

## **SECTION 300**

# **SANITARY SEWER CONSTRUCTION SPECIFICATIONS**

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**300 GENERAL**

This standard covers the installation of sanitary sewer piping systems that are intended for integration into the NMSU sewer collection system. All piping and accessory materials shall be new and unused. The sewer line and appurtenances shall be installed as shown on the Contract Documents. Deviations from these minimum standards shall have prior approval of the OFS Engineering before being constructed.

**301 DEFINITIONS**

See General Information Section  
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**302 REFERENCES**

The following documents, as applicable, are hereby incorporated into these Contract Documents by reference. If any referenced specification is in conflict with a NMSU specification, the specification requiring the most stringent condition shall take precedence.

NMDOT STANDARD SPECIFICATIONS FOR ROAD  
CONSTRUCTION - 2000 or applicable edition.

NMSU GENERAL CONDITIONS

MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES  
(MUTCD) - 2001 or applicable edition.

AMERICAN SOCIETY FOR TESTING AND MATERIALS  
(Herein: "ASTM") - 1992 or applicable edition.

INTERNATIONAL BUILDING CODE – 2006 or applicable  
edition.

INTERNATIONAL PLUMBING CODE – 2003 or applicable  
edition.

ACI BUILDING CODE REQUIREMENTS FOR REINFORCED CONCRETE (ACI 318-05) – or applicable edition. Herein: “ACI 318”

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (Herein: “AASHTO”) - Standard Test Methods

OCCUPATIONAL SAFETY AND HEALTH ACT (Herein: “OSHA”) - Construction Industry Standards; Safety Requirements

NEW MEXICO Underground Property Damage Law, Chapter 62, Article 14, NMSA 1978

SUBCONTRACTOR'S FAIR PRACTICES ACT, NMSA 1978

AMERICANS WITH DISABILITIES ACT, Latest Edition

AMERICAN WATER WORKS ASSOCIATION STANDARDS (Herein: “AWWA”), as applicable and the latest editions of:

AWWA Manual M3, Safety Practices for Water Utilities

AWWA C600-99, Installation of Ductile Iron Water Mains...

AWWA C605-94, Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and ...

UNI-BELL PVC PIPE ASSOCIATION STANDARDS, as applicable, and specifically the latest editions of:

UNI-B-6, Recommended Practice for Low-Pressure Air Testing of Installed Sewer Pipe (and ASTM F 1417-92)

UNI-PUB-6, Installation Guide for PVC Solid-Wall Sewer Pipe (4-15 inch)

### **303**

### **RECEIVING, HANDLING, AND STORAGE**

It is the responsibility of the Contractor to receive, handle, and store all pipe and appurtenances in such a manner as to insure delivery and placement in their final location in sound, undamaged condition as per this Standard, and to the acceptance of the Owner.

All materials, handling methods, and storage conditions at the Project location are subject to the Owner's inspection. Neither inspection nor the lack of Owner's inspection shall relieve the Contractor of the responsibility to provide and install materials meeting these Standards.

Stored materials shall be kept free from damage. Interiors of pipe and appurtenances shall be kept free from dirt or other foreign matter at all times. Pipe gaskets shall be stored out of direct sunlight, away from heat sources. Factory installed gaskets shall not be removed from the joints unless damaged or subject to damage.

Damaged or otherwise unacceptable materials, as determined by the P.M., or designee, shall be removed from the Project site and replaced as necessary at no cost to NMSU.

The interior of pipe and appurtenances shall be thoroughly cleaned of foreign matter before lowering into the trench and shall be kept clean during operations. Plugging or other means acceptable to the Owner shall be required of all pipe and appurtenances open ends at all times when work on that pipe is not in progress.

## **304 PIPE INSTALLATION**

Pipe shall be laid to the lines and grades as indicated in the Contract Documents, and as staked on site, beginning at the low point of the project. Pipe shall be laid upgrade in a continuous operation from structure to structure with the socket (bell) ends of the pipe directed upgrade. The Contractor shall verify existing system components for any conflicts with the Contract Documents, and shall immediately notify the P.M., or designee, of any such conflicts prior to continuing.

Trench excavations shall be made to at least four (4) inches below the pipe barrel to allow for the placement of embedment material. If the foundation of the trench is yielding, the Contractor shall over excavate and stabilize the trench. Where running or standing water occurs in the trench bottom, the water shall be removed from the trench. The trench shall be kept free from water during installation operations by suitable means until the pipe has been installed and backfill placed and compacted to a sufficient height to prevent pipe flotation. Soil migration in the pipe zone shall be prevented by use of a geotextile material or embedment material gradation or other suitable means with prior approval of the Owner. All pipe that has

the grade or joint disturbed after laying shall be taken up and re-laid at no cost to NMSU. Pipe shall not be laid in water or when trench or weather conditions are unsuitable for the work, except by permission of the Owner. All unconnected ends of pipes shall have a valve, plug, or cap installed.

Embedment material shall be added for a minimum of four (4) inches in depth, uniform in cross-section and profile, and shall be compacted to a minimum of 90% Standard Proctor, AASHTO T-99 for Type III or Type IV trenches (see referenced AWWA Standards).

Bell holes at each joint shall be provided to permit the joint to be assembled and the pipe to be supported uniformly for the full length of the pipe. Pipe shall be laid to the line and/or grade as indicated in the Contract Documents.

Field cuts for PVC pipe may be made with circular saws, handsaws or similar equipment. Field cuts shall provide a smooth end at a right angle to the longitudinal axis of the pipe. Spigot ends shall be deburred, beveled, and re-marked with the insertion line. The length and angle of field bevels should match the factory bevels.

Field cuts for ductile iron pipe (DI), when used, may be made with abrasive pipe saws, rotary wheel cutters, or similar equipment if allowed by the pipe manufacturer. Cut ends and rough edges shall be ground smooth, and for push-on joints, the cut end shall be beveled as per the manufacturers recommendations.

The sealing surface of the pipe spigot end, the pipe bell, fitting, and the electrometric gaskets shall be cleaned immediately before assembly. Factory installed gaskets should not be removed for cleaning. The joint shall be free of dirt, sand, grease, or foreign material. Pipe manufacturers approved lubricants shall be applied as specified to gasketed joints when assembling. Only gaskets supplied by the pipe and fittings manufacturer shall be used.

Push-on joints shall be made by insertion of the spigot end into the bell end. The installed pipe joint shall be kept straight while pushing the joint to completion at the insertion depth as specified by the manufacturer. Any deflections required by the Contract Documents shall be made after the joint is assembled. Timber headers shall be used against the pipe when mechanical equipment is used for pushing. Visual inspection of all assembled joints is required of the

Contractor. Additional inspections by feeler gauge or other methods may be required by the Owner.

Mechanical joints on PVC shall be assembled in accordance with the fittings manufacturer's published recommendations. Pipe spigot ends may require shortening for use with mechanical joints or fitting joints.

Mechanical joints on DI shall have the socket and plain ends cleaned. Lubrication and additional cleaning should be provided by brushing both the gasket and plain end with soapy water or an approved pipe lubricant (per AWWA C111/A21.11) just prior to installing the gasket on the plain end. The gland and then the gasket shall be installed on the plain end. Keeping the joint straight during assembly, the pipe shall be inserted into the socket firmly and evenly around the circumference. Assemble the gland and socket components and insert the joint manufacturer's bolts and nuts and hand tighten. Any required deflections shall be made after joint assembly but before tightening the bolts. Tighten the bolts to the normal range of torque as indicated in AWWA C600-99 (75-90 ft.lb. for 4"-24" joints with  $\frac{3}{4}$ " bolts) while maintaining approximately the same distance between the gland and the face of the flange at all points around the socket. Tightening the joint is accomplished by a process of alternately tightening bolts on opposing sides. The process is repeated until all bolts are within the required torque range.

Any restrained joints used, on PVC or DI, shall be installed as per the manufacturer's published recommendations.

PVC pipe may accommodate longitudinal bending, if the Contract Documents require curvature of lines. The Contractor shall block or brace pipe joints to ensure that bending of PVC pipe does not result in axial deflection in the gasketed or mechanical joints exceeding the manufacturer's published limits. The longitudinal bending in the PVC pipe barrel shall not result in a bending radius that is less than the minimum limits established in AWWA C605-94, or latest edition. Bending of PVC pipe barrels larger than 12 inches nominal diameter is to be done only with prior approval of OFS Engineering and shall be determined by the pipe manufacturer's published axial-joint-deflection limits.

DI pipe may be deflected at the joints when required by the alignments specified in the Contract Documents. The amount of joint deflection shall not exceed that shown in AWWA C600-99, or latest edition. The deflections listed are maximum deflections and shall not be exceeded. For design purposes, deflection shall be limited to 80 percent of the values listed in the referenced standard.

Embedment material shall be provided and installed such that 90% Standard Proctor densities are achieved for the pipe zone backfill, per ASSHTO T-99.

Utility Soil Bedding and Backfilling Materials shall conform to:

Utilities should be bedded in fine-grained granular material such as fine, poorly graded (uniform) sand in a fashion to avoid the development of any voids around utility lines placed. The following gradation ranges are acceptable for pipe bedding material:

Nominal Particle Size (in.) or Sieve Number	Percent Passing for sewer, water, PE gas lines.	Percent Passing for coated, steel gas lines.
¾	100	100
#4	70-100	100
#10	50-100	50-100
#200	0-35	0-35

All soil bedding materials used should be non-plastic. All soil bedding materials should extend a minimum of 4 inches in all directions.

All utility trenches should be backfilled with compacted soil below structural elements, including foundations, interior and exterior flat concrete work, and paved parking or drive areas. Although the backfill should be compacted, care should be taken not to damage the utility during backfilling and subsequent compaction.

Backfill materials may be native soils, however, no material having a maximum individual particle size or agglomeration clod size greater than two and one-half (2½) inches shall be placed within twelve (12) inches of the utility piping installed.



Sewers at or less than 0.5% slope:

All sewer lines shall be bedded in suitable embedment materials (see Sec. 509.2). All sewer lines designed for slopes at or less than 0.5% shall be bedded in suitable embedment materials that have been pre-shaped. Pre-shaping the **consolidated** placement surface shall be by means of a template made to fit the lower part of the sewer pipe exterior for a width of at least 60% of the sewer pipe breadth. The minimum thickness of the suitable embedment materials is four (4) inches, see drawing US-1.

Minimum Backfill Compaction Requirements

Utility Construction	Percent of Modified Proctor Density (ASTM D-1557)		
	Existing Surface Preparation	Fill or Backfill Placement	Maximum Finished Lift Thickness (in.)
In Roadway: Shallower than 36 " of Grade	N/A	95	6
In Roadway: Deeper than 36 " of Grade	N/A	95	12
Outside Roadway: Shallower than 36 " of Grade	N/A	90	12
Outside Roadway: Deeper than 36 " of Grade	N/A	90	18

Fittings shall be provided and installed as indicated within the Contract Documents and these Standards. All fittings shall be of the full-bodied, gasketed type. Tees and wyes shall be installed at an angle of 45 degrees above horizontal. If the depth of mains deviates such that a more vertical, or less vertical, position is deemed necessary, the Contractor may request a deviation in the placement of fittings from the P.M., or designee.

Service lines shall be installed at not less than the minimum depth and slopes indicated herein (see detail drawing US-2). Risers may be utilized where main line depths exceed seven (7) feet and while maintaining greater than minimum slopes. Care shall be taken to provide lateral support for the riser to prevent excessive pipe deflection.

Manholes shall conform to all other applicable Sections within these Standards. Concrete manhole base sections must be allowed a minimum of 24 hours curing time, or as directed by the P.M., or designee, prior to the placement of any extension barrels or backfill.

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#### **WARNING TAPE & TRACING WIRE**

**TAPE:** During the backfilling process, all sewer mains, service lines and system appurtenances shall have a continuous warning tape placed immediately above them and throughout their length at a height of fifteen (15) to eighteen (18) inches above the final utility surface. The tape shall be six (6) inches wide. Tape material shall be formulated from 100 percent virgin polyolefin resins. Resins shall be pigmented for chemical stability and resistance to sulfide staining (color fastness).

Tape shall be constructed by the mechanical (non-adhesive) lamination of two plies of three layer blown film in such a manner as to produce a bi-axially oriented structure. The tape shall be able to provide a 300 percent elongation prior to rupture as per ASTM-D882.

The tape shall meet or exceed the standards provided in the Materials Specification List, included in these Standards.

The warning tape shall be manufactured with a permanent APWA sewer line green pigment at a maximum spacing of every thirty (30) inches along its length, be imprinted with a continuous warning message as follows:

**CAUTION SEWER LINE BURIED BELOW**

At tees, tape ends, etc., the warning tape shall be tied together (spliced) with knot to create a continuous warning tape throughout the length of the pipeline and associated branch lines, appurtenances, etc.

**TRACING WIRE:** In addition to the installation of warning tape, copper-tracing wire is to be installed with all force sewer mains. The tracing wire shall be taped, using electrical tape, on top of the pipe at ten (10) foot centers, for the total length of the pipe.

The tracing wire shall be 12 AWG (average wire gauge), solid core, copper wire (solid core meaning one (1) single continuous strand of copper wire). In addition, the wire insulating coating (jacket) shall be green in color and shall have 45 mils of polyethylene insulation thickness and high molecular weight. Also the tracing wire shall be HMW – PE and rated for UL 600V construction. The wire shall be suitable for wet or dry applications. The wire size (gauge) shall be continuously affixed (printed on) the entire length of all tracing wire coating and shall be easily read.

Where a splice is required, or when a three (3) way splice is necessary, the wires shall be joined together with an appropriate size (green) wire nut which shall then be placed inside a 3M brand Direct Bury Splice kit (DBR), or approved equal of appropriate size. No bare wire shall be left exposed anywhere. All wires shall be spliced to all other wires for a continuous tracing wire system.

This wire end shall not be bare, but shall have the coating jacket intact. Location and frequency of test boxes shall be as directed by Owner. Test boxes, connected onto tracing wire system as per detailed drawings herein, shall be required at the force main ends and where spacing exceeds 500 feet. Test box locations shall be outside any street and curbing and as directed by the P.M., or designee.

No electrical connections of the tracing wire to any metal pipes or metal service lines will be allowed and care shall be taken to ensure that the tracing wire is not damaged during installation. The tracing wire will be tested for continuous signal (continuity test) across all main and service lines before asphalt is installed, and prior to sub grade preparation. Tracing wire must have a continuous signal before pipe is accepted.

**INSPECTION AND TESTING**

All testing required herein, including tracing wire and manhole testing, shall be accepted by the P.M., or designee, prior to roadway sub grade preparation.

All sewer lines installed shall be tested for leakage. All manholes installed may be tested for leakage at the option of the P.M., or designee. All PVC sewer lines shall be mandrel tested. All sewer mains laid at slopes flatter than or equal to the minimums, as specified within these Standards, shall be visually tested by closed circuit television camera. All testing indicated above, at the Contractor's expense, shall be inspected by the P.M., or designee. Visual testing of any sewer mains steeper than minimums shall be at the option of the P.M.

Mandrel testing of sewer piping by the Contractor is required of all PVC sewer mains. The mandrel testing is intended to be in compliance with ASTM D3034, latest revision. Mandrel's shall be sized for a test limit of 7½% of the statistical base inside diameter of the test section of piping. ASTM and pipe manufacturer's pipe dimensions and tolerances shall be used to determine the required mandrel sizing. The Contractor shall present such dimensions and sizing data to the Owner at the time of testing. The test shall consist of the Contractor pulling or pushing the mandrel through the test section.

Leakage testing for sewer piping (includes all mains, branches, laterals, tees, wyes, services and stubs) shall be in compliance with ASTM F 1417-92, using the time-pressure drop method, or UNI-B-6-98, or their latest revisions. The Contractor shall furnish all equipment and personnel necessary for conducting these tests and making measurements. All piping components failing these tests shall be located, and repaired or replaced and failed sections shall be retested. All sections tested shall maintain air pressure with a pressure drop not exceeding 0.5 psi from 3.5 to 3.0 psi in excess of any ground water pressure above the top of the sewer for a minimum amount of time (see below). Test pressures shall be adjusted by 0.43 psi for every foot of water above the top of the pipe. Lowering ground water levels, or selection of alternative test methods, approved by OFS Engineering, will be required if the air pressure required for the test exceeds nine (9) psi.

After all piping ends have been plugged or capped, air shall be slowly added to the test section until the pressure reaches 4.0 psi (plus any ground water adjustment). The pressure shall be maintained at between 3.5 to 4.0 psi for at least 2.0 minutes for stabilization of temperature conditions. After stabilization, the air shall be disconnected, lowered to 3.5 psi (plus any ground water adjustment). The time required for the pressure to decrease from 3.5 to 3.0 psi shall be recorded and compared to the minimum holding times required by pipe diameter as shown by the following table:

**Minimum Specified Time Required for a 0.5 psig Pressure Drop  
For Size and Length of Pipe Indicated**

Pipe Dia. (in.)	Min. Time (min:sec)	Length for Min. Time (ft.)	Time for Longer Length (sec.)	Specification Time for Length (L) Shown (min:sec)							
				100'	150'	200'	250'	300'	350'	400'	450'
4	1:53	597	0.190L	1:53	1:53	1:53	1:53	1:53	1:53	1:53	1:53
6	2:50	398	0.427L	2:50	2:50	2:50	2:50	2:50	2:50	2:51	3:12
8	3:47	298	0.760L	3:47	3:47	3:47	3:47	3:48	4:26	5:04	5:42
10	4:43	239	1.187L	4:43	4:43	4:43	4:57	5:56	6:55	7:54	8:54
12	5:40	199	1.709L	5:40	5:40	5:42	7:08	8:33	9:58	11:24	12:50
15	7:05	159	2.671L	7:05	7:05	8:54	11:08	13:21	15:35	17:48	20:02
18	8:30	133	3.846L	8:30	9:37	12:49	16:01	19:14	22:26	25:38	28:51
21	9:55	114	5.235L	9:55	13:05	17:27	21:49	26:11	30:32	34:54	39:16
24	11:20	99	6.837L	11:24	17:57	22:48	28:30	34:11	39:53	45:35	51:17
27	12:45	88	8.653L	14:25	21:38	28:51	36:04	43:16	50:30	57:42	64:54
30	14:10	80	10.683L	17:48	26:43	35:37	44:31	53:25	62:19	71:13	80:07
33	15:35	72	12.926L	21:33	32:19	43:56	53:52	64:38	75:24	86:10	96:57
36	17:00	66	15.384L	25:39	38:28	51:17	64:06	76:55	89:44	102:34	115:23

NOTE: Test sections with laterals or branches within them that fail the above required time interval, may have their required time recalculated as per the above referenced documents and be retested.

Leakage testing of manholes shall be accomplished by the Contractor at the request of the P.M.. All sanitary sewer manholes to be tested shall be tested for leakage by plugging the inlet and outlet piping with leak-proof plugs, filling the manhole with water to a depth of four (4) feet above the top of the pipe or two (2) feet above the existing ground water level, whichever is greater, and allowing one hour for saturation of the manhole material. After the one-hour saturation period, the manhole shall be refilled to the original level. Two hours after the refilling, the difference in water surface elevation from original to final level shall be measured and converted into gallons per hour lost through manhole leakage.

The allowable leakage for manholes shall be 0.75 gallons per hour per foot diameter of the manhole. All manholes are required to be waterproof to the above leakage rate.

Manholes constructed into the groundwater may be tested at the option of the P.M. by observing the rate of infiltration over time similarly to the above depths and time rates.

Visual testing of the sewer piping may be conducted. Visual testing of all sewer mains installed at minimum slope or at flatter than minimum slopes shall be conducted at the option of the Owner. This inspection shall be by closed circuit television camera equipped with the means for measuring slopes (inclinometer). This inspection shall be performed by the Contractor, and shall be at the Contractor's expense, regardless of passing or failure.

Failure of the visual testing procedure, if conducted, shall be based on the existence of any occurrences of reversal of slopes (dips or sags) located in the tested piping. Failure of any sections shall require the Contractor to excavate and re-lay or re-bed the negative slope sections of the piping.