

**SECTION 15075
REINFORCED CONCRETE PRESSURE PIPE**

PART 1: GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment and incidentals necessary to install and test reinforced concrete pipe and fittings for raw water lines and irrigation pipelines as shown on the Drawings and as specified herein.
- B. All pipe shall be manufactured for this project and no pipe shall be furnished from stock.

1.02 RELATED WORK NOT INCLUDED

- A. Excavation and backfilling are included in Section 02220.
- B. ASTM C 1103-89 Standard Practice for Joint Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines.
- C. ASTM 361, Reinforced Concrete Low-Head Pressure Pipe

1.03 SUBMITTALS

- A. Submit to the Engineer, within thirty days of the Effective Date of the Agreement, the name of the pipe and fitting suppliers and a list of materials to be furnished.
- B. Submit to the Engineer, shop drawings showing layout and details of reinforcement, joint, method of manufacture and installation of pipe, specials and fittings, and a schedule of pipe lengths (including the length of individual pipes by diameter) for the entire job.
- C. Prior to each shipment of pipe, submit certified test reports that the pipe for this Contract was manufactured and tested in accordance with the ASTM and ANSI/AWWA Standards specified herein.

1.04 QUALITY ASSURANCE

- A. The manufacturer shall be responsible for the performance of all acceptance tests as specified in Paragraph 5.1.2 of ASTM C76. In addition, all reinforced concrete pipe to be installed under this Contract may be inspected at the plant for compliance with these Specifications by an independent testing laboratory provided by the Owner. The Contractor shall require the manufacturer's cooperation in these inspections. The cost of inspection of all pipe approved for this Contract, plus the cost of inspection of a reasonable amount of disapproved pipe will be borne by the Owner.
- B. Prior to each shipment of units for the raw water, or irrigation, pipeline, hydrostatic pressure tests on the pipe and the pipe joint shall be conducted according to the procedures of ASTM 361, section 10.4. Tests will be conducted on each run at the manufacturer's facility. Tests will be conducted on each 100 units (or less) from a run. The pipe shall be tested to a pressure of 13 psi for 30 minutes, with no visible leaks in the pipe or joints. Each tests will be witnessed by the Engineer' representative.
- C. Inspection of the pipe will also be made by the Engineer or other representatives of the Owner after delivery. The pipe shall be subject to rejection at any time on account of failure to meet any of the Specification requirements, even though pipes may have been accepted as

satisfactory at the place of manufacture. Pipe rejected after delivery shall be marked for identification and shall immediately be removed from the job.

PART 2: PRODUCTS

2.01 REINFORCED CONCRETE PIPE

- A. Except as otherwise specified herein, pipe shall conform to ASTM Standards Specifications for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe, Designation C76, Class III, Wall C. The pipe interior shall be smooth and even, free from roughness, projections, indentations, offsets, or irregularities of any kind. The concrete mass shall be dense and uniform.
- B. Non-air-entraining portland cement conforming to ASTM C150, Type II shall be used. The use of a non-bleeding, water-reducing, dispersing agent may be permitted subject to the specific approval of the Engineer. The use of any other admixture will not be permitted.
- C. Fine aggregate shall consist of washed inert natural sand conforming to the requirements of ASTM C33, except for gradation, with a maximum loss of 8 percent when subjected to 5 cycles of the soundness test using magnesium sulfate. Coarse aggregate shall consist of well-graded crushed stone conforming to the requirements of ASTM C33, except for gradation, with a maximum loss of 8 percent when subjected to 5 cycles of the soundness test using magnesium sulfate. Documentation that the aggregates to be used in the manufacture of reinforced concrete pipe meet these requirements shall be submitted to the Engineer as stated in Paragraph 1.03.
- D. The 28-day compressive strength of the concrete, as indicated by cores cut from the pipe shall be not less than 6,000 psi. The concrete mass shall be dense and uniform. The average absorption shall not exceed 5.5 percent of the dry weight and no specimen shall exceed 6.0 percent. Reinforcement shall be circular for all concrete pipe. Quadrant steel shall not be used. Reinforcement shall be installed in both the bell and the spigot. At least one circumferential reinforcement wire shall be in both the bell and spigot area, and reinforcement in the bell and spigot shall be adequate to prevent damage to concrete during shipping, handling and after installation. Cores indicating reinforcing steel having less than 85 percent bond shall be cause for rejection of the lot of pipes.
- E. Pipe may be rejected for any of the following reasons:
 - 1. Exposure of any wires, positioning spacers or chairs used to hold the reinforcement cage in position, or steel reinforcement in any surface of the pipe, except for ends of longitudinal reinforcing.
 - 2. Transverse reinforcing steel found to be in excess of ¼ inch out of specified position after the pipe is molded.
 - 3. Any shattering or flaking of concrete at a crack.
 - 4. Voids, with the exception of a few minor bugholes, on the interior and exterior surfaces of the pipe exceeding 1/4 inch in depth unless properly and soundly pointed with mortar or other approved material.
 - 5. Unauthorized application of any wash coat of cement or grout.
 - 6. A deficiency greater than ¼ inch from the specified wall thickness of pipe 30 inches or smaller in internal diameter.
 - 7. A deficiency greater than 6% from the specified wall thickness of pipe larger than 30

REINFORCED CONCRETE PRESSURE PIPE

15075-2 OF 8

IFB: 08-21-2020

inches in internal diameter, except that the deficiency may be 8% adjacent to the longitudinal form joint, provided that the additional deficiency does not lie closer than 20% of the internal diameter of the pipe. The deficiencies in wall thickness permitted herein do not apply to gasket contact surfaces in gasketed joint pipe.

8. A variation from the specified internal diameter in excess of 1%, or interior surfaces which have been reworked after placing of concrete. The variation in internal diameter permitted herein does not apply to gasket contact surface in gasketed joint pipe.
9. A hollow spot (identified by tapping the internal surface of the pipe) which is greater than 30 inches in length or wider than 3 times the specified wall thickness. Repair of such defective areas not exceeding these limitations may be made as specified in Paragraph 2.01R.
10. Defects that indicate imperfect molding of concrete, or any surface defect indicating honeycomb or open texture (rock pockets) greater in size than area equal to a square with a side dimension of 2-1/2 times the wall thickness or deeper than two times the maximum graded aggregate size, or local deficiency of cement resulting in loosely bonded concrete, the area of which exceeds in size the limits of area described in Paragraph 9 above when the defective concrete is removed. Repair of such defects not exceeding these limits may be made as specified in Paragraph 2.01R.
11. Any of the following cracks:
 - a. A crack having a width of 0.005 inch to 0.01 inch throughout a continuous length of 36 inches or more.
 - b. A crack having a width of 0.01 inch to 0.03 inch or more throughout a continuous length of one foot or more.
 - c. Any crack greater than 0.005 inch extending through the wall of pipe and having a length in excess of the wall thickness.
 - d. Any crack showing two visible lines of separation for a continuous length of two feet or more, or an interrupted length of three feet or more anywhere in evidence, both inside and outside.
 - e. Cracks anywhere greater than 0.03 inch in width.
- F. The pipe shall be clearly marked as required by ASTM C76 in a manner acceptable to the Engineer. The markings may be at either end of the pipe for the convenience of the manufacturer, but for any one size shall always be at the same end of each pipe length. Pipe shall not be shipped until the compressive strength of the concrete has attained 4,000 psi and not before 5 days after manufacture, and/or repair, whichever is the longer.
- G. Pipe shall have a minimum laying length of approximately 8 feet, except for closure and other special pieces as approved by the Engineer. The Contractor shall have available at the site of the work sufficient pipe of various lengths to affect closure at structures that cannot be located to accommodate standard lengths. Short lengths of pipe made for closure etc. may be used in the pipeline at the end of construction if properly spaced. The length of the incoming and outgoing concrete pipe at each structure shall not exceed 4 feet, except where the joint is cast flush with the exterior wall of the structure, where steel wall fittings are provided or where otherwise noted on the Drawings. Maximum laying length shall not exceed 16 feet, but the installation of 16 foot lengths will depend upon the ability of the Contractor to handle such lengths of pipe in sheeted trenches, comply with trench width requirements, maintain the integrity of the sheeting and avoid disturbance to adjacent ground. If, in the

REINFORCED CONCRETE PRESSURE PIPE

15075-3 OF 8

IFB: 08-21-2020

opinion of the Engineer, the use of 16 foot lengths is impracticable, shorter lengths shall be used.

- H. After manufacture, each length of pipe shall be checked against the length noted on the shop drawings. Pipe more than 1-1/2 inch longer than that shown on the shop drawings shall not be used on this project. Variations in length of the same pipe shall not exceed ASTM C76 requirements.
- I. During manufacturing, measuring devices shall be used to assure joint assembly is within the tolerance of ASTM C76 and these Specifications.
- J. The Engineer shall have the right to cut cores from such pieces of the finished pipe as he desires for such inspection and tests as he may wish to apply. Holes left by the removal of cores shall be filled in an approved manner by and at the expense of the manufacturer. Core drilling shall be carried out by the pipe manufacturer at his expense.
- K. The Engineer shall also have the right to take samples of the concrete after it has been mixed, or as it is being placed in the forms or molds, and to make such inspection and tests thereof as he may wish.
- L. At the start of the work, a set of test cylinders shall be taken each day on which pipe is manufactured for the project or more often if required. This may ultimately be reduced to one set of three specimens for every 50 cubic yards of concrete placed, if the uniformity of results warrants, and if approved by the Engineer. At the start of the work, a relationship shall be established between ultimate strength of test cylinders stored in a standard manner as compared to cylinders steam-cured with the pipe and as compared to cores taken from the corresponding finished pipe. At least five sets of tests shall be made.
- M. Test cores may be taken for every 500 linear feet of pipe manufactured, but not less than once each day on which pipe is manufactured for the project. Cores may be reduced to one set of two per week (or possibly fewer, but not less than one set for every 1,500 linear feet), if a satisfactory relationship is established between cores and cylinders made and cured in the standard manner. This relationship shall not vary by more than 10 percent more or less from the average ratio. Cores may be drilled in any manner which will provide a smooth core face. All pipe cylinders and cores shall be 4 inches in diameter. Cores shall be carefully saw-trimmed and capped in a vertical position with a sulfur cap of minimum thickness, at least one day before being tested.
- N. Core testing shall conform to Standard ASTM Methods.
- O. At the time of inspection, the pipe will be carefully examined for compliance with the appropriate ASTM and project specifications, and shop drawings. All pipes shall be inspected for general appearance, dimension, "scratch-strength", blisters, cracks, roughness, soundness, etc. All pipes will be checked for soundness by being tapped and scratched over a reasonable portion of the area, at least once on every 50 square inches of pipe surface. The surface shall be dense and close-textured. Cores also shall serve as a basis for rejection of pipe, particularly if lamination or poor bond of reinforcement is apparent.
- P. The manufacturer shall use measuring devices to assure joint assembly is within tolerances of ASTM C76 and these Specifications. If, during construction, the pipes cannot be satisfactorily joined, the manufacturer shall pre-join the pipe at his shop.
- Q. Unsatisfactory or damaged pipe will be either permanently rejected or returned for minor repairs. Only that pipe actually conforming to the Specifications and accepted will be listed

REINFORCED CONCRETE PRESSURE PIPE

15075-4 OF 8

IFB: 08-21-2020

for approval, shipment and payment. Approved pipe will be so stamped or stenciled on the inside before it is shipped. All pipe which has been damaged after delivery will be rejected, and if such pipe already has been laid in the trench, it shall be acceptably repaired, if permitted, or removed and replaced, entirely at the Contractor's expense.

- R. Pitts, blisters, rough spots, breakage, and other imperfections may be repaired, subject to the approval of the Engineer, after demonstration by the manufacturer that strong and permanent repairs result. Repairs shall be carefully inspected before final approval. Non-shrink cement mortar used for repairs shall have a minimum compressive strength of 6,000 psi at the end of 7 days and 7,000 psi at the end of 28 days, when tested in 3-inch cylinders stored in the standard manner. Epoxy mortar may be utilized for repairs subject to the approval of the Engineer.
- S. Steel wall fittings to be used in the walls of the cast-in-place structures shall be equal to those manufactured by Interpace Corp., and shall be compatible with rubber and steel joints of reinforced concrete pipe and prestressed concrete cylinder pipe where applicable.

2.02 JOINTS FOR CONCRETE PIPE

A. Raw Water and Irrigation Pipelines

A rubber gasket shall be the sole element of the joint depended upon to provide watertightness. Rubber gaskets shall be solid gaskets of circular cross section. The gasket shall be confined in an annular space formed by the bell or bell ring and a groove in the spigot end of the pipe or spigot right or by shoulders on the bell and spigot ends of the pipe in such a manner that slight movement of the pipe or hydrostatic pressure can not displace the gasket and so that when the joint is assembled, the gasket is compressed to form a watertight seal. Joints shall be designed so that the gasket will not be required to support the weight of the pipe. The joint will be a Type R-4 with a formed gasket groove in spigot end, details conforming to Figures 5 and 6 of the Bureau of Reclamation Standard Specifications for Reinforced Concrete Pressure Pipe, November 1, 1991. Leading edge of bell shall be chamfered or rounded to facilitate entrance of gasket. The minimal cross-sectional area of annular space for gasket, with joint in normal concentric closure position, shall not be less than the cross-sectional area of gasket calculated using the maximum stretched cross-sectional diameter. Minimal cross-sectional area of annular space for gasket shall be calculated for minimum bell diameter, maximum spigot diameter, minimum groove width at spigot surface, and minimum groove depth. The average stretch cross-sectional area of the gasket shall meet the requirements of the Bureau of Reclamation specifications for Concrete pipe, dated November 1, 1991 for the Type R-4 joint.

- B. Other Rubber Gasket Joints (These joints are not acceptable for irrigation pipelines)
- C. Joints shall be the bell and spigot type of joint with provisions for using a round rubber "O-Ring" gasket in a recess in the spigot end of the pipe. The bevel on the bell of the pipe shall be between 1-1/2 degrees and 2-1/2 degrees. The diameters of the joint surfaces which compress the gasket shall not vary from the true diameters by more than 1/16 inch.
- D. The round rubber "O-Ring" gaskets shall conform to ASTM C443. Two gaskets shall be submitted to the Engineer for tests at least 30 days before joining any of the pipe. Specimens of the gaskets shall be subjected to tensile tests of approximately 100 psi before and after immersion and heating tests, and shall show an elongation of at least 25 percent. Upon release from the tensile tests, each specimen shall return to its original length.
- E. Specimens shall be heated in a dry oven to 150°F for 6-hour duration and five specimens

shall be tested by immersion, one each as follows: 2-hour immersion in petroleum ether, 72-hour immersion in saturation Hydrogen Sulfide solution, 72-hour immersion in 1 percent NaOH solution, 72-hour immersion in standard soap solution (80 per-cent alcohol), and 72-hour immersion in 10 percent NaCl solution. The specimens shall show no detrimental change in color, texture, or feeling upon completion of the above tests. The manufacturer shall supply test data and affidavits showing compliance with these requirements. Tests shall have been conducted within six months of the start of manufacture of the pipe.

- F. The gaskets shall be designed and manufactured so that the completed joint will withstand an internal water pressure in excess of 15 psi for a period of ten minutes without showing any leakage by the gasket or displacement of it, see ASTM C443. The pipe manufacturer shall provide facilities for testing the effectiveness of the joints against leakage and one such test may be required for each 500 feet of pipe. Such tests shall be made by an internal or external pressure against the joint of at least 15 psi for a period of ten minutes. The completed joint, when installed in place in the work, shall be capable of withstanding a ground water pressure of 15 psi without exceeding the allowable leakage specified herein.
- G. The pipe manufacturer shall furnish information and supervise the installation of at least the first five joints installed by the Contractor. The ends of the pipe shall be made true to form and dimension, and the bell shall be made by casting against steel forms.
- H. The manufacturer shall inspect all pipe joint surfaces for out-of-roundness and pipe ends for squareness. The manufacturer shall furnish to the Engineer a notarized affidavit stating all pipe meets the requirements of ASTM C76, these Specifications and the joint design.

PART 3: EXECUTION

3.01 LAYING CONCRETE PIPE

- A. Care shall be taken in loading, transporting, and unloading to prevent injury to the pipe or fittings and the joint surfaces. Pipe or fittings shall not be dropped. All pipe or fittings shall be examined before laying, and no piece shall be installed which is found to be defective.
- B. The pipe shall be laid to the grade shown on the plans. The Contractor at his cost shall stake the trench line with optical equipment. As soon as the excavation is completed to the normal grade of the bottom of the trench, the Contractor shall place ~~screened gravel in the trench, and the pipe shall be firmly bedded in this gravel~~ to conform accurately to the lines and grades indicated on the Drawings. ~~Screened gravel shall conform to the requirements of Section 02220. Blocking under the pipe will not be permitted. As an alternate to the above paragraph, if approved by the Engineer, the pipe shall be laid on an approved subgrade of insitu soils.~~ The trench must be excavated to grade and the trench bottom shall be finish to smooth, firm, and uniform finish. The trench shall be over excavated at the pipe bell location, so that the pipe loading shall be full resisted on the barrel of the pipe. Unstable soil shall be removed and replaced with gravel which shall be thoroughly tamped. The Engineer will determine the depth of removal, and the replacement of unstable soil shall be included in the gravel unit price item.
- C. The backfill shall be placed and compacted to give complete vertical and lateral support for the lower section of the pipe as indicated on the Drawings. A depression shall be left in the ~~supporting gravel, or trench bottom,~~ at the joint to prevent contamination of the rubber gasket immediately before being forced home. Before the pipe is lowered into the trench, the spigot and bell shall be cleaned and free from dirt. Gasket, bell, and spigot shall be lubricated by a vegetable lubricant which is not soluble in water, furnished by the pipe manufacturer, and harmless to the rubber gasket. The rubber gasket shall be equalized in the spigot groove by

REINFORCED CONCRETE PRESSURE PIPE

15075-6 OF 8

IFB: 08-21-2020

running a smooth, round object, inserted between gasket and spigot, around the entire circumference several times. The pipe shall be properly aligned in the trench to avoid any possibility of contact with the side of the trench and fouling the gasket. As soon as the spigot is centered in the bell of the previously laid pipe, it shall be forced home with jacks or come-alongs. After the gasket is compressed and before the pipe is brought fully home, each gasket shall be carefully checked for proper position around the full circumference of the joint. Steel inserts shall be used to prevent the pipe from going home until the feeler gage is used to check the final position of the gasket. The jacks or come-alongs shall be anchored sufficiently back along the pipeline (a minimum of 5 lengths) so that the pulling force will not dislodge the pieces of pipe already in place. Only a jack or come-along shall be employed to force the pipe home smoothly and evenly and hold the pipe while backfilling is in progress. Under no circumstances shall crowbars be used nor shall any of the motor driven equipment be used.

- D. As soon as the pipe is in place and before the come-along is released, screened gravel, or select, backfill shall be placed as indicated on the Drawings and compacted for at least one-half the length of pipe. The Contractor shall take extra care to compact backfill under the pipe haunches. Not until this backfill is placed shall the come-along be released. If any motion at joints can be detected, a greater amount of back-fill shall be placed before pressure is released. When pipe laying is not in progress, including lunchtime, the open ends of the pipe shall be closed by a watertight plug or other approved means.
- E. The Contractor shall carefully regulate his equipment and construction operations such that the loading of the pipe does not exceed the loads for which the pipe is designed and manufactured. Any pipe damaged during construction operations shall promptly and satisfactorily be repaired or replaced at the Contractor's expense.
- F. The interior joints of all pipes, 30 inches and larger shall be filled with non-shrinking grout after the backfilling and testing is completed. Grout shall consist of one part by volume of cement, 1-1/2 parts by volume of sand, conforming to ASTM C33 and 1/4 part by volume of EMBEKO or equal. The mixture shall have a dry, crumbly consistency and shall be pounded into place and troweled to make a smooth joint.

3.02 TESTING AND CLEANING

- A. Testing and cleaning shall be as specified in Section 01656.
- B. Irrigation, or Raw Water, Pipeline Leak Test
 - 1. The installed raw water line will be blocked and filled with water to operating pressure. All visible leaks will be repaired by the Contractor. Leak repair will be made as follows: The joint will be filled with non-shrink epoxy grout with a water activated polyurethane chemical grout pneumatically injected behind the non-shrink epoxy grout.
 - 2. If leaks are excessive in the installed line, the Engineer reserves the right to require the Contractor to successfully complete joint-by-joint hydrostatic tests to 13 psi for 10 minutes on each repaired joint before final acceptance.
- C. Low Pressure Air Test (These tests are not required for irrigation pipelines)
 - 1. For making low-pressure air tests, the Contractor shall use equipment specifically designed and manufactured for the purpose of testing sewer pipelines using low-pressure air. The equipment shall be provided with an air regulator valve or air safety valve so set that the internal air pressure in the pipeline cannot exceed 8 psig. The leakage test using low-pressure air shall be made on each manhole-to-manhole section of pipeline. Pneumatic plugs shall have a sealing length equal to or greater than

the diameter of the pipe to be tested. Pneumatic plugs shall resist internal test pressure without requiring external bracing or blocking. All air used shall pass through a single control panel.

2. Low-pressure air shall be introduced into the sealed line until the internal air pressure reaches 4 psig greater than the maximum pressure exerted by ground water that may be above the invert of the pipe at the time of the test. However, the internal air pressure in the sealed line shall not be allowed to exceed 8 psig. When the maximum pressure exerted by the ground water exceeds 4 psi, the Contractor shall conduct only an infiltration test as specified in Section 01666.
3. At least two minutes shall be allowed for the air pressure to stabilize in the section under test. After the stabilization period, the low-pressure air supply hose shall be quickly disconnected from the control panel. The time required in minutes for the pressure in the section under test to decrease from 3.5 to 2.5 psig (greater than the maximum pressure exerted by groundwater that may be above the invert of the pipe) shall not be less than that shown in the tables prepared by the National Clay Pipe Institute.
4. If the pipe section does not pass the air test, either sectionalize the section tested to determine the location of the leak or perform a hydrostatic leak test. Once the leak has been located, repair and retest.

END OF SECTION