

**NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE SPECIFICATION**

IRRIGATION PIPELINE

(FT)

CODE 430-S

STEEL PIPE (Buried, On-Ground, or Above-Ground)

GENERAL

The work shall consist of furnishing and installing steel pipe, along with the necessary fittings and appurtenances, as specified using NRCS National Engineering Handbook (NEH) Part 636, Chapter 52, Structural Design of Flexible Conduits, the NRCS Conservation Practice Standard, Irrigation Pipeline Code 430 to the lines and grades shown on the drawings and/or as staked in the field. Details of construction shown in the design drawings shall be considered as part of this specification.

RECEIVING AND HANDLING

The pipe shall not be handled in a manner to cause damage to the pipe and its coating. If the pipe is supported, as for welding, supports shall be sufficient width and number, and padded if necessary, to prevent damage to the coating. The pipe shall not be rolled or dragged on the ground. The contractor shall furnish equipment such as canvas slings or padded cables as necessary to handle and place the pipe without damaging the pipe or coating. Individual joints of pipe shall be inspected and any damaged pipe, including coatings, shall be removed and repaired or replaced.

Coated pipe shall be handled so as to prevent abrasion of the coating during transportation and handling and during placement and backfilling of the pipeline. No pipe shall be dropped from cars or trucks or allowed to roll down skids without proper restraining ropes. Each section of pipe shall be delivered in the field as near as practicable to the place where it is to be installed. When stockpiled it shall be neatly piled and blocked with strips between tiers.

MATERIALS

Pipe. Pipe shall equal or exceed the requirements of the applicable specification for the kind of pipe and the type, weight, grade, and finish specified:

- ASTM A 53, Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
- ASTM A 134, Pipe, Steel, Electric-Fusion (Arc)-Welded (Sizes NPS 16 and Over).
- ASTM A 135, Electric-Resistance-Welded Steel Pipe.
- ASTM A 139, Electric-Fusion (Arc)-Welded Steel Pipe (NPS 4 and Over).
- AWWA designation C-200, Steel Water Pipe – 6 In. (150 mm) and Larger.

Fittings, Joints, and Connections. Fittings shall conform to the requirements of the applicable specification for the types and kinds specified:

- ASTM A 858, Heat-Treated Carbon Steel Fittings for Low-Temperature and Corrosive Service.
- ASTM A 865, Threaded Couplings, Steel, Black or Zinc-Coated (Galvanized) Welded or Seamless, for Use in Steel Pipe Joints.

Unless otherwise specified on the drawings, fittings made of steel or other materials susceptible to corrosion shall be protected. At a minimum, fittings shall have equal or better corrosion protection than the pipe itself.

IRRIGATION PIPELINE (430-S)-2 Statewide

Valves and Appurtenances. Pipeline valves and appurtenances shall be of the size, type, material, and pressure rating shown on the drawings. If not shown on the drawings, pressure rating shall equal or exceed that of the pipe. All valves (including control valves, pressure relief valves, air valves, etc.) shall be installed at the locations shown on the drawings and shall be installed in accordance with the manufacturer's recommendations or as shown on the drawings. Butterfly valves shall be equipped with geared operators, unless otherwise shown on the drawings.

Pressure relief valves shall be stamped with the pressure at which the valve starts to open. Adjustable valves shall be sealed or otherwise altered to insure that the setting marked on the valve is not changed.

Interior Linings. When an interior pipe lining is specified, the lining shall meet the requirements of one of the following:

- AWWA C203, Coal-Tar Protective Coatings and Linings for Steel Water Pipelines – Enamel and Tape – Hot Applied. The interior of the pipe shall be coated with a coal-tar primer followed by a hot coat of coal-tar enamel.
- AWWA C205, Cement-Mortar Protective Lining and Coating for Steel Water Pipe – 4 In. (100 mm) and Larger – Shop Applied.
- AWWA C210, Liquid-Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines.
- AWWA C213, Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines.

Exterior Coatings. Exterior pipe coatings shall be Class A, Class B, or paint as specified for the job.

Class A Coatings. When a Class A coating is required, the coating shall meet the requirements of one of the following, as specified:

- AWWA C203, Coal-Tar Protective Coatings and Linings for Steel Water Pipelines – Enamel and Tape – Hot Applied. The outside of the pipe shall be coated with a coal-tar primer followed by a hot coat of coal-tar enamel into which shall be bonded an asbestos felt or other specified outerwrap and finished with kraft paper or one coat of water-resistant whitewash.
- AWWA C214, Tape Coating Systems for the Exterior of Steel Water Pipelines. Tape coating systems shall have a minimum nominal total system thickness of 80 mils.

Class B Coatings. When a Class B coating is required, the coating shall meet the requirements of one of the following, as specified:

- AWWA C203, Coal-Tar Protective Coatings and Linings for Steel Water Pipelines – Enamel and Tape – Hot Applied. The outside of the pipe shall be coated with a coal-tar primer followed by a hot coat of coal-tar enamel and finished with kraft paper or one coat of water-resistant whitewash.
- AWWA C209, Cold-Applied tape Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipelines.
- AWWA C210, Liquid Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines.
- AWWA C213, Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines.
- AWWA C214, Tape Coating Systems for the Exterior of Steel Water Pipelines. Tape coating systems shall have a minimum nominal total system thickness of 50 mils.

Paint. Unless otherwise specified, all above-ground and on-ground pipelines shall be painted as follows.

All grease and oil shall be removed from the pipe surface by steam cleaning or by solvent cleaning and all dirt, surface rust, and loose scale shall be removed by means of wire brushing, flame cleaning, use of rotary abrading tools, or by light sandblasting.

The cleaned steel pipe shall be painted with one coat of urethane primer at 2 to 3 mils dry-film thickness and two or more coats of gloss or semi-gloss alkyd enamel at a rate of 2 to 3 mils dry-film thickness per coat to provide a minimum total dry-film thickness of 6 mils.

Anodes. Zinc anodes shall meet or exceed the requirements specified in ASTM B418, Cast and Wrought Galvanic Zinc Anodes.

Magnesium anodes shall be either "standard" or "high" potential, as specified, and shall conform to the requirements of ASTM B843, Magnesium Alloy Anodes for Cathodic Protection.

Each anode shall have a full length core with a single strand of insulated copper wire solidly attached to it. The wire shall be No. 12 AWG or larger with THHN insulation or approved equal. If a header wire is used, the gauge of the wire must be adequate to carry the design current with no more than a 20 millivolt I-R drop.

All anodes shall be commercially packaged and the packaged backfill mix shall be of the following proportions by weight:

- Zinc – 20 to 30% Bentonite, 70 to 80% Gypsum
- Magnesium – 20 to 25% Bentonite, 70 to 75% Gypsum, 5% Sodium Sulfate

INSTALLATION

Buried Pipelines

Depth of Cover. Unless otherwise shown on the drawings, the minimum depth of cover over top of the pipe shall be:

<u>Pipe Diameter (inches)</u>	<u>Depth of Cover (inches)</u>
½ through 2½	18
3 through 5	24
6 or more	30

At low places on the ground surface or at locations where it is shallow to rock, extra fill may be placed over the pipeline to provide the minimum depth of cover. In such cases, the top width of the fill shall be no less than 10 feet and the side slopes no steeper than 6 horizontal to 1 vertical.

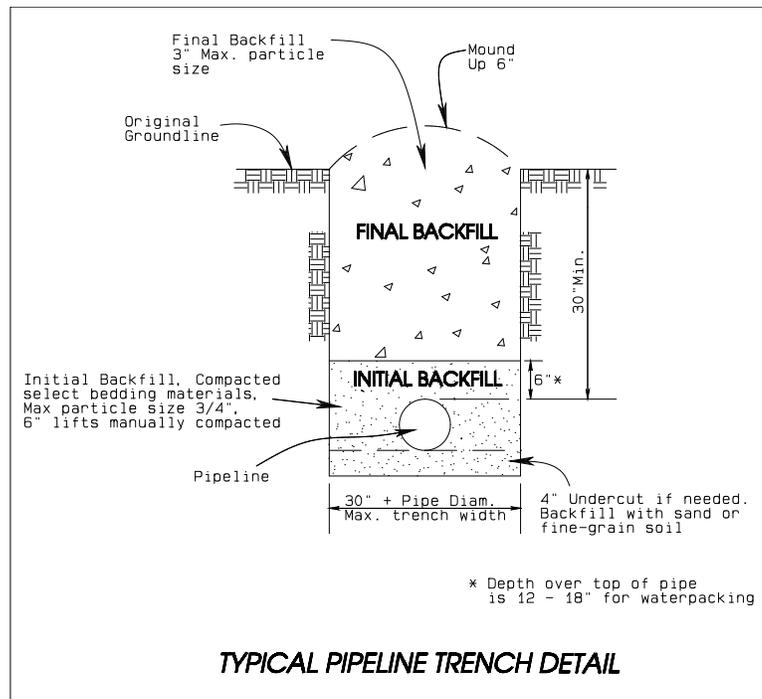
Trench Construction. Pipe trench excavations shall be to the lines and grades shown on the drawings or as laid out in the field, if not otherwise specified. Vertical alignment shall be uniform and graded such as to maintain the cover requirements, unless otherwise noted on the drawings. If irregular grades are required, thrust blocks, air valves, drains, and other appurtenances shall be installed as needed. Trench walls shall be sloped or shored as necessary to insure safe working conditions in accordance with OSHA regulations. Where trench shoring is used, its use shall not disturb the pipe location, jointing, or backfill.

IRRIGATION PIPELINE (430-S)-4 Statewide

Trench width at any point below the top of the pipe shall only be wide enough to permit the pipe to be easily placed and joined and to allow the initial backfill material to be uniformly placed under the haunches and along the sides of the pipe. The minimum trench width shall be as shown in Figure 1. The maximum trench width shall be 30 inches greater than the diameter of the pipe (i.e., the maximum clearance between the pipe and trench wall shall be 15 inches).

The trench bottom shall be uniform so that the pipe lies on the bottom without bridging. Clods, rocks, and uneven spots that can damage the pipe or cause uneven support shall be removed. Where rock, hardpan, cobbles, or other hard material that can damage the pipe are encountered in the bottom of the trench, the trench shall be undercut a minimum of 4 inches below the final grade and filled back to grade with bedding material consisting of sand or compacted fine-grained soils.

Figure 1. Trench detail.



Laying and Bedding the Pipe. Steel pipe conduits, complete with fittings and other related appurtenances, shall be installed to the lines and grades shown on the drawings. The pipe shall be firmly and uniformly bedded throughout its entire length, to the depth and in the manner specified on the drawings. Bedding material, if necessary, shall be placed and spread in uniform layers and in such a manner as to fill the floor of the trench so there are no unfilled spaces (air pockets) below the pipe. Holes shall be dug in the bedding at belled couplings and other fittings to permit the body of the pipe to be in contact with the bedding along its entire length. Blocking or mounding beneath the pipe shall not be used to bring the pipe to the final grade.

The pipe and the couplings shall be free of foreign material when assembled. At the termination of pipe laying, the open end(s) of the pipeline shall be closed off by a suitable cover or plug until laying operations are resumed.

Joints and Connections. All joints and connections shall be constructed to withstand the maximum working pressure of the pipeline without leakage and shall leave the inside of the pipeline free of any obstruction which could reduce its capacity below design requirements.

All fittings, such as couplers, reducers, bends, and tees shall be made of material that is recommended for use with the type of pipe specified and shall be installed in accordance with the recommendations of the pipe and fitting manufacturer.

On buried pipelines, high resistance joints between pipe lengths shall be electrically bridged with a welded, brazed, or soldered copper wire not smaller than 4/0 gauge in size. When coated pipe is field welded, special care shall be taken to avoid burning the protective coating. After the joints have been welded, they shall be covered with a coating equal in quality to that specified for the pipe. Dielectric connections shall be placed as shown on the drawings.

Cathodic Protection. When specified, buried steel pipelines will be protected with sacrificial galvanic anodes to supplement the protection provided by the pipe coating. The anodes shall be of the kind, size, and number as specified for the job or as shown on the drawings.

Anodes shall be placed as shown on the drawings. Anodes may be placed either horizontally or vertically. When placed horizontally, they shall be at or below the bottom elevation of the pipeline. Vertically placed anodes shall have a minimum distance of 3 feet between the ground surface and the top of the anode. Anodes shall not be placed in fill areas, and magnesium anodes must be placed a minimum distance of 10 feet from the pipeline.

Packaged anodes shall be bedded and covered with a minimum 6-inch thickness of moist fine clay, clay loam, silt, or silt loam soil materials. The packaged anodes and the fine textured soil used for bedding and covering shall be thoroughly wetted.

The lead wire from the anode, or the header wire for multiple anode installations, shall be attached to the pipeline by cadwelding, thermowelding, or other process of equal result. The area of damaged pipe coating and the weld shall then be covered with a protective coating equal in quality to the specified original pipe coating.

Anode testing station facilities shall be located and installed as specified for the job and/or as shown on the drawings. Wires at test stations shall be attached to the pipe as specified for the anode lead or header wires.

Thrust Blocks. Thrust blocks shall be placed at the locations shown on the drawings. They shall be constructed of concrete and shall be formed against a solid trench wall. The space between the pipe and the trench wall shall be filled with concrete to a minimum of the height of the outside diameter of the pipe unless otherwise shown on the drawings.

Backfill.

Initial Backfill. Water packing shall be used when possible to consolidate the initial backfill around the pipe. The initial backfill, before wetting, shall be of sufficient depth to insure complete coverage of the pipe after consolidation occurs. Water packing is accomplished by adding enough water to diked reaches of the trench to saturate the initial backfill thoroughly without excessive pooling. After the initial fill is saturated, the pipeline shall remain full until after final back filling. The water packed backfill shall be allowed to dry until firm enough to walk on before final backfill is begun.

If conditions do not permit water packing, the initial backfill shall be placed in layers and compacted around and above the pipe by hand or mechanical methods to the soil density required to provide adequate lateral support to the pipe. Compaction by hand or by hand-directed mechanical means shall be accomplished in lifts not to exceed 6 inches for all pipe sizes. The initial backfill shall be compacted firmly and evenly around and above the pipe as required to provide adequate lateral support to the pipe. The pipe shall not be displaced, deformed, or damaged by the backfilling operation.

IRRIGATION PIPELINE (430-S)-6 Statewide

The backfill shall be soil or granular material that is free from rocks, gravel, and frozen material larger than 1 inch or earth clods greater than 2 inches in diameter and shall be installed to an elevation no less than 6 inches above the top of the pipe.

The degree of compaction for all pipe sizes shall be such that lateral deflection of the pipe sidewalls will be minimal. Unless special compaction requirements are noted on the drawings, or water packing methods are used, the initial backfill material shall be compacted firmly to achieve a soil density at least equal to the density of the undisturbed side walls of the trench.

Final Backfill. Unless otherwise shown on the drawings, the final backfill material within 6 inches of the top of the pipe to the top of the trench shall be free of rocks, frozen clods or other debris larger than 3 inch in diameter. The material shall be placed and spread in approximately uniform layers so there are no unfilled spaces in the backfill. Rolling equipment or heavy tampers shall not be used to consolidate the final backfill until after the minimum depth of cover has been placed. Final backfill may be mounded over the top of the trench above ground level, but in no case shall the final backfill be lower than the natural ground along the top of the trench.

All special backfilling requirements of the pipe manufacturer shall be met.

Above-Ground Pipelines

Concrete, timber, or other pipe supports, and anchor and thrust blocks shall be constructed at the locations and to the dimensions shown on the drawings and/or as staked out in the field. Unless otherwise specified on the drawings, pipe shall be supported a minimum of one foot above the ground. Saddles shall be shaped to firmly support the pipe throughout the full arc of contact. At least two layers of felt strips shall be placed between the pipe and its support. The felt shall cover the entire area of contact between the pipe and the saddle. A graphite lubricant shall be placed between the felt strips before the pipe is placed in the saddle. Treated wood shall be used for timber supports. Pipe shall not come in direct contact with pressure-treated wood and a water resistant barrier (such as, ice and water shield, roofing felt, or polymer tape) shall be placed between the pipe and the wood.

Unless otherwise shown on the drawings, above-ground welded joint pipelines shall have expansion couplers installed at a spacing not to exceed 400 feet. The maximum distance between a coupler and a fixed or anchored location shall be 200 feet. Expansion couplers shall provide for a minimum of 4 inches of travel distance.

On-Ground Pipelines

Pipe shall be laid to the lines and grades shown on the drawings and/or as staked in the field and shall be placed so that it is protected from the hazards imposed by traffic crossings, farm operations, or other hazards. The ground shall be shaped so as to provide continuous support needed. If there are rocks or objects that might damage the pipe coating, sand or soil shall be used as a base for the pipe.

Concrete, timber, or other anchors and thrust blocks shall be constructed at the locations and to the dimensions shown on the drawings or as staked in the field, or both. Treated wood shall be used for timber supports. Pipe shall not come in direct contact with pressure-treated wood and a water resistant barrier (such as, ice and water shield, roofing felt, or polymer tape) shall be placed between the pipe and the wood.

Expansion coupler requirements for welded joint pipelines shall be the same as for above-ground pipelines.

TESTING

The pipeline shall be tested for pressure strength, leakage, and proper functioning. When water is available at the time the pipeline is installed, the system shall be tested at that time. Underground pipelines shall be tested before placing backfill over the field joints. When water is not available to complete a test, the installer shall provide a guarantee stating that they will return and fix any leaks or other problems that are found when the pipe is initially filled with water and operated. Above-ground and on-ground pipelines may be tested anytime they are ready for operation.

Prior to testing, the pipeline shall be flushed and cleaned. Partial backfills needed to hold buried pipe in place during testing shall be placed as specified in "Initial Backfill" and only the body of the pipe shall be covered, leaving the joints and connections uncovered for inspection.

For the test, the pipeline shall be filled with water, taking care to safely release any air in the pipeline and prevent water hammer. When the line is full, all valves shall be closed and the line shall be brought up to full design working pressure. All joints and valves shall then be carefully inspected for leakage and any visible leaks shall be repaired. The system shall then be re-tested.

It shall be demonstrated by testing that all valves, vents, surge chambers, and other appurtenances function properly when the pipeline is operated at design capacity. At or below design capacity there shall be no objectionable flow conditions such as water hammer, continuing unsteady delivery of water, damage to the pipeline, or detrimental discharge from control valves. Defective appurtenances shall be repaired or replaced.

BASIS OF ACCEPTANCE

The acceptability of the pipeline installation shall be determined by inspections by NRCS or Contractor certification to verify compliance with all the provisions of this specification with respect to the drawings, pipe materials, pipe markings, the appurtenances, and the minimum installation and testing requirements.

The installing contractor shall certify that his installation complies with the requirements of the specification. And the certification will identify the manufacturer and markings of the pipe used.