

CITY OF MIDWEST CITY

SEWER MAIN INSTALLATION SPECIFICATIONS

ORDINANCE NO. 1667

ADOPTED BY CITY COUNCIL

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The City of Midwest City

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Adopted by City Council on
February 10, 1981

SEWER INSTALLATION SPECIFICATIONS

SCOPE

The work under these specifications includes the furnishing of all material, equipment, tools, labor and supervision necessary to the construction of sanitary sewers complete, together with all necessary trenching, excavating, sheeting and bracing, pumping, bailing, pipe laying and backfilling, and the furnishing of all the materials and appurtenances necessary to the proper functioning of the complete sewer system.

All work shall also be done in accordance with "Standards for Water Pollution Control Facilities" adopted by the Oklahoma State Board of Health in March, 1980.

SEWER PIPE

All sewer pipe shall comply with the following requirements (cast-iron or ductile iron pipe shall be used where specifically called for on the plans, with ABS Composite Pipe, vitrified clay pipe, or PVC sewer pipe being used at all other locations):

- (a) All vitrified sewer pipe shall conform to the current American Society for Testing Materials standard specifications, serial designation C-13 or C-261, and C-200 or C-278 for standard strength or extra strength clay sewer pipe.
- (b) Ductile iron pipe shall be manufactured in accordance with AWWA C151-76 (ANSI A21.51). Thicknesses shall be as follows:

<u>Size</u>	<u>Thickness</u>	<u>Class</u>
6"	0.25"	50
8"	0.27"	50
12"	0.31"	50
16"	0.34"	50
20"	0.36"	50
24"	0.38"	50

- (c) PVC pipe shall be manufactured in accordance with the latest revision of ASTM D3034 SDR 35. Minimum dimensions are as follows:

<u>Size</u>	<u>Outside Diameter</u>	<u>Wall Thickness</u>
8"	8.400	0.240
10"	10.500	0.300
12"	12.500	0.360
15"	15.300	0.437

- (d) ABS Composite Pipe shall conform to ASTM D2680 latest revision.
- (e) A sewer line shall not be less than eight (8) inches nominal diameter.

SEWER PIPE JOINTS

- (a) Vitrified-clay sewer pipe shall be bell and spigot type fitted with factory-made resilient compression joints meeting the current ASTM specifications for vitrified-clay pipe joints having resilient properties (ASTM C-425), or plain end type with compression couplings meeting the current ASTM (American Society for Testing Materials) specifications for vitrified-clay pipe. (ASTM C-594) shall be used.
- (b) PVC sewer pipe joints shall be of integral bell type meeting the current ASTM specifications for PVC pipe (ASTM D3212 for joint tightness). Gaskets for use in gravity sewer systems should be manufactured to ASTM F477.
- (c) ABS Composite Pipe joints shall be made using primer and cement by which the spigot end of the joint is solvent cemented into the bell end to form the joint closure.

TRENCH EXCAVATION

- (a) Excavations of every description and of whatever substance encountered shall be made to the depth shown on the drawings.
- (b) All excavated material not required for backfilling or not suitable for use as backfilling material shall be disposed of within the site area as directed by the engineer.
- (c) In general excavation shall be made in open cut to the line and grade shown on the drawings. Sides of trenches shall be kept as nearly vertical as possible and shall be sheeted and braced as required.
- (d) The width of the trench shall be ample to allow the pipe to be laid and jointed properly and to allow the backfill to be placed and compacted as needed. The trench sides shall be kept as nearly vertical as possible. When wider trenches are dug, appropriate

bedding class and pipe strength shall be used. Ledge rock, boulders, and large stones shall be removed to provide a minimum clearance of four (4) inches (10 cm) below and on each side of all pipe(s).

- (e) Wherever wet, unstable soil is encountered, the engineer may, if he deems it necessary, order the trench bottom to be excavated below grade and the material so excavated to be replaced with sand, gravel or other suitable material, well-tamped in place. Where, through error or neglect, the contractor shall carry the excavation below trench grade, he shall backfill to trench grade with sand, gravel or other suitable material well-tamped in place, and the cost of such backfill shall be borne by the contractor.
- (f) Bell holes shall be cut in the bottom of the trench of sufficient size to allow for proper jointing of the pipe, but in no case shall they leave more than one-third of the pipe unsupported.
- (g) Excavated material which is to be used in backfilling shall be neatly piled along the trench in such a manner as to provide a minimum of inconvenience to other contractors and the traveling public. In no case shall waterways be obstructed without other provisions being made for the removal of water.
- (h) When utilities such as water mains, sewers, pipelines, gas mains and electric conduits are encountered in the excavation, the contractor shall notify the owner of such utility and shall take such steps as the owner and the engineer deem necessary to protect such utility from damage. Should damage occur, the contractor shall repair same at his own expense and shall pay the owner for any loss suffered on account of such damage.

PIPE LAYING AND TESTING

- (a) All vitrified clay sewer pipe shall be installed in accordance with the latest revision of ASTM C-12. Bedding and hunching materials used shall be Class A, B or C as described in the standards. All "Y" branches on clay pipe shall be encased in concrete.
- (b) All plastic sewer pipe (PVC or ABS Composite) shall be installed in accordance with the latest revision of ASTM D2321. Bedding and hunching materials used shall be Class I, II or III as described in the standards. Class IV will not be suitable for embedment.
- (c) After the pipe has been laid and backfilled the line shall be tested for tightness by air testing, and infiltration or exfiltration tests. The air test shall be in accordance with the latest revision of ASTM C 828. The maximum allowable leakage shall be 100 gallons per day per inch-mile. Deflection tests shall be performed on all flexible pipe. The test shall be conducted after the final backfill has been in place at least 30 days. No pipe shall exceed a deflection of 5%. If the deflection test is to be run using a rigid ball or mandrel, it shall have a diameter equal to 95% of the inside diameter of the pipe. The test shall be performed without mechanical pulling devices.

- (d) The work or any portion of the work under construction shall be suspended immediately on written order of the city engineer or the city council for any good cause or causes, among others of which special reference is made to the following:
- (1) Failure of the contractor to provide sufficient and proper equipment for properly executing the work.
 - (2) Deliberate failure on the part of the contractor to observe any requirements of these specifications or to comply with any orders given by the city engineer, as provided for in these specifications.
 - (3) Failure of the contractor promptly to make good any defects in materials or workmanship or any defect of any other nature, the correction of which has been directed in writing by the city engineer.
- (e) All developers who are constructing sewer mains with sewer service wyes must tie a one-inch wide plastic tape to the wye and bring the tape to the surface of the ground before backfilling the sewer main.

BACKFILLING

In general, backfilling shall be done with the material excavated from the trench. However, should the excavated material contain large pieces of rock or other material which, in the opinion of the engineer, might injure the sewer, he may reject it as backfill material or restrict its use to the upper part of the fill. Selected topsoil, free of weeds, brush, roots and other deleterious matter shall be used as backfill for embedment of sewer pipe from the bottom of the trench to a depth of six (6) inches above the top of the bell. Special care shall be used in placing and thoroughly compacting this selected topsoil to provide good bearing for the pipe. Backfilling shall be carried on in the following manner:

- (a) Where the sewer lines are laid in rock, shale or clay.

Where sewer lines are laid in rock, shale or clay, four (4) to six (6) inches of sand shall be placed in the trench between bell holes to provide a uniform and continuous bearing and support for the pipe. When the pipe is in place and the joint has been completed, the trench shall be backfilled with sand to the top of the pipe. Where mains are constructed in the parking or parallel to a road where there should normally be no traffic, the remainder of the trench shall be filled in such a manner as not to impose excessive concentrated or unbalanced loads, shock, or impact on or cause displacement of the pipe, allowing six (6) inches for top dressing, after which the entire trench shall be settled with water. After settlement, the top dressing shall be applied, but in no case shall the top dressing be applied where pools of water are standing. Where the trench is excavated in front of developed property, the top dressing must be, in general, of as good soil as the original ground,

and in the event there is a lawn, trees or decorative shrubbery, the growth shall be protected and restored to its original condition.

(b) Where the sewer main crosses roadways or rights-of-way.

Where the sewer main crosses any unpaved roadway, gravel or oil surfaced roads, driveways of any kind or railroad tracks, four (4) to six (6) inches of sand shall be placed in the trench below the grade of the pipe invert. After the pipe is laid to grade, sand shall be used for backfill to the top of the pipe, sand to be flooded with water to prevent settlement. Then the backfill from the top of the sand to the top of the trench shall be compacted in six-inch layers to a density of at least equal to that of the top six (6) to twelve (12) inches of the surrounding earth, using water if required, to get proper compaction. In case the excavation fails to furnish suitable material for the bottom of the trench or backfill, the contractor shall supply such material as will be suitable and satisfactory to the engineer, moving same from another locality or part of work if necessary. Where compaction is required or ordered, it shall be done in layers of six (6) inches or less, and shall be compacted to a density equal to that of the adjacent soil. Where sewer mains are constructed under driveways, sidewalks, under fences, foundations or other such structures, four (4) to six (6) inches of sand shall be placed in the trench below the grade of the pipe invert, and after the pipe is laid to grade the entire trench shall be backfilled with sand from the bottom to the top of the trench, and then thoroughly settled with water by flooding or jetting, being certain that the sand around and under the pipe is sufficiently wetted to attain maximum compaction.

MANHOLES

Manholes shall be constructed where shown on the plans. They shall be built of vitrified brick precast reinforced concrete, concrete block and concrete sections or cast-in-place concrete, and shall be in accordance with the dimensions shown on the detailed drawings.

(a) Steps, Rings, and Lids

- (1) Watertight manhole covers are to be used wherever the manhole tops may be flooded by street runoff or high water. Locked manhole covers may be desirable in isolated easement locations or where vandalism may be a problem.
- (2) Manhole steps, rings, and lids shall be made of gray cast iron conforming to ASTM A 48 or shall be made of other corrosion resistant materials. Steps or ladders shall be provided whenever the manhole is deeper than four (4) feet (1.2 m). Steps shall be spaced at intervals no greater than sixteen (16) inches (41 cm). Where manhole steps are not utilized, in-place or portable ladders shall be provided.

- (3) Manhole rings and lids utilized in traffic areas, i.e., streets, alley-ways, or parking lots, shall be of cast iron construction. Solid manhole covers shall be utilized. Manhole covers with a pickhole are acceptable. Manhole rings and lids of ABS Thermoplastic construction will not be approved.
- (4) Manhole rings shall be constructed on manholes so that no infiltration or inflow may enter the manhole.

(b) Manhole Bases

- (1) Materials for concrete used for manhole bases shall conform, as a minimum, to the following current specifications:

Portland Cement	ASTM C 150
Aggregate for Mortar	ASTM C 144
Fine & Coarse Aggregate	ASTM C 33

Water: Clean and free from deleterious substances. Total water content of concrete shall not exceed 6.5 gallons (54.21) of water per 100 pounds (100 kg) of cement in the mix.

- (2) The base shall be poured of a minimum 3000 psi (20,684 kn/m^2) concrete with a maximum slump of four (4) inches (10 cm), vibrated or tamped. The base shall have a minimum diameter eight (8) inches (20 cm) greater than the outside diameter of the manhole. The base shall have a minimum eight (8) inch (20 cm) thickness beneath the manhole wall.
- (3) The invert flow channel shall be formed during or immediately after the pouring of the manhole base and brush finished as soon as the concrete has sufficiently set. The flow channel through manholes shall be made to conform in shape and in slope to that of the sewers. Sewer pipe, with the top half removed, should be laid through the manhole whenever possible.

The inside bottom of the manhole shall rise a minimum of one (1) inch per foot (8.3 cm/m) from the side of the pipe or the flow channel to the wall of the manhole. Dips or projections capable of holding water or solid materials will not be permitted. The concrete shall set for 24 hours before any pipe inside the manhole is trimmed.

- (4) All sewers constructed of rigid or semi-rigid pipe extending from all manholes shall be encased with concrete for a distance of three (3) feet (0.9 m) from the outside wall of the manhole. This support may be deleted if a flexible, watertight gasket is used to connect the sewer to the manhole. No support is required for sewers constructed of flexible pipe.

(c) Brick Manholes

- (1) Brick used for brick manholes shall conform to the current ASTM designations C 32 and C 126.
- (2) The minimum manhole wall thicknesses for brick manholes shall be:

At a depth of 0 to 16 ft. (0 to 4.9 m)	8 inches (20 cm)
At a depth of 16 ft. (4.9 m) or greater	12 inches (30 cm)
- (3) The manhole shall be waterproofed on the exterior with a minimum cement plaster coating one (1) inch (2.5 cm) thick or with a minimum plaster coating one-half (1/2) inch (1.25 cm) thick in conjunction with one coating of a bituminous or other similar material waterproofing compound.

(d) Precast Reinforced Concrete Manholes

These manholes shall conform to the current ASTM specifications C 478 except for the following modifications:

- (1) Cement used in the construction of precast reinforced concrete manholes shall conform to the requirements of the Standard Specifications for Portland Cement (ASTM Designation: C 150).
- (2) The minimum shell thickness for precast concrete reinforced manholes shall be:

At a depth of 0 to 16 feet. (0 to 4.9 m)	One-twelfth internal shell diameter or 4 inches (10 cm), whichever is greater.
At a depth of 16 feet or greater. (4.9 m)	One-twelfth internal shell diameter plus 1 inch (2.5 cm), or 5 inches (13 cm), whichever is greater.
- (3) The bottom precast manhole section shall not be set upon a previously cured manhole base. Pouring three (3) to four (4) inches (7.6 to 10 cm) of concrete up along the outside walls of the bottom precast section of the manhole is recommended. Where the base extends at least up to three (3) to four (4) inches (7.6 to 10 cm) along the inside manhole walls, this protection would be necessary.
- (4) Joints between precast reinforced concrete sections shall be of such design that leakage and infiltration can satisfactorily be reduced to a minimum. The use of rubber gaskets (natural or synthetic) and mastics is recommended for this purpose. If mastics are utilized, the joint must be protected on the exterior of the manhole from the degrading action of the soil.

- (5) Any precast reinforced concrete section which has been damaged in transit or on site such that the watertightness of the section has been affected adversely shall not be utilized in the construction of the manhole.
 - (6) The use of two or three grade adjustment rings or layers of bricks under the manhole cover is recommended especially in undeveloped areas where grade adjustment may become necessary.
- (e) Concrete Block and Concrete Sections for Sanitary Sewer Manholes

These specifications cover solid, precast, curved or segmental concrete masonry units intended for use in the construction of sanitary sewer manholes.

- (1) Materials for concrete block and precast sections shall conform to the following current specifications:

Portland Cement	ASTM C 150
Aggregate for Mortar	ASTM C 144
Steel Reinforcement	ASTM C 617
Concrete Masonry Units	ASTM C 139

The strength of the concrete material shall not be less than 3000 psi (20,684 kn/m²).

- (2) The wall thickness cannot be less than:

At a depth less than 16 feet (4.9 m)	6 inches (15 cm)
At a depth greater than 16 feet (4.9 m)	8 inches (20 cm)

- (3) The manhole shall be waterproofed on the exterior with a minimum cement plaster coating one (1) inch (2.5 cm) thick or with a minimum plaster coating one-half (1/2) inch (1.25 cm) thick in conjunction with one coating of a bituminous or similar material waterproofing compound.

(f) Cast-In-Place Concrete Manholes

- (1) Materials for concrete used for cast-in-place concrete manholes shall conform, as a minimum, to the following current specifications:

Portland Cement	ASTM C 150
Aggregate for Mortar	ASTM C 144
Fine and Coarse Aggregate	ASTM C 33

Water: Clean and free from deleterious substances. Total water content of the concrete shall not exceed 6.5 gallons of water per 100 pounds (54.21/100 kg) of cement in the mix.

(2) The wall thickness cannot be less than:

At a depth less than 12 feet (3.7 m)	6 inches (15 cm)
At a depth greater than 12 feet (3.7 m)	8 inches (20 cm)

Shell thickness uniformity shall be obtained through the use of spacers located at the top and bottom of the manhole. For deep manholes, spacers located at a depth of one-half the manhole depth should also be utilized.

(3) The manhole base shall be constructed as required except for the following:

The base shall be poured monolithically with the rest of the manhole. The base shall have a minimum thickness including the area under the pipe as follows:

0 ft. to 8 ft. (0 - 2.4 m) manhole heights	8 inches (20 cm)
8 ft. to 12 ft. (2.4 - 3.7 m) manhole heights	10 inches (25 cm)
12 ft. (3.7 M) and above manhole heights	12 inches (30 cm)

CONNECTIONS TO EXISTING SEWERS AND APPURTENANCES

All connections between new and existing sewers or appurtenances shall be made in accordance with the detailed drawings or as directed by the engineer, and the cost of such connections shall be included in the price bid for sewers complete. The contractor shall use every precaution to keep earth and other foreign matter out of the existing sewer or appurtenances and shall, if so ordered by the engineer, clean the sewer or appurtenances in the immediate vicinity of the connection. If for any reason it becomes necessary for the contractor to obstruct the existing sewer, he shall, at his own expense, provide a method suitable to the engineer of diverting the sewage.

Y-Branched - Risers - Service Lines

Four (4) inch Y-branches shall only be placed under the following conditions:

- 1) When the sewer main or the service line is or will be under a paved street, a ductile iron service line is also required.
- 2) When the depth of the sewer from flow line to ground line is 10-feet or more, a riser shall be installed to a point approximately 5 feet below ground line.
- 3) As directed by the City Engineer, each Y-branch shall be laid with branch inclined up at an angle of forty-five (45°) degrees with the horizontal.

Clay Y-branches shall be the gasketed type and encased in concrete. ABS Truss Y-branches shall be the saddle cut-in solvent cement type.

PVC Y-branches shall be the in-line gasketed type. All risers shall be schedule 40 PVC, clay or cast iron.

All service line under paved street shall be 4" Class 50 Ductile iron pipe manufactured in accordance with AWWA C 151-76 (ANSI A21.51).

The end of each riser or service line shall be capped and marked with a length of 1/4" polyethylene rope with one end duct taped at the cap and other end staked on the side of the ditch 6" to 12" below ground line.