

TRENCH BEDDING & BACKFILL SPECIFICATIONS

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2.0 PURPOSE

This specification provides the requirements and standards for bedding of pipes and conduits, and for trench backfill materials and construction procedures, including testing and inspection.

3.0 GENERAL

3.1 Standard Test Methods:

The following standard test methods of the American Society for Testing and Materials (ASTM) form a part of this specification and are referred to herein by alphanumeric designation.

<u>ASTM DESIGNATION</u>	<u>TITLE</u>
C136	Sieve Analysis of Fine and Coarse Aggregates
D423	Liquid Limit of Soils
D424	Plastic Limit and Plasticity Index of Soils
D1556	Density and Unit Weight of Soil in Place by the Sand-Cone Method
D1557	Moisture-Density Relations of Soils Using 10-lb. (4.5-kg.) Rammer and 18-in. (457-mm.) Drop
D2419	Sand Equivalent Value of Soils and Fine Aggregate
D2844	Resistant R-Value and Expansion Pressure of Compacted Soils
D2922	Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

3.2 Substitute Test Method:

Where local practice prescribes revised test methods for the ASTM tests listed above, those tests may be substituted for the ASTM designated test method listed upon prior approval from NVE.

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3.3 Material Sources:

3.3.1 New Sources - The contractor or customer, at his own expense, shall have any bedding and backfill materials from sources previously undeveloped or unfamiliar to NVE, tested and certified by an approved, independent materials testing laboratory, per these specifications.

3.3.2 Existing Sources - Bedding and backfill materials from sources previously developed and familiar to NVE may be accepted without testing and certification upon written request by the contractor or customer. NVE reserves the right to determine the acceptability of all materials proposed for use.

4.0 MATERIALS

4.1 Electric Conduit Sand Bedding:

Material shall be free of ice, clay, organic matter or other objectionable material, and shall conform to the following standards:

4.1.1 Gradation per ASTM C136:

<u>SIEVE SIZE</u>	<u>PERCENT BY WEIGHT PASSING SIEVE</u>
3/8"	100
#4	90-100
#50	10-40
#100	3-15
#200	0-7

4.1.2 Alternate Electric Conduit Bedding: Upon prior approval from NVE, native material may be utilized as bedding for electric conduit. Approval granted per this section in no way relieves the contractor or customer from meeting the requirements of the remaining sections of this specification.

For NVE electric contract jobs, native material conforming to this section must be bid as an alternate material. The native material shall be free of rocks, ice, organic matter or other objectionable material, and shall conform to the following standards:

Electric Primary/Secondary Conduit - 100% by weight shall pass 3/8" sieve.

Electric Service Conduit - Native material shall be free of rocks/clods larger than 4" across their greatest dimension.

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4.2 Gas Pipe Sand Bedding:

Material shall be free of ice, clay, organic matter or other objectionable material, and shall conform to the following standards:

4.2.1 Gradation per ASTM C136:

<u>SIEVE SIZE</u>	<u>PERCENT BY WEIGHT PASSING SIEVE</u>
3/8"	100
#4	90-100
#50	10-40
#100	3-20
#200	0-15

4.2.2 Sand Equivalent per ASTM D2419: 25 minimum.

4.2.3 Plasticity Index per ASTM D4318: Non Plastic.

4.2.4 Moisture - Density per ASTM D1557: Maximum +2% of optimum, Minimum -5% of optimum.

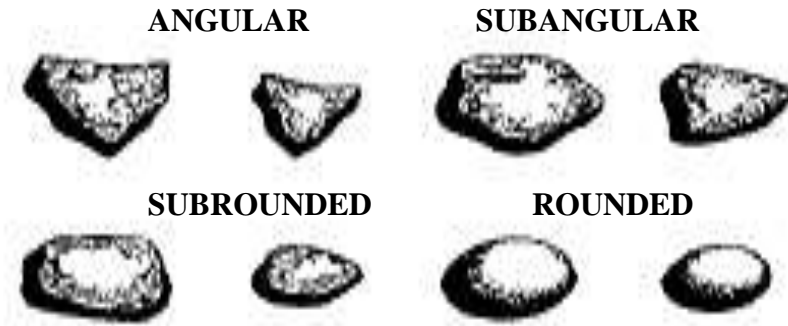
4.2.5 Any gas pipe sand bedding material retained on a #4 sieve, shall not contain angular material as described in ASTM D2488. Gas pipe sand bedding material which contains subangular, subrounded or rounded material, and conforms to Sections 4.2.1 and 4.2.2 is acceptable.

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CRITERIA FOR DESCRIBING ANGULARITY:

Angular Particles - Have sharp edges and relatively plane sides with unpolished surfaces. Examples include particles which resemble arrowheads.

Subangular Particles - Are similar to angular description but have rounded edges.



Subrounded Particles - Have nearly plane sides but have well-rounded corners and edges.

Rounded Particles - Have smoothly curved sides and no edges.

4.3 Type II Class B Aggregate Base, Road base:

Type II shall be a crusher-run, mineral aggregate free of ice, clay, organic matter, or other objectionable material, and shall conform to the following standards:

4.3.1 Gradation per ASTM C136:

<u>SIEVE SIZE</u>	<u>PERCENT BY WEIGHT PASSING SIEVE</u>
1"	100
3/4"	90-100
#4	35-65
#16	15-40
#200	2-10

4.3.2 Liquid Limit per ASTM D423: 35 maximum

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4.3.3 Plasticity Index per ASTM D424: Maximum Allowable Plasticity Index (PI) shall be determined by the formula: $PI = 15 - (S \times 100)$ where “S” is the percent by weight passing the # 200 sieve.

4.3.4 Resistance R-Value per ASTM D2844: 70 minimum

4.4 Class C Backfill, 3/4" minus clean drain rock:

Class C backfill shall be free of any organic impurities, clay lumps, or unstable substances. The material shall be graded from 3/4" to 3/8" conforming to the following gradation:

4.4.1 Gradation per ASTM C136:

<u>SIEVE SIZE</u>	<u>PERCENT BY WEIGHT PASSING SIEVE</u>
1"	100
3/4"	90-100
3/8"	10-55
#4 **	0-10

** 5% of pan material will be allowed

4.4.2 Liquid Limit per ASTM D423: 35 maximum

4.4.3 Plasticity Index per ASTM D424: Maximum Allowable Plasticity Index (PI) shall be determined by the formula: $PI = 15 - (S \times 100)$ where: “S” is the percent by weight passing the # 200 sieve.


4.4.4 Resistance R-Value per ASTM D2844: 70 minimum

4.5 Native Backfill:

Native backfill shall be excavated native granular material free of ice, clay, debris, organic matter, and rocks larger than 4" across their greatest dimension.

4.6 Substitute Material:

Substitute bedding and backfill materials may only be used if prior written approval from NVE is received. In requesting the use of a substitute material, the contractor or customer must submit adequate evidence that the material has been successfully used in similar applications for other utilities or local governmental agencies.

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5.0 CONSTRUCTION

5.1 Trench Configuration:

Trench configurations shall conform to NVE Trench Excavation Standards, TE0001U and TE0003U.

5.2 Material Installation/Repair:

Conduits, pipes, and all apparatus shall be handled, installed, and joined in accordance with NVE’s construction standards, and the manufacturer’s specifications or recommendations. The contractor or customer, at his own expense, shall repair or replace any conduits, pipes or appurtenances damaged during bedding and backfill operations.

5.3 Sand Bedding:

Sand bedding material, conforming to Sections 4.1 and 4.2, shall be placed in 12" maximum loose lifts and compacted to 90% maximum density per ASTM D1557.

5.4 Backfill:

5.4.1 **Public Rights-of-Way-** Trenches in established streets, highways, or private paved areas subject to vehicular traffic, shall be backfilled with Type II material, conforming to Section 4.3, and shall be placed in 12" maximum loose lifts and compacted per ASTM D1557. The top two lifts shall be compacted to 95% maximum density and shall extend a minimum of 12" below finish grade. The area above the sand bedding and below 12" from finish grade shall be compacted to 90% maximum density. Developers or the engineer of record are responsible for required compaction tests.

5.4.2 **Private Property-** Trenches on private property and areas not subject to vehicular traffic may be backfilled with native material, conforming to Section 4.4 and shall be placed in 12" maximum loose lifts and compacted to 80% maximum density per ASTM D1557.

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5.4.3 **Utility Easements-** Trenches in utility easements which shall be overlain with vaults, transformers, or similar equipment shall be backfilled in accordance with Section 5.4. Boxes shall be backfilled in accordance to 4.4.

5.5 Compaction:

All compaction shall be by hand-operated, plate-type, vibratory, or other suitable hand-tampers in areas not accessible to larger rollers or compactors. Extreme care shall be taken to avoid damage to conduits, pipes, and any appurtenances. Water densification by inundation or jetting shall not be permitted without prior written approval from NVE.

5.6 Trench Dewatering:

Where groundwater is encountered, the contractor or customer shall dewater the trench sufficiently to meet the bedding and backfill requirements of Sections 5.3 and 5.4. Dewatering shall continue until backfill has progressed to a minimum of two feet above the groundwater level. NVE's inspector(s) may require drain rock (3/4" minus) in addition to the sand bedding depending on condition of trench bed.

5.7 Finish Operations:

5.7.1 Fine Grading - After backfilling, all trenches except those in existing paved areas shall be graded flush with adjacent finish or subgrade elevations.

5.7.2 Temporary Patching - Unless otherwise specified, all pavement cuts shall be temporarily patched with asphaltic concrete to a minimum depth of 2", with the finish grade 1/2" above the grade of the existing asphalt.

5.7.3 Disposition of Excess Materials - Surplus excavated soils, asphalt pavement, concrete and other debris shall be promptly removed from the jobsite and properly disposed of.

6.0 FIELD SAMPLING AND TESTING

6.1 Materials Testing:

The contractor or customer, at his own expense, shall retain the services of an approved, independent materials testing laboratory to perform the following tests:

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6.1.1 Moisture-Density Relations - The sand bedding, crushed gravel, and native backfill materials shall be tested for moisture density relations per ASTM D1557, Method D. Test locations will be randomly selected by NVE.

6.1.2 Density Tests - The sand bedding, crushed gravel, and native backfill materials shall be tested for density per ASTM D1556 or D2922. Test locations will be randomly selected by NVE. The following frequencies shall apply:

Sand Bedding - Tests shall be made at a minimum of one test per lift per 800 lineal feet of trench.

TYPE II Backfill - Tests shall be made at a minimum of one test per lift per 500 lineal feet of trench.

6.1.3 Tests will be reported by specific location: Example: T-pad 1: sand bedding test @ 3' from finish grade.

6.2 Retesting:

If any test conducted per Sections 6.1.1 and 6.1.2 fails, the area shall be recompacted and two additional tests shall be performed. Test locations will be randomly selected by NVE at installer cost.

6.3 Reporting:

The results of all tests shall be submitted to NVE within 24 hours after the completion of the test.

6.4 Exceptions:

At remote locations or for small installations, as determined by NVE, the sampling and testing procedures in Section 6.0 may be waived by NVE. Such waiver in no way relieves the contractor or customer from meeting the requirements of the remaining sections of this specification.

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