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NGS Three Dimensional Rod Monument Installation Instructions

GEOMETRIC GEODETIC ACCURACY STANDARDS
AND
SPECIFICATIONS FOR USING GPS RELATIVE POSITIONING TECHNIQUES
FEDERAL GEODETIC CONTROL COMMITTEE
VERSION 5.0: May 11, 1988

APPENDIX H. - SPECIFICATIONS AND SETTING PROCEDURES FOR THREE DIMENSIONAL MONUMENTATION

A. MATERIALS REQUIRED FOR SETTING MONUMENT:
1. Rod, stainless steel, 4-foot (1220 mm) sections [SS91604]
2. Rod, stainless steel, one 4 inch (100 mm) [M1DPA]
3. Studs (threads), stainless steel [M13 thread]
4. Datum point, stainless steel [SSDP1]
5. Spiral (fluted) rod entry point, standard [SS-12 Point]
6. NGS logo caps, standard, aluminum [BMAC-1, -5, -6]
7. Pipe, schedule 40 PVC, 5 (or 6) inches (127 mm or 152 mm) inside diameter, 2-foot (610 mm) length [5PVC24] [6PVC24]
8. Pipe, schedule 40 PVC, 1 inch (25 mm) inside diameter, 3-foot (915 mm) length [TSS3]
9. Caps, schedule 50 PVC, (Slip-on caps centered and drilled to 0.567 inch [14 mm] ±0.002 [.05mm]) [TSSEC-Y]
10. Cement, for making concrete
11. Cement, PVC solvent [Eclectic® UV-6800]
12. Loctite (2 oz. bottle)
13. Grease-MIL SPEC G-10924D (B15395A, Grade 7) [Bel-Ray NO TOX AA-1-1]
14. Fine-grained washed or play sand
15. Grease Gun
16. * (Vise grips or pipe wrench (2) to tighten each rod section together)

B. SETTING PROCEDURES:
1. The time required to set an average mark using the following procedures is 1 to 2 hours.

2. Using the solvent cement [Eclectic UV-6800] formulated specifically for PVC, glue the aluminum logo cap [BMAC] to a 2-foot (610 mm) section of PVC pipe [5PVC24]. This will allow the glue to set while continuing with the following setting procedures.

3. Glue the PVC cap with a drill hole [TSSEC-Y] on one end of the 3-foot (915 mm) section of schedule 40 PVC pipe 1-inch (25 mm) inside diameter [TSS3]. Pump the PVC pipe full of grease. Thoroughly clean the open end of the pipe with a solvent which will remove grease. Then glue another cap with drill hole on the remaining open end. Set aside while continuing with the next step. *(*NOTE: This step can also be done in advance, prior to going into the field.)*

4. ***IMPORTANT:*** **Use proper eye and ear protection!** Using a power auger or post hole digger, drill or dig a hole in the ground 12 - 14 inches (300 mm - 350 mm) in diameter and 3-1/2 feet (1100 mm) deep.
5. Attach the standard spiral (fluted) rod entry point [SS-12 point] to one end of the 4-foot (1220 mm) section of stainless steel rod [SS-916-04] with the standard 3/8 inch (10 mm) stud [M-13 thread]. On the opposite end screw on a short 4 inch (100 mm) piece of rod [M-1 DPA] which will be used as the impact point for driving the rod. Drive this section of rod with a reciprocating driver such as a *Pionjar 120, Cobra 148, Wacker BHB 25* or another machine with an equivalent driving force.

6. Remove the short piece of rod used for driving [M-1-DPA] and screw in a new stud [M-13 thread]. Attach another 4-foot (1220 mm) section of rod [SS-916-04]. Tighten securely *(*using vise grips or pipe wrenches)*. Reattach the short piece of rod [M-1-DPA]and drive the new section into the ground.

7. Repeat step 6 until the rod refuses to drive further or until a driving rate of 60 seconds per foot (300 mm) is achieved. The top of the rod should terminate about 3 inches (75 mm) below ground surface.
8. When the desired depth of rod is reached, cut off the top removing the tapped and threaded portion of the rod leaving the top about 3 inches (75 mm) below ground surface. The top of the rod must be shaped to a smooth rounded (hemispherical) top, using a portable grinding machine to produce a datum point. The datum point must then be center punched to provide a plumbing (centering) point. NOTE: For personnel that may not have the proper cutting or grinding equipment to produce the datum point, the following alternative procedure should be used if absolutely necessary. When the desired depth of the rod is obtained (an even 4-foot [1220 mm] section), thoroughly clean the thread with a solvent to remove any possible remains of grease or oil that may have been used when the rod was tapped. Coat the threads of the datum point with Loctite and screw the datum point into the rod. Tighten the point firmly with vise grips to make sure it is secure. The datum point is a stainless steel 3/8 inch (10 mm) bolt [SSDP-1] with the head precisely machined to 9/16 inch (14 mm).

9. Insert the grease filled 3-foot (915 mm) section of 1-inch (25 mm) PVC pipe sleeve [TSS3] over the rod. The rod and datum point should protrude through the sleeve about 3 inches (75 mm).

10. Backfill and pack with fine-grained washed or play sand around the sleeve [TSS3] to about 20 inches (500 mm) below surface. Place the 5-inch (127 mm) PVC [5PVC24] and logo cap [BMAC] over and around the 1-inch (25 mm) sleeve [TSS3] and rod. The datum point [SSDP-1] should be about 3 inches (75 mm) below the cover of the logo cap.

11. Place concrete around the outside of the 5-inch (127 mm) PVC [5PVC24] and logo cap [BMAC], up to the top of logo cover. Trowel the concrete until a smooth neat finish is produced.

12. Continue to backfill and pack with sand inside the 5-inch (127 mm) PVC [5PVC24] and around the outside of the 1-inch (25 mm) sleeve [TSS3] and rod to about 1 inch (25 mm) below the top of the sleeve.

13. Remove all debris and excess dirt to leave area in original condition. Make sure all excess grease is removed and the datum point [SSDP-1] is clean.
[SS-916-04] = Berntsen model number of material specified.
These instructions have been taken from ***GEOMETRIC GEODETIC ACCURACY STANDARDS AND SPECIFICATIONS FOR USING GPS RELATIVE POSITIONING TECHNIQUES (pages 46-48) -- Federal Geodetic Control Committee (Rear Admiral Wesley V. Hull, Chairman) -- Version 5.0: May 11, 1988; Reprinted with corrections: January 5, 2000.***

Note: These are to be used only as a guideline for geodetic surveys using GPS relative positioning techniques. **items in italics are added procedures recommended by Berntsen International.*

REMEMBER: "Any Monument Is Only As Stable As Its Backfill".

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