule 40 as specified in ASTM D 1785-76. Two inch through 12 inch pipe for water service shall be SDR 17 for 250 psi allowable working pressure at 73.4° F and a safety factor of 2.0, as specified in ASTM D 2241-80.

- c. The pipe shall be homogeneous throughout and free from cracks, holes, foreign inclusions or other defects. The pipe shall be as uniform as commercially practical in color.
- d. The workmanship, pipe dimensions and tolerances, outside diameters, wall thickness, eccentricity, sustained pressures, burst pressures, flattening, extrusion quality, marking and all other requirements of ASTM D 2241-80 shall be conformed with in all respects.
- e. Pipe shall be furnished in 20 foot lengths. The pipe may be double plain end or with bell on one end. Male ends of pipe must be beveled on the outside.
- f. Pipe shall have a ring painted around the male end or ends in such a manner as to allow field checking of setting depth of pipe in the socket. This requirement is made to assist construction superintendents and inspectors in visual inspection of pipe installation.
- g. Pipe must be delivered to job site by means which will adequately support it, and not subject it to undue stresses. In particular, the load shall be so supported that the bottom rows of pipe are not damaged by crushing. Pipe shall be unloaded carefully and strung or stored as close to the final point of placement as is practical.
- h. Pipe must not be exposed to the direct rays of the sun for an extended period of time. If pipe is not to be installed shortly after delivery to the job site, it must be stored in a shaded location.

2. Fittings

a. PVC

- (1) Fittings shall be of the same material and type joint as the pipe. Fittings shall have a minimum rating of 250 psi for continuous operation at 73.4° F. Fittings shall be either extruded or molded. All fittings shall be approved by the pipe manufacturer and complete data sent to the ENGINEER, including the manufacturer's approval, for review. All fittings must be made of NSF approved material.
- (2) A sample of each type fitting must be submitted for the ENGINEER'S review along with the above listed material before delivery of fittings to the job.

b. Cast Iron

- (1) Cast iron mechanical joint or push-in type fittings with appropriate adapters may be used with exterior PVC pipe. All such fittings shall be approved by the pipe manufacturer, and complete data sent to the ENGINEER, including the manufacturer's approval, for review. Use of transition gaskets will not be allowed unless specifically approved by the pipe manufacturer.

3. Joints

a. Exterior Buried Pipe - Slip Joint Type

- (1) Exterior buried pipe shall be jointed with slip-type joints with rubber gaskets.
- (2) Pipe with bells shall have all parts of the bell, including the gasket groove, made from the same extruded piece, integral with the pipe, and shall be thickened to meet standard dimension ratios of wall thickness to outside diameter. The gasket groove shall be constructed such that gasket rollout will not occur. Rubber gasketing shall conform to ASTM D 3139-77.

b. Interior - Solvent Weld

- (1) Interior pipe shall be jointed by solvent welds.
- (2) Since PVC welding solvent is engineered and formulated to perform with a given joint design, all solvent must be purchased from the manufacturer of the pipe.
- (3) The PVC welding solvent shall be compounded to conform with the socket fit and the weather conditions at the time of installation and be such as to assure minimum installation cost and a weld of maximum strength.

c. Couplings

- (1) Couplings shall be of the same material as the pipe and may be of the molded, or extruded type. They shall have a beveled entrance to prevent the wiping off of the lubricant from the male end of the pipe.
- (2) PVC couplings shall have a minimum rating of 250 psi for continuous operation at 73.4 degrees Fahrenheit.

- (3) The couplings shall have a positive pipe stop that will automatically and accurately position the pipe ends within the couplings. The pipe stop shall also permit the thermal expansion or contraction of the pipe ends.

4. Service Connections

- a. All service connections shall be made by means of tees, factory tapped couplings, or bronze service clamps manufactured specifically for use with PVC pipe, with Mueller threads, Mueller Catalog No. H-134, or equal. The use of Dresser Style 294 plastic saddles or equal, will be permitted. Whenever possible, corporation stops shall be placed in plastic lines before conducting hydrostatic tests.

G. Polyethylene Pipe for Water Service

1. Pipe

- a. Polyethylene flexible pipe for sizes ½ inch through 3 inch water service piping shall be PE 3408, Type III, Grade P34 Class C, DR-11, OD Based for 200 psi working pressure at 73.4° F, meeting ASTM Specification D 1248-81a for material, D 3350-84 for cell classification and AWWA C901-88 Specification for pipe.
- b. Pipe shall meet all applicable provisions of the Commercial Standards and shall bear the National Sanitation Foundation (NSF) seal of approval.

2. Fittings

- a. Fittings shall be standard bronze fittings as specified for copper tubing in this Section of these Specifications.

H. Polyethylene Pipe for Water Mains

1. Pipe

a. General

- (1) Polyethylene pipe and fittings shall comply with the requirements of ASTM D 1248-81a, D 1505-68(1979), D 1693-70(1980), D 1928-80, D 2657-79, D 3035-81, D 2837-76(1981) and D 2321-74(1980).

b. Resins

- (1) Only virgin polyethylene resins classified as Type III, Category 5, Grade P34 per ASTM D 3035-81 with densities of 0.955 p/cc maximum and melt index of 0.15 g/10 minutes maximum shall be used in the process of making the pipe.

The resin shall contain antioxidants and be stabilized with carbon black.

c. Design

- (1) The pipe shall have a long-term strength rating of 1,600 psi or more and be resistant to environmental stress cracking per procedure C of ASTM D 1928-80 for not less than 200 hours. The maximum allowable deflection is 5 percent with the pipe installed in accordance with these Specifications, using backfill material at 130 pounds per cubic foot, H-20 live load plus 50 percent impact but no internal pressure. The live load and impact may be disregarded in the calculations for trench conditions with 8 feet or more cover. Operating pressures are shown on the Drawings. Hydrostatic loading shall be considered when the pipe is to be installed below a permanent water table or body of water.

d. Wall Thickness Calculations

- (1) The pipe manufacturer shall furnish calculations to support the pipe wall thickness for these various conditions for the ENGINEER'S review/acceptance before the materials are sent to the job site.

e. Fittings

- (1) Fittings shall be molded or fabricated from high-density polyethylene, supplied by the pipe manufacturer and capable of being butt-fused to the polyethylene pipe.

f. Quality

- (1) No cracks, holes, foreign material, blisters or other deleterious faults are permitted in the polyethylene pipe. It shall be homogeneous throughout including the heat fused joint. Polyethylene pipe will not be installed containing gouges or cuts that penetrate more than 10 percent of the wall thickness.

g. Water Stops

- (1) The pipe manufacturer shall furnish a water-stop assembly for use with the pipe where the pipe passes through a structure wall so as to provide a watertight seal. The assembly shall be attached to the pipe with non-corroding materials.

h. Marking

- (1) Each length of polyethylene pipe shall contain the manufacturer's brand name, pipe size and other data to enable an accurate tracing of the raw material source. Polyethylene pipe will not be installed containing gouges or cuts that penetrate more than 10 percent of the wall thickness.

2. Joints

a. Fusion

- (1) The fusion equipment shall have hydraulic controls and gauges for monitoring fusion pressures. Also, an engine powered facing unit to trim the irregularities of the pipe ends shall be provided. In addition, the electrically heated and thermostatically controlled plate shall contain a temperature gauge for monitoring the process.

b. Flange Adapters

- (1) Threaded or solvent weld joints and connections are not permitted. Flange adapters as manufactured by the pipe supplier shall be used, butt-fused to the pipe and connected to other pipe material using a rubber gasket for sealing.

2.02 WALL AND FLOOR SLEEVES WITH RUBBER MECHANICAL SEAL FOR CARRIER PIPE SIZES 2" THROUGH 48"

A. General

1. Sleeves shall be required for 2" through 48" carrier pipes penetrating poured concrete walls and floor slabs. The use of sleeves will require the use of rubber links, mechanical type seal assembly around the carrier pipe.
2. The CONTRACTOR shall determine the required inside diameter of each individual wall opening or sleeve before ordering, fabricating or installing. The inside diameter of each wall or floor sleeve shall be sized as recommended by the closure assembly manufacturer to fit the carrier pipe, and seal to assure a watertight joint. The CONTRACTOR shall follow the manufacturer's instructions for installing and tightening the seal to provide a watertight pipe penetration.

B. Description

1. The pipe closure assembly shall consist of a heavy wall welded or seamless steel pipe with 4" larger than sleeve O.D. continuous water stop plate, modular mechanical type interlocking synthetic rubber links shaped to continuously fill the annular space between the carrier pipe and wall or

floor opening sleeve. Links shall be loosely assembled with stainless steel bolts to form a continuous sealing element of EPDM rubber belt around the carrier pipe with glass reinforced nylon plastic pressure plate under each bolt head and nut. Tightening of the bolts shall cause the sealing element to expand and provide absolute watertight seal between the carrier pipe and wall or floor sleeve. The entire closure assembly shall be tagged for location to match the nomenclature on the Drawings.

2. The sleeve shall be factory primed per Paint Specifications, Section 09900.

C. Manufacturers

1. Thunderline Corporation, Link-Seal Century Line Model CS-100, Model LS, FS, and WS. All models used shall be for Type S corrosive service, or equal.

2.03 SOURCE QUALITY CONTROL

A. Ductile Iron Pipe (Mechanical Joint and Rubber Slip Joint Type)

1. Hydrostatic and physical properties acceptance tests shall be in accordance with ANSI/AWWA Specification C151/A21.51-81 for ductile iron pipe centrifugally cast in metal molds or sand lined molds for water or other liquids.
2. The ENGINEER shall be provided with sufficient copies of each of the tests for each Contract to permit the ENGINEER to retain 3 copies.
3. All items used for jointing pipe shall be tested before shipment.

B. Polyvinyl Chloride (PVC) Pipe (ASTM)

1. Samples of pipe and physical and chemical data sheets shall be submitted to the ENGINEER for review and acceptance before pipe is delivered to job.
2. Samples of solvents and the recommended instruction for their use must be submitted for the ENGINEER'S review and acceptance before delivery of solvent to the job.

C. Polyethylene Pipe for Water Mains and Force Mains

1. Results of tests on the raw materials and the polyethylene pipe in accordance with ASTM standards and the Plastic Pipe Institute shall be furnished along with catalogs and other descriptive literature in the number of copies required by the listing in Special Conditions before the materials are sent to the job site.

PART 3 EXECUTION

3.01 TRENCH EXCAVATION - PRESSURE PIPE

A. General

1. Trenching shall include all clearing and grubbing, including all weeds, briars, trees and stumps encountered in the trenching, regardless of size. The CONTRACTOR shall dispose of any such material by burning, burial or hauling away or as noted on the Drawings, at no extra cost to the OWNER. Ornamental shrubs, hedges and small trees (3 inches in diameter or less) shall be removed, protected and replanted, at no extra cost to the OWNER.
2. Trenching also includes such items as railroad, street, road, sidewalk, pipe and small creek crossings; cutting, moving or repairing damage to fences, poles or gates and other surface structures, regardless of whether shown on the Drawings. The CONTRACTOR shall protect existing facilities against danger or damage while pipeline is being constructed and backfilled or from damage due to settlement of the backfill.
3. Materials encountered in excavation will be divided into only 2 classes: solid rock excavation and other materials. The price bid shall include earth, loose rock, street or road surfacing and base concrete and boulders less than one-third cubic yard in one piece. Pipe must not be laid upon rock or other unyielding surface. Solid rock excavation shall be paid for at an extra unit price for extra cost over that for excavating earth, etc., unless otherwise specified.
4. In case of unclassified excavation, as designated in the Drawings and/or Specifications, the price bid shall include earth, solid rock, roots, street or road surfacing and base concrete and boulders.
5. All excavation shall be open trenches, except where the Drawings call for tunneling, boring or jacking under structures, railroads, sidewalks, roads or highways.

B. Trees and Shrubs

1. Where pipelines run through wooded terrain, cutting of trees within limits of maximum permissible trench widths, as set forth in this article, will be permitted. However, cutting of additional trees on sides of trench to accommodate operating of trenching machine will not be permitted. The CONTRACTOR shall obtain specific permission of the OWNER before cutting any tree larger than 4 inches in diameter.

C. Highways and Streets

1. Construction equipment injurious to paving encountered shall not be used. Curbs, sidewalks, and other structures shall be protected by the CONTRACTOR from damage by his construction equipment.
2. Where trenching is cut through paving which does not crumble on edges, trench edge shall be cut to at least 2 inches deep to straight and neat edges, before excavation is started, and care taken to preserve the edge to facilitate neat repaving.
3. The CONTRACTOR shall so coordinate his work as to produce a minimum of interference with normal traffic on highways and streets. He may, with the approval of the governing agency, close a street to traffic for such length of time considered necessary, provided persons occupying property abutting the street have an alternate route of access to the property which is suitable for their needs during the time of closure. It shall be the responsibility of the CONTRACTOR to give 24 hours advance notice to fire and police departments and to occupants of a street which will be closed, in a manner approved by the governing body.
4. The CONTRACTOR shall maintain road crossings in a passable condition for traffic until the final acceptance of the work, being paid only by unit price for crushed rock used, within limitations as hereinafter specified, except that additional payment for crushed rock, after initial payment, will be allowed only where wheel compacted backfill is specified.
5. The amount of crushed stone placed shall be paid for at the unit price per ton up to the maximum limits of 225 pounds per linear foot of trench over which it is placed for pipe sizes through 16 inches, 300 pounds per linear foot for pipe sizes 18 inches through 24 inches and 400 pounds per linear foot for sizes 27 inches through 48 inches. The ENGINEER shall have control of thickness and width to be placed and paid for, and may order changes in depth and width as conditions dictate. No payment will be made for crushed rock surfacing required as a result of unnecessarily wide trenches, omission of sheeting and shoring, or damage by the CONTRACTOR'S equipment, or for maintenance of surface level.
6. Highway Department requirements in regard to trenching, tunneling, boring and jacking shall take precedence over the foregoing general specifications and the following tunneling and boring or jacking specifications, where they are involved.
7. Uneven surfaces or humps in the ground encountered and high driveways and road crossings shall be dug through to such depth that pipe may be laid to a reasonably even grade and have minimum cover at the low places. Such places requiring extra depths shall be included in the bid and no extra payment will be made for such extra depths required, which are evident from an examination of the ground before bidding, as

required for 1 foot cover over valve nuts, or are indicated on the Drawings.

D. Existing Utilities

1. The CONTRACTOR shall determine, as far as possible in advance, the location of all existing sewer, culvert, drain, water, electric, telephone conduits, and gas pipes, and other subsurface structures and avoid disturbing same in opening his trenches. In case of sewer, water and gas services and other facilities easily damaged by machine trenching, same shall be uncovered without damage ahead of trenching machine and left intact or removed without permanent damage ahead of trenching and restored immediately after trenching machine has passed, without extra cost to the OWNER. The CONTRACTOR shall protect such existing facilities, including power and telephone poles and guy wires, against danger or damage while pipeline is being constructed and backfilled, or from damage due to settlement of his backfill. It shall be the responsibility of the CONTRACTOR to inform the customers of utilities of disruption of any utility service as soon as it is known that it has been or will be cut off.
2. The CONTRACTOR shall, at all times during trenching operations, carry a stock of pipe and fittings likely to be needed for replacement of pipelines to facilitate immediate repair.

E. Pipelines in Same Trench

1. Pipelines laid in same trench shall, in all cases, be bedded on original earth, or other specified bedding materials, regardless of divergence in their elevations, unless otherwise specified. They shall never be laid in unsupported backfill or one above the other. The CONTRACTOR shall receive full trenching and backfilling unit prices for each pipeline so laid, the same as if laid in widely separated trenches.

F. Location of Proposed Pipelines

1. The location of pipelines and their appurtenances as shown are those intended for the final construction. However, conditions may present themselves before construction on any line is started that would indicate desirable changes in location. Also, development of property traversed may require location changes. In such cases, the OWNER reserves the right to make reasonable changes in line and structure locations without extra cost, except as may be determined by the application of the unit prices bid to the quantities actually involved. The OWNER is under no obligation to locate pipelines so that they may be excavated by machine.

G. Trench Requirements

1. All trenches must be dug neatly to lines and grades.

2. The opening of more than 500 feet of trench ahead of pipe laying and more than 500 feet of open ditch left behind pipe laying, before backfilling, will not be permitted, except upon written consent of the OWNER. No trench shall be left open or work stopped on same for a considerable length of time. In case of objectionable delay trench shall be refilled according to backfill specifications.
3. Where subgrade of trench has insufficient stability to support the pipeline and hold it to its original grade, the ENGINEER may order stabilization by various means. Exclusive of dewatering normally required for construction and instability caused by neglect of the CONTRACTOR, it shall be paid for at unit prices set up in the Contract, such as extra excavation, crushed rock for pipe bedding, concrete cradle or piling. In the event that no particular bid price is applicable, then the payment for stabilization shall be negotiated.
4. Excavation for pipe laying must be made of sufficient width to allow for proper jointing and alignment of the pipe, but not greater than the maximums permitted in the following table:

MAXIMUM TRENCH WIDTH AT TOP OF PIPE

<u>Nominal Pipe Size (Ins.)</u>	<u>Trench Width (Ins.)</u>
4	28
6	30
8	32
10	34
12	36

5. Trenches in earth or rock shall be dug as shown on the Drawings and be sufficiently deep to insure a 30 inch or 36 inch minimum cover over water lines and force mains, as noted on the Drawings. Depths of trenching shall also be adequate for at least 1 foot minimum cover over valve nuts. In order to eliminate the necessity for digging bell holes into the trench subgrade by hand and to insure an earth cushion under the pipe for uniform bearing, trench depth shall be the cover requirement plus outside diameter of barrel of pipe plus the required bedding cushion. The cushion construction requirement shall also apply to tunnels.
6. Wherever it is deemed necessary by the ENGINEER to lay the pipes to an extra depth exceeding the depths required by the Drawings and Specifications and not apparent from unevenness of ground, the CONTRACTOR will be paid for such excavation under extra excavation in earth at the price bid per cubic yard, computed on the basis of maximum trench widths in the preceding table. In unclassified excavation contracts the same width limitations will apply.

7. Trench line stations and locations of accessories will be set ahead of the trenching. These will be set at least each 100 feet of pipeline. Trenches must be dug true to alignment of stakes. Alignment of trenches or pipes in trench must not be changed to pass around obstacles such as poles, fences and other evident obstructions without the permission of the ENGINEER. Lines will be laid out to avoid obstacles as far as possible, contingent with maintenance of alignment necessary to finding pipeline in the future and avoiding obstruction to future utilities.

H. Damage to Existing Structures

1. Hand trenching is required, at no extra payment, where undue damage would be caused to existing structures and facilities by machine trenching.
2. In case of damage to any existing structures, repair and restoration shall be made at once and backfill shall not be replaced until this is done. In all cases, restoration and repair shall be such that the damaged structure will be in as good condition and serve its purpose as completely as before, and such restoration and repair shall be done without extra charge, except as set forth under the applicable provisions of the General and Special Conditions. Where there is the possibility of damage to existing utility lines by trenching machine, the CONTRACTOR shall make hand search excavation ahead of machine trenching, to uncover same, at no extra cost to the OWNER.

I. Excavation Unclassified

1. Excavation for pipelines shall be unclassified and the cost of all excavation of whatever nature and state, including solid rock, shall be included in the CONTRACTOR'S unit price bid for furnishing, trenching, laying and backfilling the pipe.
2. Excavation for structures such as manholes, pump stations, and vaults is likewise unclassified and the cost of all excavation of whatever nature and state, including solid rock, shall be included in the CONTRACTOR'S lump sum or unit price bid, as the case may be.

J. Dewatering of Trenches

1. Dewatering of trenches shall be considered a part of trenching, at no extra cost to the OWNER. Dewatering of trenches shall include groundwater and storm or sanitary sewage. Suitable pumping and other dewatering equipment is to be provided by the CONTRACTOR, to insure the installation of the pipeline structure in a dewatered trench and under the proper conditions. Dewatering shall include all practical means available for prevention of surface runoff into trenches and scouring against newly laid pipe.

2. Piles of excavated materials shall be trenched or temporarily piped to prevent, as far as practical, blockage of drainage ditches and gutters, and water carriage of excavated materials over street and highway surfaces.

3.02 LAYING PRESSURE PIPE

A. General

1. Inspection of Materials

- a. All pipe, fittings and accessories shall be subject to an inspection by the OWNER at the job site. Any damaged materials shall be repaired or replaced to the satisfaction of the OWNER. Should repairs to the piping materials be necessary, then same shall be made in the presence of the ENGINEER using proven methods prescribed by the pipe manufacturer.
- b. The OWNER'S inspection of materials shall in no way relieve the CONTRACTOR of his responsibility.

2. Laying Requirements

- a. Pressure pipe shall be laid to lines, cover or grades shown on the Drawings.
- b. Pipes must be swabbed out before lowering into trench. In the case of pipelines 4 inch through 20 inch, a swab must also be dragged through the pipe after it is in place. Larger size pipe shall be visually inspected for cleanliness and proper jointing.
- c. The points insisted upon in the laying of pipe will be: Proper alignment, evenness of width and depth of joints, perfection in jointing, and care of the pipe in handling.
- d. Precautions must be taken to prevent flotation of the pipe should water enter the trench prior to putting the pipeline into operation.
- e. In wet, yielding and mucky locations where pipe is in danger of sinking below grade or floating out of grade or alignment, or where the backfill materials are of such a fluid nature that such movements of the pipe might take place during the placing of the backfill, the pipe must be weighted or secured permanently in place by such means as will prove effective. If crushed rock fill beneath the pipe is necessary for stability, it will be paid for at the unit price bid per ton of such material in place except in cases where instability is caused by neglect of the CONTRACTOR.
- f. Whenever pipe laying is stopped, the end of the pipe shall be securely plugged with plywood or the manufacturer's standard plug held in place by jute packing, caulked into place.

- g. Elbows, plugs, dead end valves, and tees shall be firmly blocked, as shown on the Drawings, to prevent internal pressure from springing the pipe from the intended alignment, with permanent materials solidly placed without covering pipe joints. Restrained type pipe joints may be substituted for thrust blocks with the ENGINEER'S permission. Pipe shall be free of all structures, other than manholes.
- h. No pipe shall be laid resting on solid rock, blocking or other unyielding objects. Jointing before placing in the trench and subsequent lowering of more than one section jointed together may be allowed, subject to the ENGINEER'S permission.

3. Installing Water Pipe in Cover Pipe

- a. Installation of water pipe in cover pipe is covered in Section 02326 of these specifications.

B. Laying Ductile Iron Pipe

1. Bedding and Backfilling

- a. The laying condition shall be Type 3 specified in ANSI/AWWA C600-82. The pipe shall be bedded in 6 inches minimum loose soil and the hand placed loose soil backfill lightly consolidated to the top of the pipe. "Loose soil" or "select material" is defined as native soil excavated from the trench, free of rocks, foreign materials and frozen earth.
- b. The selected material shall be hand placed to a point 12 inches above the barrel of the pipe. After the specified backfill is hand placed, rock may be used in machine placed backfill in pieces no larger than 8 inches in any dimension and to an extent not greater than one-half the volume of the backfill materials used.
- c. The top 12 inches of backfill shall contain no rock over 1-1/2 inches in diameter nor pockets of crushed rock.
- d. Larger rock fill will be allowed in wide trenches where side slopes are low enough to prevent rock from dropping over pipeline. If additional earth is required, it must be obtained and placed by the CONTRACTOR. Filling with rock and earth shall proceed simultaneously, in order that all voids be filled with earth.
- e. If select material is not available from the trench excavation, or if the CONTRACTOR so desires, he may use crushed stone bedding and backfill to the top of the pipe at no extra cost to the OWNER.

- f. Sufficient space, limited to a maximum of 2 feet length, shall be left out of the specified earth or crushed stone bedding to facilitate proper jointing of the pipe.
- g. No pipe shall be laid resting on solid rock, blocking or other unyielding objects. Jointing before placing in the trench and subsequent lowering of more than one section may be allowed, subject to the ENGINEER'S permission.

2. Installation of Pipe

- a. Ductile iron pipe shall first be thoroughly cleaned at joints, then joined according to instructions and with tools recommended by the pipe manufacturer. Sufficient copies of the manufacturer's installation instructions shall be furnished the ENGINEER to permit the ENGINEER to retain 3 copies. One copy shall be available at all times at the site of the work.
- b. All pipes must be forced and held together or "homed" at the joints before bolting. Pipe must be aligned as each joint is placed, so as to present as nearly true, straight lines and grades as practical, and all curves and changes in grades must be laid in such manner that one-half of the maximum allowable deflection shown in the pipe manufacturer's catalog is not exceeded.
- c. Concrete blocking of fittings shall be as specified hereinafter in this Specification Section 02610.
- d. Cutting of pipe may be done by special pipe cutters as the CONTRACTOR may elect, but the CONTRACTOR will be held responsible for breakage or damage caused by careless cutting or handling. Cut edges of the pipe shall be made smooth and a bevel formed on the exterior of the pipe barrel when using rubber gasket type pipe.

C. Laying Copper Pipe and Fittings

1. Bedding and Backfilling

- a. The pipe shall be bedded in 4 inches minimum of loose soil and the hand placed backfill lightly consolidated to a depth of 12 inches above the top of the pipe. "Loose soil" or "select material" is defined as native soil excavated from the trench, free of rocks, foreign materials and frozen earth. The machine placed backfill may contain rock no larger than 8 inches in any dimension and to an extent no greater than ½ the volume of backfill materials used. The top 12 inches of backfill shall contain no rocks over 1-1/2 inches in diameter nor pockets of crushed rock.

2. Installing Copper Pipe and Fittings

- a. Exterior copper pipe shall be laid of type K pipe, with brass compression fittings. Joints shall be neatly reamed and flared and joints drawn up firmly. Pipe shall have at least 36 inch cover. Joints shall be tested and all leakage stopped before backfilling the pipe trench.
- b. Interior copper pipe shall be installed of Type L pipe, with sweat joint fittings. Pipe shall be tested and all leaks stopped before the system will be accepted. The pipe shall be free of dents and bends. The sweat joints shall present a neat appearance. All pipe shall be parallel to walls and floors with unions on all runs and branches. The pipe shall be secured to the walls and ceilings by clamps and hangers manufactured for the purpose. Strap hangers are not acceptable. Unions and valves shall be placed on each outlet to facilitate dismantling and shutting off.
- c. All copper pipe shall be installed by experienced workmen.

D. Laying of Flanged or Threaded Pipe and Fittings (Interior)

1. Installation - General

- a. The CONTRACTOR shall thoroughly clean the pipe and fittings before starting erection. All scale, rust and dirt shall be removed by power brushing and/or solvent cleaning.
- b. The erection of piping requires that it progress from the equipment it is connected to, after the equipment has been accurately leveled and aligned, without putting a strain on same. The pipe shall be erected in a workmanlike manner with runs in the true horizontal or vertical plane or as shown on the Drawings.
- c. The piping shall be supported by standard pipe hangers or piers rather than by the equipment. The pipe shall be free of all openings in walls and slabs when the final position of the piping is attained and before sealing the annular space about the pipe.

2. Flanged Joint Connection

- a. All flanged type connections shall be made using an acceptable gasket and bolts. The bolts shall be tightened evenly to compress the gasket. Care is to be taken not to distort the flanges and/or piping by overtightening the bolts.

3. Threaded Joint Connection

- a. All threads shall be full, complete and made with sharp dies. The ends of the pipe shall be reamed to remove all burrs and all

threads must be free of rust and other foreign matter at the time the red lead thread compound is applied. Other thread compounds must be acceptable to the ENGINEER before use.

- b. Pipe threads shall be tapered and in accordance with API Standard 5B. Not more than 3 threads at each joint may be exposed after the connection is made.
- c. Unions shall be included to allow for proper assembly and disassembly of each run of pipe. Provide a union on each run of pipe connecting to threaded valves, devices and equipment.

F. Laying Plastic Pipe

1. Bedding and Backfill - General

- a. Existing earth bedding and backfill shall be used in lieu of crushed stone. In areas where rock is encountered the CONTRACTOR shall use locally available sand for bedding and backfill. The CONTRACTOR is to provide full crushed stone, as specified, in all traffic areas, road and driveway crossings. Compaction of the earth and sand backfill materials is required in compliance with ANSI/AWWA C605.
- b. Similar material shall be used for haunching up to the spring line of the pipe and it shall be worked under the haunch of the pipe to provide adequate side support. The crushed rock meeting the requirements of Class I (ASTM D 2321-74 (1980)) shall then be hand placed to a point 12" above the top of the pipe. The remaining backfill, except for the top 12" which shall contain no rock over 1-1/2" diameter nor pockets of crushed rock, may be excavated material containing no rock over 8" in any dimension. Larger rock will be allowed in wide trenches where side slopes are low enough to prevent rock from dropping over pipeline. If additional earth is required, it must be obtained and placed by the CONTRACTOR. Filling with rock and earth shall proceed simultaneously, in order that all voids may be filled with earth.
- c. Sufficient space, limited to a maximum of 2 feet length, shall be left out of the bedding to facilitate proper jointing of the pipe.
- d. No pipe shall be laid resting on solid rock, blocking, or other unyielding objects. Jointing before placing in the trench and subsequent lowering of more than one section may be allowed subject to the ENGINEER'S permission.

2. Installation of Polyvinyl Chloride (PVC) Pressure Pipe

- a. Prior to laying, all PVC pipe shall be stored in a shaded place for protection from the direct rays of the sun. Pipe shall be distribut-

ed from storage as the work progresses as permitted by the ENGINEER.

- b. The pipe, fittings, and valves shall be placed in the trench with care. Under no circumstances shall pipe or other materials be dropped or dumped into the trench. The pipe shall not be dragged in a manner which would cause scratching of the pipe surface. An excessive amount of scratching on the surface of the pipe will be considered cause for rejection.
- c. Sufficient copies of the pipe manufacturer's instructions for installing the pipe and accessories shall be furnished the ENGINEER by the CONTRACTOR to permit the ENGINEER to retain 3 copies. A copy is to be available at the job site at all times.
- d. Concrete blocking of fittings, as hereinafter specified, shall be required for PVC pipe with slip joints and rubber gaskets or ductile iron mechanical joint fittings.
- e. All dirt, dust and moisture shall be removed from the bell and spigot ends of pipes to be jointed. Insert gasket in bell. Apply the lubricant to spigot and gasket being careful to keep both ends free of dirt. The joint shall be homed to stop mark on spigot end of pipe. All jointing shall be done in accordance with pipe manufacturer's recommendations.
- f. All cutting of the pipe shall be done in a neat and workmanlike manner with the least amount of waste of pipe involved and without damage to existing or new lines. A fine tooth saw, tubing cutter or similar tool can be used to cut the pipe. Cut must be square and ragged edges removed with a cutting tool and/or file. A bevel or taper on the exterior of each spigot is required.

3. Installation of Polyethylene Pressure Pipe

- a. Polyethylene pipe for water lines shall be joined using tools and equipment specifically manufactured for use with polyethylene pipe. Heat fusion temperature, heating time and cooling time shall be per the pipe manufacturer's requirements. Pouring of water on completed joints to speed cooling will not be allowed.
- b. The pipe shall be snaked into the trench, employing the natural snaking tendency of the pipe. All short radius bends shall be made with fittings rather than with the pipe alone. The pipe will be rejected if it contains kinks and gouges or gouges/cuts penetrating to a depth of 10 percent of the wall thickness.
- c. Sufficient copies of the pipe manufacturer's instructions for installing the pipe and accessories shall be furnished the ENGINEER

by the CONTRACTOR to permit the ENGINEER to retain 3 copies. A copy is to be available at the job site at all time.

- d. Because of the high coefficient of expansion of polyethylene, this pipe shall not be attached to rigid structures at the ends until at least 48 hours have elapsed after backfilling and the pipe temperature has had an opportunity to stabilize.

4. Installing Polyethylene Pipe for Water Service

- a. The pipe shall be bedded in 6 inches minimum of loose soil when in dirt and 6 inches gravel when in rock, and the hand placed backfill lightly consolidated to a depth of 12 inches above the top of the pipe. "Loose soil" or "select material" is defined as native soil excavated from the trench, free of rocks, foreign materials and frozen earth. The machine placed backfill may contain rock no larger than 8 inches in any dimension and to an extent no greater than $\frac{1}{2}$ the volume of backfill materials used. The top 12 inches of backfill shall contain no rocks over 1-1/2 inches in diameter nor pockets of crushed rock.
- b. Polyethylene pipe for water services shall have the same outside diameter as copper tubing and shall be compatible for flared compression fittings. The joints to brass fittings shall be made by cutting the pipe with a tube cutter, keeping it clean and square, thence flaring the pipe and completing the joining in accordance with the manufacturer's instructions (a copy of the instructions shall be at the job site at all times). All joints shall be tested and all leakage stopped before backfilling the pipe trench.
- c. The pipe shall be snaked into the trench, employing the natural snaking tendency of the pipe. All short radius bends shall be made with fittings rather than with the pipe alone. The pipe shall be bent to a radius of not less than 12 inches.
- d. The pipe will be rejected if it contains kinks and gouges.

G. Installation of Water Service Accessories

1. Water Service Meters

- a. Water service meters and accessories shall be installed as shown on the Drawings, with meter box centered over the meter.
- b. The location of water service connections will be determined in the field, as the work progresses, thereby necessitating the tapping, in case of cast iron or ductile iron pipe, and in the case of pressure concrete, PVC, or steel pipe alternates, the use of pipe saddles and the appropriate tapping equipment. Earth backfill shall be

thoroughly tamped around meter boxes to prevent subsequent movement.

2. Air Valves and Corporation Stops

- a. The location of air valve assemblies, while being noted on the Drawings, could possibly be shifted in actual construction. For this reason, the same statements relative to the methods of installation of meters and water service connections apply to the installation of air valve assemblies. Air valve assembly boxes shall be installed in the same manner as water meter boxes except that the box will be located slightly off center of the air valve, in order to give better access to the stopcock between the valve and water main.
- b. Corporation stops, as shown on the Drawings, are required between the water main and the meter, and between the main and the air valve assembly.

H. Installation of Hydrants

1. Hydrants shall be installed in the general location as shown on the Drawings. Exact location shall be determined in the field. Hydrants shall be set such that the lowest nozzle shall be high enough above the ground to allow the uninhibited 360° swing of a 15 inch hydrant wrench.
2. Hydrant drainage pits shall be excavated below the hydrant to the depth shown on the Drawings. Crushed stone drainage media shall be of the size shown on the Drawings. Hydrant shall be set vertical and anchored as hereinafter specified.
3. Hydrants installed on this project shall be anchored to prevent the hydrant from blowing off the feeder line when suddenly opened or closed. Likewise, the hydrant pilot valve shall be anchored to prevent blow-off when the hydrant is removed. The CONTRACTOR shall anchor the hydrant and pilot valve utilizing one of the following procedures:
 - a. Where the hydrant is located immediately adjacent to the water main, install all thread rods from the main line branch tee to the valve inlet and from the valve outlet to the mechanical joint of the hydrant inlet piece.
 - b. Provide locked mechanical joint and/or restrained joint piping from the main to the hydrant including the main line tee.
 - c. Use method a or b from the water main to the pilot valve and provide a concrete thrust block on the hydrant.
 - d. Method b may not be used when the hydrant feed line is PVC pipe.

4. The additional cost of providing all-thread rods; 4 mil wrap of bolts, nuts, and flanges; locked mechanical joint pipe and fittings; restrained joint pipe and fittings; and/or the concrete thrust block at the hydrant shall be included in the CONTRACTOR'S unit price bid for the hydrant.

I. Blocking of Pipe at Bends and Ends

1. Horizontal Bends

- a. Concrete backing and/or blocking required at bends in the horizontal plane shall be accomplished per detail on the Drawings. The square footage of blocking area shall be obtained from Tables "A" and "B" through the following procedure:

Step No. 1 - From Table "A," select type soil and bearing area factor for particular fitting to be blocked.

Step No. 2 - From Table "B," select multiplier to be used for the size pipe being blocked and its test pressure.

Step No. 3 - Calculate actual bearing area required by multiplying bearing area factor from Table "A" by multiplier from Table "B" (e.g. - 16 inch tee with 250 psi test pressure in sandy clay - $9.42 \times 1.78 = 16.7$ S.F. of bearing area required). Bearing area shall in no case be less than the minimum shown in Table "B."

TABLE "A"

Type Soil	Soil Bearing Pressure (PSF)	Bearing Area Factor for Degree of Bend (Square Feet)				
		90°	Plug/Tee	45°	22 1/2°	11 1/4°
Sandy Clay	3,000	13.33	9.42	7.21	3.68	1.85
Hard Clay	6,000	6.66	4.71	3.61	1.84	0.92
Shale	12,000	3.33	2.36	1.80	0.92	0.46
Solid Rock	16,000	2.50	1.77	1.35	0.69	0.35

TABLE "B"

Pipe Dia. (In.)	Min. Bearing Area (S.F.)	Multiplier for Pipe Test Pressure (TP)						
		(TP)	(TP)	(TP)	(TP)	(TP)	(TP)	(TP)
		350 psi	300 psi	250 psi	200 psi	150 psi	100 psi	50 psi
4	1.0	0.16	0.13	0.11	0.09	0.07	0.04	0.02
6	1.0	0.35	0.30	0.25	0.20	0.15	0.10	0.05
8	1.0	0.62	0.53	0.44	0.36	0.27	0.18	0.09
10	1.0	0.97	0.83	0.69	0.56	0.42	0.28	0.14
12	1.3	1.40	1.20	1.00	0.80	0.60	0.40	0.20
14	1.5	1.91	1.63	1.36	1.09	0.82	0.54	0.27
16	1.8	2.49	2.13	1.78	1.42	1.07	0.71	0.36

- b. Consideration will be given to the use of restrained type mechanical joint pipe and fittings in lieu of concrete blocking. Use of the restrained joint pipe and fittings is subject to review and acceptance by the ENGINEER of the locking-method and adequacy of design for pressures involved.

2. Vertical Bends

- a. The use of vertical bends in lieu of extra depth trenching shall be subject to permission by the ENGINEER.
- b. Where the CONTRACTOR elects to use vertical bends, or where vertical bends are called for on the Drawings, the CONTRACTOR shall submit the blocking design, including calculations, to the ENGINEER for review and acceptance. Anchorages shall be designed to resist thrusts caused by the internal test pressure in the pipe. Protection against corrosion shall be inherent in the design.

J. Supplemental Backfilling Information

1. General

- a. Excavated materials from trenches and tunnels, in excess of quantity required for trench backfill, shall be disposed of by the CONTRACTOR. It shall be the responsibility of the CONTRACTOR to obtain location or permits for its disposal. Unit prices for trench excavation, tunneling, and backfill shall include the cost of disposition of excess excavated materials, as set forth herein, with no additional compensation being allowed for hauling.
- b. Where sod is destroyed in areas maintained equivalent to residence yards, the area shall be restored and revegetated by seeding as specified herein.

3.03 FIELD QUALITY CONTROL

A. Testing Polyvinyl Chloride (PVC) Pressure Pipe During Construction Period

1. Prior to pressure testing the pipe shall be center loaded with backfill to prevent arching and whipping under pressure. Center loading shall be done carefully so that joints will be completely exposed for examination during testing unless conditions warrant complete backfill before testing.
2. During the general construction period the following pressure testing procedure shall be followed on the first 1500 L.F. of pipe (on sections that can be separately isolated). If they cannot be isolated, temporary valves will be installed to do the testing. Valves to be at no additional cost to the OWNER.
3. After the PVC pipe is assembled in the trench a pressure test of 4 hours will be performed on the pipe. Test pressure to be the pressure class of pipe. After 2 consecutive tests have been performed without any failure, the CONTRACTOR at his option and with the ENGINEER'S permission may discontinue testing until the system is completed. Testing shall then be performed as outlined herein in this Section.

C. Testing Pressure Pipe for Leakage

1. The CONTRACTOR will be required to test all pipelines and appurtenances with water. The maximum test pressure, measured at the lowest elevation of the pipeline being tested, shall be the pressure class of the pipe unless a specific test pressure is shown on the Drawings.
2. Backfilling before testing will be allowed at the discretion of the ENGINEER, in the case of slip type or bolted joint pipe and at points where danger to the public or other hazards demand that such be done immediately after pipe is laid.
3. When the line or section being tested is pumped up to the required pressure, it shall be valved off from the pump and a pressure gauge placed in the line. The pressure drop in the line, if any, shall be noted. If no pressure drop is noted in 4 hours, the ENGINEER, with approval from the OWNER, at his discretion, may accept the line or section as being tested, or he may require the test run the full 24 hours.
4. At the end of the 24 hour test period, the pressure shall be recorded. If there is a drop in pressure, the CONTRACTOR will be required to pump the section being tested up to initial test pressure and maintain that pressure for 24 hours, measuring the amount of water required to accomplish this. The line will not be accepted until the leakage shall prove to be less than 10 gallons per inch diameter per mile of pipe per 24 hours.

5. Should there be leakage over the allowable amount, the CONTRACTOR will be required to locate and repair the leaks and retest the section. It is suggested, but not required, that the CONTRACTOR have a geophone (underground listening device) on the job at time of testing.
6. If the leakage of a section of pipeline being tested is below the allowable amount, but a leak is obvious, in the opinion of the ENGINEER, due to water at the surface of the ground, or by listening, the leak can be heard underground with the geophone, or any other means of determining a leak, the CONTRACTOR will be required to repair those leaks.
7. The CONTRACTOR shall furnish meter or suction tank, pipe test plugs, and bypass piping, and make all connections for conducting the above tests. The pumping equipment used shall be centrifugal pump, or other pumping equipment which will not place shock pressures on the pipeline. Power plunger or positive displacement pumps will not be permitted for use on closed pipe system for any purpose.
8. Inspection of pipe laying shall in no way relieve the CONTRACTOR of the responsibility for passing tests or correcting poor workmanship.
9. The Letcher County Water and Sewer District will furnish all water used in flushing, reflushing, disinfection, and accepted testing and/or retesting the completed pipelines. The CONTRACTOR shall be billed for all water used at the wholesale water rate, until all lines are satisfactorily pressure tested and obtain satisfactory bacteriological testing results.

E. Disinfection

1. Upon completion of the work and cleaning up, and prior to final acceptance, the CONTRACTOR shall disinfect all water lines constructed which are to carry treated water.
2. Prior to starting disinfection, all water mains must be thoroughly flushed to remove mud, rocks, etc. Disinfection will then be accomplished by the adding of a chlorine solution while filling the main to obtain the initial 50 ppm of chlorine. The CONTRACTOR shall supply all equipment, labor, etc., necessary for flushing and disinfecting the mains. The CONTRACTOR shall submit, in writing, to the ENGINEER, the method he proposes to use for adding the chlorine.
3. The calcium hypochlorite granule or tablet method shall not be used.
4. Disinfection shall be accomplished by filling the new and/or repaired portions of the system with water having a chlorine content of at least 50 parts per million and at the end of a 24 hour contact time a residual of at least 25 parts per million shall remain. At the end of the 24 hour contact period, the chlorinated disinfectant water shall be thoroughly flushed from the water system. The CONTRACTOR shall use such dechlorination methods necessary to meet the Kentucky Natural Resources and

Environmental Protection Cabinet regulations for dechlorination prior to discharge of same to any stream.

5. For tie-ins to an existing system such as tapping valves where keeping the main out of service would restrict service to existing customers, disinfection shall, at the ENGINEER'S discretion, consist of thoroughly cleaning the new part with a solution containing not less than 200 mg/l (ppm) chlorine.
6. After initial disinfection and flushing, the CONTRACTOR will collect water samples for bacteriological testing. A core zone, which includes up to the first ½ mile, shall be established. Two samples shall be taken from the core zone. Additionally, 1 sample taken from each mile of new distribution main shall be submitted to the cabinet. A new or routine replacement main shall not be placed in service until negative laboratory results are obtained on the bacteriological analyses. Sample bottles shall be clearly identified as "special" construction tests. If any of the samples are found to be positive or contain confluent growth, the CONTRACTOR shall repeat the disinfection procedure until the required numbers of negative samples are obtained at no cost to the OWNER.
7. The cost of all water used shall be billed to the CONTRACTOR by the Letcher County Water and Sewer Commission for all water used at the wholesale rate in disinfection, flushing, and attaining satisfactory bacteriological testing for furnishing, trenching, laying, and backfilling the pipe. The cost of a testing lab, bottles, etc. shall be the responsibility of the CONTRACTOR at no additional cost to the Letcher Count Water and Sewer Commission.f

3.04 BASIS OF PAYMENT

A. Excavation and Backfilling

1. Trenching, Laying, and Backfilling Pipelines
 - a. Unit Price Contracts
 - (1) Payment for trenching for pressure lines shall be included in the unit price bid for trenching, laying, and backfilling pipelines.
2. Solid Rock Excavation
 - a. Unclassified Excavation
 - (1) Excavation shall be unclassified and the cost of all excavation of whatever nature and state, including solid rock, shall be included in the CONTRACTOR'S unit price bid for each item of construction requiring excavation.

3. Search and Extra Depth Trench Excavation

- a. "Search" trench excavation shall be the actual measured excavation within limits as acceptable to the ENGINEER.
- b. "Extra Depth" trench excavation shall be the calculated yardage below the lowest point of excavation which would normally have been required for construction.
- c. Trench width limitations for either condition shall be as listed in the following table:

For 6" Pipe 2'-6"	For 16" Pipe 2'-11"
For 8" Pipe 2'-9"	For 18" Pipe 3'-2"
For 10" Pipe 2'-9"	For 20" Pipe 3'-5"
For 12" Pipe 2'-9"	For 24" Pipe 3'-8"
For 14" Pipe 2'-9"	For 30" Pipe 4'-4"

- d. The work of uncovering and backfilling required for locating existing sewers, water lines and other existing facilities for connection of improvements or avoidance in location of proposed pipelines where such uncovering and backfilling is not within trench for improvements, shall be paid for at a price per cubic yard for such excavation actually removed and backfilled under item for "Search or Extra Depth Trench Excavation." Such payment does not include uncovering existing utility lines for their protection during or after trenching operations for the proposed pipeline.

4. Mechanical Tamping

- a. Mechanical tamping is defined as backfill placed and compacted by power driven mechanical equipment to a greater density than can be achieved by natural settlement or hand tamping methods. Mechanical tamping will be required when ordered by the ENGINEER with payment by the cubic yard so compacted. Measurement, but not actual extent of the mechanical tamping, shall be limited by the numerical maximum allowable trench width (for each size pipe) as shown in the table listed under "Search and Extra Depth Trench." Payment for mechanical tamping shall not include the specified haunching or initial backfill required above and below the top of pipe.

B. Boring or Jacking

1. Boring or Jacking

- a. In unit price Contracts, usable holes either bored or jacked shall be paid for per linear foot of hole actually bored or jacked, according to the diameter of the hole required, measured along the centerline from the point of entrance on one side to the point of exit on the other side. When cover pipe is installed inside the bore, boring or jacking and cover pipe shall be paid per linear foot based on the length of the cover pipe installed, according to the diameter of the cover pipe required.

C. Trench and Pipe Stabilization

1. Extra Excavation

- a. Extra excavation required for trench or pipe stabilization shall be paid by the cubic yard so excavated under the item "Search and/or Extra Depth Trench Excavation" based on the limitations for that item.

2. Crushed Stone for Trench Stabilization

- a. Crushed stone ordered by the ENGINEER for trench stabilization shall be as specified in Section 02235 of these Specifications and paid by the ton so placed.

3. Crushed Stone for Pipe Bedding

- a. Additional crushed stone bedding ordered by the ENGINEER for pipe stabilization shall be as specified in Section 02235 of these Specifications and paid by the ton so placed.

4. Plain or Reinforced Concrete Arch

- a. Plain or reinforced concrete arch called for on the Drawings and/or ordered by the ENGINEER shall be paid for by the linear foot of pipeline upon which it is placed. The Form of Proposal will indicate which method is to be used.

5. Plain or Reinforced Concrete Cradle

- a. Plain or reinforced concrete cradle called for on the Drawings and/or ordered by the ENGINEER shall be paid for by the linear foot so placed.

D. Water Lines

1. Unit Price Contracts

a. Water Lines

- (1) Payment for laying, trenching and backfilling water lines shall be included in the unit price bid per linear foot of pipe laid, including length of fittings and valves, unless same are included in lump sum portions or assemblies noted on the Drawings. However, payments will not be made for branch lengths of fittings within 2.5 feet of edge of main trench. The extra cost of trenching in difficult locations, such as stream, railroad, and highway crossings, if not covered in other contract unit prices, shall be included in unit price for trenching, laying and backfilling.
- (2) All blowoff or vent branches will be measured as pipe from center of connecting tee to end of pipe.
- (3) In the case of unit price contracts, unless otherwise stated in the Special Conditions, cast iron or ductile iron fittings, laid outside lump sum assemblies, will be paid for by the pound of body castings, without joint accessories, at the weights listed in ANSI/AWWA C110/A21.10-87 or ANSI/AWWA C153/A21.53-88 in the case of ductile iron compact fittings.

E. Excess Materials

1. The unit prices for trench excavation, tunneling and backfill shall include the cost of disposition of excess excavated materials.

F. Valves

1. The unit price bid for the installation of valves shall include valves, valve boxes, the cost of the concrete collar required around the valve boxes, extension stems if required, and all thread restraint rods.

G. Testing

1. The unit price bid for furnishing, trenching, laying and backfilling pressure lines shall include testing the line and the cost of all water used will be billed to the CONTRACTOR per section 3.03, required for testing/retesting.

H. Blocking of Bends and End of Pipe

1. The payment for blocking of bends and ends of pipes shall be included in the price bid for furnishing, trenching, laying and backfilling the pipe.

I. Disinfection and Dechlorination

1. The required disinfection of pipelines, including all water, followed by disposal of the chlorinated water used in the disinfection process shall be billed to the CONTRACTOR by the Letcher County Water and Sewer Commission, per section 3.03.

J. Tracing Wire or Tape

1. The cost of tracing wire or tape installed with nonmetallic pipe shall be included in the price bid for furnishing, trenching, laying and backfilling the pipe.

END OF SECTION

SECTION 02830

FENCING

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Provide all labor, materials, equipment and services required to install fencing as shown on the Contract Drawings and as specified herein.

1.02 RELATED WORK

- A. Special sequence or schedule requirements (if any) are specified in Section 01010 - Summary of Work.
- B. Concrete is specified in Division 3.

1.03 QUALIFICATIONS

- A. The fencing shall be furnished and installed by a manufacturer and supplier who are reputable and qualified in the design, fabrication, and installation of fencing in accordance with best practices and methods.

1.04 SUBMITTALS

- A. Shop drawings and other items needed to establish compliance with the Drawings and these Specifications shall be submitted to the ENGINEER in accordance with Section 01300 - Submittals.

1.05 SYSTEM WARRANTY

- A. Refer to Division 0 and 1 for warranty requirements.

PART 2 PRODUCTS

2.01 SECURITY FENCING

A. General

- 1. Fencing shall be woven wire, chain link type, and shall be 8 feet high overall. Fabric shall be 7 feet high with 1 foot of height of three-strand barbed wire overhanging outside at a 45 degree angle.

B. Fittings

- 1. All fittings necessary to make a complete installation shall be malleable iron, pressed steel, aluminum or forgings. All ferrous materials shall be thoroughly galvanized by the hot dip method as specified in ASTM A 525-81.

TABLE 1
CHAIN LINK FRAMEWORK TABLE
(Schedule 40)

Size Pipe	Weights Lbs. Per Ft.	Depth	Concrete Diameter
1 5/8" O.D.	2.27 lbs.		
2" O.D.	2.72 lbs.		
2 1/2" O.D.	3.65 lbs.	30"	10 Inches
3" O.D.	5.79 lbs.	3 Ft.	12 Inches
4" O.D.	9.11 lbs.	3 Ft.	12 Inches
6 5/8" O.D.	8.97 lbs.	4 Ft.	14 Inches
8 5/8" O.D.	5.00 lbs.	4 Ft.	16 Inches

C. Corner, Terminal and Pull Posts

1. Corner, terminal and pull posts shall be hot galvanized inside and outside at a rate of 2.0 oz. per square foot of actual surface area. The 3 inch outside diameter seamless steel pipe shall weigh 5.79 pounds per foot and extend 3 feet below ground level. The posts shall extend high enough to allow attachment of barbed wire by 3 tension bands equally spaced to give a uniform appearance. All posts shall be capped with a heavy malleable iron top, of bullet type construction, to exclude moisture.
2. SS-40 pipe, as manufactured by Allied Tube and Conduit Corp. or equal, may be substituted for Sch. 40 pipe. The SS-40 pipe sizes may be less than the Sch. 40 sizes but shall have greater strength.

D. Line Posts

1. Line posts shall be 2-1/2 inch diameter high carbon seamless steel pipe, hot galvanized inside and outside at a rate of 2.0 oz. per square foot of actual surface area. The 2-1/2 inch pipe shall weigh 3.65 lbs. per foot and extend 30 inches below ground level. Line posts shall be capped with a barbed wire extension arm as specified herein.
2. SS-40 pipe, as manufactured by Allied Tube and Conduit Corp. or equal, may be substituted for Sch. 40 pipe. The SS-40 pipe sizes may be less than the Sch. 40 sizes but shall have greater strength.

E. Gate Posts

1. The posts shall be in conformance with the "Gate Post Schedule" and shall be capped with a heavy malleable iron top, of bullet type construction to exclude moisture. Gate posts shall be coated inside and outside with hot galvanized at a rate of 2.0 oz. per square foot of surface area. Posts will extend high enough to allow attachment of barbed wire by 3 tension bands equally spaced to give a uniform appearance.

2. GATE POST SCHEDULE

<u>Single Gates</u>	<u>Double Gates</u>	<u>Schedule 40</u>
Up thru 5'	Up thru 10'	3" O.D.
Over 5' thru 8'	Over 10' thru 16'	4" O.D.
Over 8' thru 12'	Over 16' thru 24'	6 5/8" O.D.
Over 12' thru 18'	Over 24' thru 36'	8 5/8" O.D.

3. SS-40 pipe, as manufactured by Allied Tube and Conduit Corp. or equal, may be substituted for Sch. 40 pipe. The SS-40 pipe sizes may be less than the Sch. 40 sizes but shall have greater strength.

F. Rails

1. Top rails and brace rails shall be 1-5/8 inch outside diameter seamless steel tubing, weighing 2.27 pounds per foot, hot galvanized at a rate of 2.0 oz. per square foot of actual surface area. Rails shall be not less than 20 feet in length jointed with extra long pressed steel sleeves as specified herein.
2. SS-40 pipe, as manufactured by Allied Tube and Conduit Corp. or equal, may be substituted for Sch. 40 pipe. The SS-40 pipe sizes may be less than the Sch. 40 sizes but shall have greater strength.

G. Fabric

1. The fabric shall be aluminum coated steel to meet ASTM A 491-80 composed of individual wire pickets, helically wound and interwoven from No. 9 gauge steel wire to form a continuous chain link fabric having a 2 inch mesh. Both the top and bottom edges shall be twist construction. Basic steel wire shall conform to the following:

Carbon	.18 - .31
Manganese	.60 - .90
Phosphorous	.040 Max.
Sulphur	.050 Max.

2. The aluminum coating weight shall be a minimum of 0.40 ozs. per square foot of wire surface. The breaking strength of the aluminum coated wire shall be a minimum of 1,290 ft.-lbs.

H. Gates

1. Swing frames shall be 2 inches outside diameter galvanized seamless steel pipe weighing 2.72 lbs. per foot, corners fitted with rigid watertight heavy malleable iron castings or electrically welded joints. Internal bracing shall be of 1-5/8 inch outside diameter galvanized seamless steel pipe weighing 2.27 lbs. per foot.

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2. SS-40 pipe, as manufactured by Allied Tube and Conduit Corp. or equal, may be substituted for Sch. 40 pipe. The SS-40 pipe sizes may be less than the Sch. 40 sizes but shall have greater strength.
 3. Fabric - See 2.01 G. this Section.
 4. Gate hinges shall be double clamping offset type allowing gates to swing back parallel with line of fence. They shall be of malleable iron and forged steel heavily galvanized.
 5. Gate latches shall be of the eccentric double locking type which engage the strikes securely bolted to either gate frame or gate post at both the top and bottom. In the case of double gates, latches shall also engage a heavy malleable iron non-freezing gate stop anchored in concrete footing. Latches shall be equipped for locking with padlock.
 6. Gate keepers shall be furnished with each gate frame to automatically engage gate frame when swung to open position.
 7. Barbed wire shall be 3 strands each of two No. 12-1/2 gauge twisted copper bearing steel line wires, hot dipped aluminum per ASTM A 585-81 for Class II coating. The weight of the coating shall be 0.30 oz. per square foot of surface area. The barbs shall be No. 14 gauge aluminum four-point barbs, spaced not more than 4 inches apart.
 8. Gate Posts - See 2.01 E. this Section.
- I. Chain Link Special Appurtenances (Per ASTM F 626-79)
1. Each line post shall be capped with a hot dipped galvanized barbed wire extension arm capable of passing top rail. The arm shall be of pressed steel riveted to a malleable iron base at a 45 degree angle for carrying three strands of barbed wire.
 2. Brace and tension bands shall be beveled edge type fabricated from pressed steel or aluminum. Steel bands shall be hot dipped galvanized with a minimum of 1.2 oz. of zinc coating per square foot of surface area. Brace bands shall be a minimum of 12 gauge in thickness and a minimum width of 3/4 inch or 19.05 mm. Tension bands shall be a minimum of 14 gauge with a minimum of 3/4 inch or 19.05 mm in width.
 3. All post caps and rail ends shall be designed to fit snugly over post and prevent moisture from entering the inside of the tube. Post caps shall be fabricated from malleable iron, pressed steel or aluminum. Line post caps shall be designed to allow top rail to pass through. All ferrous materials shall be thoroughly galvanized by the hot dip method with a minimum of 1.2 oz. of zinc coating per square foot of surface area.
 4. Top rail sleeve shall be fabricated from pressed steel or round steel tubing. Sleeve shall be hot dip galvanized with a minimum of 1.2 oz. of

zinc coating per square foot of surface area. The design of the sleeve shall be such that no movement along the rail can take place upon installation.

5. Tension bars for attaching fabric to terminal post shall be a minimum of 3/16 inch thickness by 3/4 inch in width. The length shall be a minimum of 2 inches less than the full height of the chain link fabric.
6. Truss rods shall be a minimum of 5/16 inch in diameter fabricated from merchant quality steel rod and hot dip galvanized with a minimum of 1.2 oz. of zinc coating per square foot of surface area. All rods shall be designed and equipped with a truss tightener.
7. Aluminum ties shall be used for attaching fabric to top rail, brace rails and line post. The aluminum ties shall be 9 gauge round wire of Alloy 1100-H 14 or equal.
8. Carriage bolts shall be hot dip galvanized or aluminum, 5/16" x 1-1/4", with nut and shall be used in conjunction with brace and tension bands. Galvanized bolts and nuts shall be coated in accordance with ASTM A 153-80. Larger bolts as required at gates or latches shall be galvanized coated in accordance with ASTM A 153-80.

2.02 FARM WIRE FENCING

A. General

1. Fencing shall be farm type fabric with 2 strands of galvanized barbed wire stretched between 9 inch diameter treated pine corner and/or pull posts set in concrete. Intermediate or line posts shall be 5-1/2 inch diameter treated pine post or standard painted steel tee section post spaced on 8 foot centers. Every third post shall be a 5-1/2 inch diameter treated pine post. The corner posts shall be braced from the center of corner posts to the center of a 6 inch diameter treated pine brace post located 8 feet from the corner post. Bracing shall be provided with a 4 inch diameter treated pine post keyed and doweled in place. Cross bracing shall be accomplished with 3 strands of No. 9 gauge galvanized brace wire wrapped from top of brace post to bottom of corner post. The tensioning adjustment shall be made with an extra heavy galvanized turnbuckle attached to a 3/4" eye bolt through the 9" corner post. The brace wire shall be tightened to a taut position and locked in place by a method acceptable to the ENGINEER.
2. Layouts of fencing and gate are as shown on the Drawings. Copies of shop drawings and descriptive literature of fencing materials shall be submitted to the ENGINEER for review and acceptance prior to the use of materials.

B. Material

1. Fence fabric shall be farm type 1047-6-9, 10 wires horizontal, 47 inches high, 6 inch stays with No. 9 gauge wire throughout with Class 2 (0.60 oz/ft.) galvanized coating per ASTM A 116-81.
2. Barbed wire shall be 2 strands each of two No. 12-1/2 gauge twisted copper bearing steel wires, hot galvanized after weaving, with No. 14 gauge aluminum 4 point barbs spaced not more than 4 inches apart. The zinc coated (galvanized) steel barbed wire shall be produced and tested in accordance with ASTM A 121-81 for Class 2 coating (0.50 oz. per ft.).
3. Wood line posts shall be 5-1/2 inch dia. x 7'-6" long pressure treated pine in accordance with the American Wood Preserver's Association Standard C5-81.
4. Steel line post shall be the standard painted steel tee section, 7'-6" long, with hooks to clasp wire.
5. Corner posts shall be 9 inch diameter x 9 feet long pressure treated pine in accordance with the American Wood Preserver's Association Standard C5-81.
6. Farm gate shall be made of tubular construction from 1-1/2 inch O.D. pre-galvanized pipe, 50 inches in height with 7 bars horizontally with spacing being closer toward the bottom.

2.03 FARM PLANK FENCING

A. General

1. Fencing shall be farm type, 4 board treated rough oak planks, treated wood posts (40 penetration) set on 7.81 feet (7'-10") centers with a treated wood batten at each post. The fence shall be 54 inches in height with a 7 inch gap between each board. The layout of the fence line and gates shall be as shown on the Drawings.

B. Material

1. All posts shall be 5-1/2 inch diameter 7'-6" long pressure treated to 0.40 penetration (min.) in accordance with the American Wood Preserver's Association Standard C5-81. All posts shall be uniform without bows or crooks. The ENGINEER reserves the right to reject any post not meeting the above stated requirements.
2. Planks shall be rough cut oak with the minimum dimensions of 6" wide, 1" thick and running 16' in length, pressure treated to 0.40 penetration per requirements established by the American Wood Preserver's Association C5-81.

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3. Post bats shall be used at each post to cover joints. The bat shall be flush with the top of top plank and extend 2" below bottom plank of fence. Bats shall meet the same quality requirements for wood and preservatives as specified for planks.

PART 3 EXECUTION

3.01 DELIVERY, STORAGE AND HANDLING

- A. Special provisions for material and equipment are given in Section 01600.

3.02 SITE PREPARATION

- A. The location of fence lines, gates and terminal posts shall be as shown on the Drawings. Prior to construction the CONTRACTOR shall locate and flag all underground utilities in or about the fence construction. Adequate clearing and grading shall be done prior to fence construction.

3.03 SECURITY FENCE INSTALLATION

A. Posts

1. All posts shall be set 10 feet or less on centers equally spaced between pull posts in a hole filled with concrete as required per Table 1. All concrete shall be left 2 inches below grade to allow for cover with sod, blacktop or other cover material. Posts shall be accurately lined and plumbed. Intermediate pull posts with bracing shall be equally spaced when a straight run becomes greater than 300 feet in length. If solid rock is encountered, excavation shall be at no extra cost to the OWNER.

B. Terminal, Gate, Pull and Corner Post Bracing

1. A center rail is required with horizontal braces and truss rod to adjacent line post, securely fastened with adequate adjustment.

C. Top Rail

1. The top rail shall run through the openings in the line post tops on a continuous grade uniformly parallel with the ground surface. Connection to the corner, gate, terminal and pull posts shall be with brace bands and rail ends. Offsets at corners will not be permitted.

D. Fabric Stretching

1. Two stretcher bars shall be threaded through the fabric from top to bottom at a location in the center of the fence section to be stretched. The bars shall be adequately spaced such that when stretched the installer has room to thread a loose picket link down through the meshing links of the 2 ends to make a perfect jointing. The stretching shall be done with 2 blocks and when released the fabric shall be taut along any

point of the fence line. The top selvage shall be dressed above the top rail and the fabric secured with tie wires spaced not more than 24" apart and uniformly tied. The fabric shall be fastened to the line posts with specified tie wires spaced not more than 14 inches on center uniformly tied.

E. Barb Wire Stretching

1. Block and tackles and come along shall be used to string barbed wire. Wire shall be placed in the openings provided in the barb arms, and locked in place by sliding the locking wire down inside the V-channel and over the barbed wire.

F. Repair of Galvanized Surfaces

1. Galvanized surfaces damaged by welding or other reasons shall be repaired according to Federal Specification MIL-P-21035 (Galvanizing Repair Spec.) as follows:
 - (a) Remove foreign matter from both damaged and contiguous undamaged area by wire brushing and cleaning with metal conditioner recommended by cold galvanizing coating manufacturer.
 - (b) Apply 2 coats of cold galvanizing coating to damaged area, ensuring an overlap of the surrounding undamaged galvanizing for continuity of galvanic protection. Cold galvanizing coating shall be Z.R.C. Chemical Products Co., "Z.R.C. Cold Galvanizing" or Galvicon Corp., "Cold Galvanizing," or equal.

3.04 FARM WIRE FENCING INSTALLATION

A. Corner Posts

1. Corner posts shall be placed, true to line and plumb at least 36 inches in the ground in concrete according to the concrete requirements shown in Table 2 in this group of the Specifications. All corner posts shall be braced to the first line post or brace post. This post shall be a standard specified 6" diameter wood post set in concrete in accordance with Table 2 of this group of the Specifications. Bracing shall be with a 4" diameter post keyed and doweled from center of corner post to the center of brace post. Wire cross bracing shall be with 3 strands of No. 9 gauge galvanized brace wire wrapped from bottom of corner post to top of brace post. Adjustment on the brace wire shall be with an extra heavy galvanized turnbuckle attached to a 3/4" eye bolt through the 9" corner post. The brace wire shall be tightened to a taut position and locked in place.

B. Line Posts

1. All line posts shall be placed on 8 foot centers at least 30 inches in the ground true to-line and plumb. Wood line posts shall be either driven into place or set in an augered hole. If augered, the hole shall be backfilled with dense graded aggregate (DGA), and hand tamped until post is tight. Mechanically tamped earth backfill will also be acceptable. Steel line posts shall be driven into place by an acceptable method which prevents damage to post.

C. Gate Posts

1. Gate posts shall be placed true to line and plumb at least 36 inches in the ground and set in concrete in accordance with concrete requirements per Table 2 of this group of the Specifications. All gate posts shall be braced back to first line post or brace post. This post shall be a 6" diameter treated wood post set in concrete. Bracing shall be with a 4" diameter post keyed and doweled from bottom of gate post to top of brace post. Wire bracing shall be with 3 strands of No. 9 gauge galvanized wire wrapped from bottom of corner post to top of brace post. Adjustment on the brace wire shall be with an extra heavy galvanized turnbuckle attached to a 3/4" eye bolt which shall be bolted through the 9" corner post. The brace wire shall be tightened to a taut position and locked in place.

D. TABLE 2: Concrete Requirements for Corner, Brace and Gate Posts

Description	Depth	Concrete Dia.
9" Corner Post	3 Ft.	16 Inches
6" Brace Post	3 Ft.	12 Inches
9" Gate Post	3 Ft.	16 Inches
9" Pull Post	3 Ft.	16 Inches

E. Fabric

1. Fence fabric shall be stretched taut between corner posts, intermediate pull posts and/or gate posts. No splicing will be permitted. Fabric shall connect to corner posts, pull posts or gate posts by wrapping the horizontal wire strands twice around post before connecting to line fabric. Fabric shall be fastened to wood line post with 1-1/4 inch staples at a rate of one per horizontal strand. Wire hooks or ties shall be used to secure fabric to steel line posts.

F. Hanging Gates

1. Gates shall be swung plumb and level and high enough to prevent dragging. Latches shall be properly fitted and firmly secured to posts. Means shall be provided for latching as well as retaining gate in the open position.

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G. Barbed Wire Stretching

1. The 2 strands of barbed wire shall be stretched to accepted tension with stretchers specifically manufactured for that purpose. All strands shall be double stapled to each wood line post and tied at each steel line post. OWNER may require at no extra cost, for strands of barbed wire to be alternated on each side of posts.

3.05 FARM PLANK FENCING INSTALLATION

A. Posts

1. All posts shall be placed at least 30 inches in the ground true to line and plumb on 7.81 feet (7'-10") centers. Posts shall be either driven in place or set in augered hole. If augered, each hole shall be backfilled with dense graded aggregate (DGA) hand tamped until post is tight. Mechanically tamped earth backfill will also be acceptable.

B. Planks

1. Plank ends shall be trimmed where cracking exists. Top plank or top rail shall be installed first by temporarily tacking in order to check alignment. Adjustment shall be made if a smooth flowing fence is not attained. Once the top rail has been installed to the ENGINEER'S satisfaction the CONTRACTOR shall install the remaining 3 planks. Each board shall be nailed with 3-#10 screw type nails per post.
2. The battens shall be placed at each post to cover post and plank joints. They shall be flush with top rail and be nailed with #10 screw type nails, 2 at the top, 2 at the bottom and 2 in the middle.

3.06 CLEAN-UP

- A. CONTRACTOR is responsible for removal of all excess material, earth, etc. due to fence construction.
- B. Earth shall be slightly mounded around each post to enhance drainage.

3.07 METHOD OF PAYMENT

- A. Payment for all fencing work under this Contract shall be specified on the bid form and in the Contract Agreement.

END OF SECTION

SECTION 02930

SEEDING

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Provide all labor, materials, equipment and services required to perform sodding and seeding as shown on the Contract Drawings and as specified herein.
- B. All areas disturbed by construction operations shall receive a protective cover of vegetation. The work shall consist of preparing the area for treatment, furnishing and placing soil amendments, fertilizer, sod, seed, inoculants, mulch and plantings as specified in the designated areas.

1.02 RELATED WORK

- A. Special requirements for materials and equipment are given in Sections 01300 and 01600.
- B. Special sequence or schedule requirements (if any) are specified in Section 01010 - Summary of Work.

1.03 QUALIFICATIONS

- A. The work shall be done by a provider who is experienced, reputable, and qualified in the tasks required.

1.04 SUBMITTALS

- A. Shop Drawings and other items needed to establish compliance with the Drawings and these Specifications shall be submitted to the ENGINEER in accordance with Section 01300 - Submittals.
- B. Where fertilizer is furnished from bulk storage, the CONTRACTOR shall furnish a supplier's certification of analysis and weight. When required by the Contract, a representative sample of the fertilizer shall be furnished the OWNER for chemical analysis.

1.05 WARRANTY

- A. Refer to Division 0 and 1 for warranty requirements.

PART 2 PRODUCTS

2.01 SEED

- A. All seed shall conform to the current rules and regulations of the state where it is being used and from the latest crop available. It shall meet or exceed the standards for purity and germination listed herein.
- B. Seed shall be labeled in accordance with the state laws and the U.S. Department of Agriculture Rules and Regulations under the Federal Seed Act in effect on the date of invitations for bids. Bag tag figures will be evidence of purity and germination. No seed will be accepted with a date of test of more than 9 months prior to the date of delivery to the site.
- C. The seed for use on this project shall be of the type as listed below with the listed germination and purity qualifications.

<u>Species</u>	<u>% Purity</u>	<u>% Germination</u>
Tall fescue (KY-31) (<u>Festuca arundinacea</u>)	98.5	80
Ryegrass (<u>Lolium multiflorum</u>)	98.0	90
Oats (<u>Avena sativa</u>)	98.0	90
Rye, grain (<u>Secale cereale</u>)	97.0	85
Redtop (<u>Agrostis alba</u>)	90.0	80
Ky. Bluegrass (<u>Poa pratensis</u>)	81.0	70

2.02 FERTILIZER

- A. Unless otherwise specified the fertilizer shall be a commercial grade fertilizer or as specified herein. The fertilizer shall meet the standard for grade and quality specified by state law.

2.03 INOCULANTS

- A. The inoculant for treating legume seeds shall be a pure culture of nitrogen-fixing bacteria prepared specifically for the species and shall not be used later than the date indicated on the container or as otherwise specified. A mixing medium, as recommended by the manufacturer, shall be used to bond the inoculant to the seed. Two times the amount of the inoculant recommended by the manufacturer shall be used, except when seed is applied by use of hydraulic seeder, in which case 4 times the amount of inoculant recommended by the manufacturer shall be used. Seed shall be sown within 24 hours of treatment and shall not remain in the hydraulic seeder longer than 4 hours.

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2.04 SOIL AMENDMENTS

- A. Lime shall consist of standard ground agricultural limestone, or equal. Standard ground agricultural limestone is defined as ground limestone meeting current requirements of the State Department of Agriculture. Agricultural lime or other needed soil amendments will be uniformly applied at the rate specified herein.

2.05 ASPHALT EMULSION

- A. Asphalt emulsion shall conform to the requirements of ASTM D 977-80, "Emulsified Asphalt." The emulsified asphalt may be rapid, medium, or slow cure materials.

2.06 STRAW MULCH MATERIALS

- A. Straw mulch materials shall consist of wheat, oat, or rye straw, hay, grass clippings cut from any native grasses or other plants acceptable to the ENGINEER. The mulch material shall be air dry, reasonably light in color, and shall not be musty, moldy, caked, or otherwise of low quality. The use of mulch that contains noxious weeds will not be permitted. The CONTRACTOR shall provide a method satisfactory to the ENGINEER for determining weight of mulch furnished.

2.07 OTHER MULCH MATERIALS

- A. Mulching materials, such as wood cellulose fiber mulch, emulsion type, synthetic fiber mulch, netting, mesh, and other mulching materials that may be required for specialized locations and conditions, when specified, must be accompanied by the manufacturer's recommendations for methods of application.

PART 3 EXECUTION

3.01 EXTENT

A. Unit Price Contracts

1. Sodding

- a. Where sod is destroyed in areas maintained equivalent to residence yards, it shall be replaced on slightly ridged backfill on trench, and where destroyed in areas adjacent to the trench, it shall be replaced by the CONTRACTOR with fresh sod. Sodding will be required only on those Contracts where specifically shown on the Drawings or called for in the Specifications or Form of Proposal.

2. Seeding

- a. Where lawns, pastures, thin grass or cover crops are destroyed by trenching, laying, backfilling, or tunneling operations, surface shall be prepared by disking, fertilizing and seeding. Seeding, fertilizing, and mulching shall be included in the price for trench-

ing and backfilling. The timing of this operation shall be controlled by the ENGINEER. Requirements of the Department of Highways for reseeding shall take precedence over these Specifications where they are involved.

- b. When the construction project is located on privately owned property on easements acquired by the OWNER and the individual landowner requires the cover grass to be the same as present at the beginning of construction, the CONTRACTOR shall supply the seed required by the landowner. Seeding and fertilizing in such instances, shall be at the rate as recommended by the seed producer with soil preparation and mulching as stated herein.
- c. When the construction project encroaches within the rights-of-way of the Department of Highways, the seed mixture, application rate and method of mulching shall be as required by the Department of Highways.

3. CONTRACTOR'S Options

- a. Where surface grasses and cover are similar in nature throughout the length of the project, the CONTRACTOR may provide seed of one type or mixture for the entire project provided there are no objections by individual landowners involved and with permission of the OWNER and ENGINEER. In such cases, the seed type and/or mixture shall be that specified for lawn areas. Pasture and/or cover crop mixtures shall not be used for lawn application for any reason.
- b. When construction facilities or construction operations are located on or encroach on privately owned properties, the CONTRACTOR may, at his election, negotiate with the individual landowners for restoration of the surface. This negotiation and settlement may be for materials or labor or both as agreeable to the individual property owner. In such cases, the CONTRACTOR shall obtain from the individual landowner a "Release of Claims" releasing the OWNER from any further liability for surface restoration, a copy of which shall be provided for the OWNER and ENGINEER. This option shall apply to surface restoration only. The CONTRACTOR shall be responsible for cleanup and regrading work and for any settlement of the trench or graded area within the one year guarantee period.

3.02 SOIL PREPARATION

- A. All areas to be seeded or sodded shall be thoroughly cleaned, removing all debris of whatever nature. After the area has been cleaned, the soil for seeding and sodding shall be prepared as follows:
 - 1. Loosen the soil to a depth of not less than 4 inches.

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2. Work the soil until it is in good condition, raking with hand rake to complete the soil preparation and make final finished grade.
3. On areas to be seeded, the raking in of fertilizer may be done concurrently with raking in of seed as hereinafter specified.

3.03 SEEDING

A. Temporary Cover (All Areas)

1. This item shall consist of seeding a temporary cover of grass, or grass and small grain, on areas disturbed on the construction site which will not be redisturbed within a 60 day period. The determination of the area to be temporarily seeded and the time of seeding shall be controlled by the ENGINEER.
2. The seed mixtures to be used for temporary cover will be governed by the time of year the seeding is accomplished. The mixtures and time of seeding shall be as follows:
 - a. Time of Seeding - 2/15 to 6/1
 - (1) Rye 1-1/2 bushels and ryegrass 25 pounds per acre; or tall fescue 30 pounds and ryegrass 20 pounds per acre.
 - b. Time of Seeding - 6/2 to 8/15
 - (1) Tall fescue 30 pounds and ryegrass 20 pounds per acre; or, spring oats 2 bushels and ryegrass 30 pounds per acre.
 - c. Time of Seeding - 8/16 to 2/14
 - (1) Rye 2 bushels and ryegrass 20 pounds per acre; or, tall fescue 30 pounds and ryegrass 20 pounds per acre.
 - d. Lime will not be required for temporary seeding.
 - e. Fertilize at the rate of 400 pounds per acre of 10-10-10 fertilizer, or equivalent, broadcast uniformly on the area to be seeded.
 - f. All seed shall be broadcast evenly over the area to be seeded and cultipacked or otherwise pressed into the soil. Seed and fertilizer may be mixed together and applied after the seed bed has been prepared.
 - g. Mulch for temporary seeding will not be required except on those areas, in the ENGINEER'S opinion, too steep to hold the seed without protective cover.

B. Seeding (Permanent Cover)

1. This item consists of seeding all areas disturbed during construction. All grading and/or filling of rills and gullies to a cross section acceptable to the ENGINEER shall be included in the seed bed preparation.
 - a. Pastures and Cover Crops
 - (1) All areas to be seeded shall be seeded with 50 pounds of tall fescue (KY-31) per acre, subject to the provisions hereinbefore stated in this Specification group.
 - (2) Prepare seed bed as specified in Article 3.02 of this Specification Section unless instructed otherwise by the ENGINEER. Apply 2 tons of lime per acre.
 - (3) No mulch will be required except when seeding is done during the period October 16 through January 31, or May 2 through July 31, tall fescue straw shall be used at the rate of 2 tons per acre.
 - b. Lawns and Yards
 - (1) This item consists of seeding all areas equivalent to residence lawns or yards disturbed during construction. All grading and filling shall be accomplished in a manner acceptable to the ENGINEER prior to the placement of seed and materials. Seed shall consist of a mixture of one part Red Top and 3 parts high grade Kentucky Bluegrass seed mixed together and broadcast at the rate of 2 lbs. to each 1,000 square feet of surface, to be seeded. Apply 2 tons of lime per acre. Apply 1500 pounds of 10-20-20 fertilizer per acre. Apply mulch at the rate of 2 tons per acre. Mulch shall be applied to all lawn areas regardless of the time seeded.

3.05 MULCHING

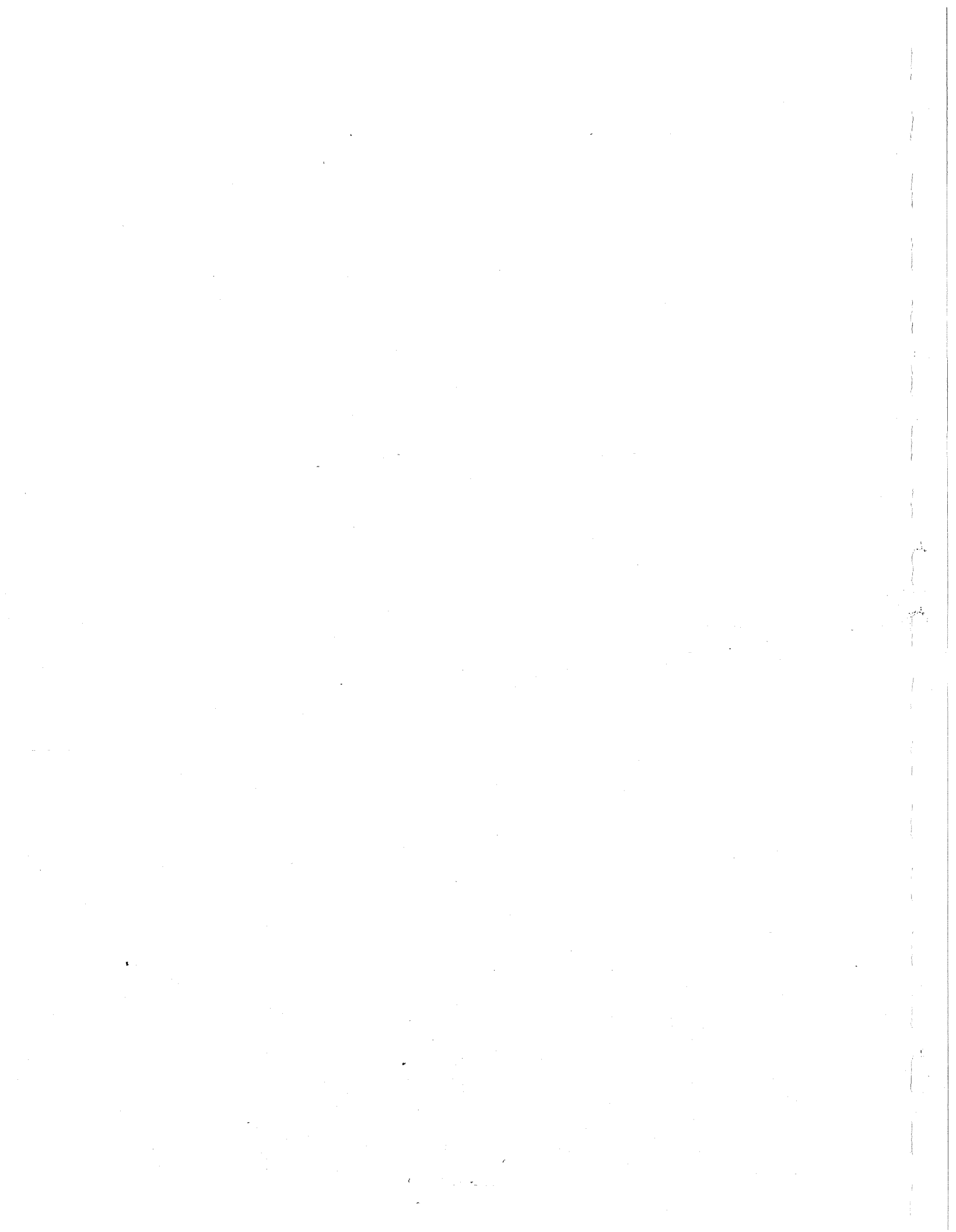
- A. Mulch materials, meeting the requirements of Part 2 of this Specification Section, shall be applied at the rate of 2 tons per acre.
- B. The mulch shall be stabilized by running a "weighted" disk harrow with disks set straight, over the area on the contour, after the mulch has been applied, so as to embed or press a part of the straw into the soil sufficiently to hold it in place. On earth embankments or areas too steep for use of mechanized equipment, the mulch shall be held in place by using small stakes and twine or other method acceptable to the ENGINEER. The blown-on bituminous-treated straw mulch method of placing the mulch, as specified in Section 212.06.03, Method 2 of the Standard Specifications for Road and Bridge Construction of the Kentucky Transportation Cabinet Department of Highways, will be an acceptable placing method.

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- C. Mesh, netting or other special protective cover shall be at locations as shown on the Drawings and shall be installed according to the manufacturer's recommendations.

END OF SECTION

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SECTION 03301

CAST-IN PLACE CONCRETE
(MINOR STRUCTURES)

PART 1 GENERAL

1.01 SUMMARY

- A. This specification delineates the requirements for cast-in place concrete for minor structures including concrete kickers for pipe blocking, sidewalks, collars, manholes, manhole bottoms, pipe cradles, piers and other areas where small quantities of concrete are required. It shall not be used for major structures such as floor slabs, structure or basin walls, roof slabs, or other structural components.

1.02 SCOPE OF WORK

- A. Provide all labor, material, equipment and services to complete all cast-in-place concrete work required by the Project as shown on the Drawings or specified herein.

1.03 REFERENCES

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 185	Specification for Steel, Welded Wire, Fabric, Plain, for Concrete Reinforcement
ASTM A 497	Specification for Welded Deformed Steel Wire Fabric for Concrete Reinforcement
ASTM A 615/A615M	Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM A 616/A616M	Specification for Rail-Steel Deformed and Plain Bars for Concrete Reinforcement
ASTM A 617/A617M	Specification for Axle-Steel Deformed and Plain End Bars for Concrete Reinforcement
ASTM A 706/A706M	Specification for Low-Alloy Steel Deformed Bars for Concrete Reinforcement
ASTM C 33	Specification for Concrete Aggregates

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- ASTM C 150 Specification for Portland Cement
- ASTM C 260 Specification for Air-Entraining Admixtures for Concrete
- ASTM C 494 Specification for Chemical Admixtures for Concrete

1.04 SUBMITTALS

- A. Copies of all materials required to establish compliance with these Specifications shall be submitted in accordance with the provisions of the General Conditions.

1.05 QUALITY ASSURANCE

- A. All work shall be performed to secure for the entire job homogeneous concrete having required strength, durability and weathering resistance, without planes of weakness and other structural defects and free of pronounced honeycombs, air pockets, voids, projections, offsets of plane and other defacements on exposed surfaces.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Do not deliver ready-mixed concrete to job site until ready for placement.
- B. All materials used for on-site mixed concrete shall be kept clean and free from all foreign matter during transportation and handling and kept separate until measured and placed in the mixer.
- C. Store concrete aggregates to prevent contamination or segregation. Store reinforcement of different sizes and shapes in separate piles or racks raised above the ground to avoid excessive rusting.
- D. Protect from contaminants such as grease, oil and dirt. Provide for accurate identification after bundles have been broken and tags removed.

1.07 PROJECT/SITE CONDITIONS

A. Cold Weather

- A. Provide and maintain 50 degrees F minimum concrete temperature. Do not place concrete when ambient temperature is below 40 degrees F. Cover concrete and provide with a source of heat sufficient to maintain 50 degrees F minimum while curing.

B. Hot Weather

- A. Concrete temperature from initial mixing through final cure shall not exceed 90 degrees Fahrenheit. Cool ingredients before mixing, or substitute chip ice for part of required mixing water or use other suitable means to control concrete temperature to prevent rapid drying of newly

placed concrete. Shade the fresh concrete and start curing as soon as the surface is sufficiently hard to permit curing without damage.

PART 2 PRODUCTS

2.01 CONCRETE

A. Mix Design

The concrete mix shall conform to the requirements of the following table according to the class of concrete required. The number in the "Class" column refers to the 28-day compressive strength of the concrete in pounds per square inch (psi).

Class	Minimum Cement Content (Lbs./Cu. Yd.)	*Maximum Slump (Inches)
3000	470	3 to 4
3500	520	3 to 4
4000	550	3 to 4

* Maximum slump unless high range water reducing admixture is used.

B. Area of Application

1. Unless otherwise noted on the Drawings, concrete mixes shall be used as follows:

Class 3000 - kickers for pipe, fittings

Class 3500 - non-reinforced portions of manholes, pipe cradles

Class 4000 - reinforced portions of manholes, sidewalks, piers

2.02 MATERIALS

A. Cement

1. Portland cement for concrete and mortar shall conform to ASTM C 150, Type I or II.

B. Water

1. Water shall be potable.

C. Aggregates

1. Aggregates shall conform to ASTM C 33. Obtain aggregates from one source. Aggregates shall not contain any substance which may be deleteriously reactive with the alkalis in the cement.

D. Admixtures

1. Admixtures for air-entrained concrete shall conform to ASTM C 260, for water reducing (Type A, D or E) accelerating (Type C) and retarding (Type B or D) ASTM C 494. Calcium chloride shall not be used as an admixture. Admixtures shall not be used without prior written approval of the ENGINEER.

E. Reinforcement

1. Reinforcing Bars

Reinforcing bars shall conform to ASTM A 615/A615M Grade 60, ASTM A 616/A616M Grade 60, ASTM A 617/A617M Grade 60 or ASTM A 706/A706M Grade 60 as applicable.

2. Welded Wire Fabric

Welded wire fabric shall conform to ASTM A 497 or ASTM A 185.

PART 3 EXECUTION

3.01 FORMS

- A. Forms shall be used to confine concrete and shape it to the required dimensions. Set forms true to line and grade and make mortar tight. Chamfer above grade exposed joints, edges and external corners 3/4 inch, unless otherwise indicated. Earth cuts may be used as forms for footing vertical surfaces, if sides are sharp and true, and not exposed in finished structure.

3.02 PLACING REINFORCEMENT AND MISCELLANEOUS MATERIALS

- A. Provide bars, wire fabric and other reinforcing materials, including wire ties, supports and other devices necessary to install and secure the reinforcement.

3.03 CONTROL AND CONSTRUCTION JOINTS

- A. For sidewalks, provide control joints spaced at an interval equal to the width of the sidewalk, the minimum spacing of 5 feet. Cut joints 1 inch deep with a jointing tool after the surface has been finished. Provide 0.5 inch thick transverse expansion joints at changes in direction, where sidewalk abuts curb, steps, rigid pavement or other similar structures; space joints not more than 40 feet apart. Limit variation in cross section to 1/4 inch in 5 feet.

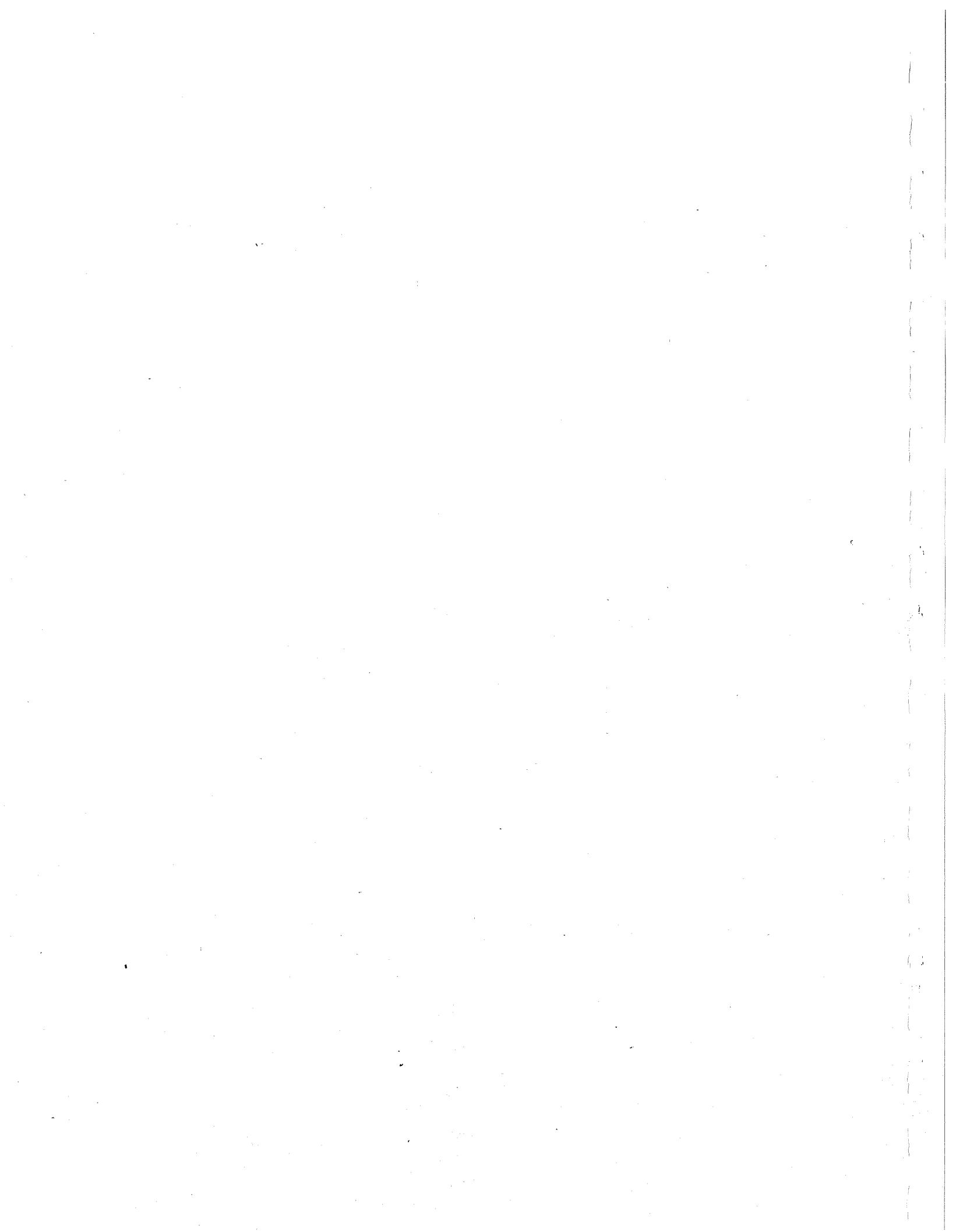
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3.04 CURING AND PROTECTION

- A. Protect concrete from injurious action by sun, wind, rain, flowing water or mechanical injury. Do not allow concrete to dry out from time of placement until the expiration of the curing period. Forms may be removed 48 hours after concrete placement.

END OF SECTION

03301-5



SECTION 05520

METAL FABRICATIONS

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Provide all labor, materials, and equipment required to construct and install metal fabrications as shown on the Drawings and specified herein. Included in this section are handrails, grating, nuts, bolts, anchors, hatches, ladders, and stairs.

1.02 RELATED WORK NOT INCLUDED

- A. Concrete work is included in Division 3.
- B. Castings are included in Division 5, Section 05540.
- C. Weirs and supports are included in Division 5, Section 05565.
- D. Flashing and sheet metal work for roofing is included in Division 7, Section 07600.
- E. Painting is included in Division 9, Section 09900.

1.03 QUALITY ASSURANCE

- A. All fabricated materials shall be of the highest quality, free of structural, handling, and workmanship defects.
- B. Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

1.04 SUBMITTALS

A. Shop Drawings

1. The CONTRACTOR shall submit to the ENGINEER in accordance with Division 1, Section 01300 detailed shop drawings of all materials to be fabricated, and shall receive the ENGINEER's certification of review before fabrication. Include plans, elevations and details of sections and connections. Show anchorage and accessory items. Provide templates for anchor bolt installation by others. Include any requirements for surface preparation, paint products, or grout.
2. Where materials or fabrications are indicated to comply with certain requirements for design loadings, include structural computations, material properties and other information needed for structural analysis.

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This shall not relieve the CONTRACTOR of responsibility for all errors, omissions, and deviations of his shop drawings from the Drawings and Specifications and from requirements of final results called for in the Drawings and Specifications.

B. Samples

1. The CONTRACTOR shall submit 2 sets of representative samples of materials and finished products as may be requested by the ENGINEER, or as specified herein.

PART 2 PRODUCTS

2.01 MATERIALS

A. Steel

1. Steel fabrication shall be done in conformity with the "AISC Load and Resistance Factor Design Specification for Structural Steel Buildings," Second Edition dated December 1, 1993, latest revision.
2. Prime and paint in accordance with Division 9, unless otherwise required or permitted.
3. Unless otherwise noted on the Drawings or in the Specifications, galvanizing shall be by hotdip process in accordance with ASTM A 525-93, Coating Designation G90 (previous Coating Class Commercial 1.25 oz. per sq. ft.).
4. Damaged zinc coating shall be repaired according to Federal Specification DOD-21035A (Galvanizing Repair Spec.) and ASTM A 780-93a as follows:
 - a. Remove foreign matter from both damaged and contiguous undamaged area by wire brushing and cleaning with metal conditioner recommended by cold galvanizing coating manufacturer.
 - b. Apply 2 coats of cold galvanizing coating to damaged area, ensuring an overlap of the surrounding undamaged galvanizing for continuity of galvanic protection. Cold galvanizing coating shall be Z.R.C. Chemical Products Co., "Z.R.C. Cold Galvanizing" or Galvicon Corp., "Cold Galvanizing," or equal.

B. Aluminum

1. Aluminum shall have a high resistance to corrosion and shall be Alloys 6061-T6, 6062-T6, 6063-T5, 6063-T6, or 6105-T5 for wrought products such as rods, bars, standard structural shapes, extrusions, and forgings; and Alloy 214 for castings, or equal.

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2. Aluminum fabrication shall be in accordance with ASCE the Aluminum Association "Specifications for Aluminum Structures," latest revision. Welding shall be done by the argon-shielded tungsten-arc method or the automatic or semi-automatic argon-shielded consumable-electrode method, or equal. Welding rods and electrodes shall be in strict accordance with above specifications.
3. Where anodic coating is required and type is not specified or shown on the Drawings, coating shall be Class II Clear (204-R1). Anodic coatings shall conform to the following requirements:
 - a. Clear Anodic Coatings
 - (1) Class II Clear (204-R1) (0.4 Mil Coating)
 - (a) The exposed surfaces of aluminum shall be cleaned of all fabricating oils and foreign matter, given a medium caustic etch pretreatment.
 - (2) Class I Clear (215-R1) (0.7 Mil Coating)
 - b. Color Anodic Coatings
 - (1) All aluminum parts (both extrusion and sheet stock) shall be of a controlled aluminum alloy and temper suitable for receiving an electrochemically produced hard anodic oxide coating. All aluminum parts (both extrusion and sheet stock) shall receive a caustic etch pretreatment to remove all surface foreign matter followed by an electrochemically produced anodic oxide coating having a minimum coating thickness of 0.7 mil. Color shall be specified by the OWNER and range samples shall be submitted to establish the upper and lower limits of color variations.

2.02 NUTS AND BOLTS

- A. Unless otherwise shown on the Drawings or required in other parts of these Specifications, all nuts and bolts shall be in accordance with ASTM A 307-93a, Grade A and shall be electrogalvanized according to ASTM B 633-85 (1994).
- B. All nuts, bolts, washers and accessories in contact with water, in any moist atmosphere or damp area such as occurs above water, or embedded in concrete exposed to the weather, shall be Type 302 or 304 stainless steel. Stainless steel nuts, bolts, and washers shall be used to fasten aluminum to all materials including aluminum.

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2.03 CONCRETE ANCHORS

- A. Sizes and spacings or numbers of anchors shall be shown on the Drawings and materials shall comply with exposure requirements listed under Nuts and Bolts above. All anchors used for securing moving or vibrating equipment (pumps, motors, gears, sluice gates, conveyors, etc.), shall be of the cast-in-place type.
- B. The size and number of anchors shall be approved by the equipment manufacturer.
- C. Unless specifically noted otherwise on the Drawings or Specifications, concrete anchors for other applications shall be chemical grout-type anchors equal to Hilti "HVA Adhesive Anchor," or Ramset "Chemset Chemical Anchors." Installation shall be in strict accordance with the manufacturer's recommendations which shall be available on the job site.

2.04 ALUMINUM LADDERS

- A. Aluminum ladders shall be fabricated as detailed on the Drawings.

2.05 HATCHES

- A. Metal hatches shall be fabricated as detailed on the Drawings.

2.06 GUARD POST

- A. Concrete filled, steel posts shall be as shown on Drawings.

PART 3 EXECUTION

3.01 GENERAL

- A. The CONTRACTOR shall be responsible for all errors, omissions, and deviations of the shop drawings from the Drawings and Specifications. Any errors or omissions shall be brought to the attention of the ENGINEER whose interpretation and instructions shall be received before proceeding with the fabrication of that portion of the work.
- B. Manufacturers' printed installation instructions shall be strictly followed and any conflicts with the shop drawings and/or Contract Drawings shall be directed to the ENGINEER for resolution before proceeding with installation.
- C. All base plates, inserts and anchorages shown embedded in concrete shall be accurately located and secured before placing concrete as per a manufacturer supplied template. All structural members and components shall be accurately leveled, plumbed and secured at locations shown on the Drawings.

D. Painting

1. Cleaning and painting of all fabricated materials shall be in strict accordance with Division 9, Section 09900, of these Specifications.

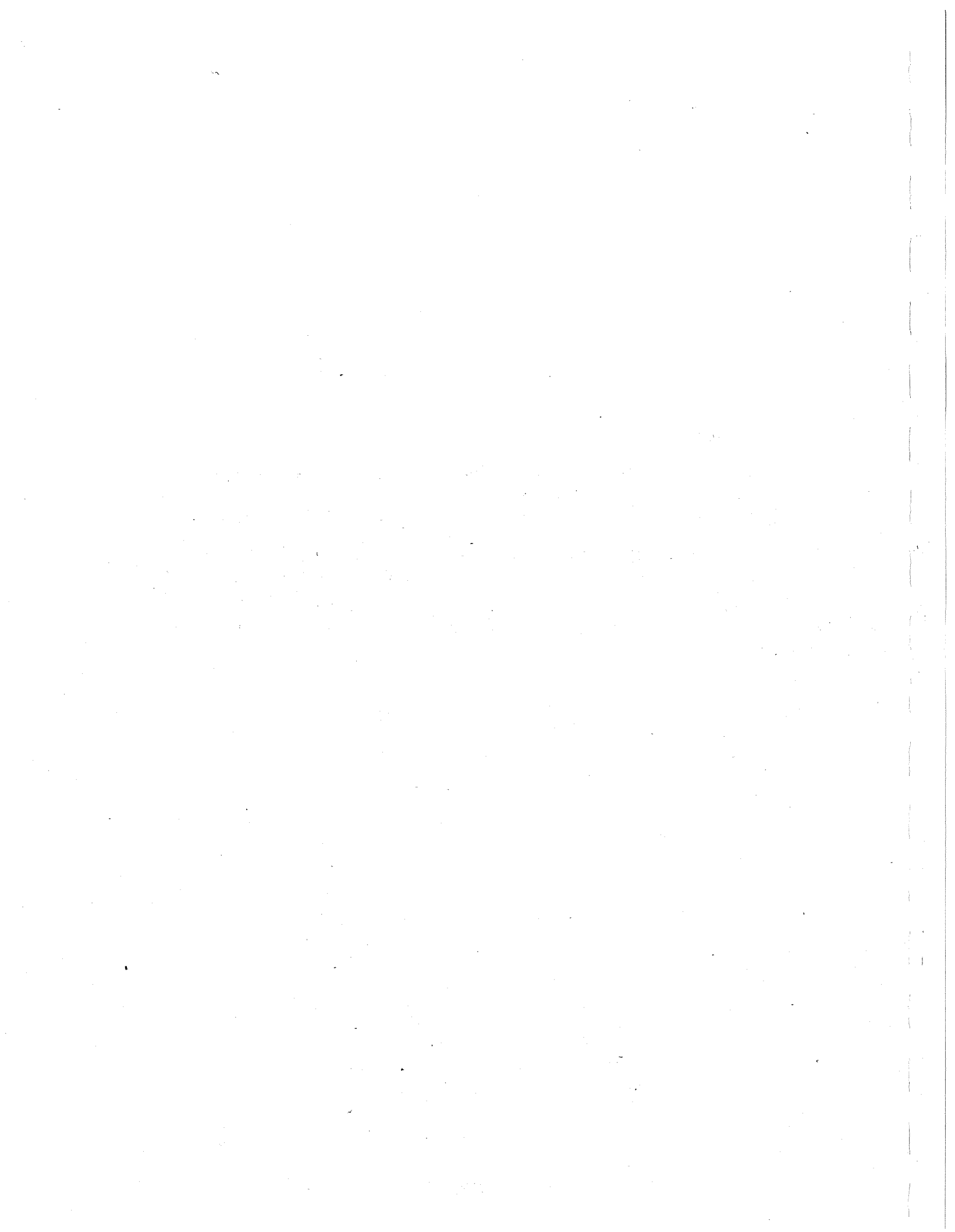
E. Steel

1. All fabrication and erection shall be done in conformity with the "AISC Load and Resistance Factor Design Specification for Structural Steel Buildings," Second Edition dated December 1, 1993, latest revision.
2. Refer to Article 2.01 A. of this Specification Section for repair of galvanized surfaces.

F. Aluminum

1. The contact surfaces of aluminum with steel, dissimilar materials, concrete and/or masonry shall be protected from corrosion by a coating of coal tar, Kop-Coat Bitumastic Super Service Black, or equal.
2. Aluminum surfaces embedded in concrete shall be protected from corrosion by a tightly adherent coating of 2 applications of zinc chromate primer.

END OF SECTION



SECTION 05540

CASTINGS

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Provide all labor, materials, and equipment required to install castings as shown on the Drawings and specified herein. Included in this section are manhole covers, steps, valve boxes, and hatch covers.

1.02 RELATED WORK NOT INCLUDED

- A. Concrete work is included in Division 3.
- B. Surface preparation and finishing of castings is included in Division 9, Section 09900.

1.03 SUBMITTALS

- A. The CONTRACTOR shall submit to the ENGINEER, in accordance with Division 1, Section 01300, copies of construction details of castings proposed for use.

PART 2 MATERIALS

2.01 GENERAL

- A. All castings shall be gray iron, conforming to the requirements of the ASTM Standards, Designation A 48-83, Class 35-B for manhole casting and class 20 for valve boxes.

2.02 VALVE BOXES

- A. Slide Type for Iron Body Gate Valves
 1. Valve boxes for sizes thru 12-inch valves shall be the cast iron slide type, without screw, of sufficient length to allow for 30 inches of cover over the top of the pipe. The inner section shall have a minimum inside diameter of 5-1/4 inches with a hood type base that will cover the packing gland on valves through 12 inches in size (minimum of 8 inches inside diameter). The base of the top section shall be flanged at least 1-1/4 inches. The caps shall be circular with a corrugated surface and have pick holes in the periphery and be marked "Water," "Gas," "Sewer," or "Air" according to use. The valve boxes shall be Tyler Pipe/Utilities Division, 6855 Series, or equal.
 2. Valve boxes for valves in the horizontal position shall be cast iron Tyler Pipe/Series 6855 or equal, with a base that is sized to allow covering of the bevel gear case and centering of the operating nut in the valve box.

PART 3 EXECUTION

3.01 INSTALLATION OF CASTINGS

A. Installation In or On Structures

1. The installation of castings is generally covered under specifications for pipe work and manholes. Castings shall be leveled, plumbed and secured before pouring concrete or attaching to masonry with solid, watertight, cement mortar joints.

B. Installation on Buried Valves

1. Valve box construction shall consist of the approved manufactured box and accessories. Line pipe shall not be accepted for use as valve boxes.
2. Mechanically tamp backfill, or backfill with crushed rock (per requirements of location - see Section 02610 of these Specifications) to the bottom of the packing gland of the operating nut. Install valve box base centered over operating nut.
3. Install valve box shafts, of the required height, and top section to proposed top elevation. Mechanically tamp backfill around box or backfill with crushed rock.
4. Place reinforced concrete collar around top section when shown on the Drawings.
5. Furnishing and installation of the valve box and accessories, including the concrete valve box collar, shall be included in the price bid for furnishing and installation of the valve.

END OF SECTION

SECTION 11213

PREFABRICATED WATER BOOSTER PUMPING STATION

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Furnish and install a complete factory built, automatic, underground water booster pumping stations with all required equipment, factory-installed and tested, in welded steel pump chambers with welded steel entrance tubes and ladders to provide access. The principal items of equipment for the station shall include: two vertical, multi-stage, base-mounted, vertical centrifugal diffuser type, motor driven pumps; valves, interior piping, central control panel with circuit breakers, motor starters and automatic pump controls per the contract drawings, lighting, sump pump, motor driven ventilator, heater, dehumidifier, and all internal wiring.

1.02 RELATED WORK

- A. Special requirements for materials and equipment are provided in Section 01300 and 01600.
- B. Special sequence or schedule requirements, if any, are provided in Section 01010 - Summary of Work.
- C. Excavation and Regrade is specified in Section 02200.
- D. Fencing is specified in Section 02830.
- E. Sodding and Seeding is specified in Section 02930.
- F. Cast In Place Concrete is specified in Section 03300.
- G. Metal Fabrications are specified in Section 05520.
- H. Castings are specified in Section 05540.
- I. Valves are specified in Section 15102.
- J. Electrical work is specified in Division 16.

1.03 QUALIFICATIONS

- A. The water booster pumping stations shall be furnished by a single manufacturer who is experienced, reputable, and qualified in the fabrication of the unit to be furnished. The station shall be designed, constructed and installed in accordance with best practices and methods. The stations shall be that as manufactured by Engineered Fluid, Inc., Centralia, Illinois, or approved equal.

1.04 SUBMITTALS

- A. Prebid submittal requirements are specified in Section 00820 - Special Conditions.
- B. Shop drawings and other items needed to establish compliance with the Drawings and these Specifications shall be submitted to the ENGINEER in accordance with Section 01300 - Submittals.
- C. Equipment submittals shall be bound and shall contain a minimum of 2 full size drawings, size 24 inches by 36 inches one each covering the booster pump station and the electrical control schematic. The booster pump station drawing shall be specific to this Project, in at least 3 different views, be to scale and illustrate the National Electrical Code (NEC) clearances per Section 110-16 of the Code. The submittal booklets will be complete with data sheets covering all individual components that make up the booster pump station and the UL file number under which the manufacturer is listed.
- D. O&M instructions shall be submitted to the ENGINEER in accordance with Section 01600.

1.05 EQUIPMENT OR SYSTEM WARRANTY

- A. Refer to Section 01600 for warranty requirements.

PART 2 PRODUCTS

2.01 WATER BOOSTER PUMPING STATION

- A. Equipment Chamber and Entrance Tube
 - 1. The station shall be fabricated in one section with entrance hatch attached to the top of the equipment chamber. The equipment chamber furnished for this Project shall be adequately sized to provide for National Standard mandated clearances and for proper clearances above, below, and around equipment to provide for safe servicing, removal, and reinstallation of that equipment.
 - 2. The lower section shall be the equipment chamber which shall contain the pumps and all other equipment necessary for the operation of the pumping station. The equipment chamber shall be a vertical cylinder with the shell fabricated from 1/4 inch or heavier structural grade steel plate, rolled to form a minimum inside diameter of the dimension shown on the Drawings. The clear height of the chamber interior shall be a minimum of 7.0 feet. The top and bottom of the cylinder shall be fabricated with 3/8 inch or heavier structural grade steel plate with 2 inch high rolled or stamped flange to overlap the shell on the outside. The lap joint shall be in full conformance with steel Tank Institute specifications and Underwriters Laboratories specifications for steel vessels in buried

service, and the American Welding Society Structural Welding Code for dynamically loaded structures. The structural shapes used in the station shall meet or exceed the requirements of ASTM A-36.

3. The equipment chamber shall be reinforced on the top with steel channel beams, in both directions, of adequate size and cross section to support the weight of the overburden plus traffic load if located within a traffic area.
4. The equipment chamber shall be reinforced on the bottom in both directions with steel I-beams or channels of such size and cross section to support the complete weight of the station on the concrete pad and to stiffen the chamber to protect against hydrostatic uplift forces. A subbase or other type mounting arrangement shall be welded to the station floor to provide a mounting or anchorage for the pumps and motors.
5. A 15 inch minimum diameter by 8 inch minimum depth sump with 1/4 inch steel structural plate walls shall be provided in the bottom of the pump chamber.
6. Lifting "eyes" or plates of adequate size to support the entire weight of the completed chamber and all equipment shall be provided for installation of the chamber by mechanized lifting equipment. Interior lifting eyes shall be placed over each piece of equipment in excess of 60 pounds of weight.
7. The upper section, entrance tube, and/or equipment hatches, if required, shall be matched to the opening in the equipment chamber. The entrance tube may be circular, square or of rectangular configuration provided the inside dimensions are such that will allow the containment of the access ladder, blower/ventilator conduits, etc. and still retain sufficient space to allow the removal of the pumps and/or motors or any other item of operational equipment. The upper section shall be fabricated of 1/4 inch structural steel plate. The entrance tube and/or equipment hatches shall be adequately sized to provide for eventual removal and replacement of any component within the station without altering the station to accomplish that task. Field welding to attach the entrance hatch will not be allowed.
8. Other station configurations, sizes, and methods of structural support will be considered based on the size necessary for the equipment to be installed and/or other special design considerations.
9. All steel structural members shall be joined by electric arc welding with fillet or butt welds of adequate section for the joint involved. Such welds shall be continuous, watertight, and in accordance with the latest standards of the American Welding Society. All shell penetrations for pipes, conduits, ducts, etc., shall be welded around the outside diameter of the

penetration inside and outside the shell walls. All welding shall be done at the factory. Field welding will not be allowed.

10. Upon completion of all welding, all weld slag, weld splatter, and sharp edges shall be removed by grinding or chipping until smooth. Prior to the application of paint, the entire interior and exterior of the pumping station including the equipment chamber, access tube, cover assemblies, uncoated equipment and piping shall be thoroughly cleaned. Cleaning shall be by sandblasting per the requirements of Steel Structures Painting Council of SP No. 6 - Commercial Blast Cleaning. Special care shall be taken to thoroughly clean all weld seams.
11. Coating systems for use on interior and exterior surfaces of the station can be either of the brand name of the following systems (minimum D.F.T. shall be 10.0 mils for any system):
 - a. Epoxy/Polyurethane System
 1. Kop-Coat Coatings
 - a. Prime Coat: 1 coat of Kop-Coat 340 Gold applied to a D.F.T. of 2 to 3 mils.
 - b. Intermediate coat: 1 coat of Kop-Coat Super Hi-Gard Epoxy applied to a D.F.T. of 5 to 7 mils.
 - c. Finish Coat: 1 coat of Kop-Coat 1122 BRS Polyurethane applied to a D.F.T. of 2.0 to 3.0 mils.
 2. Rust-Oleum Corporation
 - a. Prime Coat: 1 coat of Rust-Oleum HS 9369 Red Epoxy Primer to a D.F.T. of 2 to 3 mils.
 - b. Intermediate Coat: 1 coat of Rust-Oleum 9500 System High Build Epoxy applied to a D.F.T. of 5 to 8 mils.
 - c. Finish Coat: 1 coat of Rust-Oleum Rust-O-Thane Polyurethane finish to a D.F.T. of 2.0 to 3.0 mils.

3. Tnemec Co.

- a. Prime Coat: 1 coat of Tnemec Polyamide Primer 20-1255 to a D.F.T. of 2 to 3 mils.
- b. Intermediate Coat: 1 coat of Tnemec Series 66 Epoxoline applied to a D.F.T. of 5.0 mils.
- c. Finish Coat: 1 coat of Tnemec Series 74 Polyurethane to a D.F.T. of 3.0 to 5.0 mils.

4. Carboline

- a. Prime Coat: 1 coat of Carboline 893 Red Epoxy Primer to a D.F.T. of 3 mils.
- b. Intermediate Coat: 1 coat of Carboline 893 White Epoxy Primer to a D.F.T. of 4 to 6 mils.
- c. Finish Coat: 1 coat of Carboline 134HS Polyurethane to a D.F.T. of 3 to 5 mils.

All intermediate coats shall be similar in color to the finish coat.

- 12. For cathodic protection, four 17-pound packaged magnesium anodes shall be buried equally spaced around the station and securely connected thereto by heavy copper wires to lugs on the station provided for that purpose.
- 13. The walkway areas (that space from the entrance ladder to the control panel and the entire NEC clearance area) shall be covered with a Nyracord industrial safety matting. The mat shall be a heavy duty, 1/2-inch minimum thickness Nyracord compound (rubber blend with fiber reinforcement) of open slot design with a ribbed safety pattern (ribbed in 2 directions) to promote sure footing. The underside of the safety mat shall also be ribbed (in one direction only) to permit aeration and drainage. The safety mat shall not be glued to the floor surface.
 - a. The cover for the entrance tube or riser shall be a prefabricated metal cover, preferably rectangular in shape and of sufficient dimensions to allow the removal of the largest item of station equipment and normal entrance and exit from the station. The cover shall be constructed of 11 gauge aluminum on the exterior with a beaded, vertical flange sized and welded to the entrance tube or riser section. The cover shall be insulated with a one inch minimum thickness of fiberglass insulation covered by an 18 gauge aluminum liner.

- b. The cover shall be completely assembled with heavy hinges, compressor spring operators enclosed in telescopic tubes and be equipped with an automatic hold open arm with vinyl handle. The hold open arm shall be equipped with a lock open device to prevent accidental closing of the cover when in the open position.
 - c. The entrance cover shall be equipped with a keyed locking device of brass construction. The OWNER shall be supplied with 2 keys for the station and keyed per OWNER'S standard systems.
14. An aluminum ladder meeting UL and OSHA requirements for "Type I, Heavy Duty" use shall be provided. The ladder shall have 1-1/4 inch diameter tempered, serrated rungs with 3 inches X 1-1/8 inches full I-beam side rails. The top ends of the ladder shall be protected by plastic caps bolted into place. The ladder shall be bolted to the station at top and bottom with a minimum of 2 points each for easy removal to facilitate equipment maintenance. Rubber or polyethylene washers or spacers shall be placed between the ladder and the steel chamber to prevent corrosion from dissimilar metals.

B. Accessories

1. Dehumidifier

- a. A packaged dehumidifier assembly with hermetically sealed refrigeration type compressor with environmentally safe refrigerant, expansion coil, fan and condenser coil, shall be furnished to maintain the relative humidity of the air in the pump chamber low enough to keep the electrical equipment dry and prevent condensation on the station walls. The dehumidifier shall be capable of maintaining a relative humidity of 70 percent or below the dew-point of the temperature of all piping and equipment within the pumping station.
- b. Each dehumidifier shall be controlled automatically by an adjustable humidistat with low air temperature cutout, with contacts of adequate capacity for the dehumidifier motor. The condensate shall be drained directly to the sump.

2. Ventilator

- a. The station will also be equipped with a centrifugal type blower. The blower wheel shall be direct connected to a 115 volt, 60 cycle, single phase motor. The blower shall deliver directly through an exhaust duct to the outside.
- b. Exhaust blower ducts shall be provided with suitable permanently attached covers to prevent the entrance of rain or snow and the opening shall be properly screened to prevent entrance of foreign matter.

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- c. The blower and lights, hereinafter specified, shall be turned on automatically when the entrance cover is raised by a double pole limit switch mounted just under the cover. A manual switch shall also be mounted just below the limit switch for operation of blower and lights with the cover closed during inclement weather.

3. Lights

- a. The station shall be equipped with a minimum of two 40 watt fluorescent lamps located near the top of the equipment chamber in a thermoplastic, enclosed and gasketed fixture. The lights shall be controlled by the same switches as the blower.

4. Sump Pump

- a. Mounted in the pumping station shall be a hermetically sealed and permanently lubricated submersible sump pump with an enclosed impeller, controlled automatically by a float switch and capable of delivering a minimum of 900 gph against a TDH of 21 feet. The pump shall be piped to a union in the wall of the station with a 1-1/4 inch galvanized steel pipe containing 2 check valves and a gate valve. There shall be provisions for dewatering the drain system for freeze protection.
- b. A magnetrol or equal float switch with 4 inch stainless steel float, NEMA 4 enclosed shall be furnished and installed to signal high alarm to the local telemetry panel.

5. Heater

- a. A 3 kilowatt, 10,240 BTU/Hz heater shall be furnished and installed in the pump station. It shall be constructed of heavy gauge steel with an extruded aluminum housing. The heater shall be protected by a thermal overload cut-off, and shall be controlled by built-in thermostat.
- b. The heater shall operate on 240 volt, one phase power, and shall include an internal 20A/2P circuit breaker.

6. Wiring

- a. The station shall be completely wired at the factory in rigid conduit, except for the 120 volt equipment items which are furnished by their manufacturer with insulated cords. In these instances, conduit shall be run to a receptacle located near the equipment. Such outlet receptacles shall be polarized and grounded. Conduit run throughout the station shall be attached to studs tack welded to the station walls and shall be out-of-the-way and as inconspicuous as possible. Incoming power lines shall be connected to a conduit located inside on the entrance tube wall below the grade

D. Control Panel

1. Control panel shall be a NEMA 4 type enclosure, fabricated of steel and provided with 2 heavy doors with steel handles and suitable latching devices. On the outside, convenient to the operator, shall be the circuit breaker handles, the "hand-off-automatic" selector switches for each pump, and a convenience outlet for 120 volt power. For additional wiring see Drawings.

E. Automatic Pump Controls

1. Pumping Station

- a. Thermal-magnetic (or magnetic only) circuit breakers with dead fronts shall be provided, both as disconnect switches and overload protection for each motor, for the motor pilot circuits, and each of the service circuits. Starters shall be magnetic type, full or reduced voltage, as called for on the Drawings and shall have under voltage release. The starters shall have the thermal overload heater coils in each phase to give positive protection against "single phasing." There shall be provided with each starter a hand-off-automatic switch for each pump.
- b. The pumps shall start manually by positioning the H-O-A switch to the hand position.
- c. When on automatic operation, the pumps shall be controlled by pressure switch and radio telemetry.
- d. The entire control system shall be the product of one manufacturer who has had at least 5 years experience in furnishing similar equipment. The system shall be tested by the control manufacturer prior to shipment. Complete hydraulic and electrical diagrams and functional description shall be provided to successful manufacturer for acceptance by the ENGINEER.
- e. Control shall be in accordance with the schematic shown on the Drawings.
- f. Control for the dehumidifier for the pumping station shall be by means of a circuit breaker in the main control panel and an internally mounted humidistat.
- g. Control for the ventilating blower in the pumping station shall be by a circuit breaker in the main control panel and operated by a pressure release type limit switch attached to the top of the access hatch, and an interval timer.

- h. Control for the submersible pump motor in the pumping station shall be by a circuit breaker in the control panel and operation shall be by an easily adjustable float switch furnished with the pump.
- i. Plastic nameplates shall be furnished for each starter and controller. The plates shall be plastic and have black lettering on a white background. Where there are several identical units, they shall be assigned consecutive numbers.

F. Piping and Valves

1. General

- a. The station shall be furnished with all necessary interior piping, fittings, and valves, factory installed. The suction line to each pump shall be equipped with an individual isolation valve as specified herein. The discharge piping shall be equipped with a check valve and isolation valve on each pump to allow operation of the pumps individually or in tandem.
- b. Suction and discharge piping size shall be as shown on the Drawings. Size reduction and/or increase to match the supplied pump size shall occur as close to the pump as practical.
- c. Suction and/or discharge piping shall include a bolted fitting or sleeve to allow removal of each pump without affecting the operation of the other pump.

2. Pipe and Fittings

- a. All internal pipe and fittings shall be Schedule 40 black, seamless steel pipe manufactured in accordance with the dimensional tolerances and materials Specifications of AWWA C-200-86 for steel pipe and steel butt-weld fittings. Flanges, where required to connect to valves or other equipment, shall be of the size and pressure rating to match the valve and/or equipment to which they are to be connected.

3. Isolation Valves

- a. Isolation valves for both suction and discharge piping shall be rubber-seated butterfly valves meeting the requirements of AWWA C504-87.
- b. Butterfly valves 6 inches and smaller shall be wafer type valves, lever operated with 10 degree increment throttling plate. Valves 8 inches and larger shall be equipped with a heavy duty, gear operator complete with position indicator.

4. Check Valves

- a. Check valves shall be provided for the pump discharge piping. The check valve shall be located between the pump and isolation valve.
- b. Check valves shall be silent type check valves with compression spring for prevention of slam upon closure. Valves 8 inches and smaller may be of the wafer type construction. Valves 10 inches and larger shall be the flanged - globe type configuration.

5. Flow Control Valve

- a. A flow control valve shall be furnished in the location shown on the Drawings. The valve shall be factory set and automatically limit the rate of flow to the required capacity. The control mechanism shall consist of a self-contained, open chamber cartridge assembly with unobstructed flow passages. All internal working parts shall be Type 300 passivated stainless steel. No plated materials are acceptable. The flow control valve shall be Griswold Model 3331A, or equal.

G. Indicating Gauges

1. The station shall be equipped with a 4-1/2 inch brass indicating altitude gauge on the suction line. The gauge shall be located on the suction line between the isolation valves and the station wall. Scale of gauge shall be as shown in Division 13.
2. The discharge gauge shall be Ashcroft Duragauge, 4-1/2 inches in diameter. The gauge shall be located ahead of the discharge isolation valves. Scale of gauge shall be as shown in Division 13.
3. Each gauge shall be equipped with a 1/2 inch ball or gate valve for isolation and pulsation dampener (rubber). Gauge connections shall be 1/4 inch N.P.T. brass.
4. Gauges shall be 1/2 percent accuracy with phosphor-bronze bourdon tube, adjustable pointer, stainless steel movement, and blowout protection.

PART 3 EXECUTION

3.01 DELIVERY, STORAGE, AND HANDLING

- A. Refer to Section 01600 of these Specifications.

3.02 INSTALLATION

- A. Excavation and Backfill is specified in Section 02200.

B. Installation

1. Booster pumping station will be anchored to a poured in place reinforced concrete slab specified in Section 03300 or shown on the Drawings.
2. The station shall be set in place and bolted to the anchor bolts installed during the placement of the concrete slab. Anchor bolt locations shall be per the station manufacturer's drawings.
3. Any exterior shell coating damaged during installation shall be touched up per the manufacturer's recommendations.
4. After attaching the anodes provided with the station, the area shall be backfilled per Section 02200. Seeding and protection shall be per Section 02930.
5. Connection of wiring and electrical work shall be as specified in Division 16.
6. Installation of connecting piping shall be per Section 02610.

3.03 TESTING, START-UP, AND OWNER TRAINING

A. Factory Tests

1. Each completed pump station shall be given a running test of all equipment at the factory to check for excessive vibration, for leaks in all piping or seals, and for correct operation of the automatic control system and all auxiliary equipment. The pump suction and discharge lines shall be coupled to a reservoir and the pumps shall recirculate the water for at least one hour simulating actual service conditions. The automatic control shall be adjusted under such actual operating conditions to start and stop the pumps at the levels required by the job conditions. When desired, the ENGINEER may be permitted to witness these tests.

B. Field Tests

1. Upon completion of installation, field tests will be performed by the CONTRACTOR/SUPPLIER to verify the performance of the installed unit in actual field operating conditions. Pump capacity tests, motor amperage usage test, etc. will be conducted to verify the operation of the functional components at actual design conditions. These tests shall be witnessed by the OWNER/ENGINEER. The OWNER and ENGINEER shall be supplied with a certified copy of the results of the field testing.
2. The OWNER/ENGINEER may perform such additional field tests as deemed necessary to verify the results of the installed pumping units.

C. Start-Up and Training

1. The manufacturer of the pumping station shall provide the services of a trained field engineer to supervise, check adjustments, to place in operation and to instruct the OWNER in the proper care and maintenance of the completed pumping station. This service may be provided at the time field testing is conducted. Five copies of lubrication and operation instructions shall be provided for the OWNER.

END OF SECTION

SECTION 13212

WELDED STEEL TANKS FOR WATER STORAGE

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials and incidentals to install the complete, functioning water storage tank(s) and foundation(s) as described in these Specifications and shown on the Drawings.
- B. Tank(s) size and capacity shall be as shown on the Drawings.
- C. Dead, liquid, snow, wind, and earthquake loads shall be in accordance with Section 3, ANSI/AWWA D-100-96.
- D. Subsurface information and allowable foundation bearing pressures for foundation design are shown on the Drawings.

1.02 RELATED WORK

- A. Concrete and reinforcement are included in Division 3.

1.03 SUBMITTALS

A. Preliminary Drawings

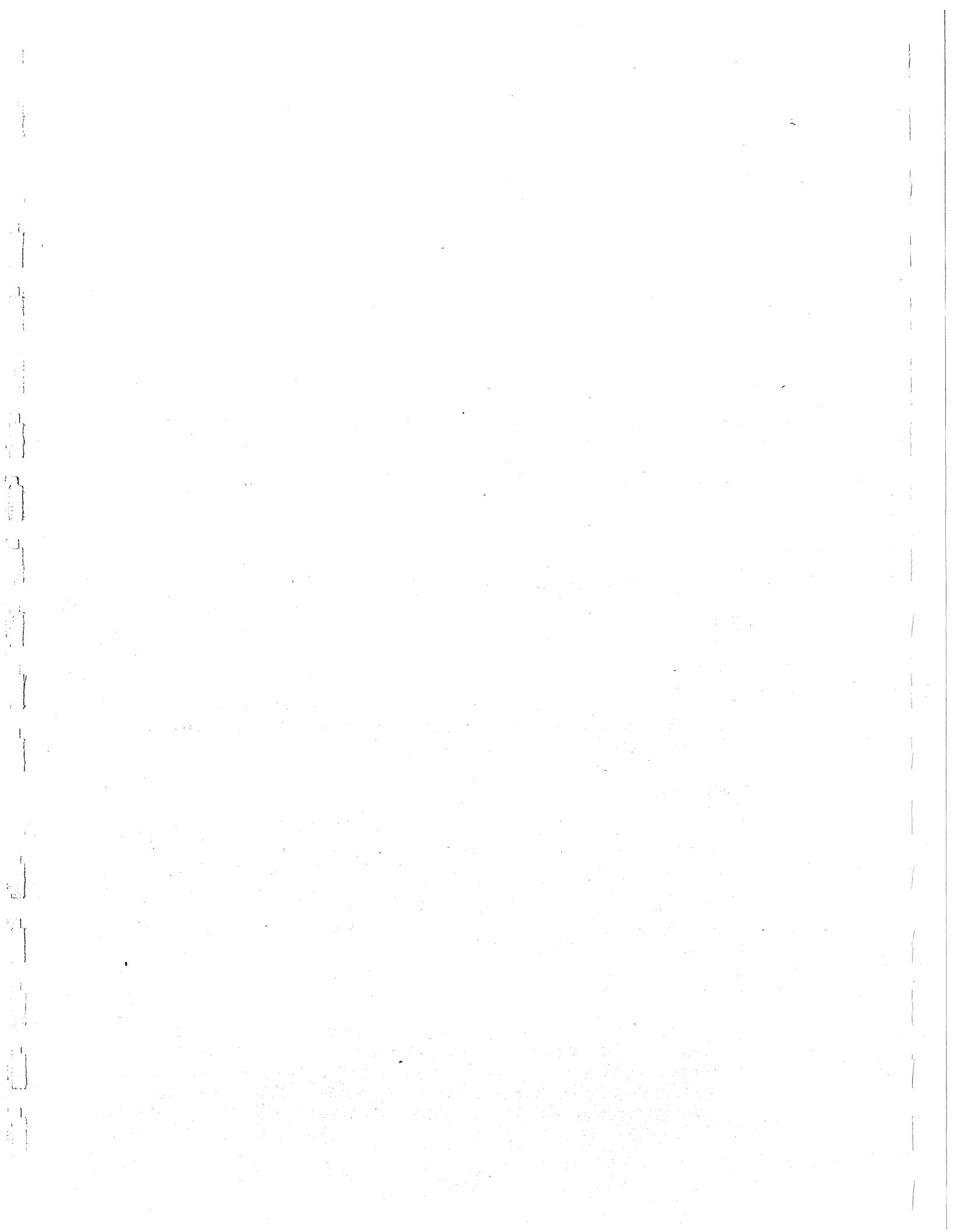
- 1. The CONTRACTOR shall attach to his bid a preliminary drawing in duplicate showing dimensions of structure with sizes, thicknesses and weights of all structural plates and members.

B. Foundation Drawings

- 1. Within 14 days after award of contract, the CONTRACTOR shall submit 6 copies of his foundation drawings with design calculation to the ENGINEER for review. The CONTRACTOR shall be responsible for the foundation design which shall be not less than indicated on the Contract Drawings. The ENGINEER shall review and return or distribute 2 copies to the ENGINEER'S file, 1 copy to the resident project representative, and 3 copies to the CONTRACTOR.

C. Initial Shop Drawings

- 1. Detailed drawings for fabrication and erection of tank(s) and appurtenances shall be submitted to the ENGINEER for review in duplicate. Drawings shall clearly show dimensions, sizes, thicknesses, and locations of all parts with methods of joining using recommended symbols of American Welding Society. Fabrication may proceed after the ENGINEER



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returns one copy of the drawing with notation indicating acceptable review.

D. Final Shop Drawings

1. The CONTRACTOR shall submit 5 finalized copies of the shop drawings to the ENGINEER for distribution to the CONTRACTOR (2), the resident project representative (1), and the ENGINEER (2).

PART 2 PRODUCTS

2.01 TANK STRUCTURE

- A. The materials, design, fabrication and erection of welded steel tanks shall conform to the Standards of ANSI/AWWA D-100-96.

2.02 TANK ACCESSORIES

- A. Reservoir exterior shell ladder with continuously welded or bolted rails and safety cage as shown on the Drawings.
- B. Two 24-inch diameter steel access manholes with stainless steel bolts and steel cover supported by davit at bottom of tank.
- C. Inlet-outlet pipe connection flush with tank floor or as shown on the Drawings.
- D. Ductile iron inlet-outlet piping, valves and fittings as shown on the Drawings and specified in Division 15.
- E. Removable silt stop over inlet-outlet or outlet pipe as shown on the Drawings.
- F. Adequately braced overflow pipe with weir box at top end and screen at bottom end as shown on the Drawings. Weir box shall be braced to roof above the overflow water level.
- G. Twenty-four inch square roof hatch with 4 inch curb, hasp, and staple for padlock. An additional roof opening and cover near center of tank similar to roof hatch but with 20 inches minimum diameter.
- H. A fixed exterior roof ladder from exterior tank ladder to roof access hatch.
- I. Interior tank ladder from roof hatch to bottom of tank with continuously welded rails.
- J. Combined roof finial and roof vent with double frost proof screened removable solid cover to prevent ingress of insects, birds, and animals, continuously welded to roof.
- K. Standard galvanized (fiberglass on tank interiors) safety climbing device attached to all ladders, equal to SAF-T-CLIMB, as manufactured by Air Space

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Devices, Horton Company or equal, shall be provided. There shall be included 2 removable SAF-T-LOC SLEEVES, 2 adjustable SAF-T-HARNESSES with center and 2 side "D" rings and 4 SAF-T-CABLES, 36 inches long, 3/16 inch diameter nylon covered, galvanized steel cables with safety snap at each end.

- L. Any additional accessories required by the previously referenced ANSI/AWWA specification.

2.03 TANK PAINT

- A. The object of these Specifications is to provide material and workmanship necessary to produce a first class job. Surface preparation, painting and associated work shall be done strictly in accordance with paint manufacturer's instruction and the Specifications.
- B. AWWA Standard for Painting Steel Water Storage Tanks, ANSI/AWWA D102-97 shall apply to this contract and is hereby made a part of these Specifications except as it conflicts with items specifically mentioned herein. The CONTRACTOR shall furnish an affidavit of compliance that the work and materials furnished under this standard meet the applicable requirements of this AWWA Standard. A First Anniversary Inspection shall be required.
- C. Paint products mentioned in this specification are set up as standards of quality. The usual "or equal" clause shall apply. Products of other manufacturers comparable in quality and type to those specified will be acceptable if offered by the CONTRACTOR with satisfactory data on past performance on water storage tanks, composition, directions for use, and other information required, and if accepted by the ENGINEER.
- D. All materials shall be brought to job site in original sealed and labeled containers of paint manufacturer, and shall be subject to inspection by the ENGINEER on job. Paint application instructions shall accompany each container of paint shipped to job and 3 copies of instructions shall be sent to the ENGINEER before shipment of paint. Colors, where not specified, shall be selected by the OWNER.

PART 3 EXECUTION

3.01 CONTINUOUS WELDS

- A. All joints on interior of tank shall be sealed to prevent gaps which paint cannot bridge and which hinder proper surface preparation. Unless gaps are closed by an acceptable (to the ENGINEER) combination of welding and filling, all joints shall be sealed by continuous welds. Where roof plates are lapped, both interior and exterior joints shall be continuously welded. Both joints may be utilized for strength requirements or exterior joint can be used for strength and interior joint considered a seal weld. Roof plates shall also be continuously welded to ribs and structural supporting members or otherwise sealed in an acceptable (to the ENGINEER) manner so as to preclude corrosion between the members and the roof which would result in premature roof failure and replacement.

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- B. All interior edges of rafters, angles, beams, etc., shall be finished by "breaking the edge," i.e., a minimum of 1/16" flat area on all corners.

3.02 GROUTING

- A. Grout shall consist of 1:1.5 cement and sand mix. Sand shall be clean, well graded particles of hard, durable stone and shall contain not more than 5 percent by weight of coal, lignite, silt, clay and other deleterious matter. Grouting shall be required under all supporting columns, plates, base elbows, between floor plate and concrete such as around encase inlet-outlet pipe, and at additional places shown on the Drawings. Grout depth shall be full length under columns and other structural members. In all other areas depth shall be as shown on the Drawings, with 9 inch minimum.

3.03 CORROSION ALLOWANCE, FOUNDATION, ASPHALT SATURATED SAND PAD, LEVELING SHIMS AND GROUT (STANDPIPE AND RESERVOIR)

- A. Corrosion allowance of 1/16 inch shall be added to calculated design thickness of cylindrical shell plates in contact with water. The tank may be designed and constructed according to Section 14, AWWA D-100-96 if indicated on the Drawings. Minimum thickness of cylindrical shell plates shall be 1/4 inch.
- B. The ringwall enclosed foundation for the flat-bottom tank shall rise uniformly from the perimeter to the center at a uniform slope of 3 inches vertical to 10 feet horizontal, not to exceed 3 inches in 10 feet. Three inches (minimum) thickness sand pad shall be provided under bottom of tank over compacted aggregate base or as otherwise shown on Drawings. Sand shall be spread and mechanically tamped to provide a uniform surface for bottom of tank.
- C. After erecting the tank and vacuum testing the floor plate joints, the sand pad shall be raked back approximately 10 inches under periphery of the floor plate. The steel leveling shims under the floor plate and the tank wall shall be left in place with a minimum clear distance of 1 inch from the edge of the floor plate. The space between the bottom of the floor plate and the top of the concrete foundation shall be packed with grout, with the exposed surface finished vertically.
- D. A 1 inch minimum space between the tank bottom and the top of the ringwall shall be filled with a 1:1.5 cement-sand grout. In place of grout under the shell, the shell may be supported on 1/2 inch thick cane-fiber joint filler meeting the requirements of ASTM D1751 if the foundation under the shell is level within $\pm 1/8$ inch in any 30 foot circumference under the shell. Regardless of space fill used, it shall be trimmed flush with the edge of floor plates.

3.04 TESTING

- A. After tank has been completely erected and the ENGINEER is present for final structural inspection, bottom plate joints shall be tested by vacuum using soap suds for detection of leaks. The CONTRACTOR shall furnish all labor and equipment for making tests. Any leaks found shall be repaired and retested.

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After determining that leaks are not in the bottom plate, tank(s) shall be tested by filling with water provided by the OWNER if water is available in required quantity at inlet pipe. When water is not available, filling shall be deferred and the CONTRACTOR shall complete work, including painting and disinfecting. The OWNER shall furnish the water and the CONTRACTOR shall furnish all labor and equipment for making tests.

- B. Any leaks which are found by filling shall be repaired by chipping or melting out defective welds, rewelding, repainting and disinfecting. No repair work shall be done on any joint, unless water in tank is at least 2 feet below point being repaired.
- C. The OWNER shall provide means for disposing of test water up to tank outlet pipe.

3.05 INSPECTION

- A. Copies of mill test reports shall be submitted to the ENGINEER in triplicate.
- B. The OWNER reserves right to make mill and/or shop inspections.
- C. The CONTRACTOR shall submit to the ENGINEER, in triplicate, copies of welders' qualifications tests (per Section 8 - Welding, ANSI/AWWA D-100-96) for each welder performing welding on tank. All welders shall be fully qualified before arriving at job.
- D. The ENGINEER shall examine credentials of the CONTRACTOR'S welders at tank site.
- E. Welds shall be inspected by radiographic testing methods unless specifically designated on the Drawings that visual/sectioning test methods may be used. The CONTRACTOR shall bear cost to provide all necessary equipment and labor to make tests and render a certified report of tests in triplicate with professional and notary seals, to the ENGINEER. Testing and additional related requirements shall be in accordance with ANSI/AWWA D-100-96 except as noted in 3.05 F.
- F. Taking of radiographs, processing of film, analyzing film, and furnishing testing reports can be done by the CONTRACTOR if he is adequately equipped and staffed or the CONTRACTOR can hire any or all of work done by a competent, acceptable (by the ENGINEER) commercial inspection and testing agency. Radiographs shall be sent to the CONTRACTOR'S or inspection agency's office for analyzing and drafting of report which shall be sent to the ENGINEER in triplicate with radiographs for review and record. Report shall include developed drawing showing location at which radiographs were taken. Field radiographs shall be taken, developed, and reviewed on site in the presence of the ENGINEER.
- G. The following scheduled inspections shall be made:
 - 1. At time of initial field welding when welders' credentials shall be accepted and project requirements including testing shall be reviewed.

2. After completion of structures and appurtenances when final structural inspection shall be made.
 3. At time of initial abrasive blasting when guidelines for acceptable surface preparation and painting requirements shall be reviewed. Refer to Painting herein for detailed requirements.
 4. During surface preparation and painting when workmanship, blast profile, cleanliness, environmental, and paint film thicknesses shall be reviewed. Cleanliness shall be in accordance with SSPC-Vis 1. Dry film thickness shall be measured in accordance with SSPC-PA-2 and surface profile shall be measured per NACE RP0287-97.
 5. After completion of painting on interior and exterior separately, when workmanship and required paint film thicknesses shall be checked for acceptability. During this inspection, adequate and safe facilities shall be provided to permit the ENGINEER to observe the taking by the CONTRACTOR of a sufficient number of thickness measurements to verify specified requirements. The CONTRACTOR shall monitor all seams and at least 30 percent of plate area for holidays in the presence of the ENGINEER with an instrument which sounds an alarm upon detecting a holiday or pinhole in accordance with ASTM D5162 or NACE RPO 0188-90.
 6. At time of disinfection.
- H. The CONTRACTOR shall pay for increased ENGINEER'S charges for additional inspections over the scheduled inspections because of the CONTRACTOR'S unacceptable and/or rejected work.

3.06 DISINFECTION

- A. After interior paint has cured at least the minimum number of days required by the paint manufacturer, the CONTRACTOR shall disinfect interior of tank with a strong chlorine solution in accordance with the latest addition of AWWA C-652 chlorination method 2 as follows:
1. Chlorination method 2: A solution of 200-mg/L available chlorine shall be applied directly to the surfaces of all parts of the storage facility that would be in contact with water when the storage facility is full to the overflow elevation.
 2. Method of Application: The chlorine solution may be applied with suitable brushes or spray equipment. The solution shall thoroughly coat all surfaces to be treated, including the inlet and outlet piping, and shall be applied to any separate drain piping such that it will have available chlorine of not less than 10 mg/L when filled with water. Overflow piping need not be disinfected.

3. Retention: The disinfected surfaces shall remain in contact with the strong chlorine solution for at least 30 minutes, after which potable water shall be admitted, the drain piping purged of the 10-mg/L chlorinated water, and the storage facility then filled to its overflow level. Following this procedure and subject to satisfactory bacteriological testing and acceptable aesthetic quality, the water may be delivered to the distribution system.
- B. The CONTRACTOR shall furnish all equipment and supplies necessary to complete disinfection. Chlorine solution may be mixed in a drum or drums on the ground and pumped with airless spray equipment into the tank and wet riser.
- C. An alternate acceptable method shall be the latest edition of AWWA C-652 method 1.
- D. Disposal of heavily chlorinated water shall be in accordance with Appendix B to AWWA C652-92 "Disinfection of Water Storage Facilities" and all local regulations.

3.07 CLEANING UP AND REPAIRING DAMAGE

- A. The Contract shall not be considered complete until all construction structures, equipment, and rubbish from construction are cleaned from site of work.
- B. All damage to existing grounds and structures caused by construction operations must be repaired or the OWNER compensated for such damage before contract shall be considered complete.

3.08 GENERAL REQUIREMENTS AND GUARANTEE

- A. The CONTRACTOR shall guarantee facility regarding design, materials, erection, workmanship and paint for a period of 1 year from date of final certificate of payment to the CONTRACTOR. Acceptance of the CONTRACTOR'S design, materials, erection, workmanship, tests, shop drawings, and/or specifications shall not relieve the CONTRACTOR of meeting requirements of these Specifications and for providing a safe, dependable facility. If any design, materials and/or workmanship proves to be defective within 1 year, they shall be replaced or repaired by the CONTRACTOR without expense to the OWNER.
- B. The CONTRACTOR shall provide all rigging in a safe manner necessary to perform the end of warranty inspection.
- C. If replacements or repairs are not made within 30 days, the OWNER shall have right to make them and charge cost of same to the CONTRACTOR or his bondsman.

3.09 APPLICATION OF PAINT

- A. The CONTRACTOR shall complete field painting on new tanks. No shop priming is specified. The tank shall be given the first coat in the field, unless specifically changed by addendum to allow shop priming, in which case an alternate coating system will be specified.
- B. Surfaces shall be primed as soon as practicable after surface preparation and always the same day they are cleaned, before any rusting occurs. Previously painted surfaces shall be free of dust, dirt, sand and any other interference material before additional paint application.
- C. After surface preparation, paint shall be applied to specified thickness strictly in accordance with paint manufacturer's instructions. If material has thickened or must be diluted for application by spray gun, coating shall be built up to same film thickness achieved with undiluted material. Paint shall dry for the minimum period recommended by the manufacturer, or longer with unfavorable drying conditions, before recoating. Deficiencies in film thickness shall be corrected by application of additional coats of paint.
- D. No paint shall be applied when surrounding air temperature, as measured in shade, is below 50 degrees Fahrenheit or when temperature of the surface to be painted is below 50 degrees Fahrenheit. Paint shall not be applied to wet or damp surfaces, in rain, snow, fog or mist, or when relative humidity exceeds 85 percent. No paint shall be applied when it is expected that relative humidity will exceed 85 percent or that air temperature will drop below 40 degrees Fahrenheit within 18 hours after application of paint. Dew or moisture condensation shall be anticipated, and if such conditions are prevalent, painting shall be delayed until midmorning to be certain that surfaces are dry. Further, the day's painting shall be completed well in advance of probable time of day when condensation will occur, in order to permit film an appreciable drying time prior to formation of moisture. No paint shall be applied when the steel surface temperature is less than 5 degrees Fahrenheit higher than the dew point. In certain cases cold weather epoxies or moisture cured cold temperature urethanes may be allowed per addendum to these specifications or by change order to the Contract, if in the best interests of the OWNER.
- E. Application of paint in a manner not in accordance with paint manufacturer's instructions or to surfaces not cleaned according to these Specifications shall be removed and restored as directed by the ENGINEER at no cost to the OWNER.
- F. The manufacturer's maximum temperature limitation shall be observed.

3.10 SURFACE PREPARATION

- A. Prior to specified surface preparation, all weld slag, weld splatter and sharp edges shall be ground and/or chipped smooth. Paint surfaces to be recoated shall be cleaned of dust, dirt, sand, salts, and all interference material before recoating. Paint applied to surfaces which have not been cleaned as specified

shall be removed and restored as directed by the ENGINEER at no cost to the OWNER.

- B. Interior Tank and Appurtenances: All rust, mill scale, and other interference materials shall be removed as specified by the Steel Structures Painting Council (SSPC), Surface Preparation (SP) No. 10, "Near-White Blast Cleaning. Special care shall be taken to clean the seams and to remove essentially all soluble salts.
- C. Exterior Tank Surfaces and Appurtenances: Rust, mill scale, and other interference materials shall be removed as specified by the SSPC SP No. 6, "Commercial Blast Cleaning." Special care shall be taken to clean the seams.
- D. Only abrasives which have less than 0.2 percent silica will be permitted.
- E. The CONTRACTOR shall employ the paint manufacturer's representative at the job site when interior and exterior blasting begins to confirm the acceptable blast cleaning and surface profile. A surface profile of 1.5 to 2.0 mils minimum shall be obtained, or higher profile as recommended by the paint manufacturer.

3.11 INTERIOR COATING SYSTEM

- A. The interior coating system must be approved by the Kentucky Cabinet for Natural Resources, Division of Water for use with potable water. and must be NSF Standard 61 Certified.
- B. All priming and painting shall be done in the field by the CONTRACTOR. Coating systems for use on interior surfaces of tanks, appurtenances and wet risers can be either of the following (minimum total DFT shall be 10.0 mils for any system). An extra coat of primer shall be rolled or brushed onto all interior weld seams and corners to a DFT of 5 extra mils:
 - 1. Epoxy System
 - a. Carboline Coatings
 - (1) Prime coat: 1 coat of Super Hi Gard 891 Epoxy applied to a minimum DFT of 5 mils.
 - (2) Finish coat: 1 coat of Super Hi Gard 891 Epoxy Coating applied to a minimum DFT of 5 mils.
 - b. Rust-Oleum Corporation
 - (1) Prime coat: 1 coat of Rust-Oleum 9271 High Build Epoxy to a DFT of 5-8 mils.
 - (2) Finish coat: 1 coat of Rust-Oleum 9222 High Build Epoxy finish to a DFT of 5-8 mils.

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c. Tnemec Co., Inc.

- (1) Prime coat: 1 coat of Tnemec Pota-Pox LT Series 40 to a DFT of 4.0 to 6.0 mils.
- (2) Finish coat: 1 coat of LT Series 40 Pota-Pox white to a DFT of 5.0 to 6.0 mils.

d. Sherwin Williams Co.

- (1) Prime coat: 1 coat of Hi-Solids Catalyzed Epoxy, B62H Series to a minimum of 5.0 mils.
- (2) Finish coat: 1 coat of Hi-Solids Catalyzed Epoxy, B62W Series to a minimum of 5.0 mils.

3.12 EXTERIOR COATING SYSTEM

- A. All priming and painting shall be done in the field by the CONTRACTOR, unless shop priming is specifically allowed by addendum, with coating system specified. Coating systems for use on exterior surfaces of tank on standpipe, tower, riser, overflow pipe outside the tank, dry riser interior and piping, valves in vault can be either of the following systems (minimum DFT shall be 10.0 mils for any system):

1. Epoxy/Polyurethane System

a. Carboline Coatings

- (1) Prime coat: 1 coat of Carboline Super Hi-Gard Epoxy 891 applied to a DFT of 3 to 5 mils.
- (2) Intermediate coat: 1 coat of Carboline 890 Epoxy applied to a DFT of 4 to 6 mils.
- (3) Finish coat: 1 coat of Carbothane 134 HS Polyurethane applied to a DFT of 2.0 to 3.0 mils.

b. Rust-Oleum Corporation

- (1) Prime coat: 1 coat of Rust-Oleum HS 9369 Red Epoxy Primer to a DFT of 2 to 3 mils.
- (2) Intermediate coat: 1 coat of Rust-Oleum 9500 System High Build Epoxy applied to a DFT of 5-8 mils.
- (3) Finish coat: 1 coat of Rust-Oleum Rust-O-Thane Polyurethane finish to a DFT of 2.0 to 3.0 mils.

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c. Tnemec Co.

- (1) Prime coat: 1 coat of Tnemec Pota-Pox LT Series 40 to a DFT of 4 to 6 mils.
- (2) Intermediate coat: 1 coat of Tnemec LT Series 40 Pota-Pox applied to a DFT of 4.0 to 6.0 mils.
- (3) Finish coat: 1 coat of Tnemec Series 74 Polyurethane to a DFT of 3.0 to 5.0 mils.

d. Sherwin-Williams Co.

- (1) Prime coat: 1 coat of Hi-Solids Catalyzed Epoxy, B 62H Series at 2.0 to 3.0 mils DFT.
- (2) Intermediate coat: 1 coat of Epolon II multi-mil, B62W800 Series at 5.0 to 6.0 mils DFT.
- (3) Finish coat: 1 coat of Hi-Solids Polyurethane, B65 Series at 2.0 to 3.0 mils DFT.

3. Signs or logos as specified on the Drawings or addendum shall be 2 coats of polyurethane, 3.0 to 5.0 mils each, followed by 1 polyurethane clearcoat.

3.13 PAINTING EQUIPMENT AND PROCEDURES

- A. Prior to commencing field painting, the CONTRACTOR shall submit to the ENGINEER for review and acceptance a list of major items of equipment and procedures he proposed to use to complete painting.
- B. The CONTRACTOR'S procedure for painting tank shall include the chronological sequence of operations.
- C. The CONTRACTOR shall have on job a positector, which shall be the standard for acceptance, to determine dry film thickness of paint. The CONTRACTOR shall conduct mil thickness tests after each coat and maintain a legible log of all such readings. The logs shall be reviewed with the ENGINEER at each site visit. Readings shall be taken in accordance with SSPC-PA2.

D. Test Equipment

1. Also to be kept on job and used by the CONTRACTOR shall be a wet-dry bulb sling psychrometer, ASHRAE Psychrometric chart and 3 surface temperature thermometers to determine dew point and acceptable surface temperature. A low voltage holiday detector will be required by the ENGINEER to be used by the CONTRACTOR, in the presence of the ENGINEER, on the interior wetted seams and plates at no additional cost (as previously specified).

3.14 PAINTING SUBCONTRACTOR

- A. If the CONTRACTOR proposes to use a painting Subcontractor, the CONTRACTOR shall submit references concerning Subcontractor to the ENGINEER for review and acceptance at least 30 days prior to commencing field painting. References shall cover last 5 tanks Subcontractor has painted, including size, type, and location of tanks, and name, address and phone numbers of the OWNER'S representative. References shall include a minimum of 2 tanks with painting systems comparable to those herein specified and where an end-of-year warranty inspection was conducted.

3.15 OCCUPATIONAL SAFETY

- A. Erection and painting shall be performed in a manner which is in full compliance with OSHA and Kentucky OSHA regulations.

END OF SECTION

SECTION 13214
FACTORY-COATED BOLTED STEEL TANKS
FOR WATER STORAGE

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, and incidentals to install the complete, functioning water storage tank(s) and foundation(s) as described in these Specifications and shown on the Drawings.
- B. Tank size and capacity shall be as shown on the Drawings.
- C. AWWA Standard Specification for Factory-Coated Bolted Steel tanks for Water Storage, ANSI/AWWA D103-97 shall apply to this Contract and is hereby made a part of the Specifications except as it conflicts with items specifically mentioned herein or as shown on the Drawings.
- D. Dead, liquid, snow, wind, earthquake loads, and tank design shall be in accordance with Section 3, ANSI/AWWA D103, latest revision, and the Kentucky Building Code, Chapter 16, as it relates to earthquake loads.
- E. Available Report
 - 1. A geotechnical investigation was done during the design phase of this project. A copy of the report is available for review at the office of Howard K. Bell, Consulting Engineers, Inc., 354 Waller Avenue, Lexington, Kentucky 40504.
 - 2. The geotechnical report is for bidder and CONTRACTOR information. It is subject to the conditions stated elsewhere in the Specifications, including instructions to Bidders.
 - 3. The geotechnical investigation report is not a part of the Contract Documents.

1.02 QUALIFICATIONS OF BIDDER

- A. The bidder shall be a specialist in the design, fabrication, and erection of factory coated bolted-steel tanks, and shall submit with his bid a list of 5 comparable tanks now in service in the United States.

1.03 RELATED WORK

- A. Concrete and reinforcement are included in Division 3.

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1.04 SUBMITTALS

A. Preliminary Drawings

1. The CONTRACTOR shall attach to his bid a preliminary drawing in duplicate showing dimensions of structure with sizes, thicknesses and weights of all structural plates and members.

B. Foundation Drawings

1. Within 30 days after award of Contract, the CONTRACTOR shall submit 6 informational copies of his foundation drawings with design calculations to the ENGINEER. The CONTRACTOR shall be responsible for the foundation design. The ENGINEER shall return or distribute 2 copies to the ENGINEER'S file, 1 copy to the resident project representative, and 3 copies to the CONTRACTOR. The foundation design shall be endorsed by a professional engineer registered in the state of Kentucky and his/her professional stamp shall be affixed to the calculations.

C. Initial Shop Drawings

1. Detailed drawings for fabrication and erection of tank(s) and appurtenances shall be submitted to the ENGINEER for review in duplicate. Drawings shall clearly show dimensions, sizes, thicknesses, and locations of all parts with methods of joining using recommended symbols of American Welding Society. Fabrication may proceed after the ENGINEER returns 1 copy of the drawing with notation indicating acceptable review.

D. Final Shop Drawings

1. The CONTRACTOR shall submit 5 finalized copies of the shop drawings to the ENGINEER for distribution to the CONTRACTOR (2), the resident project representative (1), and the ENGINEER (2).

PART 2 PRODUCTS

2.01 TANK STRUCTURE

- A. The materials, design, fabrication, and erection of bolted steel tanks shall conform to the Standards of ANSI/AWWA D103-97.

2.02 TANK ACCESSORIES

- A. Standpipe or reservoir exterior shell ladder with continuously welded or bolted rails and safety cage with step off platforms at OSHA required intervals as shown on the Drawings.

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- B. One 24-inch diameter steel access manhole with stainless steel bolts and steel cover supported by davit at bottom of tank. Inlet-outlet pipe connection flush with tank floor (unless otherwise shown on the Drawings) and shall be provided with deflectors as shown on the Drawings.
- C. The CONTRACTOR shall provide separate inlet and outlet pipes. The inlet pipe shall be Schedule 80 PVC with 316 stainless steel brackets attached to the tank shell for support. The inlet riser pipe shall be as shown on the Drawings.
- D. Removable silt stop over inlet-outlet pipe as shown on the Drawings.
- E. Adequately braced overflow pipe with weir box at top end and a flap valve with screen at the bottom end. Weir box shall be braced to roof above the overflow water level.
- F. One 24-inch by 15-inch roof hatch with a watertight, gasketed, marine-type hatch.
- G. A fixed exterior roof ladder from exterior tank ladder to roof access hatch, additional opening and vent.
- H. Roof vent with double frost proof fiberglass screened removable solid cover to prevent ingress of insects, birds, and animals, continuously welded to roof in accordance with AWWA D103-97. Roof vent shall be sized so that no pressure will build up in the tank at the maximum inflow and outflow rates.
- I. A full travel water level gauge board with float if shown on the Drawings.
- J. A locking cage guard to prevent unauthorized access as recommended by the manufacturer.
- K. Any additional accessories required by the previously referenced ANSI/AWWA specification.

2.03 TANK COATING

- A. The object of these Specifications is to provide material and workmanship necessary to produce a first class job. Surface preparation, coating, and associated work shall be done strictly in accordance with tank manufacturer's instructions and the Specifications.
- B. All wall panels shall be factory coated in accordance with the provisions of ANSI/AWWA D103-97, Section 10.4 Glass Coatings, with roof panels either the same or aluminum. Dome support angles, web trusses and miscellaneous parts may be hot dipped galvanized with bolts mechanically galvanized. The color of the tank shall be manufacturer's standard unless otherwise noted on the Drawings or in the Specifications.

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- C. The shearing of plates is acceptable for materials 3/8-inch or less in thickness. However, the plates must have rounded edges for adequate glass coating coverage.
- D. The CONTRACTOR shall furnish an affidavit of compliance that the work and materials furnished under this standard meet the applicable requirements of this ANSI/AWWA standard. A First Anniversary Inspection shall be required.
- E. Field coating, except for touch-up, will not be permitted.
- F. A customer namesheet shall be provided. The entirety of the OWNER'S name shall be included on the nameplate.
- G. All interior materials, including elastic sealant shall be NSF 61 approved.

2.04 TANK FOUNDATION

- A. The tank foundation is part of this Contract. The floor design is of reinforced concrete with an embedded glass-coated steel starter sheet.
- B. Leveling of the starter ring shall be required and the maximum differential elevation within the ring shall not exceed 1/8-inch, nor exceed 1/16-inch within any 10 feet of length.
- C. The tank foundation shall be designed by the tank manufacturer to safely sustain the structure and its live loads, wind, and seismic loads, and be in conformance with AWWA D103-97, Sections 11 and 12.
- D. Tank footing design shall be based on allowable soil bearing strength as recommended in the subsurface investigation report.

2.05 ADDITIONAL REQUIREMENTS

- A. If anchor bolts are used to prevent overturning of the tank when empty, the nominal diameter shall not be less than 1-1/4 inch. If anchor straps are used, they shall be pre-tensioned before welding to the tank shell.
- B. The bottom of any roof supporting member shall not be lower than 6" above the overflow level.
- C. The sub-base bedding material for pipe lines and appurtenances shall be placed as indicated on the Drawings. All piping passing under the tank floor and footings shall be encased with a minimum of 12 inches of 2,500 psi concrete.
- D. All concrete work exposed above grade shall have a first class rubbed finish. All exterior corners shall be chamfered.

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PART 3 EXECUTION

3.01 GROUTING

- A. Grout shall consist of 1:1.5 Portland cement-sand mix. Sand shall be clean, well graded particles of hard, durable stone and shall contain not more than 5 percent by weight of coal, lignite, silt, clay, and other deleterious matter. Grouting shall be required under all supporting columns, plates, base elbows, and at additional places shown on the Drawings.

3.02 TESTING

- A. All sheets shall be shop holiday tested. No sheets shall be shipped with known holidays.
- B. All sheets shall be holiday tested on the interior per D 103-97, Section 9.2.2, in the field after erection.
- C. Following completion of erection and cleaning of the tank, the structure shall be tested for liquid tightness by filling the tank to its overflow elevation. The CONTRACTOR shall furnish all labor and equipment and the OWNER shall supply the water for making tests.
- D. Any leaks disclosed by this test shall be corrected by the erector in accordance with the manufacturer's recommendations.
- E. The OWNER shall provide means for disposing of test water up to tank outlet pipe.

3.03 INSPECTION

- A. All sheets shall be shop holiday tested. No sheets shall be shipped with known holidays. Copies of mill test reports and holiday tests shall be submitted to ENGINEER in triplicate.
- B. OWNER reserves the right to make mill and/or shop inspections.
- C. The following scheduled inspections shall be made:
 - 1. At time of initial field erection when project requirements including testing shall be reviewed.
 - 2. During erection of structure.
 - 3. After completion of structures and appurtenances when final structural inspection shall be made.
- D. At time of disinfection.

3.04 DISINFECTION

- A. Upon acceptance of the erected structure by the ENGINEER, the CONTRACTOR shall disinfect the interior of the tank in conformance with AWWA C652-02, Method 1.
- B. The water storage facility shall be filled to the overflow level with potable water to which enough chlorine is added to provide a free chlorine residual in the full facility of not less than 10 mg/L at the end of the appropriate 6-hour or 24-hour period, as described in paragraph H. The chlorine, either as calcium hypochlorite, sodium hypochlorite, or liquid chlorine, shall be introduced into the water as described hereafter.
- C. Liquid chlorine shall be introduced into the water, filling the storage facility in such a way as to give a uniform chlorine concentration during the entire filling operation. Portable chlorination equipment shall be carefully operated and shall include a liquid chlorine cylinder, gas-flow chlorinator, chlorine ejector, safety equipment, and an appropriate solution tube to inject the high concentration chlorine solution into the filling water. The solution tube shall be inserted through an appropriate valve located on the inlet pipe and near the storage facility such that the chlorine solution will mix readily with the inflowing water.
- D. Sodium hypochlorite shall be added to the water entering the storage facility by means of a chemical feed pump or shall be applied by hand-pouring into the storage facility and allowing the inflowing water to provide the desired mixing.
- E. When a chemical feed pump is used, the concentrated chlorine solution shall be pumped through an appropriate solution tube so as to inject the high concentration chlorine solution at a rate that will give a uniform chlorine concentration in the filling water. The solution tube shall be inserted through an appropriate valve located on the inlet pipe and near the storage facility, or through an appropriate valve located on the storage facility such that the chlorine solution will mix readily with the filling water.
- F. When sodium hypochlorite is poured into the storage facility, the filling of the storage facility shall begin immediately thereafter or as soon as any removed manhole covers can be closed. The sodium hypochlorite may be poured through the cleanout or inspection manhole in the lower course or level of the storage facility, in the riser pipe of an elevated tank, or through the roof manhole. The sodium hypochlorite shall be poured into the water in the storage facility when the water is not more than 3 feet (0.9 meters) in depth, nor less than 1 foot (0.3 meters) in depth or as close thereto as manhole locations permit.
- G. Calcium hypochlorite granules or tablets broken or crushed to sizes not larger than 1/4-inch (6.4 mm) maximum dimension may be poured or carried into the storage facility through the cleanout or inspection manhole in the lower course or level of the storage facility, into the riser pipe of an elevated tank, or through the roof manhole. The granules or tablet particles shall be placed in the storage facility before flowing water into it. The granules or tablets shall be located so that the inflowing water will ensure a current of water circulating through the

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calcium hypochlorite, dissolving it during the filling operation. The calcium hypochlorite shall be placed only on dry surfaces unless adequate precautions are taken to provide ventilation or protective breathing equipment.

- H. After the storage facility has been filled with the disinfecting water, it shall stand full as follows:
 - 1. For a period of not less than 6 hours when the water entering the storage facility has been chlorinated uniformly by gas feed equipment or chemical pump, or
 - 2. For a period of not less than 24 hours when the storage facility has been filled with water that has been mixed with sodium hypochlorite or calcium hypochlorite within the storage facility as described in paragraphs D and G.
- I. After the chlorination procedure is complete and prior to putting the storage tank into service, the water from the tank shall be tested for coliform presence in conformance with the latest edition of Standard Methods for the Examination of Water and Wastewater.
- J. Chlorinated water shall be disposed of in accordance with 401 KAR 5:031 and 8:020, which state that the allowable instream concentration of chlorine is 10 ug/L, which is equal to 0.01 mg/L. If necessary, the CONTRACTOR shall in writing submit the method proposed for dechlorinating. Recommended chemicals, as given in AWWA C651 are sulphur dioxide, sodium bisulfate, sodium sulfite and sodium thiosulfate.
- K. CONTRACTOR shall furnish all equipment and supplies necessary to complete disinfection.
- L. After disinfection of the tank is completed, the OWNER will collect water samples for bacteriological testing. Negative laboratory results must be obtained prior to placing the tank in service. Bacteriological testing will be paid for by the OWNER.

3.05 CLEANING UP AND REPAIRING DAMAGE

- A. The Contract shall not be considered complete until all construction structures, equipment, and rubbish from construction are cleaned from site of work.
- B. All damage to existing grounds and structures caused by construction operations must be repaired or OWNER compensated for such damage before contract shall be considered complete.

3.06 GENERAL REQUIREMENTS AND GUARANTEE

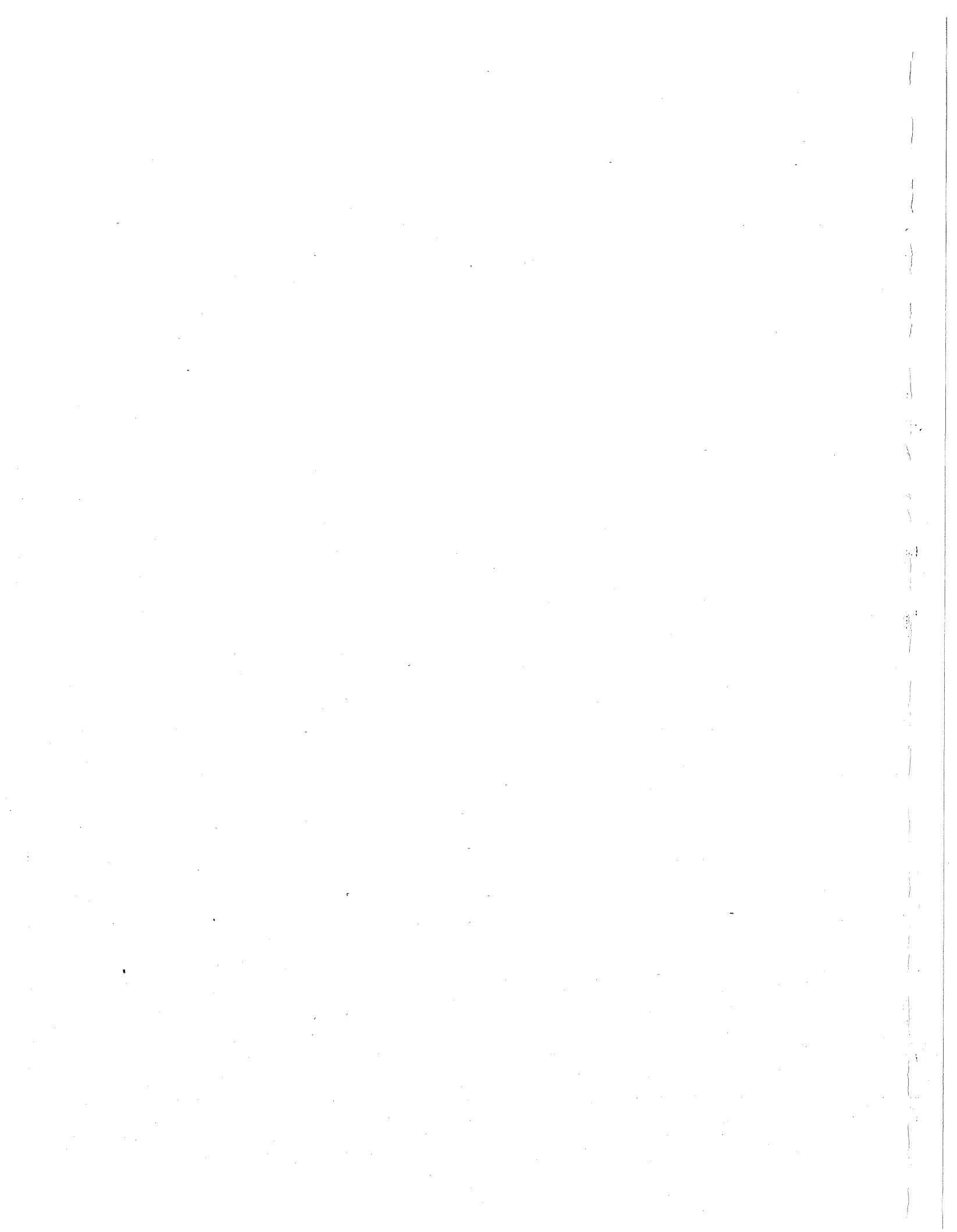
- A. CONTRACTOR shall guarantee facility regarding design, materials, erection, workmanship and paint for a period of 1 year from date of final certificate of payment to CONTRACTOR. Acceptance of the CONTRACTOR'S design, materials, erection, workmanship, tests, shop drawings, and/or Specifications shall not

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relieve CONTRACTOR of meeting requirements of these Specifications and for providing a safe, dependable facility. If any design, materials, and/or workmanship proves to be defective within 1 year, they shall be replaced or repaired by CONTRACTOR without expense to OWNER.

- B. If replacements or repairs are not made within 30 days, OWNER shall have right to make them and charge cost of same to CONTRACTOR or his bondsman.

END OF SECTION



SECTION 15100

SMALL PLUMBING VALVES, PLUMBING SPECIALTIES
AND SERVICE ACCESSORIES

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Furnish all labor, materials, equipment, and incidentals required and install complete and ready for operation all valves and appurtenances as shown on the Drawings and as specified herein.

1.02 RELATED WORK

- A. Large Plumbing Valves and Appurtenances are included in this Division, Section 15102.
- B. Excavation, Backfill and Grading are included in Division 2.
- C. Electrical is included in Division 16.

1.03 SYSTEM DESCRIPTION

- A. All of the equipment and materials specified herein is intended to be standard for use in controlling the flow of water.

1.04 QUALITY ASSURANCE

- A. All of the types of valves and appurtenances shall be products of well established firms who are fully experienced, reputable and qualified in the manufacture of the particular equipment to be furnished. All materials of construction shall be of an acceptable type and shall be designated for the pressure and temperatures at which they are to be operated, for the materials they are to handle and for the use for which they are intended. The materials shall meet established technical standards of quality and strength necessary to assure safe installations and conform to applicable standards. The equipment shall be designed, constructed and installed in accordance with the best practices and methods and shall comply with these Specifications as applicable.

1.05 REFERENCES

- A. Kentucky Building Code.
- B. Kentucky State Plumbing Law, Regulations and Code.

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1.06 SUBMITTALS

- A. Copies of all materials required to establish compliance with these Specifications shall be submitted in accordance with the provisions of the General Conditions. Submittals shall include at least the following:
1. Certified drawings showing all important details of construction and dimensions.
 2. Descriptive literature, bulletins, and/or catalogs of the equipment.

1.07 OPERATING INSTRUCTIONS

- A. Operating and maintenance instructions shall be furnished to the ENGINEER as required in the General Conditions. The instructions shall be prepared specifically for this installation and shall include all required cuts, drawings, equipment lists, descriptions, etc., that are required to instruct operating and maintenance personnel unfamiliar with such equipment.

PART 2 PRODUCTS

2.01 GENERAL

- A. All valves and appurtenances shall be of the size shown on the Drawings and as far as possible all equipment of the same type shall be from one manufacturer.
- B. All valves and appurtenances shall have the name of the maker, flow directional arrows, and the working pressure for which they are designed cast in raised letters upon some appropriate part of the body.
- C. All buried valves shall open left (counterclockwise). Insofar as possible, all valves shall open counterclockwise.

2.02 GATE VALVES

- A. Gate valves shall be used in shut-off applications and where the valves are scheduled for infrequent use.
1. Gate Valves for Water
 - a. Gate valves shall be for 250 pound water working pressure, 2-1/2 inches and 3 inches for air release. Valves 3 inches and smaller shall be standard brass construction, rising stem, double disc, parallel seat, with handwheel where exposed or key operator when in the ground. The valves shall be Crane No. 440, Jenkins 62U, or equal.
 - b. In copper solder joint piping, Chase Style 1334 or equal, gate valves are preferred with solder joint connections.

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2.03 MISCELLANEOUS COCKS

A. Air Release Cocks

1. Air release cocks shall be for 125 pound pressure, 1/2 inch, bronze plug and body, with handle operator. Air cocks shall be Crane No. 256 Tee Head, Lunkenheimer No. 1571, or equal.

B. Gauge Cocks

1. Gauge cocks for water service shall be 316 stainless steel construction rated for safe operation at 10,000 psi at 100 degrees Fahrenheit. The valve shall be nitrogen tested for seat leakage, maximum allowable leak rate 0.1 scc./min.
2. Gauge cocks shall be Whitey Co. "BV" series bleed valves or equal.

2.04 MISCELLANEOUS STOPS

A. Corporation Stops

1. Corporation stop shall be a Mueller 300 ball corporation valve, or equal, rated to 300 psi with CTS compression fittings.
2. Corporation stops shall be factory tested to 300 psi to be compatible with the pipes in which they are installed.

B. Curb Stops

1. Curb stops to be used with threaded pipe shall be brass inverted key round way with female threaded iron pipe connections for threaded iron pipe. Curb stops shall be Ford FB-1000, or approved equal.
2. Curb stops to be used with copper pipe, with threaded type connections, shall be Ford FB-1000, or approved equal.
3. Curb stops to be used with plastic pipe shall be brass, inverted key, round way with compression connections and rigid liner as recommended by curb stop manufacturer. Curb stops to be used with plastic pipe shall be Muller H/5/59 or equal.
4. The CONTRACTOR shall furnish 2 tee wrenches, 4 feet long, for operation of curb stops.

C. Service Clamps

1. Taps for services on PVC water main shall be made with the use of service clamps. Clamps shall be bronze construction with O-ring seal, 2 sections for water mains through 8 inches in diameter and 3 sections for water

mains larger than 8 inches in diameter. Service clamps shall have Mueller thread. Clamps shall be Mueller brass or approved equal.

D. Curb Stop Boxes

1. Curb stop boxes shall be cast iron, extension type, arch pattern, Mueller H-10316, or equal.

2.05 WATER SERVICE ACCESSORIES

A. Meter Setters

1. Meter setter shall be ball type with angle ball valve inlet and angle dual check valve outlet rated to 300 psi with CTS compression fittings.
2. A tandem coppersetter shall be provided when an individual pressure regulator is required, and shall include a check valve, cut off valve, and saddlenuts. The tandem coppersetter shall be Ford company Series 90, or approved equal.
3. Individual residential pressure regulators shall be Wilkins 600 Series, or approved equal, with bronze body and stem and stainless steel strainer, and pressure rated to 300 psi. Pressure regulators shall be provided at service meter settings where working pressure of line is in excess of 80 psi.
4. Service lines shall be polyethylene tubing, meeting ASTM 3408, SDR 9, and shall be approved for 200 psi pressure or copper as indicated on the plans. Polyethylene tubing shall be of an IPS size from meter toward service connection. Tubing from water main to meter shall be CTS size. Copper pipe shall meet requirements of ASTM B-88 for Type "K" copper, hard drawn for below ground.

B. Water Meters

1. The OWNER has contracted to purchase residence meters directly and the CONTRACTOR will not be responsible for either their purchase or their installation.

C. Meter and Valve Box

1. Meter box shall be Mid-States Plastics. Meter box shall be 20 inches by 24 inches with 18-inch rectangular base with cast iron lid, equal to Ford Type C, single lid cover, 20-inch I.D., or approved equal, equipped with touchread technology.

D. Master Meter

1. The OWNER has standardized on one particular make and model of master meter and desires that the master meter furnished under this

project meet that standard. The master meter shall be a Sensus TRPL (TouchRead Pit Lead) 6-inch high performance compound meter, flanged coupling adapter style, AWWA Class 11 with test plug, 1-1/2 tapered pipe threads with test nipple and valves, equipped with the TouchRead Automated Meter Reading and Billing System, or approved equal. The ECR register shall be equipped with a wired connection between the meter and a pitlid mounted module, thus enabling the underground meters to be read without opening the meter box or vault. All wired connections and terminals of the TouchRead PitLid modules and registers shall be fully sealed at the factory using a process to ensure protection from water infiltration. The connection terminals of the registers shall also be factory sealed. Additional retainage may be withheld until the equipment is accepted by the OWNER.

PART 3 EXECUTION

3.01 INSTALLATION

- A. All valves and appurtenances shall be installed in the locations shown, true to alignment and rigidly supported. Any damage to the above items shall be repaired to the satisfaction of the ENGINEER before they are installed.
- B. Control valves in all locations shall be so grouped and located that they may be easily operated, through access panels, doors, or adjacent to equipment.
- C. After installation, all valves and appurtenances shall be tested at least one hour at the working pressure corresponding to the class of pipe, unless a different test pressure is specified. If any joint proves to be defective, it shall be repaired to the satisfaction of the ENGINEER.
- D. All materials shall be carefully inspected for defects in workmanship and materials; all debris and foreign material cleaned out of valve openings, etc.; all operating mechanisms operated to check their proper functioning, and all nuts and bolts checked for tightness. Valves and other equipment which do not operate easily, or are otherwise defective, shall be repaired or replaced at no additional cost to the OWNER.
- E. Hydrants shall be set at the locations as shown on the Drawings and bedded on a firm foundation. A drainage pit as detailed on the Drawings shall be filled with screened gravel and satisfactorily compacted.
- F. During backfilling, additional screened gravel shall be brought up around and 6 inches over the drain port. Each hydrant shall be set in true vertical alignment and properly braced. Concrete thrust blocks shall be placed between the back of the hydrant inlet and undisturbed soil at the end of the trench. Minimum bearing area shall be as shown on the Drawings. Felt roofing paper shall be placed around hydrant elbow before placing concrete. CARE SHALL BE TAKEN TO INSURE THAT CONCRETE DOES NOT PLUG THE DRAIN PORTS.

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- G. If directed, the hydrant shall be tied to the pipe with suitable rods or clamps, galvanized, painted, or otherwise rustproof treated. Concrete used for backing shall be no leaner than 1 part cement, 2-1/2 parts sand, and 5-1/2 parts stone. Hydrant paint shall be touched up as required after installation.
- H. Buried flanged or mechanical joints shall be made with cadmium plated bolts. All exposed bolts and nuts shall be cadmium plated. All exposed bolts and nuts shall be heavily coated with 2 coats of bituminous paint.
- J. Buried valves and valve boxes shall be set with the stem vertically aligned in the center of the gate box. Valves shall be set on a firm foundation and supported by tamping selected excavated material under the sides of the valve. The valve box shall be supported during backfilling and maintained in vertical alignment with the top flush with finish grade.

3.02 SHOP PAINTING

- A. Interior surfaces of all valves, the exterior surfaces of buried valves and miscellaneous piping appurtenances shall be given a shop finish of an asphalt varnish conforming to Federal Specification TT-V51e for Varnish Asphalt.

3.03 INSPECTION AND TESTING

- A. The various pipelines in which the valves and appurtenances are to be installed are specified to be field tested. During these tests any defective valve or appurtenance shall be adjusted, removed and replaced, or otherwise made acceptable to the ENGINEER.
- B. Various regulating valves, strainer, or other appurtenances shall be tested to demonstrate their conformance with the specified operational capabilities and any deficiencies shall be corrected or the device replaced or otherwise made acceptable to the ENGINEER.

END OF SECTION

SECTION 15102
VALVES (WATER RELATED)

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment, and incidentals required and install complete and ready for operation all valves and appurtenances as shown on the Contract Drawings and specified herein.
- B. The equipment shall include but not be limited to, the following:
 - 1. Butterfly valves
 - 2. Gate valves
 - 3. Check valves
 - 4. Tapping valves, sleeves and crosses
 - 5. Blow-off hydrants/flush hydrants

1.02 RELATED WORK

- A. Excavation, backfill and grading is included in Division 2.
- B. Piping is included in the respective sections of Division 2.
- C. Valves and service accessories on all plumbing systems are included in Division 15.
- D. Electrical work is in Division 16.
- E. Special sequence or schedule requirements (if any) are specified in Section 01010 - Summary of Work.

1.03 DESCRIPTIONS OF SYSTEMS

- A. All of the equipment and materials specified herein is intended to be standard for use in controlling the flow of water.

1.04 QUALIFICATIONS

- A. All of the types of valves and appurtenances shall be products of well established firms who are fully experienced, reputable and qualified in the manufacture of the particular equipment to be furnished. The equipment shall be designed, constructed and installed in accordance with the best practices and methods and shall comply with these specifications as applicable.

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B. Acceptable Manufacturers

1. Butterfly Valves - Pratt, M&H, DeZurik, or equal.
2. Gate Valves - Kennedy, Clow, Mueller or equal.
3. Check Valves - Clow, Golden Anderson, APCO-Valve and Primer Corp., or equal.
4. Air Release - APCO-Valve and Primer Corp., Golden Anderson, or equal.

1.05 SUBMITTALS

A. Complete shop drawings of all valves and appurtenances shall be submitted to the ENGINEER in accordance with the requirements of Sections 00820 and 01300.

B. The ENGINEER shall be furnished 2 certified copies of reports covering the required leakages, hydrostatic and proof-of-design tests on the valves.

C. Gate Valves

1. The manufacturer shall furnish the ENGINEER 2 copies of an affidavit stating that the valve and all materials used in its construction conform to the applicable requirements of ANSI/AWWA C509-87, and that all tests specified therein have been performed and that all test requirements have been met.
2. The ENGINEER shall be furnished 2 copies of affidavit that the "Valve Protection Testing" has been done and that all test requirements have been met.
3. The ENGINEER shall be furnished with 2 copies of affidavit that inspection, testing and rejection are in accordance with AWWA C509-87 Section 6.1 through Section 6.2.

D. Check Valves

1. The ENGINEER shall be furnished 2 copies of affidavit of compliance stating that the valves and materials used in their construction conform to the applicable requirements of ANSI/AWWA C508-82, and that all tests specified therein have been made and that the test requirements have been met.

E. Air Release Valves

1. The manufacturer shall furnish the ENGINEER 2 copies of written certification that the valves have been tested hydrostatically and tested for proper performance, and that materials of construction conform to the appropriate ASTM specifications.

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1.06 OPERATING INSTRUCTIONS

- A. Manufacturer's operating and maintenance instructions shall be furnished to the ENGINEER as set forth in Section 01600.

1.07 TOOLS

- A. Special tools, if required for operation and maintenance, shall be supplied with the equipment.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. General

1. All valves and appurtenances shall be of the size shown on the Drawings and as far as possible all equipment of the same type shall be from one manufacturer.
2. All valves and appurtenances shall have the name of the maker, flow-directional arrows, and the working pressure for which they are designed cast in raised letters on some appropriate part of the body.
3. All valves must be provided with suitable operating devices and adapted for operation in the position in which they are shown on the Drawings.
4. All buried valves shall open by turning counterclockwise.
5. Valves shall have types of operators as shown on the Drawings.
6. All bolts and studs shall be in accordance with ASTM A-307 Grade B and nuts shall be in accordance with ASTM A-563. Bolts, studs and nuts shall be electrogalvanized according to ASTM B-633.
7. All bolts delivered to the job shall be free of rust and dirt and shall be stored in a manner to protect them from rust and dirt. All bolts shall be tightened to the proper torque. They shall be of the size recommended for the pipe and fittings they are to be used on and shall be in the recommended quantity. Tightening of bolts shall be alternated, so as to not produce undue stress on the valves and fittings.

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2.02 GATE VALVES

A. Resilient-Seated Gate Valve (AWWA Type)

1. General

- a. Resilient-seated gate valves shall conform in all respects to ANSI/AWWA C509-87 with non-rising or rising stems, in sizes 3, 4, 6, 8, 10, and 12 inch NPS except as otherwise noted below. They shall be designed for a working water pressure of 250 psi.
- b. Valves shall have a clear unobstructed water way, without pockets or ridges in the seating area of the valve body. When fully open the water way shall be at least as large as the pipe diameter to which it is connected.
- c. All future references to section and paragraph numbers shall be those of ANSI/AWWA C509-87.

2. Materials

a. Physical and Chemical Properties

- (1) Physical and chemical characteristics of the valve components shall be in accordance with Section 2.2, except that carbon steel castings for valves are not acceptable. Paint shall be as hereinafter specified under "Valve Protection."

3. Detailed Design

a. Valve Ends

(1) General

- (a) Valve ends shall be flanged, mechanical joint, PVC or rubber ring slip-on type as shown on the Drawings.
- (b) In resilient seated tapping valves, end connections may be a combination of flanged and mechanical joint.

b. Stem Seal

- (1) Stem seals shall be O-rings in accordance with Section 4.8, paragraph 4.8.2 and subparagraph 4.8.2.1, and materials shall be in accordance with paragraph 4.8.3.

c. Wrench Nuts and Handwheels

- (1) Wrench nuts and handwheels shall be in accordance with Section 4.10 and subparagraphs 4.10.1 through 4.10.5, except that all valves whether NRS or O S & Y shall open by turning counterclockwise.

d. Gaskets

- (1) Gaskets where used shall be in accordance with Section 4.11. O-rings shall be of Buna-N or equal material.

e. Valve Seats

- (1) Valve seats shall be in accordance with Section 4.12, except that seats applied to the valve body are not acceptable.

f. Seat Reinforcement

- (1) Seat reinforcement where used shall be in accordance with Section 4.13, except that exposed mechanical devices and hardware used shall be bronze and/or stainless steel.

4. Fabrication

a. Valve Protection (Painting and Coating)

(1) Exterior

- (a) Exterior painting of the valve may be in accordance with section 2.2.7.1, or it may be the same as that specified for interior painting of the valves.

(2) Interior

- (a) The interior of the valve shall be prepared for and painted in accordance with AWWA C550-90. The coating may be a fusion bonded epoxy, in 8 to 10 mil thickness or it may be a two-part thermosetting epoxy having the same mil thickness. After application the interior coating shall be visually examined and holiday tested in accordance with AWWA C550-90.

5. Valve Extension Stems

- a. All extension stems shall be connected by bolted couplings for connection to and removal from the valves and stands. Nuts and bolts in connections shall be stainless steel. All extension stem connecting pins shall be stainless steel.

2.03 TAPPING VALVES AND TAPPING SLEEVES AND CROSSES

A. Tapping Valves

1. Tapping valves for use with tapping sleeve and crosses shall be in accordance with the specifications for resilient seat gate valves, except that one end shall have a flanged connection and the other end either a hub or mechanical joint connection.
2. They shall be for 200 psi in sizes 2 inch thru 12 inch and 150 psi in sizes 14 inch and larger.
3. Valves shall open by turning counterclockwise.
4. Inlet flanges of valves shall meet ANSI B16.1, Class 125 standard.

B. Tapping Sleeves and Tapping Crosses

1. Tapping sleeves and tapping crosses shall have heavy cross sections to strengthen the existing water main at the point of installation.
2. Mainline end connections to existing pipeline shall be mechanical joint with large and small gaskets or hub end for lead and jute joints.
3. Mechanical joint tapping sleeves and crosses shall have a working pressure of 200 psi.
4. Outlet end of tapping sleeves and crosses shall have ANSI B16.1, Class 125 flanges.

C. Quality Standard

1. All tapping valves, tapping sleeves and tapping crosses shall be in features and quality equal to those of American Valve and Hydrant Company, Mueller Company or Dresser Manufacturing Company.

D. Test and Certification

1. Tests on tapping valves shall be in accordance with these Specifications for resilient seated gate valves.

E. Protection

1. Tapping Valves
 - a. Protection of tapping sleeves and valves shall be in accordance with these Specifications for resilient seated gate valves.

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2. Tapping Sleeves and Crosses

- a. Protection for tapping sleeves and crosses shall be in accordance with these Specifications for cast iron pipe fittings.

F. Marking and Tagging Valves

1. Tagging of tapping valves shall be in accordance with these Specifications for resilient seated gate valves.

2.04 CHECK VALVES

A. Check valves shall be of the type shown on the Drawings.

B. Swing Check Valves (AWWA)

1. General

- a. This specification covers iron-body bronze-mounted swing check valves, 2-24 inch NPS size with outside lever and weight, to operate in both horizontal and vertical position.
- b. Swing check valves shall meet all appropriate requirements of AWWA C508-82.

2. Materials

a. Steel

- (1) Steel body bolt, stud and nuts shall not be acceptable.

3. General Design

a. Closure Assembly

- (1) The closure assembly shall be designed to assume the closed position by gravity under no-flow conditions in a horizontal pipeline.

b. End Connections

- (1) End connections will be type shown on the Drawings.

c. Seating Surfaces

- (1) Seating surfaces shall be metal to rubber in accordance with Section 3, paragraphs 3.7.1, 3.7.2 and 3.7.4 of AWWA C508-82
- (2) Metal to metal seats are not acceptable.

2.05 FLUSHING HYDRANTS

A. General

1. This standard covers post-type dry barrel hydrants with compression type valves, operating against pressure. They shall meet all requirements of ANSI/AWWA Specification C502-85. Each hydrant to have brass tag and chain to read/stamped "For Flushing Purposes."
2. They shall have two 2 1/2 inch hose connection nozzles and one 4 1/2 inch steamer connection nozzle, all with caps and drains and have national standard threads. Provide minimum of 2 each hydrant wrenches.
3. Main valve opening size shall be 5 1/4 inch which must remain closed when the above ground breakable safety section of the hydrant barrel is broken off.
4. All hydrants shall have 6 inch mechanical joint bell connection designed for 200 pounds working water pressure, in accordance with ANSI/AWWA C110/A21.10. Joint accessories are to be furnished with the connecting pipe.
5. Finish paint color of the hydrant barrel above ground line shall be selected by the OWNER.
6. All hydrants shall have an automatic drain feature providing positive barrel drainage after hydrant use.
7. The lowest outlet level of the hydrant shall be located sufficiently above the indicated ground level to permit a 360° swing of a 15 inch hydrant wrench. One standard hydrant wrench is to be provided. All hydrants shall open by turning counterclockwise.
8. Where the OWNER has standardized on one particular make and model flushing hydrant and desires that the hydrants furnished under this project be such standard, that make and model hydrant, namely American Darling Model WB-67-250 or equal, will govern.
9. All further reference to section and paragraph numbers shall be those of ANSI/AWWA C502-85.

B. Affidavit of Compliance

1. The manufacturer shall furnish the OWNER, through the ENGINEER, 3 copies of an affidavit in accordance with Section 1, paragraph 1.7.

C. Materials

1. All materials used in the production of dry-barrel fire hydrants shall conform to the referenced standards for each material as set forth in Section 2 - Materials, paragraphs 2.2.1 through 2.2.5 and subparagraphs 2.2.5.1 and 2.2.5.2.

D. General Design and Detailed Design

1. General Design

- a. General design of hydrants shall be in accordance with Section 3, paragraph 3.1 and subparagraphs 3.1.1 and 3.1.2.

2. Detailed Design

a. Valves

- (1) Valves shall be in accordance with Section 3, paragraph 3.2.1 and subparagraphs 3.2.1.1 and 3.2.1.2.

b. Valve Facings

- (1) Valve facings shall be in accordance with Section 3, paragraph 3.2.2.

c. Valve Seats

- (1) Valve seats shall be in accordance with Section 3, paragraph 3.2.3.

d. Size

- (1) Hydrant size shall be in accordance with Section 3, paragraph 3.2.4, except that main valve opening diameter may not be less than 5 1/4 inches.

e. Bury-length and Trench Depth

- (1) Unless otherwise noted, depth of hydrant will be 3'-6". In the event that a hydrant is installed at a location requiring greater than the "standard bury" depth, the CONTRACTOR will be required to provide the riser sections required at no additional cost to the OWNER.

f. Barrel Sections

- (1) Hydrant barrel sections shall be in accordance with Section 3, paragraph 3.2.6 and subparagraphs 3.2.6.1 and 3.2.6.2 except that the flange or other joint at 2 inches above the ground line shall be a breakable joint.

g. Hydrant Top

- (1) Hydrant tops shall be in accordance with Section 3, paragraph 3.2.7.

h. Outlet Nozzles

- (1) Hydrant outlet nozzles shall be in accordance with Section 3, paragraph 3.2.8 and subparagraph 3.2.8.1 and 3.2.8.2 except that leading shall not be used in fastening nozzles to the hydrant barrel.

i. Operating Stem and Mechanism

- (1) The hydrant operating mechanism shall be in accordance with Section 3, subparagraphs 3.2.9.1 through 3.2.9.7.

j. Drain Outlet

- (1) An automatic drain outlet shall be provided. The outlet shall be located in the base or barrel or between the base and barrel. Tapping of the outlet is not required. Other features of the drain outlet shall be in accordance with Section 3, subparagraphs 3.2.10.1 and 3.2.10.2.

k. Drain Valve Mechanism

- (1) The hydrant drain valve shall be in accordance with Section 3, paragraph 3.2.11.

l. O-ring Seals

- (1) A seal that uses O-rings shall be used. O-rings and their ring grooves shall be in accordance with Section 3, subparagraphs 3.2.12.1 and 3.2.12.2.

m. Gaskets

- (1) Gaskets shall be in accordance with Section 3, paragraph 3.2.14.

n. Bolts and Nuts

- (1) With the exception of flange bolts at breakable hydrant barrel section, all bolts and nuts shall be of corrosion resistant material, in accordance with Section 3, paragraph 3.2.17. Breakable section bolts may be of steel.

o. Hydrant Inlet

- (1) The base of the hydrant shall have a side inlet provided with a hub end for mechanical joint connection provided with strapping lugs for strapping hydrant to water main to prevent separation of the hydrant and hydrant branch from the main line, or the hub end may be plain mechanical joint, provided locked type pipe joints are used between the hydrant and water main. Refer to Section 02610 of these Specifications for optional methods of restraint for flushing hydrants.

E. Workmanship and Painting

1. Workmanship shall be in accordance with Section 4, paragraph 4.1 and subparagraph 4.1.1 through 4.1.3.
2. Painting shall be in accordance with Section 4, paragraph 4.2 and subparagraphs 4.2.1 through 4.2.3.

F. Inspection, Testing and Rejection

1. Testing shall be in accordance with Section 5, paragraph 5.1 and subparagraphs 5.1.1 through 5.1.2. The ENGINEER shall be furnished 2 copies of all tests.
2. Inspection and rejection shall be in accordance with Section 5, paragraph 5.3, with 2 copies of affidavit being supplied the ENGINEER.

G. Marking and Shipping

1. Marking and shipping shall be in accordance with Section 6, paragraphs 6.1 and 6.2, except that hydrants having a depth of bury greater than the standard 3'-6", shall be given a tag number which corresponds to the hydrants plant location number. Tags, if required, shall be of durable materials and markings.

PART 3 EXECUTION

3.01 INSTALLATION

A. Interior

1. All valves and appurtenances shall be installed at the locations shown on the Drawings. All necessary materials, parts, operators and gaskets shall be furnished and installed under this Contract.
2. Particular attention shall be paid to the location and orientation of all valve operators to provide an accessible installation. Should any valve be located with the operator inaccessible and simple re-orientation of the valve would make it accessible, the valve shall be moved at no cost the OWNER.
3. The CONTRACTOR shall thoroughly clean the valves fittings before starting erection. All scale, rust and dirt shall be removed by power brushing and/or solvent cleaning.

B. Exterior

1. Valves in ground shall be installed with operating stems vertical, unless otherwise shown on the Drawings or called for in these Specifications. Tops of operating nuts shall be not more than 30 inches below ground surface. Where valve operating nuts are more than 30 inches below tops of valve boxes, stems shall be provided to bring the operating nut to within 12 to 24 inches of box tops.
 2. Valve boxes shall be accurately centered over valve operating nuts and the backfill shall be mechanically tamped about them, to prevent subsequent movement. Tops of boxes shall be flush with ground surface, paving, walk, or road surface.
 3. The cost of the concrete collar, required about valve boxes, shall be included in the unit price for the valve and/or box.
 4. All valves, check valves, and floor boxes, on or in structures, shall be installed as shown on the Drawings.
- C. For butterfly valves, installation shall be in accordance with Appendix B., Sections B.1 through B.5 of ANSI/AWWA C504-87.
- D. For gate valves, installation shall be in accordance with Appendix A, Sections A.5.1 through A.5.7 of ANSI/AWWA C509-87.

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3.02 SHOP PAINTING

- A. Interior surfaces of all valves, the exterior surfaces of buried valves and miscellaneous piping appurtenances shall be given a shop finish of an asphalt varnish conforming to Federal Specification TT-V51e for Varnish Asphalt.
- B. The exterior surface of various parts of valves, operators, floorstands and miscellaneous piping shall be thoroughly cleaned of all scale, dirt, grease, or other foreign matter and thereafter 1 shop coat of an approved rust-inhibitive primer applied in accordance with the instructions of the paint manufacturer.

3.03 INSPECTION AND TESTING

- A. The various pipelines in which the valves and appurtenances are to be installed are specified to be field tested. During these tests any defective valve or appurtenance shall be adjusted, removed and replaced, or otherwise made acceptable to the ENGINEER.
- B. Various regulating valves, strainer, or other appurtenances shall be tested to demonstrate their conformance with the specified operational capabilities any deficiencies shall be corrected or the device replaced or otherwise made acceptable to the ENGINEER.
- C. Testing shall be done in accordance with Section 02610 "TESTING" with no visible leaks allowed on valves.

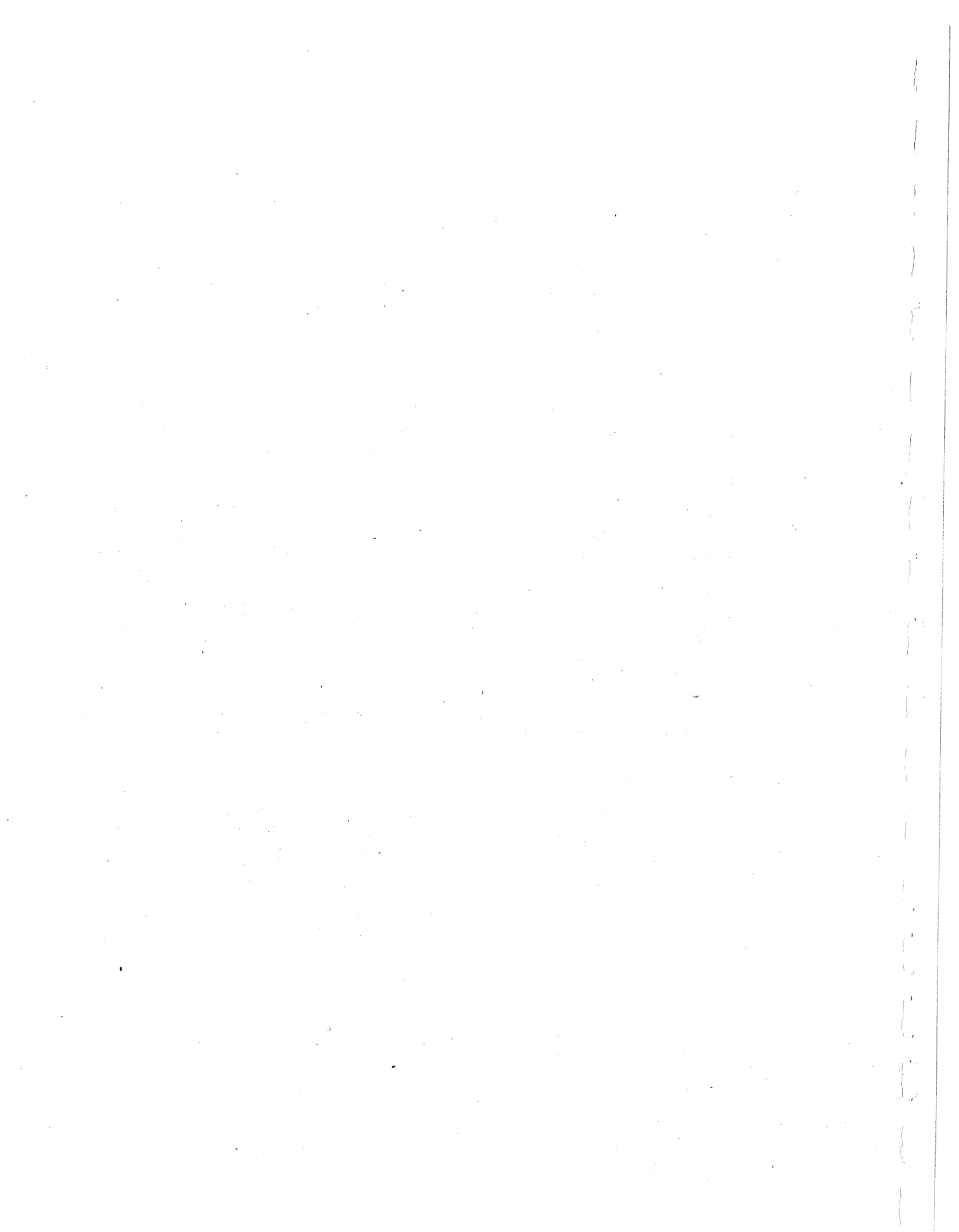
3.04 TOOLS AND SPARE PARTS

- A. "All special tools required for normal operation and maintenance shall be furnished by the valve manufacturer."

3.05 METHOD OF PAYMENT

- A. Payment for the complete system shall be included in the lump sum or unit price bid for the project and shall include the furnishing of materials, equipment and parts and installation of all components to provide a completely functional and operation system.

END OF SECTION



SECTION 15104

SPECIALTY VALVES (WATER)

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment, and incidentals required and install complete and ready for operation all valves and appurtenances as shown on the Contract Drawings and as specified herein.
- B. The equipment shall include but not be limited to, the following:
 - 1. Air and vacuum valves.
 - 2. Air release valves.

1.02 RELATED WORK

- A. Excavation, backfill and grading is included in Division 2.
- B. Piping is included in the respective sections of Divisions 2 and 15.
- C. Valves and service accessories on all plumbing systems are included in Division 15.
- D. Special sequence or schedule requirements (if any) are specified in Section 01010 - Summary of Work.

1.03 DESCRIPTIONS OF SYSTEMS

- A. All of the equipment and materials specified herein are intended to be standard for use in controlling the flow of water.
- B. See the Drawings for valve sizes, quantities, connections, class, type of actuator and location.

1.04 QUALIFICATIONS

- A. All types of valves and appurtenances shall be products of well established firms who are fully experienced, reputable, and qualified in the manufacture of the particular equipment to be furnished. The equipment shall be designed, constructed and installed in accordance with the best practices and methods and shall comply with these Specifications as applicable.
- B. Acceptable Manufacturers
 - 1. Air and Vacuum Valves - Valve and Primer Corp., APCO, Golden Anderson, or equal.

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2. Air Release Valves - Valve and Primer Corp., APCO, Golden Anderson, or equal.
3. Pressure Reducing Valves - APCO, Golden Anderson, or equal.

1.05 SUBMITTALS

- A. Complete shop drawings of all valves and appurtenances shall be submitted to the ENGINEER in accordance with the requirements of Sections 00820 and 01300.
- B. The manufacturer shall furnish to the ENGINEER 2 copies of written certification that the valves have been tested hydrostatically and tested for proper performance, and that the materials of construction conform to the appropriate ASTM specifications. Refer to the Special Conditions for the number of copies of descriptive literature, catalog data sheets, and Drawings to be submitted to the ENGINEER, for review and comment.

1.06 OPERATING INSTRUCTIONS

- A. Manufacturer's operating and maintenance instructions shall be furnished to the ENGINEER as set forth in Section 01600.

1.07 EQUIPMENT OR SYSTEM WARRANTY

- A. Refer to Section 01600 for warranty requirements.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. General

1. All valves and appurtenances shall be of the size shown on the Drawings and as far as possible all equipment of the type shall be from one manufacturer.
2. All valves and appurtenances shall have the name of the maker, flow-directional arrows, and the working pressure for which they are designed cast in raised letters on some appropriate part of the body.
3. All buried valves shall open left (counterclockwise). Insofar as possible, all valves shall open counterclockwise.
4. All valves must be provided with suitable operating devices and adapted for operation in the position in which they are shown on the Drawings.

2.02 AIR AND VACUUM VALVES

A. General

1. Air and vacuum valves shall be designed to allow large quantities of air to escape out of the orifice when filling a pipeline and to close watertight when water enters the valve. To break a vacuum, the air and vacuum valve shall also permit large quantities of air to enter through the orifice, when a pump is stopped or the pipeline is being drained. The discharge orifice area shall be equal to or greater than the inlet of the valve. The valve shall consist of a body, cover, baffle, float, seat and where called for, a water diffuser. The baffle will be designed to protect the float from direct contact of the rushing air and water to prevent the float from closing prematurely in the valve. The seat shall be fastened into the valve cover without distortion and shall be easily removable. The float shall be of stainless steel designed to withstand 1,000 psi. The float shall be center guided for positive seating.
2. Air and vacuum valves for installation on pump discharge lines, where the water working pressure is 150 psi or less, in sizes 3 inch and under, shall be provided with water diffuser and throttling devices and have screw connections. In sizes 4 inch and over they shall be provided with surge check units and have flanged connections.
3. Air and vacuum valves for installation on pump discharge lines, where the water working pressure is over 150 psi, in sizes 3 inch and under, shall be provided with diffuser and throttling devices and have screw connections. In sizes 4 inch and over they shall be provided with surge check units and have flanged inlet and outlet connections.
4. Air and vacuum valves on water transmission mains, at change of downward gradient and drastic change in gradient (not peaks), in sizes 2 inch and under, shall have water diffusers and screw connections. In sizes 3 inch and over they shall be provided with surge check units and have flanged inlet connection and protection hoods on outlet.
5. Air and vacuum valves on water transmission mains at peak changes in grade (highest point between adjacent low points) with the auxiliary (small) air release valve meeting requirement of these Specifications for Air Release Valves.

B. Materials of Construction

1. Body, Cover and Baffle
 - a. Valve bodies, covers and baffles shall be of cast iron, ASTM A48, Class 30.

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2. Float

- a. Valve floats shall be of stainless steel, ASTM A240.

3. Seat

- a. Valve seats shall be of Buna-N, nitrile rubber.

4. Bushings, Screws and Float Guides

- a. Bushings, screws and float guides shall be stainless steel or bronze, with selection being best to avoid galvanic action.

5. Water Diffuser

- a. Water diffuser shall be bronze.

C. Throttling Device

1. Throttling devices shall be of cast iron or malleable iron with screw connections, Valve and Primer Corp., APCO, or equal.

D. Surge Check Unit

1. The surge check unit shall be iron body, bronze mounted, Valve and Primer Corp., APCO Bulletin 640, Silent Check Valve, or equal. Surge check units shall have flanged ends.

E. Flanged Ends

1. Unless otherwise noted on the Drawings all flanged connections (inlet and outlet) shall be ANSI B1.6.1, 125 pound standard.

F. Drainage Provision

1. All valve bodies shall be provided with drain plugs.

G. Painting

1. Valves shall receive a heavy coat of red lead TTP86, Type IV, or equal.

H. Testing

1. All air and vacuum valves shall be hydrostatically and shop tested for proper performance prior to shipment.

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I. Marking

1. Cast markings shall appear on the valve body showing valve size, manufacturer's name or trade mark, water working pressure and model number.

2.03 AIR RELEASE VALVES (FOR PIPELINES AND PUMPS)

A. General

1. Air release valves shall be designed with a small orifice to serve as a venting port wherever air is entrained in water under pressure. They shall be capable of automatic intermittent release of accumulated air in the valve and closing tight when water enters the valve.
2. Air release valves for installation (along with air and vacuum valves) on vertical turbine and deep well pumping units, where pump operation is continuous or nearly so, and water working pressure does not exceed 150 psi, shall be simple lever type and have screw connections. If operating water pressure exceeds 150 psi, the valves shall have compound levers and screw connections.
3. Air release valves on water transmission mains, regardless of whether they are used in conjunction with air and vacuum valves (as custom combination air release valves) or whether they are used alone on long stretches of transmission main without a summit, shall be compound lever type with screw connections.

B. Material of Construction

1. Materials of construction for Air Release Valves shall be the same as specified for Air and Vacuum Valves.

C. Other Features and Requirements

1. Drainage and/or blowoff provisions, painting, testing and marking shall be the same as specified for Air and Vacuum Valves.

PART 3 EXECUTION

3.01 INSTALLATION (IN STRUCTURES, VAULTS AND BASINS)

A. Interior

1. All valves and appurtenances shall be installed at the locations shown on the Drawings. All necessary materials, parts, operators and gaskets shall be furnished and installed under this Contract.
2. All valves shall be installed with their operators located in such a plane that it will not interfere with pedestrian traffic.

3. Before being installed, the valves shall be flushed and cleaned of any dirt.
4. Fitting the valves to pipes shall be carried out with due care and accuracy, but without using force. Fitting of valves by tightening bolts forcibly or by any other method that may cause internal stresses in the valve or in the flanges shall not be permitted.
5. Only bolts of the correct diameter shall be used. The bolts for each valve shall be of equal length, which shall be such that after the nut is tightened, not less than 1 thread and not more than 3 threads of the bolt shall protrude from the nut. Tightening of the bolts shall be crosswise, gradual and uniform.
6. Only one sealing gasket shall be used between each pair of flanges. The gasket shall be of the ring type, i.e. its outer rim shall just touch the bolt holes and their inside diameter shall be equal to that of the corresponding pipe. The gasket material shall be either fabric reinforced rubber or compressed asbestos sheets of a type and make approved by the ENGINEER. All gaskets shall be fabricated by cutting from sheets. Cutting gaskets by hammering on the flange will not be permitted. When being installed, the gaskets shall be absolutely clean. Each gasket shall be used only once.

3.02 SHOP PAINTING

- A. Interior surfaces of all valves, the exterior surfaces of buried valves and miscellaneous piping appurtenances shall be given a shop finish of an asphalt varnish conforming to Federal Specification TT-V51e for Varnish Asphalt.
- B. The exterior surface of various parts of valves, operators, floorstands and miscellaneous piping shall be thoroughly cleaned of all scale, dirt, grease, or other foreign matter and thereafter on shop coat of an approved rust-inhibitive primer applied in accordance with the instructions of the paint manufacturer.
- C. Ferrous surfaces obviously not to be painted shall be given a shop coat of grease or other suitable rust-resistant coating.

3.03 INSPECTION AND TESTING

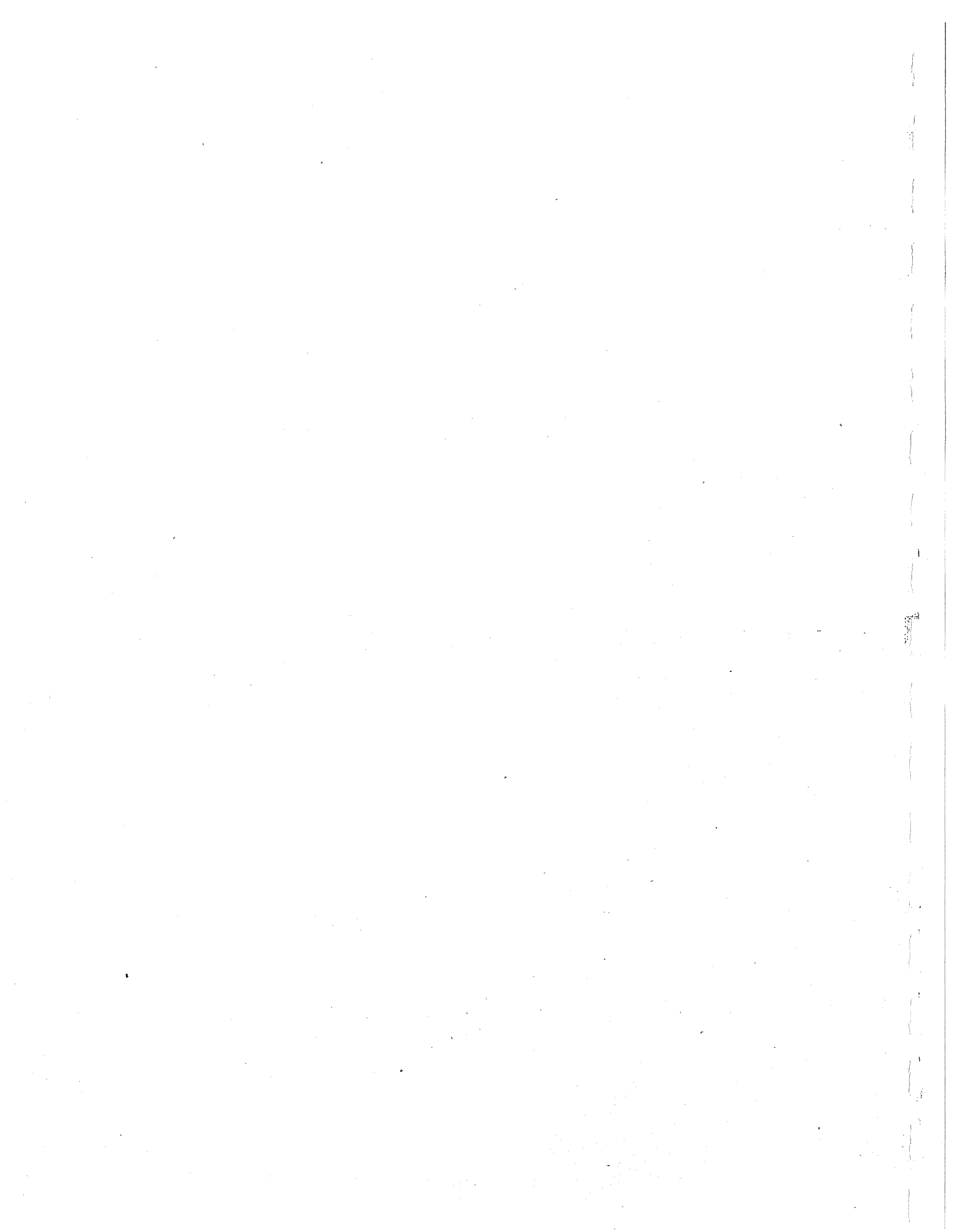
- A. The various pipelines in which the valves and appurtenances are to be installed are specified to be field tested. During these tests any defective valve or appurtenance shall be adjusted, removed and replaced, or otherwise made acceptable to the ENGINEER.
- B. Various regulating valves, strainer, or other appurtenances shall be tested to demonstrate their conformance with the specified operational capabilities and any deficiencies shall be corrected or the device replaced or otherwise made acceptable to the ENGINEER.

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3.04 METHOD OF PAYMENT

- A. Payment for the complete system shall be included in the lump sum or unit price bid for the project, and shall include the furnishing of materials, equipment any parts and installation of all components to provide a completely functional and operational system.

END OF SECTION



SECTION 16050

ELECTRICAL WORK

PART 1 GENERAL

1.01 WORK INCLUDED

- A. The Instructions to Bidders, General Conditions, Supplementary Conditions, Division 1 of the Specifications and all Contract Documents shall apply and govern the work of all sections in this Division regardless of how the work may be apportioned to various trades or subcontractors.

1.02 SCOPE

- A. The CONTRACTOR shall furnish all labor and materials and shall install complete and ready for use the lighting, power, signal and control systems as shown on the Contract Drawings and specified herein. The CONTRACTOR is required to contact power companies in writing and submit appropriate power company forms/applications a minimum of 90 days proper to the actual date power is required at the project site.

1.03 SUBMITTALS

- A. Shop drawings, clearly marked to show only items applicable to this specific contract, shall be submitted for review and shall include complete sizing of components and control schematics.

1.04 GUARANTEE

- A. The CONTRACTOR shall refer to the article on Guarantees and Warranties in the General Conditions and Special Conditions to determine the extent of his guarantee periods.

1.05 DIMENSION VERIFICATION AND DOCUMENTATION

- A. Scale dimensions as shown on the Drawings shall be considered as approximate. The CONTRACTOR shall be responsible for making field verifications. Specific attention shall be given to the exact location of any underground lines installed under this contract. These lines shall be dimensioned to easily identifiable points on permanent building structures for location and elevation and these dimensions shall be entered and shown on the record drawings.

1.06 CODES AND STANDARDS

- A. All electrical equipment and details of installations shall comply with the requirements of the latest editions of the National Electrical Code (NFPA-70), the National Electrical Safety Code (ANSI C2) and all applicable State and Local Codes.

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1.07 APPROVAL AND MARKING OF EQUIPMENT

- A. Electrical devices and materials shall be listed and/or labeled by the Underwriters' Laboratories, Inc.

1.08 EQUIPMENT SPECIFIED ELSEWHERE

- A. Certain items of control and other equipment are indicated on the Electrical Drawings for connection, but are specified in other sections of these documents. Such items are not furnished as part of the electrical work.

1.09 PROTECTION OF ELECTRICAL EQUIPMENT

- A. Electrical equipment shall be protected from the weather, especially from water dripping or splashing upon it, at all times during shipment, storage, and construction. Equipment shall not be stored outdoors even if its enclosure is rated as weatherproof, watertight, etc. Where equipment is installed or stored in moist areas, such as unheated buildings, etc., it shall be provided with an acceptable means of preventing moisture damage such as a uniformly distributed source of heat to prevent condensation.

1.10 DEFECTIVE OR DAMAGED EQUIPMENT

- A. Should it be determined by the CONTRACTOR, OWNER or ENGINEER that any equipment or material has been subjected to possible damage by water, it shall be thoroughly dried and put through a dielectric test as directed by the manufacturer, at the expense of the CONTRACTOR or shall be replaced by the CONTRACTOR without change in contract price. Any equipment found to be marginal or that fails to meet manufacturer's standards shall be replaced at no additional charge to the OWNER or ENGINEER.
- B. Any equipment damaged during shipment, while stored, or during construction shall be replaced at the Contractor's expense. Minor scratches on equipment cabinets, etc. may be repaired on site. Any current carrying parts, switch blades, operators, coils, contacts, etc. which are damaged, shall be replaced at no cost to the OWNER or ENGINEER.

1.11 PERMITS AND APPROVALS

- A. The CONTRACTOR shall obtain all permits necessary. The CONTRACTOR shall furnish inspection by an agency licensed or otherwise qualified to perform electrical inspections in the Commonwealth of Kentucky.
- B. All costs incidental to the electrical inspection shall be borne by the CONTRACTOR.
- C. The CONTRACTOR shall furnish certificates of final approval by the Electrical Inspector and **final payment will be withheld until he has presented the ENGINEER with the aforementioned certificate of approval.**

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- D. When it is determined by the Electrical Inspector that materials, equipment or installations shown on the drawings or specified herein are in violation of the National Electrical Code, the CONTRACTOR shall contact the ENGINEER immediately. The CONTRACTOR shall be prepared to tell the ENGINEER the Articles of the National Electrical Code that are violated by the project requirements.
- E. Deviations from the Contract Documents based on suggestions from and/or approval by the Electrical Inspector will not be allowed without also obtaining the concurrence of the ENGINEER before the work begins

1.12 CONTRACT DOCUMENTS

- A. These Specifications, the associated Drawings, and other Contract Documents have been prepared with the intention of their yielding, through construction, electrical installations that are fully operable, safe, complete and in full compliance with the latest editions of the National Electrical Code, local codes and ordinances, and any other authority having jurisdiction over the work. The omission of miscellaneous electrical items or accessories not specifically called for in these Contract Documents which would detract from this intention shall not relieve the CONTRACTOR of the responsibility of furnishing and installing these items and accessories.

1.13 CIRCUIT LOADS

- A. The CONTRACTOR shall verify the total load to be placed on the circuits as well as voltage, phase, frequency and connections required to equipment before rough-in and if they differ from the Plans and Specifications, he shall contact the ENGINEER immediately for further instructions before the work commences.
- B. Motor horsepowers and apparatus wattage ratings indicated on the drawings or specified herein are estimated values, and corresponding sizes of feeders and other electrical equipment indicated to serve them are minimum sizes. Motors of greater horsepower and apparatus with larger wattage ratings may be provided if necessary to meet the requirements of various sections of specification(s) in which they are specified. Where different motors or apparatus with different wattage ratings or different voltage or phase requirements are provided, feeders and other electrical equipment serving them shall be adjusted to correspond. The adjustment of the feeder and branch circuitry and of other materials or equipment in order to meet the requirements of equipment furnished under this Contract by other trades shall be at no additional cost to the OWNER or the ENGINEER. Coordinate with the Prime CONTRACTOR.

1.14 TESTS AND INSPECTIONS

- A. The CONTRACTOR shall provide all tests as specified herein and all additional tests necessary to establish the adequacy, quality, safety, completed status and suitable operation of each system and components thereof. The final inspection will be made after the ENGINEER is satisfied that the work has been completely installed and that complete preliminary tests were made which indicate the adequacy, quality, completion and satisfactory operation of the system.

1.15 RECEIPTS

- A. Some sections of the Contract Documents call for equipment, materials, accessories, etc. to be provided and "turned over to the OWNER" or like requirements. The CONTRACTOR shall obtain a receipt for each item turned over, signed by the OWNER or his representative. A copy of this receipt shall be transmitted to the ENGINEER for his files.
- B. When a question arises concerning whether items have been turned over to the OWNER, and there is no signed receipt, it will be assumed that the items were not provided.

PART 2 PRODUCTS

2.01 GENERAL

- A. All materials and equipment installed shall be new and unused and shall be of the latest design of manufacturers regularly engaged in the manufacture of such products that conform with the requirements of the Contract Drawings and Specifications.

2.02 CONDUIT

- A. No conduit smaller than 3/4-inch shall be used.
- B. Rigid Conduit: Rigid conduit shall be standard weight, mild steel pipe. The conduit shall receive a protective zinc coating both inside and outside by means of hot-dip galvanizing. Threads shall not have any coating which will reduce the conductivity of the joint. Couplings, bends, elbows, fittings, etc., shall be subject to the same requirements as for the straight lengths. All conduit and fittings shall be UL approved. Rigid conduit shall be delivered with plastic protectors on the threads.
- C. Liquid tight flexible metallic conduit shall be constructed of flexible or spirally wound galvanized steel enclosed in light gray colored PVC outer jacket. Liquid tight flexible metallic conduit shall be equal to American Brass "Sealtite" Type "UA." Connectors shall be equal to Midwest Type LT.

2.03 WIRE AND CABLE

- A. All conductors shall be insulated so that they are rated at 600 volts.
- B. No conductors smaller than AWG No. 12 shall be used except for signal or control systems, or where otherwise indicated.
- C. All conductors shall be soft drawn, 98 percent conductivity copper conforming to the latest ASTM Specifications and the requirements of the National Electrical Code.

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- D. Single conductors shall be insulated with THWN or THHN insulation and all conduits shown on the Drawings are sized accordingly. THHN insulated conductors shall be used in dry locations only. At the Contractor's option, THWN insulation may be substituted.

2.04 GROUNDING

- A. All feeder and branch circuits shall contain a separate grounding conductor in the raceway with the other circuit conductors. Size of the grounding conductor shall be as indicated or as required by Article 250 of the NEC. All metal electrical equipment cabinets (wireways, panels, switchgear, device boxes, junction and pull boxes, motor control panels, etc.) shall be securely bonded to a grounding conductor running through any conduit terminating at the cabinet or enclosure by use of a grounding lug bushing and jumper wire to the enclosure wall. Junction boxes and other enclosures shall utilize and equipment ground bus or lug as required to securely bond the equipment grounding conductor to the enclosure. The grounding conductor shall be connected with pressure connectors at the main switchgear to the main grounding system. Where screw terminals or set screw lugs are used, sufficient lugs shall be provided such that not more than one conductor is installed into each lug or terminal.
- B. No conduit shall serve as a grounding conductor.
- C. The grounding conductor serving motor circuitry shall be connected inside the entrance compartment to the motor frame with a bolted solderless pressure connector. Bolts, nuts, washers and other assorted hardware shall be bronze, cadmium plated steel, or other corrosion resistant material. The motor ground connection shall be to the motor frame and independent of the mounting bolts or sliding base.
- D. Ground Rods: Ground Rods shall be the copper clad steel type and shall be a minimum of 10 feet in length, 3/4-inch in diameter. Ground rods shall be equal to those as manufactured by Copperweld Steel Co.
- E. Grounding electrode conductors shall be bare copper. Equipment grounding conductor shall be copper, THHW insulated, green (or green with yellow tracer) in color, and rated at 600 volts.
- F. Ground clamps for use on metallic pipes shall be of copper, brass or silicon bronze with a rigid metal base providing good contact by proper seating on the pipe. Strap type clamps shall not be used.
- G. The resistance value of the main grounding conductor measured between the main switchgear and a good earth ground shall not exceed 5 ohms.

2.05 POWER DISTRIBUTION

- A. Safety switches shall be heavy-duty, load break type with a quick-make, quick-break, switch mechanism, in a NEMA rated enclosure as indicated on the

drawings. Padlocking capability shall be provided for locking the switch either in the closed (On) position or open (Off) position. Fuse clips shall be rejection type. Switches shall be provided with a cover-blade interlock so that the cover cannot be opened when the switch blades are closed, nor can the switch blades be closed with the cover open. Interlock bypassing devices shall be included for use by authorized personnel.

- B. The CONTRACTOR shall provide fuses as called for on the Drawings. Where the fuse size is not indicated, the CONTRACTOR shall size the fuse for actual load installed. Where the fuse size is indicated on the Drawings, the CONTRACTOR shall verify the actual load installed and provide fusing accordingly. Unless otherwise indicated on the Drawings, all fuses shall be rejection type, non-renewable, current limiting, dual element, time-lag type. The fuses shall have an interrupting capacity of at least 100,000 amperes RMS symmetrical.
- C. The service pole(s) shall be southern pine, pressure creosote treated, roofed and galed before treatment and of the length and class as shown on the Drawings. Pole hardware shall be galvanized steel.
- D. Equipment as manufactured by the Square D Company, General Electric Company, Westinghouse Electric Company or equal, will be considered for this project.

PART 3 EXECUTION

3.01 INSTALLATIONS

- A. Excavation, Backfilling and Grading
 - 1. The CONTRACTOR shall perform all earth and rock excavation, backfilling and grading required for this part of the work. Rock excavation shall be made to a depth of 4 inches below pipe and filled to subgrade with dense grade aggregate limestone. After the bid is submitted there will be no additional funds forthcoming for excavation work on this project. All excavation shall be bid as unclassified.
 - 2. Trenches shall be maintained free of water until backfilling is completed.
 - 3. Below Grade Outside Building Wall Line
 - a. Rock excavation shall be made to a depth of 4 inches below pipe and filled to subgrade with dense graded limestone. Backfilling material in earth excavation shall be clean earth to a line at least 12 inches above the top of the conduit. From this line upward, rock not more than 6 inches in diameter may be used provided it is spaced at least 12 inches apart. Filling between rock shall be of clean earth, thoroughly tamped in 6 inch layers to the finished grade. All surplus rock and earth shall be removed from the site as directed by the ENGINEER.

4. Below Slab-On-Grade Inside or Outside Building Wall Line
 - a. Rock excavation shall be made to a depth of 4 inches below pipe. All backfilling material shall be #9 stone or equivalent non-compacting stone fill.
5. Depth of bury for all conduit shall be a minimum of 24 inches below finished grade.

B. Conduit

1. Concrete encasements of underground conduit shall be installed where conduit passes under roadways, where shown on the Drawings or specified herein. Concrete shall be 3000 psi in strength, dyed red throughout and shall be sized as shown and/or detailed on the Drawings.
2. Rigid steel conduit shall be used for emergence from underground, or from below slab-on-grade and where exposed in mechanical rooms and such areas. Conduits shall have supports spaced not more than five feet apart and shall be installed with runs parallel or perpendicular to walls, structural members or intersections of vertical planes and ceilings with right-angle turns consisting of cast metal fittings or symmetrical bends. Conduit shall be installed so as to insure against trouble from the collection of trapped condensation. Conduit bushings shall have insulating material which has been permanently fastened to the fittings. Bushings for conduit 1-1/2 inches trade size and larger shall be complete with grounding lug and shall be bonded to the box by means of bare copper wire. All field bends shall be made with standard tools and bending equipment manufactured especially for this purpose. Bends in metallic conduit shall be made while cold and in no case shall the conduits be heated. Conduits shall not be bent through more than 90 degrees. Size of conduits shall not be less than that required by the National Electrical Code.

C. Wire and Cable

1. No cable buried directly in the earth, not in raceway will be allowed on this project.
2. Wire shall not be installed until all work of any nature that may cause injury to the wire is completed. Mechanical means shall not be used in pulling in wires No. 8 or smaller. Approved wire pulling lubricant shall be used as required to prevent insulation damage and overstressing of the wire while pulling through conduit. In no case shall conductors be greased or coated with any substance injurious to the conductor insulation or sheath.
3. All wires connected to terminal boards, terminal blocks, or to other similar terminals shall terminate by means of pressure terminals. Where terminal boards, terminal blocks, etc. are designed and manufactured to

accept bare wire and have a pressure plate on each side of the wire, no pressure terminals on the wire will be required. Where the wire would have to encircle the holding screw to make a proper connection, the wire terminals are required.

4. Where the wire is shown larger than that required for the load, it is done so for voltage drop or other purposes and must be installed as shown. Where the wire is stranded, the removal of strands in order to install the wire into a lug provided on any equipment will not be permitted. A larger lug shall be installed which will accept the wire size indicated.
5. Insulation on ungrounded conductors larger than AWG #10 and on grounded (neutral) and grounding (equipment ground) conductors larger than AWG #6 may be black with color coding accomplished with the use of colored plastic tape. Tape shall be installed on the conductors wherever they are visible and shall be wrapped at least 3 turns around the conductor.
6. All wiring on this project, except control wiring, shall reflect the phase relationship as follows:

208Y/120 or 240/120 volt system: black, red and blue for un-grounded conductors, white for neutral conductors.

D. Grounding

1. Ground rods shall be driven vertically into the earth to at least one foot below finished grade.
2. Connections to ground rods and all other ground connections below grade shall have a MINIMUM mechanical contact surface area between the conductor and the ground rod of not less than 3 square inches. All connections made below finished grade shall be exothermic. Installation of grounding conductors shall be such that they are not exposed to physical damage. All connections shall be firm and tight.
3. Installation of grounding conductors shall be such that they are not exposed to physical damage. All connections shall be firm and tight. Conductors and connectors shall be so arranged and provided so that there is no strain upon the connection. Buried equipment grounding conductors shall be buried at least 24 inches below finished grade and shall not be buried below concrete pads, or paving, except where running a tap to the grid or where shown on the contract drawings. Where buried below concrete or paving, grounding conductors shall be in rigid conduit unless shown on the drawings as a part of a grid.
5. Resistance measurements shall be made between the main grounding bar in the switchgear and a good earth ground. If this resistance is not equal to or less than the value given in paragraph 2.08.G above, an additional

grounding electrode system in the form of ground rods installed and connected together in a 10 foot by 10 foot grid shall be added. The rods shall be connected together and this grid connected to the system with AWG #3/0 bare tinned copper. The number of rods shall be as required to register the resistance value mentioned in paragraph 2.8.G hereinbefore. Measurements shall be made in normally dry conditions and, in no case, less than 48 hours after rainfall.

6. Where a bare conductor is the only conductor installed in conduit or other raceway, and this conductor is serving as a grounding conductor, it shall be bonded to the raceway that contains it at each end of the raceway. The bond shall be made using a grounding type bushing and bonding jumper. The size of the jumper shall be the maximum size that the grounding bushing lug will accept and it shall be connected to the bushing with the lug and to the grounding conductor with a split bolt connector.

PART 4 ELECTRICAL FIELD ACCEPTANCE TESTS

4.01 WORK INCLUDED

- A. After the electrical installation is complete, tests shall be made to demonstrate that the entire system is in proper working order and in accordance with the Drawings and Specifications. The tests outlined herein shall be in addition to, and not substitution for, the tests of the individual items at the manufacturer's plant. Insulation and ground resistance tests shall be made before operating tests. A copy of approved electrical inspection certificate is required to be submitted to the ENGINEER.

4.02 DEFECTIVE EQUIPMENT

- A. All wiring and equipment found defective or failing to meet the specified requirements shall be replaced by the CONTRACTOR without charge, unless written permission for repair is given by the ENGINEER.

4.03 OPERATING TESTS

- A. Switches, Circuit Breakers, Control Devices: All switches, circuit breakers and control devices shall be operated to show correct and satisfactory operation.
- B. Controls
 1. Controls circuits shall be fully operated with the power circuits to the motors de-energized to assure proper sequence and operation before the system is energized.
- C. Each motor and its associated equipment shall be operated as nearly as possible under normal operating conditions for as long as reasonable and for a length of time sufficient to demonstrate correct alignment, temperature rise, speed, and

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satisfactory operation. The motors shall be loaded to full capacity or as near thereto as possible.

4.04 GROUND RESISTANCE TESTS

- A. The CONTRACTOR shall test each entire grounding system for continuity of connections and for resistance. The ground resistance of conduits, equipment cases, and supporting frames shall not vary appreciably from that of the system as a whole and shall not exceed 5 ohms.

4.05 WITNESS

- A. The ENGINEER shall be notified at least 14 calendar days in advance of each of the tests covered in this section of the Specifications so that he may arrange to witness the tests of all electrical work associated with the CONTRACT.

4.06 TEST RECORDS

- A. A record of all tests and certifications shall be delivered to the ENGINEER before final acceptance will be forthcoming.

END OF SECTION
