

PART 4

TECHNICAL

SPECIFICATIONS

SECTION 01010 SUMMARY OF WORK

PART 1 - GENERAL

- 1.1 The City of Pierce Water Improvement project is a lump sum/unit price contract to construct approximately 2,000 L.F. of 6-inch raw water main, including 45 L.F. of directional drilled pipe, a concrete intake box located at the edge of Orofino Creek, a pump station/wet well equipped with 2-10 HP line shaft turbine pumps, electrical feed and controls for pumps and other appurtenances.

1.2 SPECIFICATIONS

- A. In case of conflict between the specifications and the various referenced standard specifications, the most stringent shall govern as determined by the ENGINEER. Where these specifications refer to recognized standards, such as ASTM, Federal Specifications, NFPA, the reference shall be to the latest edition, unless specified otherwise.

1.3 CONTRACTOR'S COPIES OF CONTRACT DOCUMENTS

- A. The CONTRACTOR will be supplied by the OWNER with 6 sets of full-sized drawings, and 6 sets of specifications. At least one complete set of Contract Documents, including one full-size set of drawings, shall be kept at the site of construction in good condition at all times, available to the OWNER and ENGINEER. Additional copies of the Contract Documents, if required, will be furnished by the ENGINEER at the net cost of reproduction.
- B. The accuracy of information furnished by the ENGINEER and/or the plans and specifications as to foundation conditions, character of soil, position and quantity of surface and groundwater, etc., are not guaranteed by the ENGINEER or by the OWNER. Bidders must satisfy themselves by personal examination and by such other means as they desire with respect to actual conditions in regard to the nature of the ground and subsoil water and in regard to the location of existing groundwater or surface/subsurface structures.

1.4 EXISTING UTILITIES

A. General:

1. Attention is directed to the possible existence of underground utility facilities within the limits of the project and which may or may not be shown on the drawings or specifically mentioned in the special conditions. The exact location of such facilities shall be ascertained by the CONTRACTOR before using equipment that may damage them or interfere with their service. The CONTRACTOR will be held liable to the owners of utility facilities for any damage or interference with services resulting from the CONTRACTOR'S

operation. The CONTRACTOR shall notify the owners of utilities at least forty-eight (48) hours in advance of starting operations that may affect the facility.

2. Minor underground utility service lines including, but not limited to, sanitary sewer services, water services, house or yard drains, and electric or telephone services, shall be located and maintained by the CONTRACTOR with the least possible interference with such services, and in no case shall the interference of such service lines be considered as a basis for extra compensation, except as specified.
3. The right is reserved by the owners of public utilities and franchises to enter upon any street, road, right-of-way or easement for the purpose of maintaining their property and for making necessary repairs or changes caused by the work.

B. Relocation:

1. Unless otherwise provided by the special conditions or drawings, utilities both above and below ground that are required to be removed, altered or relocated as a part of the project will be removed, altered or relocated in advance of construction operations at no cost to the CONTRACTOR. The CONTRACTOR is required to provide a construction schedule to the involved utility owners that notifies them of the proposed timetable for the required relocation. Since the utilities are to be removed by the owners thereof, there is the possible result that delay in removal will occur. The CONTRACTOR will work around utilities that are not to be relocated and whose relocation has not been completed at no extra compensation.
2. If, as a result of utility facilities not being removed or relocated as above provided, the CONTRACTOR sustains loss which could not have been avoided by the judicious handling of forces, equipment and plant, there will be paid to the CONTRACTOR such amount as the ENGINEER may find to be fair and reasonable compensation for such part of the CONTRACTOR'S "actual loss" as, in the opinion of the ENGINEER, was unavoidable, except as otherwise provided in this section.
3. If the CONTRACTOR determines that he will incur a loss that cannot be avoided, he shall notify the ENGINEER immediately of the situation and of the location and circumstance concerning the loss so that the ENGINEER may observe the situation and make any records necessary to confirm the loss. Any claim of the CONTRACTOR for adjustment under this section shall be asserted in writing within thirty (30) days from the date he notifies the ENGINEER.

4. Compensation for idle time of equipment shall be fifty percent (50%) of the standard rental rate. Daily rate shall be fifty percent (50%) of the hourly rate multiplied by eight (8) and compensation will be made for each calendar day, excluding Saturdays, Sundays, and legal holidays upon which the equipment is idle.
5. Compensation for labor will be made at the actual payroll cost per hour of each workman, including hourly wage, insurance, taxes and fringe benefits only. Before compensation can be paid, an approved, executed Change Order for the activity must be in existence.
6. "Actual Loss" as provided for by this subsection, shall be understood to be limited to necessary payments for idle time of men, idle time of equipment and cost of extra moving of equipment, with no allowance in any case for overhead and profit. It is further agreed and understood that this section is exclusive of any other provision for compensation or equitable adjustment contained elsewhere herein when loss is occasioned by delay in removal of utility facilities and the CONTRACTOR'S recovery therefore shall be limited to "actual loss" as defined above,
7. If performance of the CONTRACTOR'S work is delayed as a result of the failure of the owners to remove or relocate utility facilities within the specified times, a commensurate extension of time will be granted.

1.5 TEMPORARY UTILITIES

A. General:

1. The CONTRACTOR shall furnish, install and maintain any temporary utilities required for the construction, including their removal on completion of the work. All components making up temporary utilities shall comply with Federal, State and local codes and regulations and with utility company requirements. Materials may be new or used, must be adequate in capacity for the required usage, must not create unsafe conditions, and must not violate requirements of applicable codes and standards.

B. Electricity and Lighting:

1. The CONTRACTOR shall arrange with utility company to provide service required for power and lighting. The CONTRACTOR shall pay all costs for service and for power used.
2. The CONTRACTOR shall provide connections to existing facilities sized to provide service required for power and lighting. The CONTRACTOR shall pay the costs of power used.

3. The CONTRACTOR shall install circuit and branch wiring, with area distribution boxes located so that power and lighting is available throughout the construction site by the use of construction- type power cords.
4. The CONTRACTOR shall provide adequate artificial lighting for all areas of work when natural light is not adequate for work and for areas accessible to the public.

C. Heat and Ventilation:

1. The CONTRACTOR shall provide temporary heat and ventilation as required to maintain adequate environmental conditions to facilitate progress of the work, to meet specified minimum conditions for the installation of materials, and to protect materials and finishes from damage due to temperature or humidity. Portable heaters shall be standard approved units complete with controls.
2. The CONTRACTOR shall provide adequate forced ventilation of enclosed areas for curing of installed materials, to disperse humidity, and to prevent hazardous accumulations of dust, fumes, vapors or gases.
3. The CONTRACTOR shall pay all costs of installation, maintenance, operation and removal, and for fuel consumed.

D. Sanitary Facilities:

1. The CONTRACTOR shall provide sanitary facilities in compliance with applicable laws and regulations. The CONTRACTOR shall service, clean and maintain facilities and enclosures.

E. Removal:

1. The CONTRACTOR shall completely remove all temporary materials and equipment when their use is no longer required.
2. The CONTRACTOR shall clean and repair damage caused by temporary installations or use of temporary facilities.

1.6 DUST CONTROL

- A. The CONTRACTOR shall maintain an active program for the control of dust throughout the duration of the project. Dust control activities shall not be confined to the CONTRACTOR'S normal working hours, but shall also include night times, weekends, and holidays. The program for dust control shall include all areas of the project disturbed by the CONTRACTOR'S operations.

- B. All subgrade and compacted trenches on the project, whether within streets or not, shall be kept in a continually moist condition to prevent the occurrence of dust. Areas or streets not specifically within the project limits, but contaminated by the CONTRACTOR'S activities, shall be kept in a moist condition and completely cleaned as soon as construction activities permit. Trench excavation and spoil piles shall be kept in a surface moist condition to prevent the occurrence of dust.
- C. In the event of water control equipment failure or breakdown, the CONTRACTOR shall, of his own volition, cease all construction activities contributing to the dust situation. Construction activities associated with the rise of dust shall not resume until such time that all dust is controlled and the equipment is in operational condition.
- D. The CONTRACTOR shall submit a statement of intent to employ an active dust abatement and control program in accordance with the requirements of this section. The CONTRACTOR shall furnish the ENGINEER the names and phone numbers of not less than three individuals authorized by the CONTRACTOR to perform dust control operations during other than normal working hours.
- E. There shall be no separate payment for the water distribution, water used, and all dust control operations. Obtaining water for these operations will be the responsibility of the CONTRACTOR. The payment for dust control shall be considered incidental to the other Contract bid items.

1.7 PUBLIC SAFETY AND TRAFFIC CONTROL

- A. The CONTRACTOR shall comply with all rules, regulations and laws of the State, County and community regarding the closing of public streets or highways to the use of public traffic. The CONTRACTOR shall conduct the work so as to insure the least possible obstruction to traffic and normal commercial pursuits. He shall protect all obstructions and excavations within traveled roadways with approved signs, barricades and lights where necessary to protect the safety of the public. The convenience of the general public and residents along the work, and the protection of persons and property is of prime importance and shall be provided for in an adequate and satisfactory manner.
- B. The CONTRACTOR shall furnish, install and maintain all necessary barricades, warning signs, warning lights, safety cones, and other devices to properly control both pedestrian and vehicular traffic within and around his construction operations. All roads, streets, or highways damaged or affected by construction shall be maintained to a level that is required by the State, County or City maintenance authority.
- C. Whenever the CONTRACTOR'S operations create a hazardous condition, he shall furnish flagmen and guards as necessary to give adequate warning to the public of any dangerous condition encountered.

- D. The CONTRACTOR shall take every precaution to protect pedestrian and vehicular traffic. All traffic control devices shall conform to the current edition of the "Manual of Uniform Traffic Control Devices".
- E. The cost for all necessary traffic control and road maintenance by the CONTRACTOR shall be incidental to the entire project and shall be included in the Contract unit prices.
- F. In addition to the above, flagmen, barricades, signs and traffic control shall conform to the standards established in the latest edition of the "Manual of Uniform Traffic Control Devices" published by the U.S. Department of Transportation. Copies may be purchased from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

1.8 RESTORATION

A. General:

- 1. Whenever any of the work is accomplished on or through property other than that owned by the Project OWNER, the CONTRACTOR shall furnish the Project OWNER, before final acceptance of the work by the Project OWNER, a written release from the property owner or proper authority acting for the owner of the property affected, stating that the restoration of structures and surfaces has been satisfactorily accomplished. If, in the opinion of the Project OWNER, the release is arbitrarily withheld, the Project OWNER may, at its sole discretion, accept the portion of the work involved and cause final payment therefore to be made.
- 2. In addition to the requirements of any applicable utility permit, street use permit or franchise relating to this Contract, the CONTRACTOR shall, as a minimum for any restoration work, conform to standard plans and specifications of the agency which controls the use of the right-of-way in which this construction work is performed.
- 3. Compensation for all costs incurred in all restoration work shall be considered incidental to the other contract bid items and shall be included in the bid items. The CONTRACTOR shall not receive any extra compensation for said restoration work unless stated otherwise in later sections of these specifications or on the Bid Schedule.

B. Structures:

- 1. The CONTRACTOR shall remove such existing structures as may be necessary for the performance of the work and, if required, shall rebuild the structures thus removed in as good a condition as found with minimum requirements as herein specified. He shall also repair all existing structures, which may be damaged as a result of the work under the Contract.

C. Curbs, Gutters, Driveways and Sidewalks:

1. All curbs, gutters, driveways, sidewalks, bike paths, and similar structures that are broken or damaged by the installation of the work shall be reconstructed by the CONTRACTOR. Reconstruction shall be of the same kind of material with the same finish and in not less than the same dimensions as the original work. All concrete shall be as specified herein unless otherwise indicated. Repairs shall be made by removing and replacing the entire portions between joints or scores and not merely refinishing any damaged part. All work shall match the appearance of the existing improvements as nearly as possible.

D. Roads and Streets:

1. All roads and streets in which the surface is removed, broken or damaged, or in which the ground has caved or settled due to work under this Contract, shall be completely resurfaced and brought to the original grade and crown section unless otherwise indicated. Before resurfacing material is placed, edges of pavements shall be trimmed back far enough to provide clean, solid, vertical faces and shall be free of any loose material. Paving shall be as indicated and specified. Roadways used by the CONTRACTOR for hauling materials, equipment, supplies, etc. shall be cleaned and repaired if the condition of the roadway is damaged or otherwise affected due to the CONTRACTOR'S operations.

E. Cultivated Area and Other Surface Improvements:

1. All cultivated areas, either agricultural or lawns, and other surface improvements which are damaged by actions of the CONTRACTOR, shall be restored as nearly as possible to their original condition. The CONTRACTOR shall be responsible for paying all crop and private property damage claims.

F. Existing Stakes and Marks:

All section, section subdivision, plat, USC and GS, USGS, and other official monuments or benchmarks, shall be carefully preserved or replaced. In the event any such monument or marker is disturbed as a result of the CONTRACTOR'S operations, the CONTRACTOR shall effect the replacement or resetting of the monument or marker in a manner satisfactory to the ENGINEER. Replaced or reset monuments shall be of acceptable type and quality, and shall be located so as to clear existing utilities or any other interferences. They shall be placed in a manner consistent with good and recognized engineering and surveying practices by or under the direct supervision of a licensed Surveyor or Engineer. The CONTRACTOR shall pay all costs for said replacement.

G. Waterways, Channels, Drainage Ditches, Drains and Culverts:

1. All waterways, channels, drainage ditches and similar facilities, which are damaged by actions of the CONTRACTOR, shall be restored as nearly as possible to their original condition. Where necessary, the CONTRACTOR shall provide temporary facilities or temporarily realign such watercourses to maintain a continuously serviceable facility until it is restored to its original location and condition. Restoration of such facilities shall be as shown and specified. The CONTRACTOR shall pay for all costs of said restorations and temporary facilities. No extra payment shall be made for crossing under culverts with water or sewer lines.

H. Poles, Fences and Irrigation Features:

1. The CONTRACTOR shall remove or relocate all poles (except power and telephone poles which will be removed by the OWNER), fences, irrigation features, or other private property from the limits of the construction zone. He shall maintain their operation during the construction time and then replace them in their original operation condition and location by the time of final acceptance and approval. This work shall be incidental to the project. There shall be no payment for this work.

I. Road Signs:

1. The CONTRACTOR shall remove and temporarily relocate all road signs in the construction zone. All road signs shall be replaced in their original condition and location prior to final acceptance and approval of project work. This activity shall be considered as an incidental part of the project. There shall be no measurement and payment for this activity.

1.9 CLEANUP

- A. Cleanup shall be done nightly before the CONTRACTOR leaves the jobsite such that hazards to pedestrians and vehicles are minimized. Partial cleanup shall be done by the CONTRACTOR when he feels it is necessary, or when in the opinion of the ENGINEER, partial cleanup should be done prior to major cleanup. The cleanup work shall be done immediately upon written notification from the ENGINEER and other work shall not proceed until this partial cleanup is accomplished. All cleanup work shall be completed prior to final inspection.

**SECTION 01050
FIELD ENGINEERING**

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. The CONTRACTOR shall provide sufficient and safe facilities to enable the ENGINEER to set stakes, points and elevations.
- B. The CONTRACTOR shall keep the ENGINEER informed of his staking requirements far enough in advance of the time when stakes will be required to provide a reasonable amount of time for the ENGINEER to set the stakes. Requests for stakes shall be made at least 3 working days prior to the need to commence staking operations. Delays by reason of lack of stakes are deemed a risk to the CONTRACTOR and shall not be the basis for claims for additional compensation.

**SECTION 01060
REGULATORY REQUIREMENTS**

PART 1 - GENERAL

1.1 APPLICABLE CODES AND REGULATIONS

- A. The CONTRACTOR shall be responsible for conducting his work and operations in accordance with all pertinent codes and regulations, latest revisions including, but not limited to the following:

APWA - American Public Works Association

ASTM - American Society for Testing and Materials

AWWA - American Water Works Association

ACI - American Concrete Institute

CRSI - Concrete Reinforcing Steel Institute

NPC - National Plumbing Code

NEC - National Electrical Code

NFC. - National Fire Code

WWPA - Western Wood Products Association

APA - American Plywood Association

IBC - International Building Code.

SECTION 01085 APPLICABLE STANDARDS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Throughout the Contract Documents, reference is made to codes and standards which establish qualities and types of workmanship and materials and which establish methods for testing and reporting on the pertinent characteristics.
- B. Materials or workmanship required by these Contract Documents shall meet or exceed the specifically named code or standard.
- C. It is also the CONTRACTOR'S responsibility, when so required by the Contract Documents or by written request from the ENGINEER, to deliver to the ENGINEER all required proof that the materials or workmanship, or both, meet or exceed the requirements of the specifically named code or standard. Such proof shall be in the form requested in writing by the ENGINEER, and generally will be required to be copies of a certified report of tests conducted by a testing agency approved for that purpose by the ENGINEER.

1.2 QUALITY ASSURANCE

A. Familiarity With Pertinent Codes and Standards:

- 1. In procuring all items used in this work, it is the CONTRACTOR'S responsibility to verify the detailed requirements of the specifically named codes and standards and to verify that the items procured for use in this work meet or exceed the specified requirements.

B. Rejection of Non-Complying Items:

- 1. The ENGINEER reserves the right to reject items incorporated into the work which fail to meet the specified minimum requirements. The ENGINEER further reserves the right, without prejudice, to other recourse. Other recourse may include the acceptance of non-complying items, subject to an adjustment in the Contract Amount, as approved by the ENGINEER and the OWNER.
- 2. Applicable standards listed in these Specifications include, but are not necessarily limited to, standards promulgated by the following agencies and organizations:

AASHTO - American Association of State Highway and Transportation Officials,
341 National Press Building, Washington, D.C. 20004.

ACI - American Concrete Institute, P.O. Box 19150, Redford Station, Detroit, Michigan 48219.

AISC - American Institute of Steel Construction, Inc., 1221 Avenue of the Americas, New York, New York 10020.

ANSI American National Standards Institute (successor to USASI and ASA), 1430 Broadway, New York, New York 10018.

ASTM American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103.

AWS - American Welding Society, Inc., 2501 N.W. 7th Street, Miami, Florida 33125.

AWWA - American Water Works Association, Inc., 6666 W. Quincy Avenue, Denver, Colorado 80235.

CRSI - Concrete Reinforcing Steel Institute, 228 N. LaSalle Street, Chicago, Illinois 60610.

CS - Commercial Standard of NBS, U.S. Department of Commerce, Government Printing Office, Washington, D.C. 20402.

FGMA - Flat Glass Marketing Association, 3310 Harrison, Topeka, Kansas 66611.

NAAMM - The National Association of Architectural Metal Manufacturers, 1033 S. Boulevard, Oak Park, Illinois 60302.

NEC - National Electrical Code

NEMA - National Electrical Manufacturers Association, 155 East 44th Street, New York, New York 10017.

FFPA - Fire Fighters Protection Association, Batteryman Park, Quincy, Massachusetts 02269.

SDI - Steel Deck Institute, 135 Addiston Avenue, Elmhurst, Illinois 60125.

SSPC - Steel Structures Painting Council, 4400 Avenue, Pittsburg, Pennsylvania 15213.

TCA - Tile Council of America, Inc., P.O. Box 326, Princeton, New Jersey 08540.

UL - Underwriter's Laboratories, Inc. , 207 E. Ohio Street, Chicago, Illinois 60611.

Fed Specs and Fed Standards-

Specifications Sales 3FRI), Bldg. 197, Washington Navy Yard, General Services Administration, Washington, D.C. 20407.

SECTION 01300 SUBMITTALS

PART 1 - GENERAL

1.1 GENERAL

- A. The following submittals are required following award of Contract, for review, pursuant to Contract provisions. Other provisions pertaining to submittals are included in the General Conditions, Special Conditions, and in some of the sections of the technical specifications.

1.2 PRODUCT DATA

- A. Within ten (10) calendar days after award of the Contract, the CONTRACTOR shall submit to the ENGINEER a typewritten list of proposed materials to be furnished. For each item submitted include the following information only:
1. Type
 2. Manufacturer
 3. Catalog Number Series
- B. Subsequent to the submittal of the list of materials in Item A, no variations from the list will be permitted except by written consent of the ENGINEER and only for unusual or special circumstances.
- C. Within thirty (30) calendar days after award of the Contract, the CONTRACTOR shall submit to the ENGINEER (for review) full technical and descriptive data on proposed materials. Submit data all at one time, in six (6) copies, and in bound form with table of contents and index tabs.
- D. For each item submitted, include the manufacturer, type, style, catalog number, complete specifications, certified dimensions and description of physical appearance. General catalogs will not be accepted. Reproductions of catalog data shall be clear and legible to show all details. Clearly mark the item to be supplied, i.e., circle or mark with arrow, etc.
- E. Submit with each copy a transmittal letter verifying that all included equipment submittals have been carefully considered for quality, dimensions, function, and have been coordinated with the Drawings and Specifications. Guarantee that proposed materials will meet or exceed the quality and function of those specified. Each item of submittal shall bear review stamp of CONTRACTOR.

A. The ENGINEER will review product data, and will return two (2) copies stamped as applicable to design responsibility with one of the review stamps shown below:

- Pierce Water Improvement Project
Progressive Engineering Group, Inc.

SECTION 01310 CONSTRUCTION SCHEDULE

PART 1 - GENERAL

- A. Promptly after award of the Contract, the CONTRACTOR shall prepare and submit to the ENGINEER a construction progress schedule for the work, with subschedules of related activities which are essential to its progress. The CONTRACTOR shall assure that the methods, dates and other pertinent matters are acceptable to the ENGINEER. The CONTRACTOR shall be responsible for proper coordination of all work involved in the Contract. The CONTRACTOR shall submit revised progress schedules each month at the Project Meeting - See Section 01200.
- B. Concurrently, the CONTRACTOR shall submit a schedule listing the anticipated monthly payments for the work to be completed during each month.
- C. Format for schedules shall be as follows:
 - 1. Prepare construction progress schedule in the form of a horizontal bar chart.
 - 2. Provide separate horizontal bar for each trade, each operation and each segment; i.e., each section of a sewer system or water system, etc.
 - 3. Horizontal time scale: Identify first work day of each week.
 - 4. Scale and spacing: To allow space for notations and revisions.
 - 5. Minimum sheet size: 11" x 17".
 - 6. Format of listings: The chronological order of the start of each item.

SECTION 01400 QUALITY CONTROL

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. The work covered in this section shall consist of all quality control work required by the Contract as specified herein and further specified in the technical sections.

1.2 TESTING METHODS

- A. All tests shall be made in accordance with commonly recognized standards of national organizations unless alternate specific testing methods are set forth in the technical specifications.

1.3 SAMPLES

- A. The CONTRACTOR shall supply samples if and when required by the specifications or the ENGINEER. These samples or test specimens shall be prepared and furnished with information as to their source in such quantities and size as may be required for proper examination and tests, with all freight charges prepaid. All samples shall be submitted before shipment of materials to the site of the work and in ample time to permit the making of proper tests, analysis, examination, rejections and resubmissions before the time required to incorporate the materials into the work. No such materials shall be used in work until they have been accepted in writing by the ENGINEER. Samples of materials will be retained by the ENGINEER for reference and comparison purposes.

1.4 CERTIFICATION

- A. Producers and associations which have instituted approved systems of quality control and have been approved may submit certifications of compliance in lieu of further testing. Concrete mixing plants, plants producing fabricated concrete products certified, lumber and plywood grademarks by approved associations and materials for equipment bearing Underwriter's Laboratory label require no further plant inspection and testing, unless more restrictive requirements are required, or otherwise specifically required in the specifications.

1.5 CONTRACTOR'S RESPONSIBILITY

- A. Access:
 - 1. The CONTRACTOR shall furnish free access to all parts of the work and assist testing inspection personnel in performance of their duties at no additional cost to the OWNER.

B. Concealed Work:

1. When directed by the ENGINEER, the CONTRACTOR shall open for inspection any part of the work which has been concealed. Should the CONTRACTOR refuse or neglect such a request, the OWNER may employ any other person to open up the same or do so himself. If any parts of the work have been concealed in violation of the ENGINEER'S instructions, or if on being opened, the work is found not to be in accordance with the terms of the Contract Documents, the expense of opening and recovering, whether done by the CONTRACTOR or not, shall be charged to the CONTRACTOR. If the work has been concealed but not in violation of the ENGINEER'S instructions and is found to be in accordance with the terms of the Contract Documents, the actual necessary expense of opening and recovering shall be borne by the OWNER. If the work of opening and recovering is done by the CONTRACTOR, it shall be considered as extra work and paid for accordingly.

C. Data:

1. The CONTRACTOR shall furnish samples, records, drawings, certificates and similar data as may be required by testing and inspection personnel to assure compliance with the Contract Documents.

D. Notices:

1. The CONTRACTOR shall notify the ENGINEER not less than 48 hours before work requiring inspection is started. Portions of the work requiring inspection and testing shall be scheduled by the CONTRACTOR so that the ENGINEER'S time on the project is continuous and as brief as possible.

1.6 INSPECTORS

A. Appointment:

1. The ENGINEER may appoint inspectors to observe any and all portions of the work. Such observations may extend to any or all parts of the work and to the preparation or manufacture of materials to be used.

B. Authority of Inspector:

1. Inspectors employed by the OWNER shall be authorized to inspect all work done and all material furnished. Such inspection may extend to any or all parts of the work and to the preparation, fabrication or manufacture of the materials to be used. The inspector is not authorized to revoke, alter or waive any requirements of the specifications. He is authorized, but not obligated, to call the attention of the CONTRACTOR to any failure of the work or materials to conform to the specifications and Contract. He shall have the authority to reject materials or

work until any questions at issue can be referred to and decided by the ENGINEER.

2. The Inspector shall in no case act as foreman or perform other duties for the CONTRACTOR nor interfere with the management of the work by the latter.

1.7 DEFECTIVE WORK

- A. The CONTRACTOR shall remove and replace any work found defective or not complying with requirements of Contract Documents at no additional cost to the OWNER.
- B. Work will be checked as it progresses, but failure to detect any defective work or materials shall not in any way prevent later rejection when such defect is discovered, nor shall such failure to detect defective work obligate the ENGINEER for final acceptance.

SECTION 01600
MATERIALS AND EQUIPMENT

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Material and equipment shall be new and of a quality equal to that specified or accepted and shall be furnished in quantities required to avoid delays in the progress of the work.
- B. The work shall be executed in conformity with the best accepted standard practice of the trade so as to contribute to maximum efficiency of operation, accessibility and appearance, minimum cost of maintenance and construction of future alterations and additions. It shall be so executed that the completed work will conform and adjust itself to any existing installation.
- C. When materials are specified to conform to ASTM, Federal or other reference specifications, the materials delivered to the site shall bear the manufacturer's printed labels stating that the materials meet the requirements of such referenced specifications.
- D. Any requirements that are specified elsewhere in these specifications or required by law are additional to the provisions included in this section.

1.2 TRANSPORTATION AND HANDLING

- A. Factory packaged products shall be delivered in the manufacturer's original containers.
- B. Products shall be transported and handled in such a manner as to prevent their damage.
- C. Arrange for delivery of products within the time limits established to meet the construction schedule.
- D. Furnish workmen to receive and unload products delivered to the site. Do not deliver or have delivered any products to the site unless such personnel are available.

1.3 STORAGE AND PROTECTION

- A. Neatly pile, store and protect products in suitable locations.
- B. Protect products subject to damage by temperature or other weather conditions.

**SECTION 01700
CONTRACT CLOSEOUT**

PART 1 - GENERAL

1.1 CLEANING

- A. Under this item the CONTRACTOR shall furnish all labor, material, tools, and equipment required to remove from the site all rubbish and construction debris of all designation. He shall remove his buildings, storage facilities, temporary connections for water, light, power, telephone and any other services. He shall restore his work area to smooth surfaces closely approximating the original ground conditions and elevations where such may be separated from grading done under Section 02220.
- B. The completed structures shall be thoroughly cleaned of dirt and debris. Brick, concrete block, exposed concrete and metal work shall be left clean and free from blemish, stain and the like. Any damaged surfaces and the obvious imperfections of workmanship shall be corrected.
- C. All equipment furnished hereunder and the installation work performed under this contract will be tested and inspected by the ENGINEER and shall be in proper operating condition and properly installed within the limit of responsibility of the CONTRACTOR.
- D. It is the intent of this contract that the collection system and treatment plant shall be delivered to the OWNER completely cleaned, with all equipment in proper operating condition and such state that the system may be placed into operation without further work being required on the plant structures, piping or equipment.
- E. Grading of ground in general, covering disturbed areas with topsoil and planting grass shall be done as specified under Section 02480.

1.2 FINAL INSPECTION AND COMPLETION

- A. The CONTRACTOR shall arrange the work schedule to allow one rough-in inspection and one final inspection. Any deviation from this arrangement shall be scheduled with the ENGINEER prior to work on the project.
- B. After final testing and trial operation of the installation, the CONTRACTOR shall promptly complete all minor uncompleted work, clean up all debris, and leave installation in a neat, workman-like condition. The work will not be considered complete until it meets with the satisfaction of the ENGINEER.

1.3 PROJECT RECORD DOCUMENTS

- A. Record drawings in the form of reproducible mylars of the process control system, shall be submitted and approved, along with requirements of satisfactory operation of the system as further specified in Section 01150 prior to issuance of final payment of the "Process Control Instrumentation" work.
- B. The record drawings shall include schedules showing terminal numbers at each wiring and piping termination. Use standard symbols.

SECTION 02001 MOBILIZATION

PART 1 - GENERAL (NOT USED)

PART 2 - MEASUREMENT AND PAYMENT

- A. Payment for the performance of the mobilization will be made at the contract unit price per lump sum for "Mobilization".
- B. The amounts to be allowed for "Mobilization" in the partial payment to be made under the Contract will be made as follows:
 - 1. When 5% of the total original contract amount is earned from other bid items, 50% of the amount bid for mobilization or 5% of the total original contract amount, whichever is the least, will be paid.
 - 2. When 10% of the total original contract amount is earned from other bid items, 100% of the amount bid for mobilization or 10% of the total original contract amount, whichever is the least, will be paid.
 - 3. Upon completion of all work on the project, payment of any amount bid for mobilization in excess of 10% of the total original contract amount will be paid.
- C. Payment will be made under:

Mobilization - Lump Sum

PART 3 - EXECUTION

- A. Mobilization shall include but not be limited to preparatory work and operations necessary: for the movement of personnel, equipment, supplies and incidentals to the project site; to get equipment, supplies and incidentals onto the site; for the establishment of offices, buildings and other facilities necessary for work on the project; for premiums on bond and insurance for the project; and for all other work and operations which must be performed or costs incurred before beginning production work on the various contract items. Mobilization cost for subcontracted work shall be considered to be included in the contract unit price bid by the Prime Contractor.

**SECTION 02100
SITE PREPARATION**

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Scope:

- 1 Under this Section, the CONTRACTOR shall provide all labor, materials, tools and equipment necessary for the preparation of the site of the wastewater treatment plant project (Schedule B).

B. Related Work Specified Elsewhere:

1. Excavation, filling, and site grading - Section 02220.

1.2 JOB CONDITIONS

A. Protection of Existing Improvements:

1. Provide protection necessary to prevent damage to existing improvements indicated to remain in place. Restore damaged improvements to their original condition, as acceptable to parties having jurisdiction.

B. Control of Water Pollution:

1. The CONTRACTOR shall conduct his work in a manner that will not cause damaging pollution of the water in Pataha Creek. The ENGINEER will advise the State of Washington Department of Ecology (DOE) of the proposed work. All work of water pollution control is subject to inspection by the DOE.
2. All applicable regulations of fish and wildlife agencies and statutes relating to the prevention and abatement of pollution shall be complied with in the performance of the Contract.
3. The disturbance of lands and waters that are outside the limits of construction as staked is prohibited, except as found necessary and approved by the ENGINEER.
4. The CONTRACTOR shall conduct his work in such manner as to prevent the entry of fuels, oils, bituminous materials, chemicals, sewage or other harmful materials into Pataha Creek.
5. Water from aggregate washing or other operations containing sediment shall be treated by filtration, by use of a settling basin or other means to reduce the sediment content to a level acceptable to the DOE.

6. The CONTRACTOR shall not pump water directly from any excavation into Pataha creek, but shall construct and maintain stilling basins to receive the pumpage with an overflow from the basins to the creek. The basins shall be of sufficient size to allow proper settling of sediment before the water flows into the creek. The CONTRACTOR shall remove and/or restore the basin area to original condition after backfilling is complete. Water from well points may be discharged directly into the creek providing such operation does not result in erosion of creek banks.

C. Pumping and Drainage:

1. Adequate pumping and drainage facilities shall be provided and water, from whatever source, entering the work during any stage of construction shall be removed promptly and disposed of in a manner satisfactory to the ENGINEER. All pumping and drainage shall be done with no damage to property or structures and without interference with the right of the public, owners of private property, pedestrians, vehicular traffic, or the work of other contractors. Dewatering shall be done in such a manner that the soil under or adjacent to existing structures shall not be disturbed, removed or displaced.
2. The overloading or obstructing of existing drainage facilities shall not be permitted, and the CONTRACTOR shall be solely responsible for any damages caused to such existing drainage facilities during his operations.

D. Winter Construction:

1. The ENGINEER shall have permissive authority over the work which is proposed to be done during the winter months. The Contractor shall provide adequate weather protection, temporary heating and take any other measures which are necessary to insure that the work performed during the winter months is properly installed and protected against damage from freezing.
2. When and if temporary heating is used, the CONTRACTOR shall take every precaution to insure that the hazard of fire is reduced to a minimum, and he shall be completely responsible for any damage which may result from the use of temporary heating devices.

E. Sanitary Requirements:

1. The CONTRACTOR shall provide adequate sanitary facilities for all persons employed on the project. The sanitary facilities shall conform in every way to the requirements of the "General Safety Rules and Regulations for the Construction Industry".

PART 2 - PRODUCTS

(NOT APPLICABLE)

PART 3 - EXECUTION

3.1 SITE CLEARING

A. General:

1. Remove vegetation, improvements, or obstructions interfering with installation of new construction and as specifically indicated.

B. Topsoil Removal:

1. Remove heavy growths of grass from areas before stripping.
2. Strip topsoil to whatever depths encountered in a manner to prevent intermingling with the underlying subsoil or other objectionable material.
3. Strip topsoil from all areas of new construction and where existing grades will be altered.
4. Stockpile topsoil in storage piles in areas where directed. Construct storage piles to freely drain surface water.

C. Clearing:

1. Remove vegetation as indicated or as directed by the ENGINEER.

D. Removal of Improvements:

1. Remove above-grade and below-grade improvements necessary to permit construction, and other work as specifically indicated.

3.2 DISPOSAL OF WASTE MATERIALS

A. Burning on OWNER'S Property:

1. Burning is not permitted on the OWNER'S property.

B. Removal to OWNER'S Spoil Area:

1. Transport unsuitable and excess soil materials to designated spoil areas on the OWNER'S property and dispose of as directed.

C. Removal from Owner's Property:

1. Remove waste materials from the OWNER'S property and dispose of legally.

3.3 TEMPORARY ROADWAYS

- A. The location of temporary roadways and/or access drives shall be subject to the approval of the ENGINEER.

3.4 WORK AREA AND STORAGE OF MATERIALS

- A. The working area shall be developed in an orderly manner with storage and tool sheds, offices and sanitary facilities, parking areas for employees, and all other necessary facilities developed and maintained by the CONTRACTOR.
- B. All materials, supplies and equipment, whether furnished by the CONTRACTOR or by the OWNER, shall be delivered, stored and handled as to prevent the inclusion of foreign materials and/or damage by water, freezing, breakage or other causes. Packaged materials shall be delivered in the original unopened containers and shall be stored until ready for use. All materials which have been stored shall meet the requirements of the specifications at the time they are used in the project.

SECTION 02230
EXCAVATION, TRENCHING AND BACKFILLING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Scope:

1. The work covered by this section shall consist of furnishing all materials, equipment and labor for the excavating, trenching and backfilling required to install or repair the gravity wastewater piping and other structures shown on the Drawings and referred to in these Specifications.

B. Related Work Specified Elsewhere:

1. Manholes, Sanitary: Section 02601.
2. Watermain piping: Section 02100.
3. Forcemain Piping: Section 02700.
4. Gravity Wastewater Piping: Section 02722.

C. Related Work Not in This Contract:

1. Testing laboratory services.

1.2 JOB CONDITIONS

A. Dust Control:

1. Use all means necessary to control dust on and near the work if such dust is caused by the CONTRACTOR'S operations during performance of the work, or if resulting from the condition in which the CONTRACTOR leaves the site.
2. Thoroughly moisten all surfaces as reburied to prevent dust being a nuisance to the public, neighbors and concurrent performance of other work on the site.

B. Protection:

1. Use all means necessary to protect all materials of this Section before, during and after installation and to protect all objects designated to remain.

2. In the event of damage, immediately make all repairs and replacements necessary for the approval of the ENGINEER and at no additional cost to the OWNER.

1.3 SUBSURFACE CONDITIONS

A. Information:

1. The CONTRACTOR should visit the site and become acquainted with all existing conditions prior to bidding. Bidders may make their own subsurface investigations to satisfy themselves as to site and subsurface conditions, but such subsurface investigations shall be performed only under time schedules and arrangements approved in advance by the OWNER through the ENGINEER.

B. Quality Assurance:

1. Soil engineering services will be provided by the OWNER to observe performance of work in connection with excavating, trenching and backfilling. Readjust all work performed that does not meet technical or design requirements, but make no deviations from the Contract Documents without specific and written approval of the ENGINEER.

C. Samples:

1. Samples of soil materials proposed to be used by the CONTRACTOR shall be furnished to the testing service by the CONTRACTOR.

D. Existing Utilities:

1. Request underground utility locates before excavating. Locate existing utilities by hand excavation as required and protect them from damage. Should uncharted, or incorrectly charted, utilities be encountered during excavation, consult utility Owner and the ENGINEER immediately for directions.
2. Cooperate with the Owner of utility companies so as to keep services in operation. Do not interrupt utility connections without providing temporary utility services acceptable to the ENGINEER. Repair damaged utilities to the satisfaction of utility Owner and the ENGINEER.
3. Remove existing underground utilities from site which are indicated to be removed, or which interfere with construction. Coordinate with utility companies and with the ENGINEER for temporary shut-off of services as required. Give adequate notice before shut-off. Provide temporary services as required at CONTRACTOR'S expense.

1.4 PROTECTION OF PERSONS AND PROPERTY

- A. Provide fences, barricades, signs and lights to protect the area of work. Fence or barricade open trenches, excavations or other hazardous conditions and provide warning lights and signs. Comply with governing safety regulations.

PART 2 - PRODUCTS

2.1 BACKFILL MATERIAL

- A. All backfill material shall be free from cinders, ashes, refuse, sod, frozen lumps, vegetable or organic material, boulders, rocks or stones, or other material which, in the opinion of the ENGINEER, is unsuitable. However, from one foot above the top of the pipe to finish grade or subgrade of a structure, material containing stones up to six (6) inches in their greatest dimension may be used.
- B. Where the type of backfill material is not specified, the CONTRACTOR may backfill with the excavated material, provided that such material meets the requirements of Section 2.1.A. Where excavated material is to be used for backfill and there is a deficiency due to rejection of part thereof, the CONTRACTOR shall furnish the required amount of sand, gravel or other approved material at no additional cost.

2.2 BACKFILL UNDER STRUCTURES

- A. Where the excavation is made through or under existing or proposed pavement, curb, shoulders, driveways, sidewalks, or where such structures are undercut by the excavation or where noted on the Drawings, the entire backfill to the subgrade of the structure shall be made with sound earth. Sound earth is defined as a compactable soil or soil-rock mixture which is free from organic matter and other deleterious substance; it shall contain no rocks or lumps over six (6) inches in greatest dimension and not more than 15% of the rocks or lumps shall be larger than 2-1/2 inches in greatest dimension. Native soil which meets this definition of sound earth shall be used wherever possible. The sound earth shall be placed in layers not exceeding nine (9) inches in thickness and compacted to 95% of maximum unit weight. This requirement shall also apply to any trench that is within a one-on-one slope from the shoulder point or back of curb line.

PART 3 - EXECUTION

3.1 GENERAL

- A. Notification:
 - 1. Notify the ENGINEER at least two (2) full working days prior to commencing the work of this Section.

B. Familiarization:

1. Prior to all work of this Section, become thoroughly familiar with the site, the site conditions and all portions of the work falling within this Section.

C. Clarification:

1. The Drawings do not purport to show all objects existing on the site.
2. Before commencing the work of this Section, verify with the ENGINEER all objects to be removed and all objects to be preserved.

D. Backfilling Prior to Approvals:

1. Do not allow or cause any of the work performed or installed to be covered up or enclosed by work of this Section prior to all required inspections, tests and approvals.
2. Should any of the work be so covered up or enclosed before it has been approved, uncover all such work at no additional cost to the OWNER.

E. Scheduling:

1. Schedule all work in a careful manner and provide limits of construction related activities, with all necessary consideration for neighbors and the public.
2. Avoid interference with the use of, and passage to and from, on-site or adjacent buildings and facilities.
3. After the work has been completely tested, inspected and approved, make all repairs and replacements necessary to restore the work to the condition in which it was found at the time of uncovering, all at no additional cost to the OWNER.

3.2 FINISH ELEVATIONS AND LINES

- A.** The ENGINEER will set and establish finish elevations and lines; carefully preserve all data and all monuments set by the ENGINEER and, if displaced or lost, immediately replace to the approval of the ENGINEER at no additional cost to the OWNER.

3.3 EXCAVATION

A. General:

1. Excavation includes clearing the site of the proposed work and removal of all materials to a depth which is sufficient to permit the installation of the pipe or the

construction of the structure in accordance with the Drawings. Excavated materials may be temporarily stored along the trench in a manner that will not cause damage to trees, shrubbery or other properties, and that will not endanger the banks of the trench by imposing too great a load thereon.

B. Length and Width of Trench:

1. Not more than 200 feet of open trench will be permitted at any time, unless pedestrian bridges are maintained at 200 foot intervals and vehicular crossings of at least one lane are maintained at 300 foot intervals.
2. Streets shall not be completely blocked without written permission from the ENGINEER. All fire alarm boxes and fire hydrants must be kept clear and accessible at all times.
3. The width of the trench shall be ample to permit the pipe to be laid and joined properly and the backfill to be placed and compacted as specified.
4. In order to limit excessive loads on the pipe, the maximum width of trench shall not be more than two (2) feet greater than the nominal inside diameter of the pipe. Trenches shall be of such extra width, when required, as will permit the convenient placing of timber supports, sheeting and bracing and handling of special fittings.

C. Bracing, Sheeting and Shoring:

1. Open cut trenches shall be sheeted and braced as required by any governing state or federal laws and as may be necessary to protect life, property or the work. When close sheeting is reburied, it shall be so driven as to prevent adjacent soil from entering the trench either below or through such sheeting. Where sheeting and bracing are used, the trench width shall be increased accordingly. An approved pipe laying box may be used in lieu of sheeting where safety of the workmen and/or protection of the work is the sole consideration.
2. Sheeting and bracing left in place must be removed for a distance of three (3) feet below the established street grade or the existing surface of the street, whichever is lower.
3. Trench bracing, except that which must be left in place, may be removed when the backfilling has reached the respective levels of such bracing. Sheeting, except that which has been ordered left in place, shall be removed as the backfilling progresses.
4. The cost of bracing, sheeting and shoring shall be incidental to and included in the unit price of the pipe or structure placed in the excavation.

D. Pumping, Bailing and Draining:

1. The CONTRACTOR shall provide adequate pumping and draining facilities for the removal and disposal of water from trenches or other excavations. CONTRACTOR shall provide pumping and draining facilities for bulkheaded sewer sections and shall operate same until bulkheads have been removed or constructions completed if bulkheads are to be left in place. The drainage system must be maintained until the pipe has been covered with sufficient backfill material to prevent floating of the installed pipe sections.
2. Where work is in ground containing an excessive amount of water, the CONTRACTOR shall provide, install and maintain a suitable dewatering system and shall so operate it to ensure proper construction of the work. The determination of whether an excessive ground water condition existed that is, or might be detrimental to the sewer construction, will be made by the ENGINEER.

E. Excavation to Grade:

1. The trench shall be excavated to the depth required so as to provide a uniform and continuous bearing and support for the pipe barrel on solid and undisturbed ground. The CONTRACTOR shall excavate the last four (4) inches of depth to grade using hand tools.
2. Any part of the bottom of the trench excavated below the specified grade shall be refilled with approved materials, thoroughly compacted to a minimum of 95% of maximum unit weight. The finished subgrade shall be prepared accurately by means of hand tools. Blocking to bring the pipe to grade will not be permitted. Bell holes in the subgrade must be provided to allow for continuous support of the pipe barrel.
3. If, in the opinion of the ENGINEER, subgrade pipe support conditions at some locations are found to be unsatisfactory, the ENGINEER shall have the authority to order subgrade preparation at these locations in accordance with the provisions for special foundations in clay, rock or poor soils (See Sections 3.3.F and 3.3.G).

F. Special Foundation in Clay or Rock:

1. Subgrade consisting of clay or rock shall be excavated to at least three (3) inches and not more than six (6) inches below the specified grade. Before the pipe is laid, the subgrade shall be prepared by backfilling with an approved granular material in three (3) inch thick compacted layers. The layers shall be thoroughly tamped as directed by the ENGINEER so as to provide a uniform and continuous bearing and support for the pipe barrel with a minimum compaction of 95% of maximum unit weight. The CONTRACTOR will not be allowed any extra compensation for this work.

G. Special Foundations in Poor Soil:

1. Where the bottom of the trench at subgrade is found to consist of unstable material which will, in the opinion of the ENGINEER, not provide adequate pipe support, the ENGINEER shall have the authority to require either the removal of the unstable material and replacement with approved materials or require the CONTRACTOR to construct a foundation for the pipe consisting of piling, timber or other materials in accordance with plans prepared by the ENGINEER. The CONTRACTOR will not be allowed extra compensation for this work.

3.4 BACKFILLING

A. Backfilling Around Pipes:

1. From the bottom of the trench to a point twelve (12) inches above the top of the pipe, the trench shall be backfilled by hand with 5/8 inch minus crushed rock.
2. The CONTRACTOR shall use care in placing the pipe bedding portion of the backfill so as to make sure sufficient material has been worked under the pipe haunches and also to avoid damaging or moving the pipe. All backfilling around PVC pipe shall be done in accordance with ASTM D2321-74, Standard Recommended Practice for "Underground Installation of Flexible Thermoplastic Sewer Pipe".

B. Backfilling to Natural Grade:

1. From twelve (12) inches above the top of the pipe to the grade shown on the Drawings, or as specified herein, the trench shall be backfilled by mechanical methods approved by the ENGINEER. A minimum compaction of 95% of maximum unit weight is required unless noted otherwise herein or on the Drawings.
2. Provide a minimum of 30 inches of cover over the top of the pipe before application of wheel loading and 48 inches before use of heavy compaction equipment.

C. Grading Tolerances:

1. Finish Grade:

- a. Subgrade under roads, sidewalks, curbs, etc.:
 - 1) Plus or minus 0.1 foot.
- b. Landscaped areas:
 - 1) Plus or minus 0.2 foot.

3.5 FIELD QUALITY CONTROL TESTING DURING CONSTRUCTION

- A. The CONTRACTOR shall cooperate with testing service furnished by OWNER to inspect and approve all subgrades and fill layers under sidewalks, roadways, parking areas, etc. The CONTRACTOR shall give the testing schedule at least two (2) days advance notice of the CONTRACTOR'S earthwork schedule so the testing service will have adequate time to inspect and approve such work and not cause delay in the work.
- B. If, in the opinion of the ENGINEER, based on the results of the testing and inspection, the CONTRACTOR'S work or materials are not acceptable, additional work will be performed by the CONTRACTOR until satisfactory results are obtained at no additional expense to the OWNER.

3.6 MAINTENANCE

- A. Maintain all finished work during the period of this construction project. Repair and re-establish grades in settled, eroded and rutted areas to grading tolerances specified in Section 3.4.C. Where completed compacted areas are disturbed, scarify surface, reshape and compact to reburied density prior to further construction.

3.7 DISPOSAL OF EXCESS AND WASTE MATERIALS

- A. Transport acceptable excess excavated materials to off-site approved soil disposal areas. Stockpile soil or spread as directed by the ENGINEER.
- B. Remove all excess or waste materials, including unacceptable excavated material, trash and debris and transport to legal disposal off-site.
- C. All required compaction testing will be provided by Progressive Engineering Group, Inc. throughout the project.

SECTION 02510 ASPHALT SURFACING

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. The work covered by this Section shall consist of furnishing all materials, equipment, and labor for the placement of asphalt surfacing.

PART 2 - PRODUCTS

2.1 ASPHALT SURFACES

- A. Base Course material shall comply with Section 02513.
- B. Plant Mix Pavement shall comply with Section 02515.

PART 3 - EXECUTION

3.1 ASPHALT SURFACES

- A. The backfill shall be compacted to 95% maximum density.* Base material layer shall be at least 6 inches in depth and shall be compacted to the density required in Section 02513.
- B. The plant mix asphalt shall be placed in a manner that conforms to Section 02515. The depth of the finished plant mix asphalt shall be 3 inches as shown on the Plans.

*Maximum density as determined in accordance with ASTM D-1557.

3.2 MAINTENANCE

- A. Throughout the project, all streets damaged or affected by construction shall, be maintained to a level that is required by the City of Stites.

* Maximum density as determined in accordance with ASTM D-1557.

SECTION 02512 ROLLING

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. The work in this section consists of furnishing and using rollers for the compaction of base and surface course in accordance with these specifications.

PART 2 - EQUIPMENT

2.1 STEEL-WHEEL ROLLERS

- A. Steel-wheel rollers shall consist of 3-wheel or tandem type self-propelled rollers equipped with cleaning devices to prevent adhesion of material to the wheels. Steel-wheel rollers for use on base material and reconditioning shall have a minimum weight of 10 tons and a minimum compression of 325 pounds per inch width for the rear wheels or drum.
- B. Steel-wheel rollers for use on plant mix shall be of the tandem type weighing 8 to 12 tons. A 3-axle tandem weighing 10 to 14 tons may be used for final finishing.

2.2 VIBRATORY COMPACTION

- A. Vibratory compactors of the roller type shall have a minimum width of 56 inches, a minimum static weight of 60 pounds per inch of width and generate a minimum centrifugal force of 250 pounds per inch of width. Roller vibratory compactors shall be operated in accordance with the manufacturer's recommendation at a speed of 2 to 5 miles per hour.
- B. Vibratory compactors of the pan type shall have a minimum width of 120 inches and shall be capable of applying a minimum force of 2,700 pounds per ' foot of width based on the manufacturer's rating. Pan type vibratory compactors shall be operated in accordance with the manufacturer's recommendation at a speed of 20 to 90 feet per minute.
- C. Vibratory compactors meeting the above requirements may be used to compact base courses. Towed vibratory compactors may be used to compact the top course of base material provided that the finish rolling is done by a steel-wheel roller or a self-propelled, pneumatic-tire roller.

2.3 PNEUMATIC ROLLERS

- A. Pneumatic rollers shall be an approved type. The use of wobble-steel rollers will not be permitted. Self-propelled rollers are required for the top course of base and all asphalt surfaces.

PART 3 - EXECUTION

- A. Unless otherwise provided, rolling shall start longitudinally at the sides and proceed toward the center, overlapping on successive trips by at least one half of the width of the roller unit. The rollers, unless otherwise directed, shall operate at a speed of from 3 to 5 miles per hour.

**SECTION 02513
AGGREGATE BASE COURSE**

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. The work covered in this section consists of furnishing and placing one or more courses of aggregate on a prepared surface in accordance with these specifications and in reasonably close conformity with the lines, grades, thickness and typical cross sections shown on the plans or established by the ENGINEER.

PART 2 - PRODUCTS

- A. The aggregates shall meet the following requirements:

<u>Sieve Designation</u> <u>Square Openings</u>	<u>Weight Passing Sieves</u> <u>3/4" Maximum Surfacing</u>
3/4 Inch	100
No. 4	40-65
No. 10	25-45
No. 200	3-9

- B. The sand equivalent shall be not less than 30 if 5% or more of the material passes the No. 200 sieve. Sand equivalent will not be required if less than 5% of the material passes the No. 200 sieve, or for aggregate to be used for lime or cement treated base. The aggregate will be accepted at the crushing plant.

PART 3 - EXECUTION

3.1 PLACING

- A. If the required compacted depth of the base course exceeds 0.5 feet, the base shall be constructed in two (2) or more layers of approximate equal thickness. The maximum compacted thickness of any one layer shall not exceed 0.5 feet. When vibrating or other approved types of special compacting equipment are used, the compacted depth of a single layer of the base course may be increased to 0.8 feet upon approval.

3.2 MIXING

- A. Unless otherwise specified, the CONTRACTOR shall mix the base course by any one or a combination of the three methods specified below.

1. Stationary Method:

The aggregate and water shall be mixed in an approved mixer. Water shall be added during the mixing operation in an amount necessary to facilitate compaction. After mixing, the base material shall be placed on the roadbed by means of an approved aggregate spreader.

2. Travel Plant Method:

After the material for each layer of base course has been placed through an aggregate spreader or window sizing device, the base shall be uniformly mixed by a traveling mixing plant. During the mixing, water shall be added in an amount necessary to facilitate compaction.

3. Road Mix Method:

After material for each layer of base course has been placed, the materials shall be mixed by motor graders or other approved equipment until the mixture is uniform throughout. During the mixing, water shall be added in an amount necessary to facilitate compaction.

3.3 COMPACTING

- A. After each layer has been spread, it shall be compacted for its full width. Compaction equipment will be chosen by the CONTRACTOR. Compaction shall continue until not less than 95% of the maximum density, determined by ASTM D-1557 is obtained.
- B. The surface of each layer shall be maintained during the compaction operations in such a manner that uniform texture is produced and the aggregates firmly keyed. Water shall be uniformly applied over the base materials during compaction in the amount necessary for proper consolidation.
- C. Field determination of density of soil in place and percent compaction shall comply with ASTM D-1557.

**SECTION 02515
PLANT MIX PAVEMENT**

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. The work covered in this section shall consist of constructing one or more courses of plant mix pavement on a prepared base in accordance with these specifications and in reasonably close conformity with the lines, grades, thickness and typical cross sections shown on the plans or established by the ENGINEER.

1.2 GENERAL

- A. Asphalt plant mix pavement and its placement shall meet or exceed the provisions for Class B plant mix given in Sections 5-04 and 9-03.8(6) of the Washington State Department of Transportation Standard Specifications for Road, Bridge and Municipal Construction, latest approved edition.

PART 2 - PRODUCTS AND EQUIPMENT

2.1 COMPOSITION OF MIXTURE

- A. The plant mix shall be composed of a mixture of aggregate, filler if required, and asphalt and shall meet the Washington State Department of Transportation standard specification for asphalt pavement, Class B. Aggregates shall be from an approved source. The several aggregate fractions shall be sized, uniformly graded and combined in such proportions that the resulting mixture meets the grading requirements of the job-mix formula.
- B. The job-mix formula for each mixture shall be approved by the ENGINEER. The job-mix formula with the allowable tolerances shall be within the master range specified. The job-mix formula for each mixture shall be in effect until modified in writing by the ENGINEER. The job-mix formula for each mixture shall establish a single percentage of aggregate passing each required sieve size and a single percentage of asphalt to be added to the aggregate. The temperature at which the mixture is to be delivered at the point of spreading will be established when the source and grade of the asphalt have been determined.
- C. Should a change in sources of materials be made, a new job-mix formula shall be established before the new material is used. When unsatisfactory results or other conditions make it necessary, the ENGINEER may establish a new job-mix formula.
- D. The aggregate will be accepted for master range gradation and quality requirements at the crushing plant and for job-mix gradation at the gradation unit of the mixing plant.

- E. Asphalt shall be grade AR4000W. The grade may be changed one step by the ENGINEER at no change in unit price. Asphalt furnished shall meet the applicable requirements of Section 9-02 of the Washington State Department of Transportation Standard Specifications.

2.2 MIXING PLANT

- A. The mixing plant shall be approved by the ENGINEER prior to submission of proposal by the Contractor.

2.3 HAULING EQUIPMENT

- A. Trucks used for hauling plant mix materials shall have tight, clean, smooth metal beds. When necessary, each truck shall have a cover of canvas or other suitable material of such size as to protect the mixture from the weather. Truck beds shall be insulated and covers shall be securely fastened when necessary to deliver the mixture on the road at the specified temperature.

2.4 PAVERS

- A. Pavers shall be self-propelled units provided with an activated screed or strike-off assembly, heated if necessary and capable of spreading and finishing courses of plant mix material in lane widths applicable to the specified typical section and thicknesses shown on the plans.
- B. The paver shall be equipped with a receiving hopper having sufficient capacity for a uniform spreading operation. The hopper shall be equipped with a distribution system to place the mixture uniformly in front of the screed.
- C. The screed shall be equipped with automatic controls which will make adjustments in both transverse and longitudinal directions. The sensing device shall be adaptable to picking up grade information from a string-line, rail, ski, or adjacent strip of pavement. In the event of failure of the automatic controls, the Contractor will be permitted to finish the day's run using manual controls. He will not be permitted to resume operations until the automatic controls are repaired.

2.5 ROLLERS

- A. All rollers shall meet the requirements of Section 02512. Rollers shall be operated at speeds slow enough to avoid displacement of the pavement or excessive crushing of the aggregate.

2.6 BASE

- A. Base materials shall conform to Section 02513.

PART 3 - EXECUTION

3.1 WEATHER LIMITATIONS

- A. Plant mix materials shall not be placed on any wet surface. Plant mix material shall not be placed when weather or surface conditions otherwise prevent the proper handling or finishing.

3.2 CONDITIONS OF EXISTING SURFACE

- A. When the surface of the existing pavement or old base is irregular, it shall be brought to uniform grade and cross section as directed by the ENGINEER. Payment for leveling will be made at the contract unit price for the items used.
- B. Contact surfaces of existing asphalt surfaces shall be painted with a thin, uniform coating of asphalt prior to the pavement being placed against them.

3.3 PREPARATION OF AGGREGATES

- A. The aggregates for the mixture shall be heated to the required temperature. Flames used for heating shall be adjusted to avoid damage to the aggregate and to avoid soot on the aggregate.
- B. The aggregates immediately after heating, shall be screened into 3 or more fractions and conveyed into separate compartments. The moisture content of the aggregate at the time of mixing shall not exceed one percent.

3.4 MIXING

- A. The heated aggregates shall be combined in the mixer in the amount of each fraction of aggregates required to meet the job-mix formula. The asphalt shall be measured or gaged and introduced into the mixer in the amount specified by the job-mix formula.
- B. After the required amounts of aggregate and asphalt have been introduced into the mixer, the materials shall be mixed until a complete and uniform coating of the particles and a thorough distribution of the asphalt throughout the aggregate is obtained. Wet mixing time shall be determined by the ENGINEER for each plant and for each type of aggregate used.
- C. The mixture shall be produced at the lowest temperature that will produce a workable mix. The temperature shall be maintained such that the asphalt viscosity is greater than 150 centistokes and less than 300 centistokes as determined from the temperature - viscosity curve for the material being used.

3.5 LAYING

- A. The mixture shall be laid upon an approved surface. Pavers shall be used to distribute the mixture either over the entire width or over such partial width as may be practicable.
- B. When laying mixtures, the paver shall be operated at forward speeds consistent with satisfactory laying of the mixture.

3.6 JOINTS

- A. Placing of the paving mixture shall be as continuous as possible. Rollers shall not pass over the unprotected end of a freshly laid mixture unless authorized by the ENGINEER. Transverse joints shall be formed by cutting back on the previous run to expose the full depth of the course. A brush coat of SS-1 emulsified asphalt shall be used on contact surfaces of transverse joints just prior to placing additional mixture against the previously rolled material.

3.7 ROLLING

- A. Unless otherwise directed, the initial or breakdown rolling of the paving mixture shall consist of one complete coverage performed with a 2-axle tandem roller. The initial or breakdown rolling shall be followed by a complete coverage with a pneumatic-tire roller while the temperature of the mixture is at or above 185°F. The final rolling shall be performed in such a manner that cracking, shoving or displacement will be avoided. Final rolling shall be completed the same day the pavement is placed.
- B. Any displacement occurring as a result of the reversing of the direction of the roller or from other causes shall be corrected immediately by the use of rakes and addition of fresh mixture when required. Care shall be exercised in rolling not to displace the line and grade of the edges of the pavement.
- C. To prevent adhesion of the mixture to the rollers, the wheels shall be kept properly moistened with water or water mixed with very small quantities of detergent or other approved material. Excess liquid will not be permitted.

3.8 SURFACE SMOOTHNESS

- A. The completed surface will be tested. The surface shall not vary more than 0.25 inch from a 10 foot straight edge.

3.9 BASE MATERIAL

- A. Base material shall be applied to conform with Section 02513.

3.10 SUB-BASE MATERIAL

- A. Sub-base material shall be compacted in conformance with Section 02226.

3.11 CORRECTION OF DEFECTS

- A. All improper workmanship and defective materials resulting from overheating, improper handling, or application, shall be removed from the roadway by the CONTRACTOR and be replaced with approved materials and workmanship at his own expense.

3.12 TRAFFIC AND DETOURS

- A. The CONTRACTOR shall furnish and place all necessary detour, caution, and other required signs, and barricades. All signs shall comply with the "Manual on Uniform Traffic Control Devices for Streets and Highways".

**SECTION 02610
WATERMAIN PIPING AND FITTINGS**

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Scope:

1. The work covered by this Section shall consist of furnishing all labor, materials and equipment required for the installation of watermain piping and fittings in accordance with the Drawings and Specifications.

B. Related Work Specified Elsewhere:

1. Excavation, Trenching and Backfilling; Section 02230.
2. Testing and Disinfection of Water Lines; Section 02675.
3. Concrete Thrust Blocks; Section 03371.
4. Gate Valves; Section 15100.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General:

1. All pipe and fittings shall be new and unused material of the size and type shown on the Drawings and shall conform to the requirements of the Specifications.
2. All pipe and fittings shall be the standard products of reputable manufacturer's normally engaged in the manufacturing of the particular item in question.

B. C900 PVC Watermain:

1. PVC watermain pipe shall meet or exceed all of the requirements of ASTM Designation D1784, cell class 12454B (latest editions). The pipe shall be pressure class 150 and the minimum wall thickness shall meet the requirements of DR 18.

C. Fittings:

1. All fittings shall be ductile iron. Mechanical joint ductile iron fittings shall be designed and produced in accordance with the latest revision of ANSI/AWWA Specifications C153/A 21.53 and ANSI/AWWA C111/A21.11. Fittings shall be designed to withstand a minimum working pressure of 200 psi and a minimum hydrostatic test pressure of 300 psi.
2. All ductile iron fittings shall be cement lined and seal-coated in accordance with ANSI/AWWA specifications C104/A21.4.
3. All ductile Iron fittings and other appurtenances shall be connected to the watermain using mechanical joints.

D. Pipe Joints:

1. PVC watermain pipe joints shall be integral bell gasketed joints meeting the same strength requirements as the C900 pipe and the requirements of ASTM D3139 (latest edition).
2. Mechanical joints shall conform to ANSI Standard AWWA Standards C110 and C111 along with ANSI Specifications A 21.10 and A 21.11. Rubber gaskets shall conform to manufacturer's standards.

PART 3 - EXECUTION

3.1 INSTALLATION OF PIPE AND FITTINGS

A. General:

1. All pipe and fittings shall be installed in strict conformance with the manufacturer's recommendations. All piping and fittings for watermains shall be of the types of materials herein specified. The pipe and fittings shall be new and unused.
2. During loading, transporting and unloading, exercise care to prevent damage to materials. Pipe and fittings shall not be dropped. All materials shall be stored under protective coverings and kept clean. Materials shall never be stored directly on the ground. The inside of all pipe and fittings shall be kept free of dirt and debris at all times.
3. Before installation, all pipe and fittings shall be inspected for defects and any section of pipe or fitting found to be defective, before or after laying, shall be rejected and replaced with sound materials.

4. Before, during and after installation, all pipe and fittings shall be protected from conditions that would result in damage or deterioration to the materials.

B. Trench Excavation:

1. The full length of each section of pipe shall rest solidly upon the pipe bed with recesses provided to accommodate the joint bells. Each pipe section shall be laid true to line and grade and in such a manner as to form a close concentric joint with the adjoining pipe and to prevent sudden offsets of the flow line.

C. Pipe Deflections:

1. Deflections from a straight line or grade, as required by vertical curves, horizontal curves or offsets shall not exceed one (1) inch per lineal foot of pipe for pipe less than ten (10) inches in diameter between the centerlines extended of any two connecting pipes. If the alignment requires deflections in excess of these limitations, special bends or a sufficient number of shorter lengths of pipe shall be furnished to provide the angular deflection required. For pipes 12 inches and larger, the maximum deflection per joint shall not exceed 1/2 inch per lineal foot of pipe. If necessary, special bends or shorter lengths of pipe shall be furnished to provide the angular deflection required.

D. Installation of Pipe and Fittings:

1. The interior of the pipe and fittings shall be thoroughly cleaned of foreign matter before being lowered into the trench and shall be kept clean during laying operations by plugging the ends.
2. As the work progresses, the interior of the pipe shall be cleared of all dirt and superfluous material of every description. Where cleaning after laying is difficult because of small pipe size, a suitable swab or drag shall be kept in the pipe and pulled forward past each joint immediately after the joining has been completed. Trenches shall be kept free from water, and pipe shall not be laid when the condition of the trench or the weather is unsuitable for such work. At times when work is not in progress, open ends of pipe and fittings shall be securely and satisfactorily closed so no water, earth, animals or other substance will enter the pipes. No pipe or fittings shall be laid in water or when the trench or weather conditions are unsuitable or work.
3. The joints of pipe shall be made in accordance with the manufacturer's recommendations.

4. All fittings at bends or junctions in the pipeline shall have concrete thrust blocks as shown on the Drawings and as specified in Section 03371 of these Specifications to prevent the fittings from being blown off of the pipeline when under pressure. Pipe ends left for future connections shall be valved, capped and anchored with a concrete thrust block as shown on the Drawings.

E. Field Cutting of Pipe:

1. When pipe is cut in the field, the outside of the cut shall be tapered back about 1/8 inch at an angle of 30° with the centerline of the pipe to remove any sharp or rough edges.

D. Connections Between New and Existing Conditions:

1. Where connections are made between new work and existing watermain, the connections shall be made by using special pipes and fittings as required to suit the actual conditions.
2. No connections to existing mains shall be made until the new main has been pressure tested and chlorinated and is ready to be placed into service. When making the connection, swab pipe and fittings with four percent (4%) chlorine solution.

3.2 RELATION TO SANITARY SEWER MAINS

A. Horizontal and Vertical Separation:

1. All watermain shall be laid at least ten (10) feet horizontally from any existing or proposed sanitary sewer mains. The separation distance shall be measured edge to edge.
2. In cases where it is not practical to maintain the 10 foot separation, special approval will be required from the State of Idaho Division of Environmental Quality (DEQ).

B. Crossings:

1. Watermain crossing sanitary sewer mains shall be laid to provide a minimum vertical distance of 18 inches between the outside edge of the watermain and the outside edge of the sewer main. This shall be the case whether the watermain is either above or below the sewer main. The crossing shall be arranged so that the watermain joints will be equidistant and as far as possible from the sewer main joints. Where the watermain crosses under a sewer main, adequate structural support shall be provided for the sewer to maintain line and grade.

2. When it is impossible to obtain the proper horizontal and vertical separation as specified above, the watermain shall be encased in a watertight carrier pipe that extends 10 feet on both sides of the crossing, measured perpendicular to the watermain. The carrier pipe shall be ductile iron pipe.

SECTION 02675
TESTING AND DISINFECTION OF WATER LINES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Scope of Work:

1. The work covered in this Section shall consist of providing all of the labor, materials and equipment necessary for hydrostatic testing and disinfection of all new watermain piping.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Liquid Chlorine:

1. Liquid Chlorine shall conform to AWWA Specification B-301.

B. Hypochlorite:

1. Hypochlorite shall conform to AWWA Specification B-300.

PART 3 - EXECUTION

3.1 TESTING WATERMAIN

A. General:

1. Prior to connecting any new watermain to an existing watermain, the new main shall be pressure tested, flushed and chlorinated as outlined herein and in Section 02610 of these Specifications.
2. A physical gap of at least three (3) feet shall be left between the new watermain and the existing watermain until all of the testing and disinfection results are satisfactory.
3. The testing sequence shall be as follows:
 - a. pressure test;
 - b. flushing, and;
 - c. disinfection.

4. Water required for testing may be taken from a nearby hydrant by using fittings to accommodate a standard fire hose. A check valve must be used on the connection to the main being used to prevent backflow into the existing system.

B. Pressure Testing:

1. All new watermain, or sections thereof, shall be pressure tested in the presence of the ENGINEER, and all leaks shall be made tight to meet the requirements specified below. All piping, pumps and other equipment required to carry out the pressure test shall be approved by the ENGINEER prior to testing.
2. The section of main to be tested shall be slowly filled with water at least 24 hours prior to starting the test. Expel air through corporation stops installed at all high points in the line.
3. At the start of testing, the new watermain shall be pumped up to a pressure of 150 psi and the test period shall start immediately thereafter. The line shall then be maintained under this test pressure for a continuous period of two (2) hours by pumping water into the line at frequent intervals. The volume of water so added shall be measured and considered to represent the leakage from the line under test during the interval.
4. The leakage per hour under the conditions of test shall not exceed the values in the following table:

Pipe Size (Inches)	Average Test Pressure in Line (psi)				
	50	100	150	200	250
	<u>Allowable Leakage per 1000 ft. or 50 Joints in gal/hr</u>				
4	0.19	0.27	0.33	0.38	0.43
6	0.29	0.42	0.50	0.57	0.64
8	0.38	0.54	0.66	0.76	0.85
10	0.48	0.68	0.83	0.96	1.07
12	0.57	0.81	0.99	1.15	1.28
16	0.66	0.94	1.15	1.24	1.48

5. In the event the leakage exceeds the specified amount, all of the joints in the line shall be carefully inspected for leaks and repaired where necessary. Any pipes, or fittings, found to be cracked shall be removed and replaced with new pieces. After this work has been done, the test shall be repeated. Final acceptance of the lines will not be made until satisfactory tests have been passed.

6. Where there is a considerable elevation difference in the section of watermain being tested, the test pressure shall average 150 psi over the length of main, but shall be not less than 140 psi at the highest elevation.
7. All main line valves and hydrant lead valves within the test section shall remain open during the pressure test.
8. At the completion of the two (2) hour pressure test, each valve shall be checked against the test pressure.

C. Flushing of Mains:

1. After pressure testing and prior to chlorination, all new watermain shall be flushed clean of sand and debris.

D. Disinfection:

1. After the pressure testing and flushing have been completed, disinfection shall be completed as per the procedures prescribed by AWWA C-651.

SECTION 03300 CONCRETE WORK

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. General:

1. Work includes, but is not necessarily limited to the following:
 - a. Footings
 - b. Slabs on Grade
 - c. Walkways
 - d. Forms, Accessories, Expansion Joints
 - e. Vapor Barriers
 - f. Tests, Protection, Certificates, Affidavits

B. Related Work Specified Elsewhere:

1. Grout; Section 03360.

1.2 QUALITY ASSURANCE

A. Codes and Standards:

1. All concrete work shall be in strict conformance with "ACI Specifications for Structural Concrete for Buildings" (ACI 301, latest edition), and the recommendations of Portland Cement Association's "Design & Control of Concrete Mixtures" (latest edition).

B. Concrete Testing:

1. Concrete will be tested periodically during the progress of the concrete work. The CONTRACTOR shall assist the ENGINEER in preparing a sufficient number of standard test cylinders to accurately represent the concrete placed in forms for each days pour. The required testing will be performed by the ENGINEER. Samples of concrete will be obtained in accordance with ASTM C-172 and will be transported to a location on the site where tests can be made and cylinders stored without being disturbed for the first 24 hours. Cylinders for strength tests will be made in accordance with ASTM C-31 and ASTM C-94. Any additional testing required because of apparent failure of concrete to meet specification requirements shall be paid for by the CONTRACTOR. When there is a question as to the quality of the structure because of cylinder strength-test failures, strength tests made on specimens secured from the structure in accordance with ASTM

C-42 will generally be required by the ENGINEER and provided by the CONTRACTOR at no additional cost to the OWNER.

2. Slump tests will be performed by the ENGINEER following the procedure in ASTM C-143. Slump tests will always be made of concrete from any batch from which strength tests are made. If the measured slump falls outside of the limits specified, a check test will be made immediately on another portion of the same sample. In the event of a second failure, the concrete will be considered to have failed to meet the requirements of the specifications.
3. Air content tests will be made by the ENGINEER in accordance with either ASTM C-138 or ASTM C-231. If the measured air content falls outside of the limits specified, a check test will be made immediately on another portion of the same sample. In the event of a second failure, the concrete will be considered to have failed to meet the requirements of the specifications.
4. The cost of additional testing of concrete desired by the ENGINEER, including the cement content or chloride presence, shall be borne by the OWNER for tests which show the concrete to be in compliance with the requirements of the specifications. The cost of such additional testing of the concrete will be borne by the CONTRACTOR for all tests which show failure of the concrete to comply with the requirements of the specifications. All other additional or special testing costs shall be borne by the OWNER.

1.3 SUBMITTALS

A. Certificates:

1. The following certificates shall be submitted:
 - a. Ready-mix delivery tickets.
 - b. Material certificates on all concrete items.
 - c. Design mix for concrete.

PART 2 - PRODUCTS

2.1 REINFORCING MATERIALS

A. General:

1. All reinforcement shall be free from rust scale, grease, clay and other coatings or foreign substances that would reduce or destroy the bond between the reinforcing and concrete.

2. Reinforcement that has bends not shown on the plans or on approved shop drawings or which is reduced in section by rusting shall not be used.

B. Reinforcing Bars:

1. Reinforcing steel shall consist of deformed bars of the size called for on the Drawings. All reinforcing steel bars shall conform to ASTM A-615, Grade 60. Deformation shall conform to ASTM 305. The CONTRACTOR shall clean, bend and splice steel in accordance with ACI 315-74. Hooks shall conform to Table 2.1 of ACI 315-74. No reinforcing steel shall be straightened or rebent. All bars shall be bent cold. Fabrication shall be in accordance with the CRSI Manual of Standard Practice.

C. Wire Mesh:

- 1 Wire mesh shall conform to "Specifications for Welded Steel Wire Fabric for Concrete Reinforcement" (ASTM A-185, latest edition). All mesh shall be 6 x 6 x 9 ga., unless noted otherwise.

2.2 CONCRETE MATERIALS

A. Portland Cement:

1. Cement shall conform to "Standard Specification for Portland Cement" (ASTM C-150, latest edition) or "Specifications for Air-Entrained Concrete" (ASTM C-175, latest edition), and shall be types I, Ia, III or IIIa.

B. Aggregate:

1. Aggregate shall conform to "Standard Specification for Concrete Aggregates" (ASTM C-33, latest edition). Maximum coarse aggregate size for all members less than eight (8) inches in thickness shall be 3/4". For members with thicknesses greater than or equal to eight (8) inches, the maximum coarse aggregate size is 1-1/2".

C. Mixing Water:

1. All water used in concrete shall be from a potable supply.

D. Air-Entraining Admixtures:

1. Air-entraining admixtures shall conform to "Standard Specification for Air-Entrained Admixtures for Concrete" (ASTM C-260, latest edition). Air-entrainment shall be 4.5% to 6% for concrete with a maximum aggregate size of 1-1/2" and shall be 5% to 7% for concrete with a maximum aggregate size of 3/4".

2.3 RELATED MATERIALS

A. Moisture Barrier:

1. Clear, 6 mils thick, polyethylene complying with ASTM E-154.

B. Membrane- Forming Curing Compound:

1. Provide products complying with "Specifications for Liquid Membrane- Forming Compounds for Curing Concrete", ASTM C-309, Type I.

C. Forms and Form Ties:

1. Soft wood forming lumber shall be kiln-dried and shall conform to Product Standards PS 20. Light framing members or studs for plywood forms shall be 2 inches by 4 inches nominal in width and thickness and shall be standard grade. Plywood shall be softwood plywood type PS 1. All wood forms shall be treated with an approved non-staining mineral oil film coating.
2. Steel forms may be used.
3. All form ties shall be designed so that when forms are removed, no metal will be within one (1) inch of the finished concrete surface. The CONTRACTOR shall take due precaution to prevent future leakage or seepage along ties in all walls which will be subjected to water pressure. Ties used in all walls shall be cut back into the face of the wall at least one (1) inch and the resulting holes pointed up with 1:3 grout.

D. Grout:

1. Grout shall conform to the requirements of Section 03360.

2.4 CONCRETE MIX DESIGN AND PROPORTIONING

- A. All concrete shall be air-entrained, shall have a minimum 28 day compressive strength of 3,000 psi and shall be limited by ACI tolerances for the ultimate strength design method. The water-cement ratio shall not exceed 0.49 and there shall be at least 560 pounds of Portland cement per cubic yard of concrete.
- B. The concrete shall be from an approved batch plant and shall be of a consistency to work easily into corners, angles of forms and around reinforcement. The slump shall not exceed 4.5 inches.
- C. The concrete mix design shall be submitted to the ENGINEER for approval at least 48 hours prior to placing any concrete.

PART 3 - EXECUTION

3.1 FORMS

A. General:

1. Forms shall conform to shapes, lines and dimensions of the members as called for on the Drawings, and shall be sufficiently tight to prevent leakage of mortar. They shall be properly braced or tied together so as to maintain position and shape.

B. Removal of Forms:

1. Forms shall be removed in such a manner as to ensure the complete safety of the structure.

3.2 PLACING REINFORCING STEEL

A. Cleaning and Bending Reinforcement:

1. At the time concrete is placed, steel reinforcement shall be free from loose rust or other coatings that will destroy or reduce the bond between the reinforcement and concrete. All bars shall be shop bent cold, unless otherwise permitted by the ENGINEER. No bars partially embedded in concrete shall be field bent except as shown on the Drawings or as specifically permitted by the ENGINEER.

B. Placing Steel Reinforcement:

1. All steel reinforcement shall be accurately placed according to the Drawings and approved shop drawings and shall be adequately secured in final position by concrete, metal or other approved chairs, spacers and ties so as not to be displaced during the placement of the concrete.
2. Place rods accurately, rigid, wired and held by appropriate supports, spacers or hangers, not in contact with exposed surfaces. Place mesh in the top third of slabs on grade. Wires and supports do not run to surface of concrete. Lap all mesh and wire together.

C. Concrete Protection for Reinforcement:

1. Reinforcement shall be protected by the thickness of concrete cover indicated in the Drawings. Where not otherwise shown, the thickness of concrete cover over the reinforcement shall be as follows:
 - a. For all concrete to be deposited on grade or against the earth: not less than 3".

- b. For all concrete that is placed in forms and exposed to earth or weather: not less than 2".
- c. In walls not exposed to water, ground or weather: not less than 1-1/2".
- d. For interior slab or surface against air: not less than 3/4".

3.3 JOINTS

A. Construction Joints:

- 1. Construction joints shall be at locations approved by the ENGINEER and shall be made at points of minimum shear in the structure. Where a joint is to be made, the surface of the concrete shall be thoroughly cleaned and all laitance removed. In addition, joints shall be thoroughly wetted and slushed with a coat of neat cement grout immediately prior to placement of new concrete.

3.4 MIXING AND PLACING CONCRETE

A. Preparation:

- 1. Lay perimeter insulation horizontally, in a single layer, under perimeter areas of on-grade floor slabs prior to placement of moisture barrier.
- 2. Place moisture barrier of 6-mil polyethylene over sub-grade of all interior slabs on grade just prior to placement of reinforcement. Keep foot traffic over moisture barrier to a minimum. Moisture barrier shall be made continuous with folded 18" side and end lap seams.

B. Preparation of Equipment and Place of Deposit:

- 1. Before placement, all equipment for mixing and transporting the concrete shall be cleaned, and all debris and ice shall be removed from the places to be occupied by the concrete. Forms shall be oiled or wetted (oiled in freezing weather). The reinforcement shall be thoroughly cleaned of ice, dirt, loose rust or other coatings.
- 2. Water shall be removed from place of deposit before concrete is placed. All laitance and other unsound material shall be removed from hardened concrete before additional concrete is added.

C. Mixing:

1. All concrete shall be ready-mixed. Ready-mixed concrete shall be mixed and delivered in accordance with "Specifications for Ready-Mixed Concrete" (ASTM C-94, latest edition).

D. Conveying:

1. Concrete shall be conveyed from the mixer to the place of final deposit by methods that will prevent segregation or loss of materials.
2. Equipment for chuting, pumping and pneumatically conveying the concrete shall be of such size and design as to ensure a practically continuous flow of concrete at the delivery end without segregation of materials.

E. Placing:

1. Concrete shall be deposited as nearly as practical to its final position to avoid segregation due to rehandling or flowing. Concrete shall be placed at such a rate that it is at all times plastic and flows readily between reinforcing bars. No concrete contaminated by foreign material shall be used, nor shall retempered concrete be used unless approved by the ENGINEER.
2. Tank wall concrete shall be continuously placed in horizontal lifts of not over two (2) feet in height around the periphery of the tank. Adjacent lifts shall be placed at a rate so that the previously placed concrete has not begun to set.
3. All concrete, except floor slabs on grade, pavement and sidewalks shall be consolidated and densified in place by immersion type vibrators, using equipment and techniques approved by the ENGINEER. Do not over vibrate or damage reinforcement while vibrating concrete.

F. Protection, Curing and Sealing:

1. General:

- a. Concrete surfaces shall be moist cured and protected from drying for at least seven (7) days after pouring. For horizontal surfaces, water retaining coverings may be used so as to keep concrete continuously moist. Forms may be left in place to achieve moist-cure of formed surfaces. After the initial seven (7) day moist curing period, membrane curing compound shall be applied.

2. Membrane Curing Compound:

- a. Apply membrane-forming curing compounds in accordance with manufacturer's instructions and recommendations.
- b. The compound shall be applied after the initial seven (7) day moist curing period.
- c. Apply membrane-forming curing compound in continuous curing operation by power spray or roller in accordance with manufacturer's directions. Recoat areas which are subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.
 - 1) All cast in place floors shall receive one coat of membrane-forming curing compound.
 - 2) All floors shall receive a second application just prior to completion of the project.

G. Protection of Concrete:

1. All concrete surfaces shall be protected against injury. During the first 72 hours after placing the concrete, any wheeling, working or walking on the concrete shall not be permitted. No concrete top surfaces of walls shall be placed during rain unless acceptable protective shelter is provided. During such weather, all concrete placed within the preceding 12 hours shall be protected.

H. Cold Weather Requirements:

1. Adequate equipment shall be provided for heating concrete materials and protecting concrete during freezing or near freezing weather. No frozen materials or materials containing snow or ice shall be used.
2. All Concrete materials, steel reinforcement, forms, fillers and ground with which the concrete is to come in contact with shall be free from snow, ice or frost. Whenever the temperature of the surrounding air is below 40° F, all concrete placed in the forms shall have a temperature of between 60° F and 70° F for seven (7) days. Adequate means shall be provided for maintaining the temperature of all uncured concrete between 50° F and 80° F during the curing period. After placement, the concrete shall be maintained at a minimum temperature of 50° F for at least 5 days. After this initial protection, maintain a temperature of at least 40° F for 4 more days. Discontinuance of protection from freezing must be gradual so the drop in temperature of any portion of the concrete will not exceed 40° F in any 24 hour period.

3. The housing, covering or other protection used in connection with curing shall remain in place for at least 24 hours after the artificial heating is discontinued. Housings used to maintain the proper temperature during curing shall be adequately ventilated to prevent the accumulation of CO and CO₂ gases. The use of salt or chemicals for the prevention of freezing is prohibited. Protect concrete from carbon dioxide damage.
4. When heating of concrete materials is required, the mixing water and aggregate shall be heated to not more than 90° F prior to being placed in the mixer so that the temperature of the mixed concrete shall be not less than 70° F nor more than 80° F. Aggregate shall be heated either by steam or by dry heat and the heating apparatus shall be of a type which will heat the mass uniformly and in such a manner as to preclude the possible occurrence of overheated areas or hot spots which will burn the materials. Flame throwers or other similar direct heating devices will not be permitted.

I. Hot Weather Requirements:

1. When hot weather conditions exist that would seriously impair the quality and strength of the concrete, the concrete placement shall comply with ACI 305. Suitable precautions shall be taken to avoid drying of the concrete prior to finishing operations. Use of windbreaks, sunshades, fog sprays or other devices shall be provided as directed by the ENGINEER.
2. Concrete deposited in hot weather shall not have a placement temperature that will cause difficulty from loss of slump, flash set or cold joints. Concrete temperature shall not exceed 90° F.

J. Construction Details:

1. Exposed edges of concrete on the outside of structures and all those in the inside of structures shall be chamfered or beveled at an angle of 45 degrees, with bevel being 3/4 inch on each side. If directed by the ENGINEER; however, the CONTRACTOR shall provide square edges for any portion of the work.

K. Tolerances:

1. Flat surfaces of walls and slabs shall be plus or minus 1/8 inch in 10 feet.
2. Linear alignment of structure lines shall be as follows:

10 foot length - 1/8 inch
20 foot length - 3/8 inch
40 foot length - 1/2 inch
Over 40 foot - 3/4 inch

3.5 CONCRETE FINISHES

A. Surface Treatment After Removal of Forms:

1. Within 24 hours following the removal of forms, all form ties shall be cut off at a depth of at least 1/2" beneath the surface of the concrete. The resulting holes shall be pointed up with cement grout.
2. Fins or other projections on the surface shall be carefully removed and offsets leveled. All other surface defects shall be repaired in accordance with the requirements of ACI 301, Chapter 9 and as follows. Immediately after the removal of forms, repair and/or patch defects only after approval of method by the ENGINEER. Repair and/or patch defects within 48 hours after removal of forms and cure simultaneously with concrete. Patching mixture shall be in accordance with ACI 301, Paragraph 9.2.2 where patching is allowed. The CONTRACTOR shall determine exact mix by trial mixtures before patching and obtain approval of mix proposed prior to application. The holes shall be repaired in accordance with ACI 301, Paragraph 9.3.

B. Finish of Exposed Surfaces:

1. General:

All concrete shall be finished without excessive floating and a minimum amount of working. Finishing shall be done when concrete is in proper condition to avoid working water and fine materials to surface. Concrete will retain the specified finish.

2. Exterior Slabs and Sidewalks:

The surface shall first be float-finished, then lightly troweled with a steel trowel and finally slightly roughened by means of a broom.

SECTION 03360 GROUT

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. The Contractor shall furnish and install all grout materials as shown on the plans and called for in other parts of these specifications.

PART 2 - PRODUCTS AND EXECUTION

- A. Grout shall be used where shown on the drawings for encasing pipe, grouting anchors and dowels, providing bedding, etc. Grout shall be as specified below. Grout shall be an approved commercially available nonshrink epoxy type suitable for locations being continuously submerged in water. The manufacturer's instructions and recommendations will be followed in the preparation and installation of grout. All grout used shall meet or exceed the following testing requirements:

<u>REQUIREMENTS</u>	<u>TEST METHOD</u>	<u>REMARKS</u>
Volume Change	ASTM C 827	To verify whether grout does not shrink below placement volume. Also establishes type and length of cure.
Workability Initial Set Flow	ASTM C 191 CRD-C 79	To verify that grout can be placed within 45 minutes of mixing and initial set.
Comprehensive Strength	ASTM C 109	To verify specified strength characteristics.
Nonshrink	Field Test*	To test field mixes for nonshrink.

- * Fill standard 6 x 12 inch test cylinder with grout mix. Place 1/2 inch steel plate with two 1 1/2 inch holes over freshly screeded concrete in cylinder. After 3 days plate should be bonded to grout.

SECTION 03371 CONCRETE THRUST BLOCKS

PART 1 - GENERAL

- A. Concrete thrust blocks shall be constructed as shown on the Drawings or as required in other sections of these specifications.

PART 2 - PRODUCTS

- A. 3,000 psi concrete shall be used to construct all concrete thrust blocks.

PART 3 - EXECUTION

A. INSTALLATION

1. All thrust blocks shall be constructed against undisturbed earth.
2. The excavation bank or bottom that will contact and support the concrete shall be cleaned of all loose material and shaped prior to placing the concrete.
3. Thrust blocks shall not be backfilled for a minimum of 24 hours after placing.
4. All thrust blocks shall be rough formed, with all exposed surfaces smoothed off in a neat and presentable manner.
5. All surfaces of the fitting which will be in contact with concrete shall be covered with a polyethylene sheet to facilitate future removal if necessary.
6. Thrust blocks shall be constructed in accordance with the details shown on the Drawings.

SECTION 05310 METAL SIDING AND ROOF DECKING

PART 1 - GENERAL

1.1 QUALITY ASSURANCE

A. Codes and Standards:

1. Comply with the provisions of AISI "Specifications for the Design of Cold-Formed Steel Structural Members"; SDI "Steel Roof Deck Design Manual".

1.2 SUBMITTALS

A. Shop Drawings:

1. Submit detailed drawings showing layout of deck panels, anchorage details and every condition requiring closure panels, supplementary framing, special jointing or other accessories.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Metal Siding and Roof Decking:

1. Zinc aluminum alloy conforming to ASTM A792.

B. Outside Corner Trim:

1. Zinc aluminum alloy conforming to ASTM A792.

C. Closure Strips for Roof Panels:

1. Polyethylene foam type to fit Delta Rib profile. Provide continuous closure strips along both top and bottom of all roof panels.

D. Sidelap Mastic:

1. Provide mastic sealant in sidelaps between all siding and roof panels. Sidelap mastic shall be closed cell neoprene butyl.

2.2 FABRICATION

A. General:

1. Fabricate panels of 30 gauge sheets 24 inches wide x length required to run full width of roof and height of wall without joints.
2. All metal siding, roof decking and outside corner trim shall be furnished painted by the manufacturer. Provide color as selected by ENGINEER from manufacturer's standard colors.

B. Delta Rib:

1. All siding panels, roof deck panels and outside corner trim shall be "Delta Rib" style as supplied by BHP Steel Building Products USA, Inc., or approved equal.
2. Depth of ribs shall be 7/8 inch; ribs shall be spaced at approximately 8" O.C. with stiffener ribs located midway between the main ribs.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:

1. Install roof deck, siding units, outside corner trim and accessories in accordance with manufacturer's recommendations and final shop drawings, and as specified herein.

B. Installing Panels:

1. Install top and bottom closure strips as per manufacturer's recommendations.
2. Place panels and adjust to final position before permanently fastening to wafer board sheathing. Do not stretch or contract the sidelap interlocks. Place panels flat and square, secured to adjacent framing without warping or excessive deflection.
3. Install sidelap mastic at top of rib on the leading edge of each panel as per manufacturer's recommendations.
4. If roof decking bundles are placed on the roof prior to final placement, locate bundles so as to prevent overloading of roof truss members.
5. Do not use installed roof decking panels for storage or working platforms.

C. Fastening Panels:

1. Fasten panels to wafer board sheathing as per manufacturer's recommendations utilizing screw fasteners with neoprene and metal washers specifically designed for Delta Rib siding and roof panels. The minimum wood penetration by the screw fasteners shall be 1 inch.
2. Fasten at intervals of 8" O.C. along panel ends and 12" O.C. along sidelaps between panels.

D. Installing Outside Corner Trim:

1. Install outside corner trim as per manufacturer's printed instructions.

E. Cutting and Fitting:

1. Cut and fit panels and accessories around other work projecting through or adjacent to panels as shown on the Drawings. Provide neat, square and trim cuts.

F. Touch-Up Painting:

1. After installation of all panels, wire brush, clean and paint any scarred areas with the same paint used in the shop, as recommended by the panel manufacturer.

SECTION 06100 CARPENTRY

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. The extent of carpentry work is shown on drawings and in schedules. Materials and installation requirements for other work, commonly assigned to the carpentry trade, are specified in other sections of these specifications.

1.2 QUALITY ASSURANCE

- A. Lumber Standard: comply with PS 20.
- B. Wafer Board Standard: Comply with APA rated sheathing.
- C. Identification: Factory-mark each piece of lumber and plywood with type, grade, mill and grading agency.

1.3 PRODUCT HANDLING

- A. Keep materials dry at all times. Protect against exposure to weather and contact with damp or wet surfaces. Stack lumber and wafer board and provide air circulation within stacks.

1.4 JOB CONDITIONS

- A. Fit carpentry work to other work; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds and similar supports to allow proper attachment of other work.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Lumber, General:
 - 1. Nominal sizes are indicated, except as shown by detail dimensions. Provide actual sizes as required by PS 20, for moisture content specified. Provide dressed lumber, S4S, kiln dried with 15% maximum moisture content at time of dressing.

B. Framing Lumber:

1. For structural framing, provide any species and grade which meets or exceeds the following values:
 - a. Fb (minimum extreme fiber stress in bending); 1200 psi (1400 psi repetitive).
 - b. E (minimum modulus of elasticity): 1,500, 000 psi

C. Plywood:

1. For roof sheathing, provide 5/8" thick plywood.
2. For wall sheathing, provide 1/2" thick plywood.

2.2 MISCELLANEOUS MATERIALS

A. Fasteners and Anchorages:

1. Provide size and type as indicated and as recommended by applicable standards, complying with applicable Federal Specifications for nails, staples, screws, bolts, nuts, washers, and anchoring devices.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:

1. Set carpentry work accurately to required levels and lines, with members plumb and true and accurately cut and fitted.
2. Securely attach carpentry work to substrate by anchoring and fastening as required by recognized standards. Use finishing nails for interior finish work, countersink nail heads and fill holes. Make tight connections between members. Install fasteners without splitting of wood: predrill as required.

B. Wood Framing, General:

1. Provide framing members of sizes and on spacings shown, and frame openings as shown, or if not shown, comply with recommendations of "Manual for House Framing" of National Forest Products Association. Do not splice structural members between supports.

2. Anchor and nail to comply with "Recommended Nailing Schedule" of "Manual for House Framing" and other recommendations of N.F.P.A.
3. Install framing members at spacings indicated, or if not indicated, at 16" O.C.

C. Gables:

1. Frame gable end walls as shown. Cut studs to fit and toe nail to top plates of wall framing. If roof framing overhangs at gable end, provide top plate for gable end wall framing. If roof framing is flush with gable end wall, notch studs to fit and nail to end rafter.

D. Installation of Plywood:

1. General:

- a. Comply with recommendations of the American Plywood Association (APA), for the installation of plywood.

2. Sheathing:

- a. Install with face grain across supports, using panels continuous over 2 or more spans with end joints between panels staggered and located over center of supports.
- b. Nail 6" O.C. along panel ends and 12" O.C. at intermediate supports of roof sheathing and 10" O.C. at intermediate supports of wall sheathing. Use 8d common nails.
- c. Provide support at unsupported long edges with "Plyclips" or wood blocking.
- d. Allow 1/16" open space between end joints and 1/8" open space between edge joints for expansion and contraction of panels.

SECTION 06170
PREFABRICATED STRUCTURAL WOOD

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. General:

1. The extent of prefabricated structural wood is indicated on the drawings.
2. The types of prefabricated structural wood required include the following:
 - a. Roof trusses, double pitched.

B. Related Work Specified Elsewhere:

1. Wood support framing and wafer board roof sheathing: Section 06100.

1.2 QUALITY ASSURANCE

A. Standards:

1. Comply with applicable requirements of the NLMA's "National Design Specifications for Stress Graded Lumber and Its Fastenings" and the Truss Plate Institute's "Light Metal Connected Wood Trusses". Truss bracing shall be in accordance with the Truss Plate Institute's "Bracing Wood Trusses: Commentary and Recommendations".

B. Fabricator:

1. Provide pre-engineered and shop-assembled wood trusses by a recognized manufacturer of wood trusses. Design for the span, loading, shape and spacing shown. Fabricate in the plant of the -manufacturer or his licensed fabricator.

1.3 SUBMITTALS

A. Shop Drawings:

1. Submit shop drawings showing pitch, span and location, size, specie and stress grades of all members, details of metal connectors at joints, connection details to support framing, etc.

B. Engineering Calculations:

1. Submit engineering calculations to show compliance with design criteria shown. Calculations to be certified by a registered professional structural engineer, registered in the state where the construction project is located.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Lumber:

1. Provide dressed lumber, S4S, kiln dried with 15% maximum moisture content at time of dressing. All lumber shall comply with PS 20.
2. Provide size, specie and stress grades required to comply with design loadings and spacings indicated.

B. Accessories:

1. Provide all framing anchors, shoes, caps, etc., as called for on drawings or as required for installations complying with all governing codes and regulations and details shown on drawings.

2.2 FABRICATION

- A. Shop assemble wood trusses in the plant of a recognized manufacturer of wood trusses, or in a plant of a fabricator licensed by such a manufacturer.
- B. Design wood trusses for a live loading of 30 pounds per square foot, plus actual dead loads, with a maximum deflection equal to $L/360$.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with "Light Metal Connected Wood Trusses" by Truss Plate Inst. , and with "Natural Design Specifications for Stress Graded Lumber and Its Fasteners" by NLMA.
- B. Store, handle and erect wood trusses in accordance with manufacturer's printed instructions. Provide temporary and permanent supports and braces as required by governing standards and codes or as recommended by wood truss manufacturer.

- C. The wood trusses shall be erected and installed in accordance with the drawings, the approved shop drawings and installation details. Temporary construction loads which cause member stresses beyond design limits are not permitted. Erection bracing, in addition to specified bridging, shall be provided to keep the wood trusses straight and plumb as required to assure adequate lateral support for the individual wood trusses and entire system until the sheathing material has been applied. The CONTRACTOR shall give notification prior to enclosing the wood trusses to provide an opportunity for the ENGINEER to inspect the installation.

SECTION 07200 THERMAL INSULATION

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. General:

1. The applications of thermal insulation specified in this section, include the following:
 - a. Foundation wall insulation (supporting backfill).
 - b. Blanket type building insulation.
 - c. Foam type caulking

1.2 QUALITY ASSURANCE

A. Thermal Conductivity:

1. The thickness shown are for the thermal conductivity (k-value at 75°F) specified for each material. Provide adjusted thickness as directed for the equivalent use of material having a different thermal conductivity.

1.3 PRODUCT HANDLING

- A. Do not allow insulation materials to become wet, soiled, or covered with ice or snow. Comply with manufacturer's recommendations for handling, storing and protecting. Protect plastic insulation from exposure to sunlight.
- B. Do not deliver plastic insulating materials to the project site ahead of installation time. Protect against ignition. Complete installation and concealment as rapidly as possible.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. General:

1. All insulation materials, including facing, shall have a flame-spread rating not to exceed 25 and a smoke density of not more than 450 when tested in accordance with UBC Standard 8-1 [UBC Section 707.3].

B. Extruded Polystyrene Plastic Board Insulation:

1. Rigid, closed-cell, polystyrene insulation board; FS HH-I-524, type II, Class B; 40 psi compressive strength; 1.0 perm-inch maximum vapor transmission; 0.7% maximum water absorption; k-value of 0.20; manufacturer's standard lengths and widths.
 - a. Provide "Styrofoam SM", by Dow Chemical U.S.A. or "Foamular", by UC Industries.

C. Mineral/Glass Fiber Blanket/Batt Insulation:

1. Inorganic fibers, flexible resilient blankets, FS HH-I-521; k-value of 0.27; manufacturer's standard lengths and widths required to coordinate with spaces to be insulated.
 - a. For attics, provide Type I, unfaced units.

D. Foamed in Place Polyurethane "Caulking":

1. Single component polyurethane foam, manufactured specifically for caulking gaps around doors and windows.
 - a. Provide Polycell I, Fomofill, Great Stuff or equal.

2.2 MISCELLANEOUS MATERIALS

A. Adhesive for Bonding Insulation:

1. The type recommended by the insulation manufacturer.

B. Mechanical Anchors:

1. Type and size as recommended by the insulation manufacturer for the type of application shown, and condition of substrate.

C. Vapor Barrier:

1. Clear, 6 mil thick, polyethylene complying with ASTM E 154.

PART 3 - EXECUTION

3.1 PREPARATION OF SUBSTRATE

- A. Install vapor barrier to all wood framed ceiling areas. Overlap joints a minimum of 2". Secure vapor barrier to wood framing with staples.

3.2 INSTALLATION

A. General:

1. Comply with manufacturer's instructions for the particular conditions of installation in each case.
2. Extend insulation full thickness as shown over entire area to be insulated. Cut and fit tightly around obstructions, and fill voids with insulation. Remove projections which interfere with placement.
3. Apply a single layer of insulation of the required thickness.

B. Perimeter and Under-slab Insulation:

1. On vertical surfaces, set units in adhesive applied in accordance with manufacturer's instructions.

C. General Building Insulation:

1. Apply insulation units to the substrate by methods complying with the manufacturer's recommendations.

D. Foamed in Place Caulking:

1. Fill entire gap around door and window frames, around pipes penetrating exterior walls, around electrical outlets in exterior walls, etc., with foamed in place caulking. Apply in accordance with manufacturer's printed instructions and recommendation for conditions shown.

**SECTION 07600
FLASHING AND SHEET METAL**

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. General:

1. The following types of work are specified in this Section:
 - a. Metal flashing
 - b. Soffit and ridge vent system
 - c. Eve gutters
 - d. Flexible flashing system
 - e. Miscellaneous trim, flashing and accessories.

1.2 JOB CONDITIONS

- A.** Coordinate metal flashing and trim work with adjacent work, including installation of roofing, siding, flexible flashing, blocking, nailers and framing.

PART 2 - PRODUCTS

2.1 METAL FLASHING, TRIM, SOFFITS AND GUTTERS

A. Aluminum Sheet:

1. ASTM A 792, Alloy 3003-H16; 0.032" thick, mill finish.
2. Provide color as selected by ENGINEER from manufacturer's standard colors.

2.2 MISCELLANEOUS MATERIALS

A. General:

1. Provide fasteners recommended by manufacturer for installation of metal flashing, trim, soffits and gutters.

B. Flexible Flashing:

1. Provide EPDM (ASCP Standard) flexible flashing system for sealing opening around penetrations of roof or siding panels.
2. Install flexible flashing system as per manufacturer's printed instructions.

2.3 FABRICATED PRODUCTS

A. General:

1. Provide color as selected by ENGINEER from manufacturer's standard colors.

B. Soffits, Fascia and 1/2" Wide Faced "J" Channel:

1. Fabricate of 0.0175" aluminum. Product shall meet A.A.M.A. Specification 1402-86.
2. Provide end caps and splice caps by same manufacturer.
3. Soffits, Fascia and "J" channels shall be by Alsco Building Products, Roxboro, N.C., or approved equal.

C. Ridge Vent:

1. Fabricate of 0.019" aluminum. Provide 18 square inches of punched 0.125" x 0.875" louver opening per lineal foot of ridge vent. Fill inside of ridge vent with glass fiber weather filter.
2. Ridge vents provided shall be by Air Vent Inc., Peoria Hts., Ill, or approved equal.

D. Roof Gutters and Downspouts:

1. Fabricate of 0.026 aluminum alloy type 3105.
2. Provide end caps and downspouts by same manufacturer.
3. Roof gutters and downspouts shall be by Alsco Building Products, Roxboro, N.C., or approved equal.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. Comply with manufacturer's instructions and recommendations for handling and installing flashing and prefabricated products.
- B. Coordinate the work with other work for the correct sequencing of items which make up the entire system of weatherproofing. It is required that the flashing and sheet metal work be permanently watertight and not deteriorate in excess of manufacturer's published limitations.

3.2 INSTALLATION OF METAL WORK

A. General:

1. Comply with details and profiles as shown on the Drawings and with SMACNA "Architectural Sheet Metal Manual's" recommendations for installation of the work.
2. Provide for thermal expansion of all exposed sheet metal work exceeding 15' - 0" running length, at 10' - 0" maximum spacing and located 2' - 0" from corners and intersections.
3. Conceal fasteners and expansion provisions wherever possible. Fold back edges on concealed side of exposed edges to form a hem.

SECTION 07900 JOINT SEALERS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. General:

1. The extent of each type of joint sealer is indicated on Drawings and by provisions of this section.
2. The required applications include, but are not necessarily limited to, the following:
 - a. flashing joints
 - b. joints at penetrations of walls, decks and floors by piping and other services and equipment
 - c. under all metal thresholds at exterior openings, full bed
 - d. around perimeter of all door, window, louver and other openings in exterior walls from both interior and exterior

1.2 SUBMITTALS

A. Samples:

1. Submit 3, 12" long samples of each color required (except black) for each type of joint sealer exposed to view.

1.3 JOB CONDITIONS

- ##### **A.**
- Do not proceed with installation of sealants under adverse weather conditions, or when temperatures are below or above manufacturer's recommended temperature range for installation. Proceed with the work only when forecasted weather conditions are favorable for proper cure and development of high early bond strength. Where joint width is affected by ambient temperature variations, install elastomeric sealants only when temperatures are in lower third of manufacturer's recommended installation temperature range.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Colors:

1. Provide color as selected by ENGINEER from manufacturer's standard colors. For concealed materials, provide natural color which has best overall performance characteristics.

B. Compatibility:

1. Before purchase, confirm its compatibility with each other material it will be exposed to in joint system.

C. Size and Shape:

1. As recommended by manufacturer for type and condition of joint.

2.2 ELASTOMERIC SEALANTS

A. Two Component Polyurethane Sealant:

1. Polyurethane-based, 2-part elastomeric sealant, complying with FS TT-S-00227, Class A, type 1 (self-leveling) unless Type 2 recommended by manufacturer for application shown.
 - a. Use under metal thresholds.

B. Two Component Polytremdyne Terpolymer Sealant (2PT-S):

1. Two part elastomeric sealant, low modulus, complying with FS TT-D-00227E, Class A, gun grade, non-sag.
 - a. Provide "Dynmeric" by Tremco.

C. One Component Low Modulus Silicone Sealant (1LMSR-S):

1. Silicone rubber-based, one part elastomeric sealant, low modulus, complying with FS TT-S-001543.
 - a. Provide one of the following:
 - 1) 790 Building Sealant; Dow Corning Corporation
 - 2) Silpruf; General Electric Company

2.3 NON-ELASTOMERIC SEALANTS

A. One Component Acrylic Sealant:

1. Acrylic terpolymer, solvent-based, one-part, thermo-plastic sealant compound: solids not less than 95% acrylic; complying with FS TT-S-00230, Class B, Type II; recommended by manufacturer for general use as an exposed building construction sealant.
 - a. Use for all interior construction joints.

2.4 JOINT FILLERS, PAVEMENT TYPES

A. Bituminous and Fiber Joint Filler:

1. Provide resilient and non-extruding type premolded bituminous impregnated fiberboard units complying with ASTM D 1751, FS HH-F-341, Type I and AASHTO M 213.

2.5 GASKETS

A. Hollow Neoprene Gasket:

1. Hollow or compartmentalized neoprene extrusion, designed to withstand compression to 40% of normal width without extrusion from joint, and with full recovery; with heavy, durable top member; hardness of approximately 55 Shore A; ASTM D 2628.

2.6 MISCELLANEOUS MATERIALS

A. Joint Primer/Sealer:

1. Provide type of joint primer/sealer recommended by sealant manufacturer for joint surfaces to be primed or sealed.

B. Bond Breaker Tape:

1. Polyethylene tape or other plastic tape as recommended by sealant manufacturer to be applied to sealant-contact surfaces where bond to substrate or joint filler must be avoided for proper performance of sealant. Provide self-adhesive tape wherever applicable.

C. Sealant Backer Rod:

1. Compressible rod stock of polyethylene foam polyethylene jacketed polyurethane foam, butyl rubber foam, neoprene foam w other flexible, permanent, durable non-absorptive material as recommended for compatibility with sealant by sealant manufacturer.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

- A. Comply with manufacturer's printed instructions.

3.2 JOINT PREPARATION

- A. Clean joint surfaces immediately before installation of sealant. Remove dirt, insecure coatings, moisture and other substances which would interfere with bond of sealant. Etch concrete and masonry joint surfaces as recommended by sealant manufacturer. Roughen vitreous or glazed joint surfaces as recommended by sealant manufacturer.
- B. Prime or seal joint surfaces where shown or recommended by sealant manufacturer. Do not allow primer/sealer to spill or migrate onto adjoining surfaces.

3.3 INSTALLATION

A. General:

1. At contractor's option, provide either 2PT-S or 1LMSR-S sealant as specified for all exterior locations where sealants are required, but not called out or specified as to type.
2. Set joint filler units at proper depth or position in joint to coordinate with other work. Do not leave voids or gaps between ends of joint filler units.
3. Install sealant backer rod for liquid elastomeric sealants, except where recommended to be omitted by sealant manufacturer for application shown.
4. Install bond breaker tape where required by manufacturer's recommendations to ensure that elastomeric sealants will perform properly.

B. Sealants:

1. Employ only proven installation techniques, which will ensure that sealants will be deposited in uniform, continuous ribbons without gaps or air pockets, with complete "wetting" of joint bond surfaces equally on opposite sides. Fill sealant rabbet to slightly concave surface, slightly below adjoining surfaces. Where horizontal joints are between a horizontal surface and vertical surface, fill joint to form a slight cove, so that joint will not trap moisture and dirt.
2. Install sealant to depths as recommended by sealant manufacturer.
3. Do not allow sealants or compounds to overflow or spill onto adjoining surfaces, or to migrate into voids of adjoining surfaces. Clean adjoining surfaces by whatever means may be necessary to eliminate evidence of spillage.

C. Gaskets:

1. Recess exposed edges of gaskets and joint fillers slightly behind adjoining surfaces so that compressed units will not protrude from joints.
2. Bond ends of gaskets together with adhesive or "weld" by other means as recommended by manufacturer to ensure continuous watertight and airtight performance. Miter-cut and bond ends at corners unless molded corner units are provided.

3.4 CURE AND PROTECTION

- A. Cure sealants in compliance with manufacturer's instructions and recommendations, to obtain high early bond strength, internal cohesive strength and surface durability.

**SECTION 08110
STANDARD STEEL DOORS AND FRAMES**

PART 1 - GENERAL

1.1 QUALITY ASSURANCE

A. General:

1. Provide doors and frames complying with the Steel Door Institute "Recommended Specifications, Standard Steel Doors and Frames" (SDI 100), and as herein specified.

B. Manufacturers:

1. Manufacturer's offering products that comply with the requirements for steel doors on frames include, but are not necessarily limited to, the following:
 - a. Amweld Building Products Division
 - b. Ceco Corporation
 - c. Fenestra
 - d. Pioneer Industries
 - e. Republic Building Products Corporation
 - f. Steelcraft Manufacturing Company

1.3 SUBMITTALS

A. Shop Drawings:

1. Include details of each frame type, elevations of frame types and of door design types, conditions at openings, details of construction, location and installation requirements of finish hardware and reinforcements, and details of joints and connections. Show anchorage and accessory items.
2. Provide schedule using same reference numbers for details and openings as those on contract Drawings.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Deliver hollow metal work cartoned or crated to provide protection during transit and job storage.
- B. Inspect upon delivery for damage. Minor damages may be repaired as acceptable to ENGINEER; otherwise, remove and replace as directed.

- C. Store at building site under cover. Place units in a manner that will prevent rust and damage and will promote air circulation. Avoid use of non-vented plastic or canvas shelters which could create a humidity chamber.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Steel Sheets and Strip:

1. Hot-rolled, commercial quality carbon steel, pickled and oiled, complying with ASTM A 569 and ASTM A 568: cold-rolled, commercial quality carbon steel, complying with ASTM A 366 and ASTM A 568.

B. Galvanized Steel Sheets:

1. Zinc-coated carbon steel sheets of commercial quality, complying with ASTM A 526, with ASTM A 525, G60 zinc coating, mill phosphatized.

C. Supports and Anchors:

1. Fabricate of not less than 18 gauge galvanized sheet steel.

D. Inserts, Bolts and Fasteners:

1. Manufacturer's standard units, except hot-dip galvanized items to be built into exterior walls, complying with ASTM A 153, Class C or D, as applicable.

E. Shop-Applied Paint:

1. For steel surfaces, use rust-inhibitive enamel or paint, either air-drying or baking, suitable as a base for specified finish paints.
2. For galvanized surfaces, use zinc dust-zinc oxide primer, or other type primer recommended by door and frame manufacturer and suitable as a base for specified finish paints.

2.2 FABRICATION, GENERAL

A. General:

1. Fabricate units to be rigid, neat in appearance and free from defects, warp or buckle.
2. Fabricate exposed faces of doors and panels from only cold-rolled steel.

3. Fabricate frames, concealed stiffeners, reinforcement, edge channels and molding's, from either cold-rolled or hot-rolled steel (at fabricator's option).
4. Fabricate all exterior doors and frames and scheduled interior doors and frames from galvanized sheet steel.

B. Finish Hardware Preparation:

1. Prepare units to receive mortised and concealed finish hardware, including cutouts, reinforcing, drilling and tapping in accordance with final Finish Hardware Schedule and templates provided by hardware supplier. Comply with applicable requirements of ANSI A115, "Specifications for Door and Frame Preparation".
2. Reinforce hollow metal units to receive surface-applied hardware. Drilling and tapping for surface-applied finish hardware may be done at project site.
3. Locate finish hardware as shown on final shop drawings, or if not shown, in accordance with "Recommended Locations for Builder's hardware", published by the Door and Hardware Institute.

C. Shop Painting:

1. Clean steel surfaces of mill scale, rust, oil, grease, dirt and other foreign materials before the application of shop coat of paint.
2. Apply shop coat of prime paint of even consistency to provide a uniformly finished surface ready to receive field-applied paint.

2.3 FABRICATION, DOORS

A. General:

1. Comply with SDI 100 for minimum materials and construction requirements for types and styles as follows:
 - a. Exterior doors: Type III, Style 2 (16 gauge)
 - b. Interior doors: Type II, Style 2 (18 gauge)
2. Provide flush top cap on all exterior doors, of manufacturer's standard material.
3. Provide 14 gauge "Z" shaped astragal on inactive leaf of all double leaf exterior doors.
4. All exterior doors, except for the exterior door located on the east side of the mechanical building, shall be supplied with a 2'-0" x 2'-6" safety glass window.

B. Insulated Doors:

1. All exterior doors shall have an insulated core of polystyrene, polyurethane or fiberglass (as per manufacturer's standards) to provide an overall minimum "U" value of 0.38.

2.4 FABRICATION, FRAMES

A. General:

1. Provide types and styles indicated on Drawings and complying with SDI 100 for minimum materials and construction requirements.
2. Fabricate frames with mitered, welded and ground smooth corners.
3. Provide means of drainage to the exterior for water and condensation which may accumulate in rabbets of exterior hollow metal units.

B. Door Silencers:

1. Drill stops to receive 2 silencers on strike jambs on single-swing frames and 2 silencers on heads of double-swing frames. Factory install silencers.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:

1. Install hollow metal units and accessories in accordance with final shop drawings and manufacturer's data, and as herein specified.

B. Placing Frames:

1. Comply with the provisions of SDI 105 "Recommended Erection Instructions for Steel Frames", unless otherwise indicated.
2. Place frames prior to construction of enclosing walls and ceilings. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders, leaving surfaces smooth and undamaged.

C. Door Installation:

1. Fit hollow metal doors accurately in their respective frames, within clearances specified in SDI 100.
2. Finish hardware is specified in Section 08700.

3.3 ADJUST AND CLEAN

A. Final Adjustments:

1. Check and readjust operating finish hardware items in hollow metal work just prior to final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including doors or frames which are warped, bowed or otherwise damaged.

B. Prime Coat Touch-Up:

1. Immediately after erection, sand smooth any rusted or damaged areas of prime coat and apply touch-up of compatible air-drying primer.

SECTION 08700 BUILDERS HARDWARE

PART 1 - GENERAL

1.1 QUALITY ASSURANCE

A. Acceptable Hardware Designs:

1. Submit to ENGINEER, for his review, samples of lock-sets with trim, push/pull units, which CONTRACTOR proposes to furnish.

B. Acceptable Hardware Manufacturers:

1. All hardware components provided shall be standard products offered by the manufacturers listed in the hardware schedule, or approved equal.

1.2 SUBMITTALS

A. Samples:

1. Prior to submittal of final hardware schedule and prior to delivery of hardware, submit one sample of each exposed hardware unit, finished as required.
2. Samples will be returned to the supplier. Units which are acceptable and remain undamaged may, after final check of operation, be used in the work, within limitations of keying coordination requirements.

B. Hardware Schedule:

1. General:

- a. Submit five (5) copies of the hardware schedule. Include a separate key schedule, showing clearly how the OWNER's final instructions on keying have been fulfilled.

2. Hardware Schedule Format:

- a. Hardware schedule submitted shall be in the same format as set forth in the Specifications. Add additional information, such as total quantities of each hardware item as may be deemed necessary by the builders hardware supplier.

1.3 JOB CONDITIONS

- A. Furnish templates required for installation of hardware to each fabricator of doors, frames and other work to be factory prepared.

PART 2 - PRODUCTS

2.1 MATERIALS AND FABRICATIONS

- A. Produce hardware units of basic metal and forming methods of not less than commercially recognized quality for applicable hardware units by FS FF-H-106, FS FF-H-111, FS FF-H-116 and FS FF-H-121.
- B. Furnish complete set of specialized tools for OWNER's continued adjustment, maintenance, removal and replacement of hardware.

2.2 HARDWARE FINISHES

- A. Provide matching finishes for hardware units at each door to the greatest extent possible. Provide hardware with US 26D, Satin Chrome finish or type finish as approved by ENGINEER.
- B. Quality of finish shall comply with manufacturer's standards, but in no case less than specified for the applicable units of hardware by FS FF-H-106, FS FF-H-111, FS FF-H-116 and FS FF-H-121.

2.3 HARDWARE SCHEDULE

- A. Hardware Designation Numbers:

- 1. The requirements for material, type, grade, size and function of builders hardware items is indicated by particular manufacturer's product number, as specified.

- B. Hardware Schedule:

- 1. Hardware Set For All Interior Doors:

1	Lockset	Schlage C10PD
3 Pr.	Butt Hinges	Hager BB1199
1	Roller Bumper	Ives 470

2. Hardware Set For All Exterior Doors:

1	Lockset	Schlage C53PD
3 Pr.	Butt Hinges	Hager BB1199
1	Door Closure	Norton 7500SS
1	SS Kick Plate	Qual 859-314 8" x 34"
1	SS Threshold	Pemko 172SS
1 Set	Weather-stripping	160 Jamb x 700 Head

C. Keying:

1. All locksets and cylinders to be keyed alike. Keys shall match all other locks in City's system unless directed otherwise by ENGINEER and/or OWNER.
2. Furnish six (6) keys for system, unless otherwise directed.

PART 3 - EXECUTION

3.1 **INSTALLATION**

- A. Install in compliance with manufacturer's instructions and recommendations. Cut and fit hardware onto or into surfaces which are to receive field applied finish. Remove and store to greatest extent possible. Re-install after completion of finishing operations.
- B. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.
 1. Blocking required in stud walls for securement of builders hardware shall be done during wall erection by trade involved, but responsibility for accurate location and sizing of blocking is part of this work.
- C. Drill and countersink units which are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards. Attach all door closures with hex bolts.
- D. Mount hardware units at heights indicated in "Recommended Locations for Builders' Hardware" by DHI, except as otherwise required to comply with governing regulations.
- E. Cut and fit thresholds to profile of door frames, with mitered corners and hairline-joints. Screw to substrate with No. 10 or larger screws, of proper type for permanent anchorage and which will not corrode with threshold metal.
- F. Adjust and check each item of hardware and each door to ensure proper operation and function. Lubricate moving parts with type of lubrication recommended by hardware manufacturer. Replace units which cannot be adjusted or lubricated to operate freely and smoothly as intended for the application made.

- G. Return to the work one month after OWNER's occupancy, and make final check and adjustment of all hardware items. Clean and lubricate operating items as necessary to restore proper function and finish of hardware and doors.
 - 1. During final adjustment of hardware, instruct the OWNER's personnel in the proper adjustment and maintenance of hardware.

SECTION 09900 PAINTING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Includes painting and finishing of interior and exterior exposed items and surfaces throughout the project, except as otherwise indicated.
- B. Includes field painting of bare and covered (insulated) pipes, hangers, exposed steel and iron work, and primed metal surfaces of equipment installed under mechanical and electrical work.
- C. Paint all exposed surfaces. Where items or surfaces are not specifically mentioned, paint same as adjacent similar materials or areas. If color or finish is not designated, the ENGINEER will select these colors.

1.2 PAINTING NOT INCLUDED

- A. Shop Priming:
 - 1. Shop priming of ferrous metal items and fabricated components are included under their respective trades.
- B. Mechanical and Electrical Work:
 - 1. Painting of mechanical and electrical work not exposed to view is specified in Divisions 15 and 16, respectively.
- C. Pre-finished Items:
 - 1. Do not include painting of factory-finished or installer-finished items such as (but not limited to) metal toilet enclosures, acoustic materials, casework, finished mechanical and electrical equipment.
- D. Concealed Surfaces:
 - 1. Painting not required in concealed areas and generally inaccessible areas.
- E. Finished Metal Surfaces:
 - 1. Do not paint surfaces of anodized aluminum, stainless steel, chromium plate, copper, bronze and similar materials.

F. Operating Parts and Labels:

1. Do not paint moving parts of operating units, or over any code required labels, or any equipment identification, performance rating, name, or nomenclature plates.

1.3 QUALITY ASSURANCE

- A. To the greatest extent possible, obtain primary paint materials from only one manufacturer for the entire project. Provide secondary materials (and materials not available from the primary paint materials manufacturer) from sources which are recommended by the manufacturer of the primary paint materials.
- B. Provide finish coats which are compatible with prime paints used. Provide barrier coats over incompatible primers or remove and reprime as required.
- C. Paint shall not be stored under freezing conditions.

1.4 DELIVERY AND STORAGE

- A. Deliver materials to job site in original, new and unopened packages and containers bearing manufacturer's name, trade name and label analysis.
- B. Store paint materials and equipment in one place as directed by ENGINEER. Provide protective covering over floor in storage area. Use plywood, hardboard, corrugated cardboard, or similar material. Storage space shall be kept clean and orderly. Any damage to such storage area, caused by paint applicator's operations, shall be repaired by paint applicator at his expense.

1.5 JOB CONDITIONS

- A. Apply paints when temperature of surfaces and surrounding air are within manufacturers specified temperature limits for each type paint being applied.
- B. Do not apply paint in snow, rain, fog or mist; or when relative humidity exceeds 85%; or to damp or wet surfaces; unless otherwise permitted by paint manufacturer's printed instructions.

PART 2 - PRODUCTS

2.1 COLOR AND FINISHES

A. Color Schedule:

1. Prior to beginning work, the ENGINEER will furnish a color schedule with sample color chips, for surfaces to be painted, their various locations and types of finish, satin, flat, gloss, etc.

2. Colors selected may not be manufacturer's standard colors, and shall be furnished as scheduled. Final acceptance of colors will be from samples applied on the job.

2.2 MATERIAL QUALITY

- A. Provide best quality grade of the various types of coatings specified. Federal specifications establish a minimum acceptable quality for paint materials.
 1. Manufacturer's products which comply with the coating qualitative requirements of applicable Federal Specifications, yet differ in quantitative requirements, may be used only when acceptable to the ENGINEER.
- B. Provide undercoat paint produced by the same manufacturer as the finish coats. Use only thinners approved by the paint manufacturer.

2.3 EXTERIOR PAINT SYSTEMS (EPS)

- A. System EPS-6 - Silicone Alkyd Enamel:
 1. 1st Coat (Primer):
 - a. Ferrous Metal: Oxide Red rust Inhibitive (TT-C-530)
 - b. Galvanized Metal: Zinc dust-zinc oxide primer (TT-P-641)
 2. 2nd Coat and 3rd Coat:
 - a. Silicone Alkyd Copolymer Enamel, High Gloss (FS TT-E-490)
 3. Apply to the following exterior surfaces:
 - a. hollow metal doors and frames, both interior and exterior surfaces.
 - b. rolling service doors, both interior and exterior surfaces.
 - c. vent stacks
 - d. all primed ferrous metal parts of all process equipment as specified under the various 11000 sections.
 - e. all other fabricated steel components

2.4 INTERIOR PAINT SYSTEMS (IPS)

A. System IPS-2: Semi-Gloss Enamel:

1. 1st coat (Primer):
 - a. Ferrous Metal: Alkyd Enamel Underbody (TT-E-545)
2. 2nd Coat and 3rd Coat:
 - a. Odorless Alkyd Enamel, Semi-Gloss (FS TT-E-509)
3. Apply to the following interior surfaces:
 - a. Hollow metal doors and frames except those scheduled to receive paint system EPS-6.

B. System IPS-10: Polyamide Epoxy:

1. 1st Coat (Primer):
 - a. Type primers and/or barrier coats recommended by finish coating manufacturer for surfaces scheduled to be painted.
2. 2nd Coat:
 - a. 2-Component Polyamide Epoxy, "Poly/ep" as manufactured by Degracon or other approved.
3. 3rd Coat:
 - a. 2-Component Polyamide Epoxy, "Poly/ep" as manufactured by Degracon or other approved.
4. Apply to the following interior surfaces:
 - a. All plywood and gypsum drywall walls and ceilings
 - b. All primed ferrous metal parts of all process equipment as specified under the various 11000 sections.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

A. General:

1. Perform preparation and cleaning procedures in strict accordance with paint manufacturer's instructions for each particular substrate condition.
2. Remove all hardware, hardware accessories, machined surfaces, plates, lighting fixtures, and similar items in place and not to be finish-painted, or provide surface-applied protection. Reinstall removed items.
3. Protect floors and installed finished materials, in areas where paint is being applied, with clean drop cloths or other suitable methods.

B. Wood and Plywood:

1. Prime, stain, or seal wood required to be job-painted. Prime edges, ends, faces, undersides, and backsides of such wood.

C. Ferrous Metals:

1. Touch-up shop-applied prime coats wherever damaged or bare. Clean and touch-up with the same type shop primer.

D. Galvanized Surfaces:

1. Clean rust from galvanized surfaces by methods recommended by paint manufacturer. Spot prime such areas after proper preparation with type primer recommended by paint manufacturer.

3.3 MATERIALS PREPARATION

A. General:

1. Mix and prepare painting materials in accordance with manufacturer's directions.
2. Store materials not in actual use in tightly covered containers. Maintain container used in storage, mixing and application of paint in a clean condition, free of foreign materials and residue.
3. Stir materials before application to produce a mixture of uniform density, and stir as required during the application of the materials. Do not stir surface film into the material. Remove the film, and if necessary, strain the material before using.

B. Tinting:

1. Tint each undercoat a lighter shade of the finish coat to facilitate identification of each coat where multiple coats of the same material are to be applied.

3.4 APPLICATION

A. General:

1. Apply paint in accordance with the manufacturer's directions. Use applicators and techniques best suited for the substrate and type of material being applied.
 - a. The number of coats and paint film thickness required is the same regardless of application method.
2. Apply additional coats when undercoats, stains or other conditions show through final coat, until paint film is of uniform finish, color and appearance.
3. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Paint surfaces behind permanently-fixed equipment or furniture with prime coat only, before equipment is installed.
4. Finish exterior doors on top, bottom, side edges and interior face the same as the exterior face (same type paint system).
5. Sand lightly between each succeeding enamel coat as required to produce an even, smooth surface.
6. Omit the first coat (primer) on surfaces which have been shop-primed and touch-up painted.

B. Scheduling Painting:

1. Apply first coat material to cleaned, pretreated or otherwise prepared surfaces as soon as practicable after preparation and before subsequent surface deterioration.
2. Allow sufficient time between successive coatings to permit proper drying. Do not recoat until paint has properly dried, feels firm, does not deform or feel sticky, and application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.

C. Minimum Coating Thickness:

1. Apply each material at not less than the manufacturer's recommended spreading rate, to establish a total dry film thickness as recommended by coating manufacturer.

D. Mechanical and Electrical Work:

1. Painting of mechanical and electrical work is limited to those items exposed to view in mechanical equipment rooms and in occupied spaces.

E. Prime Coats:

1. Apply prime coat to material which is required to be painted or finished, and which has not been prime coated by others.
2. Recoat primed and sealed surfaces where there is evidence of suction spots or unsealed areas in first coat, to secure a finish coat with no burn-through or other defects due to insufficient sealing.

F. Pigmented (Opaque) Finishes:

1. Completely cover to provide an opaque, smooth surface of uniform finish, color, appearance and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness or other surface imperfections will not be acceptable.

G. Completed Work:

1. Match approved samples for color, texture and coverage. Remove, refinish or repaint work not in compliance with specified requirements.

3.5 CLEAN-UP PROTECTION

A. Clean-up:

1. Remove from the site all discarded paint materials, rubbish, cans and rags.
2. All oily or solvent soaked rags, cardboard, waste materials and other items that would constitute a fire hazard, shall be removed from the building and building site at the end of each day's work, or such materials shall be placed in self-closing metal receptacles and emptied when full. Legally dispose of all such waste materials. Observe all safety standards.
3. Upon completion of painting work, clean paint-spattered surfaces. Remove spattered paint by proper methods of washing and scraping, using care not to scratch or otherwise damage finished surfaces.

B. Protection:

1. Protect work of other trades against damage by painting and finishing work. Correct any damage by cleaning, repairing or replacing, and repainting.

2. Provide "Wet Paint" signs to protect newly-painted finishes. Remove temporary protective wrapping provided by others for protection of their work, after completion of painting operations.
3. At completion of work of other trades, touch-up and restore all damaged or defaced painted surfaces.

SECTION 11000 EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Related Documents:

1. The requirements of this section apply to the work specified in the following section of these specifications:
 - a. 11230 UV Disinfection Equipment
 - b. 11332 Primary Screens

B. Scope:

1. The work to be executed under this item of the specifications shall consist of purchasing, unloading, moving, storing, assembling, installing and testing all equipment as shown on the Drawings and specified herein. The CONTRACTOR shall coordinate the work covered by this item of these specifications with the work of all other items, and with the work of other contractors, to provide a complete and workable installation ready for startup as scheduled and when accepted by the OWNER.
2. The CONTRACTOR shall provide for the placing, shimming, anchoring, grouting, cleaning, lubricating, assembling and adjusting of the equipment. The CONTRACTOR shall provide all supervision, labor, tools, equipment, and materials for all phases of the job as required to perform the installation of equipment and accessories furnished.
3. The CONTRACTOR shall furnish, install and field check the functioning of each specified element, providing supervision of the manufacturer's representative when and as required, to assure proper installation and satisfactory operation of the equipment. The CONTRACTOR shall cooperate with the ENGINEER in the selection, installation and testing of the equipment to the end that each element will be properly suited to its function, will operate in a manner meeting the intent of the design and will perform its function without undue maintenance.

1.2 SUBMITTALS

A. Contractor's Drawings and Data:

1. The CONTRACTOR shall furnish data and drawings in sufficient detail to define the functioning, the space requirements and installation requirements and to show compliance with the contract specifications and Drawings. The submission of drawings and data shall conform to the requirements of Section 01300.

B. Shop Drawings:

1. The CONTRACTOR shall prepare complete shop drawings as required for his work, for review by the ENGINEER before fabrication, showing all loose and shop assembled pieces as well as all connections to other trade work construction, and all welding and bolting.
2. The detail of each piece and connections shall show the size and weight of the members detailed, the size and spacing of all holes, and the size of all bolts and the type, size and length of all welds.
3. The CONTRACTOR shall verify all dimensions and take such field measurements as may be required to execute the work and shall assume full responsibility for figured dimensions of this work. All field measurements and verifying of field conditions shall be completed before submitting shop drawings to the ENGINEER for review.
4. The CONTRACTOR shall submit six (6) copies minimum of all shop drawings to the ENGINEER for review.
5. The ENGINEER shall be at liberty to alter or amend such drawings and descriptions, if in his opinion the work as shown or described is not of materials, sizes, arrangements or workmanship best adapted for the purpose.
6. The ENGINEER'S signature on the shop drawings is to be considered as review for general compliance with the Contract Documents. Such review shall not in any way relieve the CONTRACTOR from the necessity of correcting without charge, such details on the drawings and/or in the completed work as may thereafter be found to be deficient in strength or otherwise faulty. Nor does the ENGINEER'S review relieve the CONTRACTOR from the responsibility for figured dimensions on the shop drawings.

C. Operation and Maintenance Manuals:

1. The CONTRACTOR shall obtain from the manufacturer of all systems or major items of equipment six (6) copies of Instruction Manuals covering operation, maintenance, service and lubrication of the system or equipment. Any manufacturer supplying a system comprised of related equipment and controls shall supply an instruction manual that contains a section describing the operation of the complete system as well as sections describing the operation of individual components. Instruction manuals shall include descriptions of all start up, normal operation, shut down, trouble shooting, emergency safety, maintenance, lubrication and testing procedures necessary to insure that the supplied system or equipment can be operated and maintained as intended by the manufacturer. Any manufacturer submitting a standard instruction manual or catalog sheets describing more than one system or piece of equipment shall clearly indicate

which system or piece of equipment has been furnished. All manuals shall be filed with the ENGINEER after reviewed shop drawings have been returned to the CONTRACTOR and/or prior to fifty percent completion of the project.

D. As-Built Drawings:

1. The CONTRACTOR shall keep one set of general arrangement, equipment and mechanical drawings on the site for recording of any changes necessitated by the nature of the work in deviation from the original Drawings. Only the CONTRACTOR'S authorized representative or field engineer shall record changes on these Drawings and each shall be initialed and dated by the ENGINEER as recorded. This set of Drawings will be returned to the ENGINEER at the end of the job for correction of Drawings before release to the OWNER.

1.3 QUALITY OF WORKMANSHIP

- A. All equipment shall be installed true and level, and to the exact location as shown on the Drawings.
- B. The CONTRACTOR shall be responsible for installation of the equipment in accordance with good practice and in a manner consistent with the performance warranties and equipment workmanship of the manufacturer.

1.4 RESPONSIBILITY FOR EQUIPMENT

- A. The CONTRACTOR shall be entirely responsible for the condition of all equipment from time of removal from the carrier until accepted by the OWNER after installation, and shall maintain all items in first-class condition during this period. This shall include any material furnished to the CONTRACTOR by the OWNER.

1.5 DESIGN, FABRICATION AND ERECTION

- A. Unless otherwise noted, the material under this or separate headings shall be of steel manufactured in accordance with the American Society for Testing Materials, and the design, fabrication and erection of the steel shall be done in accordance with the applicable American Institute of Steel Construction specifications, current issue.
- B. All work shall be erected in proper lines and levels, plumb and true and in correct relation to the adjoining work.

1.6 STANDARDIZATION

- A. For ease in establishing a spare parts inventory and maintenance, the Contractor shall coordinate with equipment suppliers to insure that the same manufacturer of supplemental equipment is used throughout, i.e., motors, motor starters and disconnects, instruments and valves.

1.7 GUARANTEE

- A. The CONTRACTOR shall furnish the guarantee of the manufacturer, for each item of equipment furnished, that the equipment will perform its intended service and that any parts which may be defective in design or workmanship will be replaced without expense to the OWNER, for material cost and that the entire unit will be replaced with a proper unit if it fails to perform the specified and intended function.
- B. The CONTRACTOR shall guarantee to repair or replace any element which may fail to function properly due to improper design, material, workmanship or installation without expense to the OWNER.
- C. The guarantee period of the manufacturer's guarantee and the CONTRACTOR'S guarantee shall be one year from the date of acceptance of the project by the OWNER, unless specified otherwise in these specifications.

PART 2 - PRODUCTS

2.1 MATERIAL

A. Bolts:

- 1. The CONTRACTOR shall furnish bolts as required for installation of equipment and connection of accessories. Where practicable, semi-finished ANSI "Heavy Series" bolts and nuts shall be used in the installation work.

C. Electrical Equipment:

- 1. Any electric control equipment, which is specified to be furnished under this item shall be installed under Electrical Work, except as otherwise specified. All conduit and wiring for control equipment shall be furnished and installed under Electrical except as otherwise specified in a subsection of this item.

3.5 GROUTING

- A. The grouting work shall include all required forms and incidental work necessary for installation of equipment.
 - 1. When placing grout on other concrete previously poured, the surface of the old work shall be thoroughly cleaned of all scum, laitance and the surface roughened by picking if necessary. The cleaned surface shall be wetted, all excess water removed, and a neat cement grout broomed on just prior to placing grout.
 - 2. After removal of forms, any honeycombed grout shall be cut out as required or as directed by the ENGINEER and these openings filled with new grout. The surface of all exposed grout shall be left smooth, true and free from form marks.

3. The CONTRACTOR shall do all filling in with grout for pickets and openings left to receive supports, piping, etc., under this contract.
4. All concrete work shall be in accordance with Section 03300 of these Specifications.

3.6 WELDING

- A. All welding shall be done by the electric arc method and in accordance with the American Welding Society Code for this type of welding. All welds shall be a solid homogeneous part of the metals joined and free from pits or incorporated slag or scale. Surfaces of welds shall be smooth and regular, and of full area and length indicated and required to develop the required strength of the connection. Spacing of welds shall be intermittent when possible.
- B. The CONTRACTOR shall be responsible for all welds as concerns the composition of the materials being welded and their property changes due to the work.

3.7 OPEN HOLES

- A. The CONTRACTOR shall provide open holes as required for assembly of his work or for the attaching of the work of other trades.

3.8 FIELD MEASUREMENTS

- A. Wherever fabricated miscellaneous iron is used in places where the work with which it must fit is in place, field measurements of the work already in place shall be taken, before fabrication of the miscellaneous iron is begun, and the work shall be fabricated accordingly.

3.9 BURNING

- A. No burning with gas torches shall be done by the CONTRACTOR to the building structure or to correct deviations in his own work unless specifically authorized by the ENGINEER.

3.10 SPECIAL TOOLS

- A. Any special tools required for proper maintenance of any item of equipment furnished under this item shall be furnished, tagged and placed in storage for plant use at start-up.

3.11 TEST OPERATION

- A. When any portion of the equipment as designated by the ENGINEER, including all controls and associated items, has been completely installed, and the work of the electrical and mechanical trades contractors has been completed, the CONTRACTOR

shall notify the ENGINEER and shall at such time as directed by the ENGINEER, test operate the equipment to the ENGINEER'S satisfaction.

- B. After completion of test operations, the CONTRACTOR shall "run in" and make ready for operation such items of equipment, which in the opinion of the ENGINEER require the same.
- C. Completely installed" shall be construed to mean that the installation is complete as concerning utility connections, adjustment and cleanup.
- E. "Ready for operation" shall be construed to mean fully aligned, tested under full load, adjusted cleaned, and such general condition as to permit immediate commencement of full scale production operations.

3.12 PAINTING

- A. CONTRACTOR shall be responsible for touching up all scratches, gouges, and bare spots on the equipment and accessories installed by him. All painting, shop and field, shall be in accordance with Section 09900 of these specifications.

3.13 FIELD SERVICE

- A. The CONTRACTOR shall secure the services of a qualified equipment manufacturer representative to inspect and check the installation of the equipment, make any necessary mechanical adjustments, initiate start-up and instruct the OWNER'S personnel in the proper operation and maintenance of the equipment.

**SECTION 11320
LINE SHAFT VERTICAL TURBINE PUMP**

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. The requirements of Section 11000 – EQUIPMENT shall apply to the work in this Section.

1.2 DESCRIPTION OF WORK

A. Scope:

1. Under this Section, the CONTRACTOR shall provide all materials, labor and services necessary for furnishing and installing two (2) new line shaft vertical turbine pumps with above ground discharge at the locations shown on the Drawings.

B. Process Requirements for Two (2) New Vertical Turbine Pumps:

1. Each of the two (2) new line shaft vertical turbine pumps shall have the following characteristics and be properly selected to perform under the following conditions:

Pump Capacity	350 gpm
Total Dynamic Head	62 feet
Pump Speed	1750 rpm
Minimum Pump Efficiency	75%
Motor Voltage	480 Volt, 3 Phase

2. To ensure stable operation, the pump curves shall be constantly rising from run-out to shut-off.

C. Related Work Specified Elsewhere:

1. Valves; Section 15100.
2. Process Pipe Work; Section 15415.

1.3 SUBMITTALS

A. Performance Curve:

1. The line shaft vertical turbine pump manufacturer shall submit six (6) copies of the pump performance curve showing the expected performance of the pumps at the expected design points. The curve shall show head, capacity, efficiency and horsepower based on bowl performance and shall cover the complete operation range of the pump from zero capacity to the maximum capacity.

B. Detailed Drawings:

1. Before Manufacture, the CONTRACTOR shall submit six (6) sets of installation and detailed drawings of the new line shaft vertical turbine pump equipment for the ENGINEER'S review and approval. The equipment shall not be released for production until the drawings have been approved.

C. Operating and Maintenance Manuals:

1. The line shaft vertical turbine pump manufacturer shall furnish six (6) copies of the manufacturer's printed operating and maintenance manuals at the time of the shop drawing submittals.

D. Testing:

1. Each pump shall be tested at the manufacturer's plant before shipment in accordance with Hydraulic Institute standards. Certified copies of the test curves shall be furnished to the ENGINEER.

E. Vibration Limitations:

1. The limits of vibration as set forth in the standards of the Hydraulic Institute shall govern.

F. Noise Limitations:

1. Each pump shall be capable of continuous operation without producing noise in excess of Hydraulic Institute and OSHA guidelines.

1.4 ACCEPTABLE MANUFACTURERS

- A.** All new line shaft vertical turbine pumps shall be supplied by the same manufacturer. Provide pumps as manufactured by National Pump Company, or approved equal.

1.5 GUARANTEE

- A. The line shaft vertical turbine pump manufacturer shall guarantee that the equipment and materials furnished hereunder will be of the kind and quality specified herein, free from defects in workmanship and materials. The guarantee shall be in force and effect for a period of twelve (12) months from the date of final acceptance testing, or a period of eighteen (18) months from the date of initial start-up, whichever occurs first.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Discharge Head:

1. The discharge head shall be constructed of close grained cast iron ASTM A48 Class 30, accurately machined with a rabbet fit for mounting the driver and supporting the pump column assembly and with above ground discharge flange machined and drilled to ANSI standards for 150 pound rating and six (6) inches inside diameter. The design shall allow for the head shaft to couple above the stuffing box.
2. The standard stuffing box shall be cast iron and rated for 150 psi discharge pressure and shall contain a minimum of five (5) acrylic packing rings and shall have a grease chamber. The packing gland shall be bronze secured in place with stainless steel studs and adjusting nuts. The stuffing box bearing shall be C-844 bronze. A rubber slinger shall be installed on the top shaft above the packing gland. The top shaft shall be 416 SS and shall extend through the stuffing box.
3. Impeller adjustment shall be provided at the top of the head shaft by means of an adjusting nut which shall be locked in place.

B. Column Pipe:

1. The column pipe shall be ASTM grade B steel pipe six (6) inches in diameter. The column pipe shall be furnished in a single section and shall be threaded. Each end of the column pipe shall be machined with 8 threads per inch with 3/16" taper and faced parallel and the threads machined to such a degree that the ends butt against the bearing retainer shoulder to ensure proper alignment and to secure the bearing retainers when assembled.

C. Line Shaft:

1. The line shafts shall be constructed of 416 stainless steel, turned, ground and polished. They shall be furnished in a single section to properly match the discharge column. Each shaft shall be sized in accordance with

the maximum recommended horsepower for a given size of shaft, taking into account the effect of the hydraulic thrust on the pumping equipment and the weight of the shaft and suspended rotating parts. To ensure accurate alignment of the shafts, the shafts shall be straight within 0.005 inch, total indicator reading for the entire length of each shaft.

D. Bowl Assembly:

1. The pump bowls shall be constructed of close- grained, cast iron ASTM A48 Class 30. They shall be free of blow- holes, sand holes, or other detrimental faults and shall be accurately machined and fitted to close tolerances. The bowls shall have vitrious enamel lined waterways to reduce friction losses and to provide maximum efficiency and wear protection. The intermediate bowls shall be provided with C-844 bronze bearings. The intermediate bowls shall be fitted with replaceable wear rings of bronze C-844.

E. Impellers:

1. The impellers shall be constructed of CDA836 cast bronze and shall be enclosed type accurately machined, balanced and filed for optimum performance. They shall be securely fastened to the shaft with a taper split collet constructed of 416 stainless steel.

F. Column Adapter:

1. The column adapter shall be constructed of close grained cast iron ASTM A48 Class 30, threaded to properly match the discharge column pipe.

G. Suction Bell:

1. The suction bell shall be fitted with a replaceable wear ring constructed of C-844 bronze, grease packed C-844 bronze bearing and protected by a C-844 bronze sand collar. The suction bell shall be fitted with a galvanized steel clip on type basket strainer.

H. Bowl Shaft:

1. The bowl shaft shall be constructed of ASTM A582 grade 416 stainless steel, turned, ground and polished.

I. Motor:

1. The motor shall be squirrel cage induction design, NEMA design B, 1750 RPM vertical hollow shaft motor (solid shaft with mechanical seal), with a non-reverse ratchet. The thrust bearing shall be chosen to handle the entire hydraulic thrust load of the pump plus the weight of the rotating parts. The motor shall have a AFBMA B-10 one year minimum or five year average life under design conditions. The motor shall be premium efficiency with a WP-1 enclosure, 1.15 service factor for use with 480 volt, three phase 60 cycle electric service. The motor rating shall be such that at design it will not be loaded beyond the nameplate rating and at no point on the pump curve shall the loading exceed the service factor.

2.2 SPARE/REPLACEMENT PARTS

- A. All normally required spare and replacement parts shall be available in kit form and shall be field selectable from pump name plate data. It shall not be necessary to reference any drawing when selecting spare or replacement parts.

PART 3 – EXECUTION

A. Installation:

1. The CONTRACTOR shall be responsible for off-loading and installation of all assemblies and related equipment. The CONTRACTOR shall follow manufacturer's printed handling recommendations and procedures.

B. Field Service:

1. The line shaft vertical turbine pump manufacturer shall provide a trained field representative to inspect the completed installation and correct or supervise the correction of any defects or malfunctions, and instruct the operating personnel in the proper operation and maintenance of the pumps. One (1) trip for a minimum of one (1) day duration shall be furnished.

SECTION 15100 VALVES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Scope:

1. Under this Section, the CONTRACTOR shall provide all materials, labor and services necessary for furnishing and installing all the valves, valve operators and accessory equipment shown on the Drawings and specified herein.

B. Related Work Specified Elsewhere:

1. Process piping - Section 15415.

1.2 SUBMITTALS

A. Detailed Drawings:

1. The CONTRACTOR shall submit six (6) sets of installation and detail drawings of this equipment for the ENGINEER'S review and approval.

B. Operating and Maintenance Manuals:

1. The manufacturer of each item furnished under this Section shall furnish six (6) copies of manufacturer's printed operating and maintenance manuals at the time of shop drawing submittals.

1.3 QUALITY ASSURANCE

- A. All valves and operators installed under this specification shall conform to the applicable requirements of AWWA, ASTM and ANSI standards governing materials of construction, dimensional tolerances and workmanship of the valves. Every valve and operator shall carry the name or trademark of the manufacturer.

1.4 GUARANTEE

- A. Each manufacturer shall guarantee that the equipment and materials furnished hereunder will be of the kind and quality specified herein, free from defects in workmanship and materials. The guarantee shall be in force and effect for a period of twelve (12) months from the date of final acceptance testing, or a period of eighteen (18) months from the date of initial start-up, whichever occurs first.

PART 2 - PRODUCTS

2.1 VALVES

A. Gate Valves:

1. Valves shall be resilient seat type valves with a cast or ductile iron body and bonnet with a minimum non-shock W.O.G. working pressure of 200 psi. Seats shall be steel reinforced rubber and shall be replaceable, mounted to disc with stainless steel screws. The disc shall be a solid wedge; cast iron with permanently rolled in bronze faces, or all bronze. Stem shall be bronze of the rising stem design and shall be packed with TFE impregnated asbestos packing. Packing shall be replaceable while valve is in service. All stem washers and bushings shall be bronze, grease, or permanently lubricated. Valves shall have ANSI 125 pound standard drill flat faced flanges and shall be epoxy coated both inside and outside.

B. Swing Check Valves:

1. Valves shall have a cast or ductile iron body and bolted cap with a minimum non-shock W.O.G. working pressure of 200 psi. Seats shall be bronze and shall be screwed into the valve body. The disc shall be bronze or cast iron with permanently rolled in bronze faces. The disc hinge pin shall be bronze or stainless steel riding in bronze bushings, one on each side of the valve. Valves shall have ANSI 125 pound standard drill flat faced flanges unless otherwise specified or shown on the Drawings.

2.2 VALVE BOXES

A. Valve Boxes:

1. Furnish and install valve boxes where required or shown on the Drawings. Valve boxes shall be of all cast iron construction. They shall be of the three piece, screw type adjustable design. All valve boxes shall be installed flush with the top of the proposed site grade. Covers shall be designed to be removed easily to provide access to the valve operating nut, but strong and rugged enough to stay in position and resist damage under heavy traffic conditions.

2.3 PAINTING FOR VALVES

- A. All iron work of valves, stem guides, operating stands and accessories to be installed within buildings shall be painted as specified in Section 09900 of these specifications.
- B. All iron work of valves installed in manholes, valve vaults and in contact with the ground, shall be thoroughly cleaned at the shop and given two coats of epoxy enamel or other approved coating. All flanges shall be coated with epoxy enamel or other ENGINEER approved protective coating after facing and drilling.

PART 3 - EXECUTION

3.1 INSTALLATION

- A.** The CONTRACTOR shall be responsible for off-loading and installation of all valves and related equipment. The CONTRACTOR shall follow manufacturer's handling and installation recommendations and procedures. Valves, valve boxes and related equipment shall be installed where shown or specified and shall be set plumb. Valve boxes shall be centered on the valves. Boxes shall be installed over each outside valve unless otherwise shown. Where feasible, valves shall be located outside the area of roads and streets. Earthfill shall be carefully tamped around each valve box to a distance of 4' on all sides of the box, or to the undisturbed trench face if less than 4'.

3.2 VALVE SCHEDULE

- A.** The following valve schedule is, intended to list size, type, function and general accessories of major valves to be furnished and incorporated in the Contract.
- B.** The following valve schedule does not limit the CONTRACTOR'S responsibility to install all valves and accessories, which are to be provided under this item of the specifications and as shown on the Drawings. No consideration or allowance will be granted for failure to examine the drawings for any alleged misunderstanding of valves and accessories to be furnished and installed.

**SECTION 15415
PROCESS PIPE WORK**

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Scope:

- 1 Under this section, the CONTRACTOR shall provide at his own expense all labor, materials, tools and equipment required to furnish and install all pipes, fittings, and accessories for the process piping systems as shown on the drawings and specified herein.

B. Related Work Specified Elsewhere:

1. Excavation, Filling and Backfilling - Section 02220
2. Excavation, Trenching and Backfilling – Section 02230
3. Concrete Thrust Blocks - Section 03371
4. Valves - Section 15100

C. Codes, Plans and Specifications:

1. Piping installations shall conform to the following:
 - a. All applicable Federal, State and Local Codes.
 - b. Applicable industry codes:
 - 1) American National Standards Institute, Inc. (ANSI)
 - 2) American Society for Testing and Materials (ASTM)
 - 3) American Water Works Association (AWWA) Standards
 - 4) U.S. Department of Commerce, Commercial Standard
 - c. OWNER'S Drawings and/or piping specifications.

D. Pipe Receiving, Handling and Storing:

1. Cleanliness in all piping systems is of paramount importance and procedures used in receiving, handling and storing shall be directed toward assuring that all lines are clean and free of rust, scale dirt and all foreign material that can damage equipment or contaminate potable systems or processes. Similar precautions must be taken in handling and storing of fittings, valves, pumps and other equipment to insure a clean pipeline assembly.
2. Any pipe damaged in transport or handling shall be rejected and removed from the job site by the CONTRACTOR.
3. Care shall be taken not to injure any pipe or pipe coating and no damaged or imperfect pipe shall be used in the work except minor damage which may be repaired subject to the approval of the ENGINEER.

E. Material Acceptance:

1. Prior to fabrication and/or installation, all piping, fittings, valves and equipment shall be inspected as required. Any materials not meeting the Specifications, or obviously faulty material, shall be rejected by the ENGINEER and removed from the job site by the CONTRACTOR.

PART 2 - PRODUCTS

2.1 DUCTILE IRON (DI) PIPE AND FITTINGS

A. Pipe:

1. All of the pipe shall be furnished in 18 or 20-foot lengths, unless otherwise specified. All joints inside the structure shall be flanged. Joints outside the structures shall be either mechanical joint, or flanged joint, as shown on the Drawings.
2. The ductile iron pipe to be furnished and delivered under this specification shall meet all the requirements of the latest revision of the American National Standards Institute specification A21.50 and A21.51, except as otherwise specified herein. The pipe shall meet the thickness class requirements shown in the table below:

Size <u>Nominal Inside</u>	Thickness Class	
	<u>Exterior Use</u>	<u>Interior Use</u>
4	50	50
6	50	50
8	50	50
10	50	50

- A. Tolerances permitted under ANSI A21.51 specification shall apply to the above dimensions.
- B. Fittings:
1. The ductile iron pipe fittings to be furnished and delivered under this specification shall meet all the requirements of the latest revision of ANSI specification A21.10, except as otherwise specified herein, for a working pressure of 50 psi for gravity flow piping and 125 psi for pressure piping.
- C. Mechanical Joints:
1. Mechanical joints shall conform with the requirements of the latest revision of ANSI specification A21.11. Mechanical joints on all pressure piping fittings shall have ductile iron retainer glands. Gland set screws shall be torqued to 75 foot pounds. All buried pipe shall be connected in this manner unless otherwise shown on the drawings and specified herein.
- D. Flanges:
1. Flanged joints shall conform with the requirements of the latest revision of ANSI-B16.1 for 125 pound cast iron flange drilling and bolting. They shall be assembled using full face rubber gaskets or equal material approved by the ENGINEER. Flanged pipe shall be minimum class 53.
- E. Flexible Flanges:
1. Flexible flanges shall be Uni-Flange Series 400 or equal.
- F. Coatings:
1. The outside of all ductile iron pipes, except that installed indoors, shall be covered with a uniform coating of coal tar varnish or enamel applied hot having a minimum dry thickness of 1.0 mil. The coating material shall be applied uniformly and shall be of a quality necessary to provide a firm tenacious and tough coating which will not sag or flow when exposed to pipe temperatures of 140° F nor crack, peel or check when pipe temperatures attain 20° F.
 2. Two coats of cold applied coal tar base paint may be substituted for the hot applied enamel provided all other requirements of these specifications are met.
 3. These coatings, after drying 48 hours, shall have no deleterious effect upon the quality, color, taste or odor of potable water.

PART 3 - EXECUTION

3.1 MATERIAL PREPARATION

- A. All pipe, fittings and accessories shall be free of all foreign matter. Any accumulations of dirt, rust scale, mud, etc., shall be removed prior to installation. All pipe ends shall be reamed and deburred to prevent loose particles from getting into the pipe line.

3.2 ABOVE GROUND INSTALLATION

A. General:

1. Only men competent at installing the various types of pipe shall be employed on this phase of the work, and complete suitable equipment necessary for the execution of same is required. Any incompetency observed by the ENGINEER must be removed at his request, and where improper equipment or lack of same appears to be impairing the quality or speed of the work, such adjustments in same shall be made to the ENGINEER'S satisfaction.
2. Piping shall be installed straight and true, with approved offsets around obstructions as shown on the drawings or as required for satisfactory installation and operation. Horizontal piping shall be sloped to permit drainage. All vertical pipe shall be installed plumb and parallel with the building lines.
3. Piping shall be run in an orderly manner consistent with good operation, neatness of appearance and safety of operating personnel . Wherever possible interior piping will be grouped in banks with a change in elevation when a change in direction occurs. Provisions should be made in establishing piping runs to allow for maximum accessibility for servicing. Space allowance should be made for possible future changes or additions. Pockets which will prevent complete drainage of a line should be avoided. Valves, gauges, controls, and other piping specialities shall be conveniently located for operating and servicing. Piping shall not be run through electrical control rooms or over electrical equipment.
4. Piping shall not be run in such a manner as to interfere with the operation, adjustment or maintenance of equipment. Piping should not be located directly over pumps, motors, or equipment so as to impede their removal.
5. A minimum clearance of 8'-0" headroom shall be maintained over working areas, passageways and platforms.
6. Branch lines off main headers such as process or water should be shut-off valved to permit maintenance on equipment or piping without disrupting service to other areas. Valves in sludge line branches should be located close to the main line to prevent plugging ahead of the valve.

7. Where pipe sections are pre-fabricated, it shall be the CONTRACTOR'S responsibility to check all dimensions and possible interferences in the field. Provisions shall be made to adjust for any discrepancies which may occur between routing and dimensions shown on the Drawings to avoid possible interferences and to compensate for final field placement of equipment.
8. All cutting of the pipe shall be done in a neat workmanlike manner with the least amount of waste and without damage to existing or new lines. A fine tooth saw, tubing or pipe cutter or similar tool shall be used to cut the pipe. Cuts must be square and ragged edges removed with a burring tool and/or file.
9. After cutting bell and spigot or socket pipe, a stop mark shall be made with pencil or crayon using dimensions as shown by the manufacturer's instructions or by using another pipe in the field as a guideline.
10. At the termination of pipe installation, any open ends of pipelines shall be closed off with a suitable cover until installation operations are resumed.
11. All piping connections to equipment shall be aligned and supported in such a manner that no load or thrust will be exerted upon the equipment by the piping at installation or in operating conditions.

B. Sleeves:

1. Pipes passing through concrete or masonry structures shall be sleeved. Sleeves for pipe 2-1/2" and smaller shall be fabricated from steel pipe with an inside diameter not less than 1" greater than the outside diameter of the pipe. Sleeves for pipes 3" and larger shall be cast iron wall sleeves. All floor sleeves shall project a minimum of 3" above the floor. Sleeves for all pipe penetrations shall conform to the above unless otherwise specified elsewhere or shown on the Drawings. The cutting of concrete for pipe and sleeves shall be avoided wherever possible, and in no case where such cutting is necessary shall reinforcing bars be cut or disturbed, and no such cutting shall be done without the permission of the ENGINEER. All openings made for pipe work shall be neatly cored and patched in a workmanlike manner. Sleeves through floors above wet wells or on the ground should be field sealed after piping has been completed.
2. The CONTRACTOR shall furnish the shop drawings of sleeves to the ENGINEER for his approval.

C. Vents:

1. All high points of long water lines should be provided with vent connections and valves for venting during operation. Valved vents must be provided wherever necessary to permit air admission at high points of lines which must be drained. Light wall pipe not normally under vacuum but subject to occasional vacuum

where reversal of flow could occur in a vertical discharge pump line from a closed vessel when the pump is stopped, should be provided with automatic vacuum breaker. Pressure relief valves should be provided as needed for systems where locked in fluid or gas pressures can exceed the normal designed system pressure and the vents shall be piped safely to atmosphere or drain.

D. Purge Connections:

1. Steam, water, or fluid purge connections shall be provided when the service requires. Block valves and couplings are to be of material specified for the line being purged rather than the purging fluid.
2. Where there is the possibility of a higher pressure in the line being purged than in the purge lines, a check valve of the material specified for the line being purged shall be installed.

E. Miscellaneous Connections:

1. Small size connections (for gauges, instruments, samples, etc.) to large size pipe or headers may be made with weld-o-lets, threaded-olets, couplings or half couplings welded onto steel piping, tapped bosses on cast iron fittings or tapping saddles.

F. Pipe Supports:

1. Hangers, guides, anchors and sway bracing. Hangers for process piping will normally be clevis hangers with mild steel rod, and malleable or wrought steel beam clamps. Piping may be supported by the resting type on proper structural designed brackets or racks. No welding to structural steel building members shall be permitted without express approval of the ENGINEER. Welding to auxiliary steel pipe support beams will be permitted. Suitable anchors, guides, sway braces, vibration dampeners, and flexible joints shall be provided to prevent excessive vibration or expansion forces on equipment. Heavy valves shall be supported to keep undue strain off of piping and adjacent equipment. Where supporting piping at valves, pumps, heat exchangers and equipment requiring periodic maintenance, support to allow easy removal of equipment with a minimum of temporary supports. Where pipe, resting on beam supports or stanchions, is subject to linear or lateral movement, Teflon slides or graphite pipe slides cemented to pipe and support members shall be used to eliminate abrasion and corrosion which commonly occur at these points.
2. Hangers and supports shall be in accordance with the ANSI Code for Pressure Piping B31.1. These shall be the product of Plasti Fab, Inc., Grinnel Company, Power Piping company, or equal.

3. Fiberglass hangers shall be used for horizontal thin walled stainless steel piping unless otherwise specified.
4. Hanger rods shall be connected to beam clamps or concrete inserts. These devices shall be Underwriter's Laboratories approved. "C" clamps will not be allowed. Expansion anchors may be used upon written consent of the ENGINEER. These anchors shall be McCulloch "Kwik-Bolt", Phillips "Red Head" or equal. Drilling of holes in concrete shall be made by rotary drill only - not by hammers of any kind.
5. Vertical piping shall be supported at each floor or grating level with approved riser clamps except where prohibited by piping flexibility requirements. Lateral movement of exposed vertical piping at building walls shall be restrained by anchor devices attached to walls except where prohibited by piping flexibility requirements. Riser clamps shall be Grinnel figure 261, Power Piping Company Figure 36, or equal. Provide retaining straps when clamps are used.

G. Piping Joints:

1. Flanged joints or unions shall be provided at connections to equipment, valves, instruments, etc., as required for removal and/or servicing. Provisions must be made for removal and reinstallation of units located between flanged or union joints by: 1) providing flexibility in the piping, 2) use of elbow connections, 3) or other means approved by the ENGINEER.
2. Aside from connections at equipment, valves, instruments, etc., joints in the pipe line shall be held to a minimum consistent with cleaning or servicing requirements. Flanged joints are preferred to union joints. Welded joints are preferred to screwed joint. Mechanical joints are preferred to caulked joints. For welded pipe joints, pipe ends shall be square cut for pipe with wall thickness of .065" or less. For wall thickness over .065", the ends shall be beveled 37-1/2" degrees with a 1/16" thick land base. Use of welding rings shall be avoided, unless otherwise agreed to in writing by the ENGINEER.
4. Screwed joint compound shall be oil and graphite, TFE tape or other ENGINEER approved material suitable for the particular service. Joint compound shall be applied only to the male thread. Care shall be exercised to prevent compound from reaching the pipe interior.

H. Cleaning and Flushing:

1. Unless special cleaning procedures are noted in the respective piping specifications, these general methods shall apply for cleaning lines before start-up. Installations of all piping shall be done with extreme care to insure clean pipe lines free of scale, rust, weld splatter or beads, sand, dirt, grease and all other impurities or foreign matter. All piping shall be installed to permit cleaning by

flushing through all portions of the piping system with provisions made to open the lines at all low points to permit release of any accumulation of foreign material and to drain off the flushing fluid. Where this flushing operation may be detrimental to specialties and/or equipment, provision must be made for isolation or removing these components from the system. When feasible, this flushing operation shall be done with the same medium that will normally be conveyed in the line, (ie., air for air or gas lines, water for water lines and liquids, oil for oil piping, etc.). At branch connections to operating equipment, provisions must be made to blow down through an open pipe line.

I. Testing:

1. Field pressure testing of the installed pipe line will normally be done at a pressure of 1-1/2 times of the maximum operating pressure by pneumatic or hydrostatic means. The pipe ends may be valved or blanked off and the test pressure shall be maintained for a sufficient length of time to permit an inspection of all joints and connections for any leaks or failures. All pressure piping such as water, oils and gasses shall be tested in accordance with latest ANSI B 31.1 code for pressure piping. Provisions must be made for completely draining a pipe line after hydrostatic testing is completed. Testing of non-ferrous piping, plastics, fiberglass reinforced resin and other materials shall be made within the recommended limits of the manufacturer.

3.3 UNDERGROUND INSTALLATION

A. General:

1. Only men competent at laying the various types of pipe shall be employed on this phase of the work, and complete suitable equipment necessary for the execution of same is required. Any incompetency observed by the ENGINEER must be removed at his request, and where improper equipment or lack of same appears to be impairing the quality or speed of the work, such adjustments in same shall be made to the ENGINEER'S satisfaction.
2. The location of the piping as shown on the drawings, has been determined to avoid, insofar as possible, interference with structures or fixtures above ground and other underground mains, services, utilities, or structures. Any change in location or alignment of piping, which may be found more feasible or practicable as the work progresses, shall be made by the CONTRACTOR, as the ENGINEER may direct.
3. Unless otherwise specified, each pipe shall be laid in a trench as specified under Section 02230. Whenever it is necessary to deflect pipe from a straight line, either in the horizontal or vertical plane, to avoid obstructions, or where long radius curves are permitted, the amount of deflection allowed shall not exceed that required for satisfactory jointing and shall be approved by the ENGINEER. In no

case shall deflection of joints exceed the manufacturer's recommended maximum deflection.

4. All pipe and fittings shall be carefully lowered and moved into position in trench or vault in a controlled manner such as will prevent damage to the pipe and any coatings or lining. 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.
5. All pipe shall be laid true to the required lines and grades. All trenches when pipe laying is in progress shall be kept dry and all pipes and specials shall be uniformly supported on a properly trimmed excavation with holes at each joint to receive bells. All gravity flow pipe shall be laid with bells uphill .
6. Each section of pipe in the trench shall rest upon the pipe bed for the full length of its barrel. The bottom of the trench shall be free from rocks, clods, or other sharp-edge objects. The subgrade upon which the pipe is placed shall consist of material suitable for supporting the pipe without excessive settlement or stress development.
7. The grade as shown on the Drawings is that of the pipe centerline or invert as noted on the Drawings and that to which the work must conform. The ENGINEER will set all grade and line stakes which the CONTRACTOR must maintain and keep uncovered so they may be examined at any time. Stakes, labor for driving them, and rodmen shall be furnished by the CONTRACTOR at his expense. The grade shall be kept by laser and other tools which shall be furnished by the CONTRACTOR at his expense.
8. All backfill shall be in accordance with Section 02230.
9. In the event difficulty is experienced in obtaining a satisfactory hydrostatic test, the joints shall be exposed and repaired in a satisfactory manner. In no case will the test requirements be relaxes because the trench may have been backfilled.
10. External anchorage designed to hold the pipe to proper line and grade against internal static and dynamic forces and external loads shall be provided at all tees and wyes and wherever the pipe is deflected from a straight line and the resultant forces are not self-contained through the use of flanges, anchor tires and the like. Concrete thrust blocks or anchorage shall be as detailed on the Drawings and Section 03371 of these specifications.
11. All cutting of the pipe shall be done in a neat workmanlike manner with the least amount of waste and without damage to existing or new lines. A fine tooth saw, tubing or pipe cutter or similar tool shall be used to cut the pipe. Cut must be square and ragged edges removed with a cutting tool and/or file.

12. After cutting bell and spigot or socket pipe, a stop mark shall be made with a pencil or crayon using dimensions as shown by the manufacturer's instructions or by using another pipe in the field as a guide.
13. Breaks in pipe or joints shall be repaired to the satisfaction of the ENGINEER and at the expense of the CONTRACTOR.
14. At the termination of pipe laying, any open ends of pipelines shall be closed off by a suitable cover until laying operations are resumed.

B. Cleaning and Flushing:

1. Unless special cleaning procedures are noted in the respective piping specifications, these general methods shall apply for cleaning lines before startup. Installation of all piping shall be completed with extreme care to insure clean pipe lines free of scale, rust, weld splatter or beads, sand, dirt, grease and all other impurities or foreign matter. All piping shall be installed to permit cleaning by flushing through all portions of the piping system with provisions made to open the lines at all low points to permit release of any accumulation of foreign material and to drain off the flushing fluid. Where this flushing operation may be detrimental to specialties and/or equipment, provision must be made to blow down through an open pipe line.

C. Testing:

1. Field pressure testing the installed pipe line will normally be done at a pressure of 1-1/2 times of the maximum operating pressure by pneumatic or hydrostatic means. The pipe ends may be valved or blanked off and the test pressure shall be maintained a sufficient length of time to permit an inspection of all joints and connections for any leaks or failures. All pressure piping such as steam, water, oils and gasses shall be tested in accordance with latest ANSI B31.1 code for pressure piping. Provision must be made for completely draining a pipe line after hydrostatic testing is completed. Testing of non-ferrous piping, plastics, fiberglass reinforced resin and other materials shall be made within the recommended limits of the manufacturer.

