

## SECTION 02605

### VALVE (MANHOLE) CHAMBER

#### PART 1 - GENERAL

##### 1.01 WORK INCLUDED

- A. Precast concrete sections.
- B. Frames and covers.
- C. Valve (Manhole) Chamber steps.

##### 1.02 RELATED WORK

- A. Cast-in-place concrete.
- B. Section 02200 – Earthwork Excavation and Backfill

##### 1.03 STANDARD REFERENCES

- A. ASTM C478
- B. ASTM C443
- C. ASTM C207
- D. ASTM C32

#### PART 2 - PRODUCTS

##### 2.01 GENERAL

- A. The Contractor shall construct all valve chambers as indicated on the Drawings and as specified.
- B. Description:
  - 1. Valve Chambers shall conform in shape, size, dimensions, materials, and other respects to the details indicated on the Drawings or bound in the specifications or as ordered by the Engineer.
  - 2. All valve chambers shall have precast reinforced concrete developed bases unless otherwise specified. Sloping invert channels shall be constructed whenever the difference between the inlet and outlet elevation is two feet or less.
  - 3. Valve chamber walls (barrels and cones) shall be precast concrete sections. The top of the cone shall be built of reinforced concrete adjustment rings or brick to permit adjustment of the frame to meet the finished surface.

4. The inverts of the developed bases shall conform accurately to the size of the adjoining pipes. Side inverts shall be curved and main inverts (where direction changes) shall be laid out in smooth curves of the longest possible radius which is tangent, within the valve chamber, to the centerlines of adjoining pipelines.
  5. The cast-iron frames and covers shall be the standard frame and cover unless otherwise specified.
  6. All cast-in-place concrete shall conform to the requirements specified under Division 3 - Concrete, Section 03300.
- C. Definitions: The following definitions cover the types of valve chambers used on the project.
1. Standard Valve Chamber: A standard valve chamber is defined as any valve chamber that is greater than 5 feet in depth, as measured from the invert of the valve chamber base at its center to the existing ground.
  2. Shallow Valve Chamber: A shallow valve chamber is defined as any valve chamber that is 5 feet or less in depth, as measured in the preceding sentence.

## **2.02 PRECAST CONCRETE SECTIONS**

A. Precast concrete sections and appurtenances shall conform to the ASTM Standard Specifications for Precast Reinforced Concrete Manhole Sections, Designation C478, latest revision, with the following exceptions and additional requirements:

1. The wall sections shall be not less than 5" thick.
2. Type III cement shall be used except as otherwise permitted.
3. Joints between sections shall be made watertight through the use of O-ring gaskets or a 1-1/4" diameter flexible joint sealer, No. 2 Kent-Seal as manufactured by Hamilton Kent Manufacturing Company or approved equal. Gaskets shall conform to the ASTM Standard C443, latest revision.
4. Joints between sections shall also be sealed on the exterior with non-shrink grout.
5. Valve Chamber section shall not contain valve chamber steps.
6. Sections shall be cured by subjecting them to thoroughly saturated steam at a temperature between 100 degrees and 130 degrees F for a period of not less than 12 hours or, when necessary, for such additional time as may be needed to enable the sections to meet the strength requirements.
7. No more than two lift holes may be cast or drilled in each section.
8. Flat slab tops shall be reinforced.
9. The date of manufacture and the name or trademark of the manufacturer shall be clearly marked on the inside of the barrel.

10. Acceptance of the sections will be on the basis of material tests and inspection of the completed product.
11. Cones shall be precast sections of similar construction.
12. The tops of the bases shall be suitably shaped by means of accurate bell-ring forms to receive the barrel sections.

### **2.03 VALVE CHAMBER FRAMES AND COVERS**

A. The Contractor shall furnish all cast-iron valve chamber frames and covers conforming to the standard details, or as hereinbefore specified.

B. The castings shall be of good quality, strong, tough, evergrained cast-iron, smooth, free from scale, lumps, blisters, sandholes, and defects of every nature which would render them unfit for the service for which they are intended. Contact surfaces of covers and frame seats shall be machined to prevent rocking of covers.

C. All castings shall be thoroughly cleaned and subject to a careful hammer inspection.

D. Castings shall be at least Class 25 conforming to the ASTM Standard Specifications for Gray Iron Castings, Designation A-48, latest revision.

E. Before being shipped from the foundry, castings shall be given one coat of coal-tar-pitch varnish, applied in a satisfactory manner so as to make a smooth coating, tough, tenacious and not brittle or with any tendency to scale off.

F. Unless otherwise specified, manhole covers shall be 22-3/4" in diameter, weighing not less than 425 pounds per frame and cover. Valve Chamber covers shall set neatly in the rings, with contact edges machined for even bearing and tops flush with ring edge. They shall have sufficient corrugations to prevent slipperiness. The covers shall have two pick holes about 1-1/4" wide and 1/2" deep with 3/8" undercut all around. Covers shall not be perforated. Frames and covers shall be J.R. Hoe and Sons MC-425, Neenah R-1785, or approved equal.

G. Where indicated on the Drawings, valve chamber covers shall be of the watertight type and shall not leak when subjected to an external pressure of five pounds per square inch. Bearing surfaces shall be machined and sealed with a rubber gasket. Watertight valve chamber covers shall be fastened to the frame by counter-sunk stainless steel hexagonal-head cap screw. Covers shall be furnished with concealed pick holes.

H. All covers shall be marked in large letters "WATER" in the center, or as otherwise specified.

### **2.05 OPENINGS**

A. Provide a minimum of 2 1/2 inch clearance between precast chamber and pipe.

B. Provide 1/2 inch expansion felt around the pipe the full thickness of the chamber wall.

C. Provide cement mortar grout thoroughly at all openings around the pipe.

## **PART 3 - EXECUTION**

### **3.01 INSTALLATION - SETTING PRECAST MANHOLE SECTIONS**

A. Precast-reinforced concrete manhole sections shall be set so as to be vertical and with sections and steps in true alignment.

B. Rubber gaskets or flexible joint sealer shall be installed in all joints in accordance with the manufacturer's recommendations.

C. All holes in sections used for their handling shall be thoroughly plugged with rubber plugs made specifically for this purpose or with mortar. The mortar shall be one part cement to 1-1/2 parts sand, mixed slightly damp to the touch (just short of "balling"), hammered into the holes until it is dense and an excess of paste appears on the surface, and then finished smooth and flush with the adjoining surfaces.

### **3.02 SETTING MANHOLE FRAMES AND COVERS**

A. Manhole frames shall be set with the tops conforming accurately to the grade of the pavement or finished ground surface or as indicated on the Drawings or directed. Frames shall be set concentric with the top of the masonry and in a full bed of mortar so that the space between the top of the manhole masonry and the bottom flange of the frame shall be completely filled and made watertight. A thick ring of mortar extending to the outer edge of the masonry shall be placed all around and on the top of the bottom flange. The mortar shall be smoothly finished and have a slight slope to shed water away from the frame.

B. Water-tight manhole frames shall be anchored to the eccentric cone of the manhole with four one-inch anchor bolts and of sufficient length to extend through any leveling rings which may be required.

C. Manhole covers shall be left in place in the frames on completion of other work at the manholes.

### **3.03 ADJUSTING MANHOLE FRAMES AND COVERS TO GRADE**

A. Except where shown on the Drawings, the top of the precast concrete eccentric cone of a standard manhole or the top of the flat slab of a shallow manhole shall terminate 4-inches below existing grade in an unpaved non-traffic area other than in a residential yard and 13-inches below existing grade in a paved or unpaved traffic area and in a residential yard. The remainder of the manhole shall be adjusted to the required grade as described hereinafter in subparagraphs "B" and "C".

B. When a manhole is located in an unpaved non-traffic area other than a residential yard, the frame and cover shall be adjusted to an elevation 3-inches to 5-inches above the existing grade at the center of the cover. If field changes have resulted in the installed manhole invert elevation to be lower than the invert elevation shown on the Drawings, the adjustment to an elevation of 3-inches to 5-inches above existing grade shall be accomplished by the use of precast concrete rings. If field changes have resulted in the complete manhole invert to be greater than the invert shown on the Drawings and the cover higher than 5-inches above existing grade, then the top of the barrel section, when used, shall be trimmed down so that the manhole cover, after installation, is no greater than 5-inches above existing grade at the center of the cover. The area around the adjusted frame and cover shall be filled with the required material, sloping it away from the cover at a grade of 1-inch per foot.

C. When a manhole is located in a bituminous, concrete, or crushed stone traffic area, or in a residential yard, the frame and cover shall be adjusted to the grade of the surrounding area by the use of precast concrete rings. The adjusted cover shall conform to the elevation and slope of the surrounding area. If field changes have resulted in the installed manhole invert elevation to be so much higher than the invert elevation shown on the Drawings that the top of the eccentric cone, when used, or the top of the flat slab, when used, is less than the thickness of the frame and cover (7-inches) from the grade of the surrounding area, then the top of

the cone or barrel section shall be trimmed down enough to permit the cover, after installation, to conform to the elevation and slope of the surrounding area. After installation the inside and outside surfaces of the concrete rings shall receive a waterproofing bitumastic coating.

**- END OF SECTION -**

## SECTION 02610

### WATER MAIN PIPE AND FITTINGS

#### PART 1 - GENERAL

##### 1.01 WORK INCLUDED

Provide all labor, materials, equipment and services required for furnishing and installing all piping and appurtenances specified herein. All water main and fittings shall be ductile iron.

##### 1.02 RELATED WORK

- A. Section 02200 – Earthwork, Excavation and Backfill
- B. Section 02640 - Valves
- C. Section 02645 – Hydrant Assembly

##### 1.03 LIMITATIONS

All existing piping as shown on the Contract Documents is based on the best information available, but the Owner/Engineer makes no guarantees as to the accuracy of the locations or type of piping depicted. All new piping which ties into existing lines must be made compatible with that piping. So that piping conflicts may be avoided, Contractor shall excavate trenches well ahead of the pipe laying operation to confirm exact locations and sizes of existing piping before installing any new piping. Contractor shall provide all fittings and adapters necessary to complete all connections to existing piping.

##### 1.04 REFERENCES

- A. AWWA C104 – Cement Mortar Lining for DIP and Fittings.
- B. AWWA C105 – Polyethylene Encasement for DIP Systems.
- C. AWWA C110 – Ductile Iron and Grey Iron Fittings.
- D. AWWA C111 – Rubber Gasket Joints for DIP and Fittings.
- E. AWWA C115 – Flanged DIP with Threaded Flanges.
- F. AWWA C150 – Thickness Design of DIP.
- G. AWWA C151 – DIP Centrifugally Cast.
- H. AWWA C153 – Ductile Iron Compact Fittings
- I. AWWA C900 – PVC Pressure Pipe and Fittings 4” through 12”
- J. ASTM C443 – Precast Concrete Manhole Joints

K. ASTM C478 – Precast Concrete Manhole Sections

**PART 2 - PRODUCTS**

**2.01 DUCTILE IRON PIPE AND FITTINGS**

A. Ductile Iron Pipe shall be manufactured to conform to all of the requirements of the ANSI/AWWA C151/A21.51 Standard (latest revision). Ductile iron pipe shall include asphaltic outside coating and inside lining and coating in accordance with the ANSI/AWWA C151/A21.51 Standard (latest revision), and, Ductile Iron Pipe shall include cement lining in accordance with the ANSI/AWWA C104/A21.4 Standard (latest revision) unless otherwise indicated.

B. Restrained joint pipe shall be ductile iron manufactured in accordance with the requirements of ANSI/AWWA C151/A21.51. Push-on joints for such pipe should be restrained with Field Lok Gasket and shall be in accordance with ANSI/AWWA C111/A21.11. Pipe thickness shall be designed in accordance with ANSI/AWWA C150/A21.50. Restrained push-on joint pipe shall be capable of being deflected after assembly.

C. Compact fittings shall be ductile iron mechanical joint conforming to ANSI/AWWA C153/A21.53. All ductile iron fittings shall be rated at 350 psi water working pressure. Ductile iron fittings shall be ductile cast iron grade per ASTM Specifications A536. Mechanical joint restraint shall be "MEGALUG" as produced by EBAA Iron, Inc. or approved equal.

D. Pipe shall be minimum Special Thickness Class 50.

E. Each piece of pipe shall bear the manufacturer's name or trademark, the year in which it was produced and the letters "DI" or the word "DUCTILE". Pipe manufacturer shall furnish notarized certificate of compliance to the above AWWA and ANSI specifications.

F. The cleaning and assembly of pipe and fittings joints shall be in accordance with the manufacturer's recommendations.

G. Interior surfaces of all ductile iron pipe, fittings and specials shall be cleaned and lined in the shop with a standard thickness cement mortar lining applied in conformity with AWWA C104, Portland cement mortar. Every precaution should be taken to prevent damage to the lining. If lining is damaged or found faulty at delivery site, the damaged or unsatisfactory portions shall be repaired or replaced with lining conforming to these Specifications. Minimum lining thickness shall be 1/16" per AWWA C104.

H. Polyethylene Encasement for Ductile Iron Pipe

1. Pipe should be wrapped with Polyethylene, film thickness 8 mils, in accordance with ASTM D-1248, Type I - Class A or C - Grade E-1 - flow rate, 0.4 max - Dielectric Strength, Volume Resistivity minimum ohm-cm=10.

Tensile strength	3600 psi minimum
Elongation	800 % minimum.
Dielectric Strength	800 volts/mil thickness minimum

2. Bends, reducers, offsets and other pipe-shaped appurtenances shall be covered with the polyethylene in the same manner as the pipe.

3. Valves, tees, crosses and other odd-shaped pieces which cannot be wrapped



practically in a tube shall be wrapped with a flat sheet or split length of polyethylene tube.

4. Care must be taken to prevent damage to the polyethylene wrapping during backfill operations. Any damaged wrapping will be replaced by the Contractor at no additional cost to the Owner.

I. All items used for joining pipe shall be furnished with the pipe and tested before shipment. The joints shall be made with tools and lubricant in strict conformity with the manufacturer's instructions. If requested, three (3) copies of such instructions shall be delivered to the Engineer at the start of construction.

## **2.02 COPPER PIPE AND FITTINGS**

Exterior copper pipe shall be Type K pipe (ASTM B88449), with compression fittings. Joints shall be drawn up firmly and shall be tested before backfilling and any leakage stopped.

## **2.03 PIPE COUPLINGS**

The pipe couplings shall be of a gasketed, sleeve-type with diameter to properly fit the pipe. Each coupling shall consist of one (1) steel middle ring, of thickness and length specified, two (2) steel followers, two (2) rubber-compounded wedge section gaskets and sufficient track-head steel bolts to properly compress the gaskets. The couplings shall be assembled on the job in a manner to insure permanently tight joints under all reasonable conditions of expansion, contraction, shifting and settlement, unavoidable variations in trench gradient, etc. The coupling shall be Dresser, Style 38, as manufactured by Dresser Manufacturing Division, Bradford, PA, or equal.

## **PART 3 - EXECUTION**

### **3.01 GENERAL**

A. The pipe shall be protected during handling against impact shocks and free fall. Care shall be taken to avoid dragging the spigot ring on the ground or allowing it to be damaged by contact with gravel, crushed stone, or other hard objects.

B. After being delivered alongside the trench, the pipe shall be carefully examined for soundness or damage. No piece of pipe or fitting which is known to be defective shall be laid or placed in the lines. If any defective pipe or fitting shall be discovered after the pipe is laid, it shall be removed and replaced with a satisfactory pipe or fitting without additional charge. Before each piece of pipe is lowered into the trench, it shall be thoroughly cleaned out. Each piece of pipe shall be encased with polyethylene wrap and lowered safely and separately in the trench. In case a length of pipe is cut to fit in a line, it shall be so cut as to leave a smooth end at right angles to the longitudinal axis of the pipe.

C. The bell and spigot of the joint shall be cleaned of dirt and foreign matter immediately prior to jointing. The contact surfaces shall be coated with the lubricant, primer or adhesive recommended by the manufacturer, and then the pipe shall be pushed together until the joint snaps distinctly in place. The pushing together of the pipe may be done by hand or by the use of a bar. Polyethylene wrap shall extend 2' longer than the length of the pipe section, to provide a 1' overlap at each adjacent pipe section. Repair any rips, punctures, or other damage to the polyethylene with adhesive tape or with a short length of the polyethylene tube cut open, wrapped around the pipe and secured in place.

D. Trenches shall be kept dry during pipe laying. Before pipe laying is started, all water that may have collected in the trench shall be removed.

E. All pipe extensions shall be laid starting at the source of water, or as approved by the Engineer, and generally installed so that the bell ends point in the direction of the flow. When pipe laying is stopped, the end of the pipe shall be securely plugged or capped.

### 3.02 GENERAL TESTING REQUIREMENTS

A. All apparatus and equipment required for testing shall be furnished by the Contractor at no expense to the Owner.

B. The Contractor shall perform pressure tests on all pipe lines and appurtenances. Prior to the testing, all air shall be expelled from the pipe. All pipe lines and appurtenances shall be tested up to 100 percent over the normal system operating pressure or to the pipe pressure rating class, whichever pressure is less. The normal system operating pressure shall be determined at the low point of the test pipe section. At no time shall the test pressure exceed the pressure pipe rate class.

C. A pipe section shall be accepted as passing the pressure test if the test pressure does not decrease more than five (5) percent for the two (2) hour test period. For each test pipe section, the Engineer will waive the requirement of a leakage test (see following section) if there is no drop in pressure during the pressure test. Recording pressure charts shall be turned over to the Engineer at the conclusion of the tests.

### 3.03 LEAKAGE TESTS (FOR DI PIPE)

A. The Contractor shall furnish suitable test plugs, water pumps, and appurtenances, and all labor required to properly conduct the tests on pipe sections of approved length.

B. The Contractor shall test all pipelines and appurtenances at normal operating pressure for at least a 24-hour period. Normal operating pressure shall be determined by averaging six (6) pressure readings taken at a point in the test pipe over a minimum period of three hours.

C. The test pipe section shall be considered acceptable if the amount of liquid added to the system at the end of the test period to restore the test pressure does not exceed that allowed by the following formula:

$$L = \frac{ND(P)^{\frac{1}{2}}}{7400}$$

Where L = allowable leakage in gallons per hour.

N = number of joints in length of pipe tested.

D = nominal diameter of pipe (inches).

P = test pressure (psig).

D. If loss exceeds L, the Contractor shall locate and repair to the Engineer's satisfaction all leaks until the pipe section will pass another leakage test. Allowable leakage per AWWA C600 is presented in the following table:

<b>Allowable Leakage gph per 1000 feet of Pipeline</b>			
Average Test Pressure		Nominal Pipe Diameter (in.)	
Psi	(bar)	8"	12"
450	(31)	1.27	1.91
400	(28)	1.20	1.80
350	(24)	1.12	1.69
300	(21)	1.04	1.56
275	(19)	1.00	1.49
250	(17)	0.95	1.42
225	(16)	0.90	1.35
200	(14)	0.85	1.28
175	(12)	0.80	1.19
150	(10)	0.74	1.10
125	(9)	0.67	1.01
100	(7)	0.60	0.90

E. For the pipe line to be accepted, the following will be required:

1. Pass the pressure test.
2. Pass the leakage test, unless waived under the pressure test.
3. All evidence of leakage identified and repaired.

F. Should the sections under test fail to meet the requirements, the Contractor shall do all work of locating and repairing the leaks and retesting as the Engineer may require without additional compensation.

G. If in the judgment of the Engineer, it is impracticable to follow the foregoing procedures for any reason, modifications in the procedures shall be made as required and as acceptable to the Engineer, but in any event, the Contractor shall be responsible for the ultimate tightness of the line within the above test requirements.

### 3.04 PRESSURE TESTING AND DISINFECTION OF WATER MAINS

A. The pipe shall be hydrostatically tested at 50 psi above the rated working pressure. The duration of the test(s) shall be two hours during which time the pressure shall not fall more than 5 psi. The pipe shall be tested for allowable leakage according to AWWA C-600 (latest revision) concurrently with the pressure test.

B. Where practicable, pipelines shall be pressure tested between line valves or plugs in lengths of not more than 1500 feet. Testing shall proceed from the source of water toward the termination of the line. The line shall be tested upon the completion of the first 1500 feet.

C. Duration of test shall be not less than 2 hours.

D. Lines which fail to meet tests shall be repaired and retested as necessary until test requirements

are complied with.

E. All pipe, fittings, and other materials found to be defective under test shall be removed and replaced at the Contractor's expense.

F. Sterilization of potable water line shall be in accordance with the American Water Works Association Specification C 651 using liquid chlorine or approved equal method. The pipe line shall be disinfected by using a 50 mg/l chlorine solution for a contact period of 24 hours. At the end of the 24 hour retention period, the required residual shall be at least 25 ppm and the disinfection shall be followed by a thorough flushing.

G. Sampling locations shall be approved either by the Engineer or the public health agency having jurisdiction (Boone County Water District).

H. After sterilization and flushing, the Contractor must secure and obtain satisfactory bacteriological samples, at the points specified in 401 KAR 8:150 Section 4 (2), and results of the finished water from the public health agency having jurisdiction (Boone County Water District).

I. The satisfactory report must be submitted to the Owner and Engineer before authorizing domestic consumption of the water.

J. Sterilization procedures shall be continued until approved samples have been obtained.

### **3.05 CLEAN-UP**

Upon completion of the installation of the piping and appurtenances, the Contractor shall remove all debris and surplus construction materials resulting from the work. The Contractor shall grade the ground along each side of pipe trenches in a uniform and neat manner leaving the construction area in a shape as near as possible to the original ground line.

**- END OF SECTION -**

## SECTION 02640

### VALVES

#### PART 1 - GENERAL

##### 1.01 WORK INCLUDED

A. The Contractor shall furnish and install valves, and miscellaneous piping appurtenances, as indicated on the Drawings and as herein specified.

B. The Drawings and Specifications direct attention to certain features of the equipment, but do not purport to cover all the details of their design. The equipment furnished shall be designed and constructed equal to the high quality equipment manufactured by such firms as are mentioned hereinafter, or as permitted by the Engineer. The Contractor shall furnish and install the equipment complete in all details and ready for operation.

C. Enclosures shall be of a suitable type for the atmosphere in which they are installed.

D. Sizes and capacities not specified herein are indicated on the Drawings.

##### 1.02 SUBMITTALS

A. Copies of all materials required to establish compliance with the Specifications shall be submitted in accordance with the provisions of Section 01300. Submittals shall include at least the following:

1. Certified shop and reaction drawings and other data.
2. Literature on drawings describing the equipment and showing all-important details of construction and dimensions.
3. All data required by Section 01300.
4. The recommended summer and winter grades of lubricants along with alternative references to equal products of other manufacturers.
5. A list of the manufacturer's recommended spare parts, with the manufacturer's current prices for each item.

B. In the event that it is impossible to conform to certain details of the Specifications due to different manufacturing techniques, describe completely all nonconforming aspects.

C. Submit to the Engineer the equipment manufacturer's Certificate of Installation, Start-Up, and Testing.

##### 1.03 TOOLS AND SPARE PARTS

A. Furnish one (1) set of all special tools required for normal operation and maintenance.

B. Furnish the manufacturer's recommended spare parts.

C. All spare parts shall be furnished in containers clearly identified with indelible markings as to their contents. Each container shall be packed with its contents protected for prolonged storage.

D. Furnish a one (1) year supply of lubricants (as applicable). Lubricants shall include summer and winter grades, with alternate reference to equal products of other manufacturers, and shall include lubricant specifications such as viscosity, AGMA number, etc.

#### 1.04 OPERATING INSTRUCTIONS

Operating and maintenance instructions shall be furnished to the Engineer.

### PART 2 – PRODUCTS

#### 2.01 GATE VALVES

A. Gate valves shall conform to AWWA C509 Standard for Resilient Seated Gate Valves for Water and C-550 Protective Epoxy Interior Coatings for Valves and Hydrants, and shall be ductile body, resilient wedge, non-rising stem with rubber “O” ring packing seals. The valves shall open by turning counterclockwise. All valves shall have openings through the body of the same circular area as that of the pipe to which they are attached. Valves shall have mechanical joint ends unless otherwise shown on the plans or directed by the District. All valves shall be designed for a working pressure of 250 pounds per square inch (PSI) unless otherwise noted on the plans or in the “Supplemental Specifications. The Contractor shall make all valves tight under their working pressures after they have been placed and before the main is placed in operation.

1. Body – The valves shall be AWWA Class 250B designed for tight shut-off against a differential pressure of 250 psi. Valve bodies shall be constructed of ductile iron. Two trunnions for shaft bearing shall be integral with the valve body. The valves and appurtenances shall be suitable for buried service.
2. Ends – Valves shall have mechanical joint ends and shall be furnished with high strength COR-10 tee head with hex nuts, ductile iron glands, and rubber gaskets for each mechanical joint end.
3. Discs – Valve discs of cast steel, fabricated steel, or cast bronze are not acceptable.
4. Seats – Seats bonded on the discs are not acceptable.
5. Shaft Seals – If stuffing boxes are utilized for shaft seals they shall be constructed of cast iron, ASTM A126. Gland assemblies shall be of cast bronze, ASTM B132. The packing gland shall be housed in solid walled cast iron, ASTM A48, Class 40 one-piece structure or equal.
6. Operators – The valve operating mechanism shall be for **counterclockwise opening**. There shall be no external moving parts on valve or operator except the operator input shaft. Input shaft is to be operated by a 2-inch square operating nut. Maximum required input force on the operator shaft to open and close the valve shall be 40 pounds. The total number of turns applied to the operating nut required to completely open the valve from a completely closed position shall not be less than twice the normal valve diameter. An extension stem shall be furnished to bring the operating nut within 4 feet of the finished grade. Extension stems shall be securely fastened to the valve stem.

## 2.02 TAPPING SLEEVES AND VALVES

A. Tapping sleeves and valves shall be designed for a working pressure of 250 psi. The tapping sleeve together with the tapping valve shall be tested at 250 psi for visible leakage and pressure drop before the main is tapped. Tapping sleeve and valve used in high pressure areas shall be tested at 350 psi.

B. Tapping Sleeves – Tapping sleeves shall be two piece with mechanical joint type ends, and be so designed as to assure uniform gasket pressure and permit centering of the sleeve on the pipe.

C. Tapping Valves – Tapping valves shall have a flange on one end for bolting to the tapping sleeve and a mechanical joint type end connection to the tapping machine. The valves shall open by turning counterclockwise. Tapping valves shall conform to AWWA C509.

## 2.03 AIR/VACUUM VALVES

A. Air/vacuum valves shall be suitable for water working pressure of 250 psi and shall be of the type that automatically exhausts large quantities of air during the filling of a pipeline and allows air to reenter during the draining or when a negative pressure occurs.

B. For 8" and smaller water mains, tap size and piping shall be ¾", 12" water main – 1", and 16" and larger water main – 2". Temporary taps of suitable size may be required at certain points on the water main for the release of air for filling and/or flushing purposes. Temporary taps will be removed and plugged after use.

C. Valves, size ½-inch through 2-inch, shall have N.P.T. inlets and outlets.

D. All air/vacuum valves shall be constructed of cast iron with stainless steel trim and Buna-N seating. Valves shall be manufactured by APCO Air Release Valves Model #200-A, or approved equal.

## 2.04 VALVE BOXES

A. Each buried stop and valve shall be provided with a suitable valve box. Boxes shall be of standard, adjustable, heavy duty cast iron extension type, two piece, 5 ¼" shaft, screw type, and of such length as necessary to extend from valve to finished grade, Tyler #562-S, Tyler #564-S or approved equal. They shall be so designed and constructed as to prevent the direct transmission of traffic loads to the pipe or valve.

B. The upper or sliding section of the box shall be provided with a flange having sufficient bearing area to prevent undue settlement. The lower section of the box shall be designed to enclose the operating nut and stuffing box of the valve and rest on the valve bonnet.

C. The boxes shall be adjustable through at least 6" vertically, without reduction of the lap between sections to less than 4".

D. The inside diameter of boxes for valves shall be at least 4½" and the lengths shall be necessary for the depths of the valves or stops with which the boxes are to be used.

E. Each valve box shall have a two piece AFC Centering Ring that centers the valve box directly over the valve and aligns the box in a vertical position. The Centering Ring must have an adjustable detented slide to compensate for multiple stem diameters. The installation of the alignment ring below the operating nut should not disturb the function of the operating nut nor should the operating nut have to be removed to install

the Centering ring. Alternate centering devices other than that listed above must have the approval of the Boone County Water District.

F. Valve box cover shall be stamped "Water". Covers for valves shall be close fitting and substantially dirt-tight. Tops shall be set at final established grade.

G. The top of the cover shall be flush with the top of the box rim. An arrow and the word OPEN to indicate the direction of turning (**counterclockwise**) to open the valve shall be cast in the top of the valve covers.

## **2.05 T-HANDLE OPERATING WRENCHES**

T-handle operating wrenches shall be provided by the Contractor in the number and lengths necessary to permit operation of all valves by operators of average height working in normal positions.

## **2.07 CORPORATION STOPS**

Corporation stops to be used with copper pipe with compression type connections, where connected into cast iron pipe, shall be Mueller H-15000, H-15010, H-15020, Ford, or equal. Corporation stops shall be factory tested to 150 psi to be compatible with the pipes in which they are installed.

## **PART 3 - EXECUTION**

### **3.01 INSTALLATION**

A. Valves shall be installed as nearly as possible in the positions indicated on the Drawings consistent with conveniences of operating the handwheel or wrench. All gates and valves shall be carefully erected and supported in their respective positions free from all distortion and strain on appurtenances during handling and installation.

B. All material shall be carefully inspected for defects in workmanship and material, all debris and foreign material cleaned out of openings and seats, all operating mechanisms operated to check their proper functioning, and all nuts and bolts checked for tightness.

C. Valves and other equipment which do not operate easily or are otherwise defective shall be repaired or replaced at the Contractor's expense.

D. Valves shall not be installed with stems below the horizontal.

E. Valves shall be set plumb and supported adequately in conformance with the instructions of the manufacturer. Valves mounted on the face of concrete shall be shimmed vertically and grouted in place. Valves in the control piping shall be installed so as to be easily accessible.

F. Valves shall be provided with extension stems where required for convenience of operation. Extension stems shall be provided for valves installed underground and elsewhere so that the operating wrench does not exceed 8 ft. in length.

G. A permanent type gasket of uniform thickness shall be provided between flanges of valves.

### **3.02 PAINTING**



A. The exterior surfaces of all hydrants, iron body gate valves, the exterior surfaces of buried or submerged valves and miscellaneous piping appurtenances shall be given a shop finish of an asphalt varnish.

**- END OF SECTION -**

## SECTION 02645

### HYDRANT ASSEMBLY

#### PART 1 - GENERAL

##### 1.01 WORK INCLUDED

The Contractor shall furnish and install, where indicated on the Drawings, and as herein specified, the following equipment.

##### 1.02 RELATED WORK

- A. Section 02610 – Pipe and Fittings
- B. Section 02200 – Earthwork, Excavation and Backfill
- C. Section 02640 - Valves

#### PART 2 - PRODUCTS

##### 2.01 HYDRANT ASSEMBLY

A. Fire hydrants shall be improved AWWA compression model with 5-1/4" hydrant valve, two (2) 2-1/2" hose outlets, one (1) 4-1/2" pumper nozzle, old Cincinnati thread/national standard threads, national standard 1-inch square operating nut **opening left-hand (counterclockwise)**. Fire hydrant shall be equipped with safety flanges designed to prevent barrel breakage when struck by a vehicle, flanged inlets and auxiliary gate valves. Hydrant assemblies connected to mains 4" and larger shall have 6" inlets. Hydrants shall be Kennedy, Mueller, M&H, Clow, American Darling B-84-B 5-1/4.

B. Hydrants shall comply with ANSI/AWWA C502.

C. Inlet cover depth shall be 48" (or as shown on the plans) and the minimum dimension from ground to centerline of lowest opening shall be 18". Hydrants shall be supported on a poured-in-place concrete thrust block and provided with a drainage pit as indicated on Standard Detail Sheet. Hydrants shall be mechanical joint type, designed to close with the pressure of flow, and open **counter clockwise**. The hydrant shall have an internal diameter of standpipe of at least 6-inches and a 5-1/4-inch valve opening. The hydrant shall have two, 2-1/2-inch hose nozzles and one steamer nozzle with Cincinnati threads, a 6-inch hub connection, and be designed for 4-foot + minimum bury. The minimum depth for the main pipeline is 4-feet.

D. Each hydrant shall be installed with an auxiliary gate valve and valve box; valve box cover shall be marked "WATER" as required.

E. Hydrants shall be of the dry top design with O-ring sealed oil reservoir, post type dry barrel dual bronze drain valves, and a contoured shoe designed for full flow.

F. The hose and pumper nozzles shall be field replaceable and shall have large radius, full flow openings for low friction loss.

G. The operating nut shall be 1-inch square and open left (**counterclockwise**).

H. Hydrants shall be designed for 250 psig maximum working pressure and 400 psig test pressure. Each hydrant shall be subjected a 300 psi hydrostatic test prior to shipment with the main valve both open and closed. Under test, the valve shall not leak, the drain shall function, and leakage into the bonnet shall not occur.

I. The hydrant shall be given one shop coat of primer and two coats of Koppers Co. Glamortex enamel paint or approved equal. The color shall be Yellow as selected by the Owner.

### **PART 3 -- EXECUTION**

#### **3.01 INSTALLATION**

Hydrants and hydrant assemblies shall be installed in accordance with the manufacturer's directions and as detailed on the Contract Drawings.

A. Hydrants shall be set at the locations as shown on the Drawings and placed on a stone or concrete foundation at least 6-inches thick and 12" X 18". The space surrounding the slab and above the base of the hydrant to a height of at least 18-inches and a distance of at least 12-inches from outside the hydrant around the entire circumference shall be filled with No. 57 stone.

B. During backfilling, additional screened gravel shall be brought up around and 6-inches over the drain port. Each hydrant shall be set in true vertical alignment and properly braced and blocked against solid bearing. Concrete thrust block shall be placed between the back of the hydrant inlet and undisturbed soil at the end of the trench. Minimum bearing area shall be as shown on the Drawings. Felt roofing paper shall be placed around hydrant elbow before placing concrete. **CARE SHALL BE TAKEN TO INSURE THAT CONCRETE DOES NOT PLUG THE DRAIN PORTS.**

C. Fire hydrants shall be connected to the main with a 6-inch ductile iron branch controlled by a 6-inch gate valve unless otherwise shown.

D. The hydrants and auxiliary valves shall be tied to the pipe with anchor coupling, anchoring tee, or suitable rods or clamps, galvanized, painted, or otherwise rustproof treated. Concrete used for backing shall be no leaner than 1 part cement, 2-1/2 parts sand, and 5-1/2 parts stone. Paint coating on the hydrant shall be touched up as required after installation.

**- END OF SECTION -**

## SECTION 02700

### SITE RESTORATION

#### PART 1 - GENERAL

##### 1.01 CLEAN-UP

Within 30 days of completion of the installation of the water main and appurtenances, the Contractor shall remove all debris and surplus construction materials resulting from his work. The Contractor shall grade the ground along each side of the pipe trench and/or structure in a uniform and neat manner leaving the construction area in a shape as near as possible to the original ground line.

#### PART 2 - PRODUCTS

##### 2.01 SEEDING

Specification Section 02936 details seeding products and procedures.

#### PART 3 - EXECUTION

##### 3.01 SITE RESTORATION

A. After installation of water lines, the construction site will be restored to its original condition or better. All paved streets, roads, sidewalks, curbs, etc. removed or disturbed during construction shall be replaced, and all materials and workmanship shall conform to standard practices and specifications of the Owner, Boone County Publics, and/or to the Kentucky Department of Highways (KDOH) requirements, and specifications, whichever applies. Gravel, cinder or dirt streets, drives and shoulders shall be replaced and sufficiently compacted to provide a surface suitable for carrying the type of traffic normally imposed at the location.

B. All seeded areas shall be watered daily during the germination period, unless rain supplies the required moisture. The Contractor shall replace, at his own expense, trees, shrubs, etc. disturbed during construction.

C. The Contractor shall replace in-kind, at his own expense, all fences removed or disturbed during construction, to the owner's satisfaction.

D. The Contractor shall remove from the site all equipment, unused materials and other items at his expense. The construction site shall be left in a neat, orderly condition, clear of all unsightly items, before the Work is finally accepted.

- END OF SECTION -

## SECTION 02936

### SEEDING

#### PART 1 - GENERAL

##### 1.01 WORK INCLUDED

- A. Preparation of subgrade to receive topsoil.
- B. Spreading topsoil.
- C. Seeding and fertilizing.
- D. Seed protection on slopes.
- E. Hydroseeding.
- F. Maintaining seeded areas until acceptance.

##### 1.02 RELATED WORK

Section 01450 - Quality Control.

##### 1.03 QUALITY ASSURANCE

Test top soil under provisions of Section 01450.

##### 1.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver grass seed in original containers showing analysis of seed mixture, percentage of pure seed, year of production, net weight, date of packaging and location of packaging. Damaged packages are not acceptable.
- B. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.

##### 1.05 EXISTING CONDITIONS

Beginning work of this Section means acceptance of existing conditions.

#### PART 2 - PRODUCTS

##### 2.01 GROWING MEDIA

- A. Existing Topsoil: Natural, fertile agricultural soil capable of sustaining vigorous plant growth, not in frozen or muddy condition, containing not less than 6 percent organic matter, and corrected to pH value of 5.9 to 7.0. Free from subsoil, slag, clay, stones, lumps, live plants, roots, sticks, crabgrass, couchgrass, noxious weeds, and foreign matter.

B. Fertilizer: 10-10-10 commercial type with 50 percent of the elements derived from organic sources.

## **2.02 SEED**

Seed shall be proportioned by weight as follows: Kentucky Fescue, 70%; Creeping Red Fescue, 15%; Annual Rye Grass, 10%; and White Dutch Clover, 5%.

## **2.03 ACCESSORIES**

A. Mulching Material: Straw from oat, wheat, rye or barley, reasonably free from seeds and foreign matter detrimental to plant life, and in dry condition.

B. Mulching Material: Wood or wood cellulose fiber free of growth or germination inhibiting ingredients.

C. Establishment Blanket: Uniform, open weave jute matting.

## **PART 3 - EXECUTION**

### **3.01 PREPARATION**

A. Protect existing underground improvements from damage.

B. Remove foreign materials, plants, roots, stones, and debris, from site. Do not bury foreign material.

C. Remove contaminated subsoil.

D. Cultivate to depth of 3 inches, area to receive topsoil. Repeat cultivation in areas where equipment has compacted subgrade.

### **3.02 SPREADING TOPSOIL**

A. Spread topsoil to depth of 6 inches over area to be seeded. Place during dry weather, and on dry unfrozen subgrade.

B. Cultivate topsoil to depth of 6 inches with mechanical tiller. Cultivate inaccessible areas by hand. Rake until surface is smooth.

C. Remove from site, foreign materials collected during cultivation.

D. Grade to eliminate rough spots and low areas where ponding may occur. Maintain smooth, uniform grade.

E. Assure positive drainage away from buildings.

F. Finish ground level firm and sufficient to prevent sinkage pockets when irrigation is applied.

### **3.03 FERTILIZING**

A. Apply fertilizer, at a rate of 15 lbs. per 1,000 sq. ft.



- B. Do not apply grass seed and fertilizer at same time in same machine.
- C. Lightly water to aid breakdown of fertilizer and to provide moist soil for seed.

### **3.04 SEED**

- A. Apply seed at a rate of 6 lbs. per 1,000 sq. ft. evenly in two intersecting directions. Rake in lightly.
- B. Do not sow immediately following rain, when ground is too dry, or during windy periods.
- C. Roll seeded area with roller not exceeding 112 lbs.
- D. Apply water with fine spray immediately after each area has been sown.
- E. Seed shall be sown from March 15 to April 15 or from August 25 to September 25 or as approved by the Engineer.

### **3.05 HYDROSEEDING**

- A. Apply slurry at rate of 6 lbs. per 1,000 sq. ft. evenly in two intersecting directions and with hydraulic seeder.
- B. Immediately following hydroseeding, mulch areas by means of mulch blower at rate of 1,200 pounds per acre on level grades, 2,000 lbs. on slopes.
- C. Do not seed area in excess of that which can be mulched on the same day.

### **3.06 SEED PROTECTION ON SLOPES**

- A. Cover seeded slopes where grade is 3:1 or greater with jute matting. Roll matting down over slopes without stretching or pulling.
- B. Lay matting smoothly on soil surface, boring top end of each section in narrow 6-inch trench. Leave 12-inch overlap from top roll over bottom roll. Leave 4-inch overlap over adjacent section.
- C. Staple outside edges and overlaps at 36-inch intervals.
- D. Lightly dress slopes with topsoil to ensure close contact between matting and soil.
- E. In ditches, unroll matting in direction of flow. Overlap ends of strips 6 inches with upstream section on top.

### **3.07 MAINTENANCE PERIOD**

Maintenance Period: Until final acceptance.

### **3.08 MAINTENANCE**

- A. Maintain surfaces and supply additional topsoil where necessary, including areas affected by erosion.

- B. Water to ensure uniform seed germination and to keep surface of soil damp.
- C. Apply water slowly so that surface of soil will not puddle and crust.
- D. Cut grass first time when it reaches height of 2-1/2 inches (60 mm) and maintain to minimum height of 2 inches. Do not cut more than 1/3 of blade at any one mowing. Remove clippings.
- E. After first mowing, water grass sufficiently to moisten soil from 3 inches to 5 inches (76 to 127 mm) deep.
- F. Apply approved weed killer when weeds start developing during calm weather when air temperature is above 50 degrees F.
- G. Replant damaged grass areas showing root growth failure, deterioration, bare or thin spots, and eroded areas.

### **3.09 RESTORATION**

Restore grassed areas damaged during execution of work of this Section.

### **3.10 ACCEPTANCE**

Seeded areas will be accepted at end of maintenance period when seeded areas are properly established and otherwise acceptable.

**- END OF SECTION -**

## SECTION 03300

### CAST-IN-PLACE CONCRETE

#### PART 1 - GENERAL

##### 1.01 WORK INCLUDED

The work in this section shall include providing all labor, equipment, and services, including formwork, shoring, bracing, anchorage, concrete reinforcement and accessories, for placing and finishing cast-in-place concrete as specified herein.

##### 1.02 GENERAL REQUIREMENT

All concrete construction shall conform to all applicable requirements of ACI 301 Specifications for Structural Concrete for Buildings, except as modified by the supplemental requirements specified herein.

##### 1.03 REFERENCES

A. The Contractor shall obtain and have available in the field office at all times, the following references:

1. Specifications for Structural Concrete for Buildings ACI 301 (latest revision).
2. Field Reference Manual SP-15 (81).
3. Manual of Standard Practice - CRSI (latest revision).
4. Placing Reinforcing Bars - CRSI (latest revision).
5. Building Code Requirements for Reinforced Concrete ACI 318 (latest revision).

B. The following standards shall also apply to this work:

1. ANSI A-116.1
2. ASTM A-120
3. ASTM A-615
4. ASTM C-33
5. ASTM C-94
6. ASTM C-143
7. ASTM C-150
8. ASTM C-260
9. ASTM C-494
10. ASTM D-638
11. ASTM D-695
12. ASTM D-570
13. ASTM D-1252
14. ASTM D-2146
15. Federal Specifications FF-S-325

##### 1.04 SUBMITTALS

A. The Contractor shall submit the following data to the Engineer for review:

1. Concrete mix designs, test results and curves plotted to establish water-cement ratio if Method 1 of ACI 301 is used.
  2. Proposed mix designs and all necessary substantiating data used to establish proposed mix designs if Method 2 of ACI 301 is used.
  3. Mix designs for all mixes proposed or required to be used, including all mixes containing admixtures.
  4. A certified copy of the control records of the proposed production facility establishing the standard deviation as defined in Paragraph 3.8.2.3 of ACI 301.
- B. Certification attesting that admixtures equal or exceeds the physical requirements of ASTM C-494 for Type A admixture and, when required, for Type D admixture.
- C. Drawings showing locations of all proposed construction joints.
- D. Shop drawing for reinforcing steel showing bar schedules, location, and splices.

## **PART 2 - PRODUCTS**

### **2.01 CLASSES OF CONCRETE AND USAGE**

- A. Structural concrete of the various classes required shall be proportioned by either Method 1 or 2 of ACI 301 to produce the following 28-day compressive strengths:
1. Selection of Proportions for Class A Concrete:
    - a. 4,000 psi compressive for strength at 28 days.
    - b. Type I cement plus dispersing agent and air.
    - c. Maximum (water)/(cement and dispersing agent) ratio = 0.50.
    - d. Minimum cement content = 564 lbs. (6.0 bags)/cu. yd. concrete.
    - e. Nominal maximum size coarse aggregate = No. 67 (3/4" maximum) or No. 57 (1" maximum). Walls with architectural treatment shall use No. 67 (3/4" maximum).
    - f. Air content = 5% plus or minus 1% by volume.
    - g. Slump = 2"-3" in accordance with ASTM C-143.
  2. Selection of Proportions for Class B Concrete:
    - a. 3,000 psi compressive strength at 28 days.
    - b. Type I cement plus dispersing agent and air.
    - c. Maximum (water)/(cement and dispersing agent) ratio = 0.56.

- d. Minimum cement content = 470 lbs. (5.0 bags)/cu. yd. concrete.
  - e. Nominal maximum size coarse aggregate = No. 67 (3/4" maximum ) or No. 57 (1" maximum). Walls with architectural treatment shall use No. 67 (3/4" maximum).
  - f. Air content = 6% plus or minus 1% by volume.
  - g. Slump - 3"-4" in accordance with ASTM C-143.
- B. Concrete shall be used as follows:
- 1. Class A concrete for all concrete work except as noted below.
  - 2. Class B concrete for concrete fill and thrust blocks, and where indicated on the Drawings. All water mains shall have restrained joints and concrete thrust or "kicker" blocks at all pipe intersections and changes of direction to resist forces acting on the pipeline. Where concrete is to be placed over, around, or beside ductile iron piping, pipe and fittings shall first be wrapped with polyethylene to prevent direct contact between pipe and concrete.
- C. All testing shall be or have been performed by a recognized independent testing laboratory.
- D. Cement for exposed concrete shall have a uniform color classification.
- E. Coarse aggregate shall conform to all requirements of ASTM C-33.
- F. Manufactured sand shall not be used as fine aggregate in concrete.

## **2.02 ADMIXTURES**

A. An air entraining admixture shall be used on all concrete and shall be the neutralized vinsol resin type such as Master Builders MB-VR, or Euclid Chemical Co. AIR-MIX or equal. The admixture shall meet the requirements of ASTM C-260. Certification attesting to the percent of effective solids and compliance of the material with ASTM C-260 shall be furnished, if requested.

B. A water-reducing, set controlling admixture (non-lignin type) shall be used in all concrete. The admixture shall be a combination of polyhydroxylated polymers including catalysts and components to produce the required setting time based on job site conditions, specified early strength development, finishing characteristics required, and surface texture, as determined by the Engineer.

C. Certification shall be furnished attesting that the admixture exceeds the physical requirements of ASTM C-494, Type A, water-reducing and normal setting admixture, and when required, for ASTM C-494, Type D, water-reducing and retarding admixture when used with local materials with which the subject concrete is composed.

D. The admixture manufacturer, when requested, shall provide a qualified concrete technician employed by the manufacturer to assist in proportioning concrete for optimum use. He shall also be available when requested to advise on proper addition of the admixture to the concrete and on adjustment of the concrete mix proportions to meet changing job conditions.

E. The use of admixtures to retard setting of the concrete during hot weather, to accelerate setting during cold weather, and to reduce water content without impairing workability will be permitted if the following condition is met:

The admixture shall conform to ASTM C-494 except that the durability factor for concrete containing the admixture shall be at least 100 percent of control, the water content a maximum of 90 percent of control and length change shall not be greater than control, as defined in ASTM C-494.

F. Where the Contractor finds it impractical to employ fully the recommended procedures for hot weather concreting, the Engineer may at his discretion require the use of a set retardant admixture for mass concrete 2.5 feet or more thick and for all concrete whenever the temperature at the time concrete is cast exceeds 80-F. The admixture shall be selected by the Contractor subject to the review of the Engineer. The admixture and concrete containing the admixture shall meet all the requirements of these Specifications. Preliminary tests of this concrete shall be required at the Contractor's expense.

G. Admixtures shall be used in concrete design mixes in the same manner and proportions as in the field so that the effects of the admixtures are included in preliminary tests submitted to the Engineer for review prior to the start of construction.

H. When more than one admixture is used, all admixtures shall be compatible. They should preferably be by the same manufacturer.

I. Calcium chloride will not be permitted as an admixture in any concrete.

### **2.03 REINFORCEMENT, DOWELS AND ACCESSORIES**

Bar reinforcement, dowels and accessories shall conform to the requirements of ACI 301.

### **2.04 OTHER MATERIALS**

A. Anchorage items shall be of standard manufacture and of type required to engage with the anchors to be installed therein under other sections of the Specifications and shall be subject to approval by the Engineer.

1. Inserts shall be malleable iron or steel and of sturdy design adequate strength for the load to be carried. All inserts shall be galvanized. Adjustable wedge inserts shall have an integral loop or strap at the back or shall be provided with lugs to take reinforcing bars. They shall be slotted to receive a special-headed bolt not smaller than 5/8-inch in diameter and of the required length and fitted with hexagonal nut. Other inserts shall be either threaded or slotted as required by their usage. Threaded inserts shall have integral lugs to prevent running.
2. Concrete anchors shall be an approved expansion type conforming to Federal Specification FF-S-325, Groups I, II, III, or VIII and shall be installed in strict accordance with the manufacturer's recommendations. Anchors shall develop ultimate shear and pull out loads of not less than the following values in Class A concrete:

<u>BOLT DIAMETER (INCHES)</u>	<u>MINIMUM SHEAR (POUNDS)</u>	<u>MINIMUM PULL-OUT LOAD (POUNDS)</u>
1/2	4,500	4,600
5/8	6,900	7,700
3/4	10,500	9,900

- B. Reglets shall be correctly placed into forms prior to placing concrete in formwork.
- C. Premolded expansion-joint filler strips shall conform to ASTM D-1752 and shall be 3/8-inch thick unless otherwise shown.
- D. Joint sealants shall conform to ANSI A116.1. The following joint sealants are acceptable:
1. Colma by Sika Chemical Corporation.
  2. Hornflex by A.C. Horn, Inc.
  3. Sonolastic by Sonneborn Division of Contech, Inc.
- E. Nonshrink grout shall be Embeco 885 grout by Master Builders Company, Euco Firmix grout by the Euclid Chemical Company, or equal. The approved product shall be delivered to the site of the work in the original sealed containers, each bearing the trade name of the material and the name of the manufacturer.
- F. Porous fill shall be crushed rock or gravel of such size that all will pass a 1-1/2 inch screen and not more than 5 percent will pass a No. 4 screen, free from earth, clay or other foreign substances.

### **PART 3 - EXECUTION**

#### **3.01 FINISHES**

- A. Exposed to Public View Concrete Surfaces:
1. All concrete exposed to view in the completed structure shall be produced using materials and workmanship to such quality that only nominal finishing will be required. The provisions of paragraphs 13.3, 13.4, and 13.6 of ACI 301 shall apply to all exterior exposed to public view concrete surfaces.
  2. All formed exposed to public view concrete surfaces shall have a "smooth rubbed finish". Exterior vertical surfaces shall be rubbed to one foot below grade.
- B. Patching of holes due to removal of tie ends and other repairable defective areas, shall be as follows: Entire contact area of hole shall be coated with two-part moisture insensitive epoxy bonding compound as specified in Par. 2.04.B. in accordance with manufacturer's specifications, and prior to placing of freshly mixed patching mortar. Patching mortar shall be mixed and placed in general accordance with ACI Par. 9.2.2, 9.2.3, and 13.6.
- C. Where not otherwise specified, finishes shall be in accordance with Paragraphs 10.4 and 11.8 of ACI 301.

#### **3.02 TESTING**

All testing shall be in accordance with provisions of ACI 301. Testing services listed in ACI Sections

16.3, 16.4 and 16.5 shall be performed by a testing agency acceptable to the Engineer. Testing services of ACI Section 16.5 shall be paid for by the Contractor at his expense. Test shall be made for each 50 cubic yards of concrete and/or each day concrete is placed.

### **3.03 ADDITIONAL REQUIREMENTS**

A. Unless otherwise directed by the Engineer, the vertical surfaces of all footings shall be formed. Excavations and reinforcement for all footings shall have been inspected by the Engineer before any concrete is placed.

B. The installation of underground and embedded items shall be inspected before slabs are placed. Pipes and conduits shall be installed below the concrete unless otherwise indicated. Porous fill not less than 6 inches in compacted thickness shall be installed under all slabs, tank bottoms, and foundations. The fill shall be leveled and uniformly compacted to a reasonably true and even surface. The surfaces shall be clean, free from frost, ice, mud and water. Waterproof paper, polyethylene sheeting of nominal 4-mil minimum thickness, or polyethylene-coated burlap shall be laid over all surfaces receiving concrete.

C. Concrete in walls shall be placed in layers not over 18 inches deep and each layer shall be compacted by mechanical internal-vibrating equipment supplemented by hand spading, rodding and tamping as directed. Vibrators shall not be inserted into lower courses that have begun to set.

D. Concrete mixed in stationary mixers and transported by non-agitating equipment shall be placed in the forms within 45 minutes from the time ingredients are charged into the mixing drum. Concrete that is truck mixed or transported in truck mixers or truck agitators shall be delivered to the site of the work and discharge completed in the forms within the time specified in Paragraph 10.7 of ASTM C-94, except that when the concrete temperature exceeds 85-F, the time shall be reduced to 45 minutes. Transit-mixed concrete that is completely mixed at the site of concrete placement or batched cement and aggregates transported to mixers shall be placed in the forms within 1-1/2 hours after cement has been added. Concrete shall be placed in the forms within 15 minutes after discharge from the mixer at the job site.

E. If concrete is placed by pumping, no aluminum shall be used in any parts of the pumping system which contact or might contaminate the concrete. Aluminum chutes and conveyors shall not be used.

F. All concrete surfaces not in contact with forms shall be moist cured by the application of absorptive mats or double thickness of fabric kept continuously wet. Forms shall be kept continuously wet. Use of other curing methods will not be permitted unless written authorization is received from the Engineer.

G. Concrete which, in the opinion of the Engineer, has excessive honeycomb, aggregate pockets or depressions will be rejected and the Contractor shall, at his own expense, remove the entire section containing such defects and replace it with acceptable concrete.

**- END OF SECTION -**