

COUNTY OF MONROE

GEODETIC MONUMENT INSTALLATION REQUIREMENTS MULTIPLE MONUMENT SEQUENCE

The geodetic monument shall be a Berntsen Top Security Rod Monument with Access Cover, constructed as described below in the Berntsen Monument Installation Instructions, at locations as directed by the County Surveyor. The survey marker cap shall be inscribed in accordance with County of Monroe standard detail specifications. The name or numbering required on the monuments is to be coordinated with the County Surveyor.

The monument access cover shall be a Berntsen BMAC-5 Access Cover, installed in accordance with County of Monroe standard sheet specifications and as described below in the Berntsen Monument Installation Instructions. Monument access cover shall be set centered over the survey monument, placed true to line and grade, make full and even bearing on the underlying surface, and are to be non-rocking when in place. The monument access cover shall be set flush with the finished grade.

The series of geodetic monuments shall be set in an intervisible sequence wherever possible.

The County of Monroe requires this work to be performed by, or under the direction of and certified by a Professional Land Surveyor who is licensed and registered to practice in New York State.

MANUFACTURER MONUMENT INSTALLATION INSTRUCTIONS

Berntsen Top Security™ 3-D Rod Monument Installation Instructions

MONUMENT INSTALLATION INSTRUCTIONS **FOR TOP SECURITY™ GPS 3-DIMENSIONAL ROD MONUMENT SYSTEM**

*****CAUTION: Before beginning any monument installation, contact your local ONE-CALL Utility Location Service to verify the safety of your chosen location*****

*****IMPORTANT - Read all instructions completely and thoroughly before starting installation.*****

MATERIALS REQUIRED FOR SETTING MONUMENT:

1. Top Security™ Rod with thread
2. Aluminum rod sections with thread
3. Spiral drive point
4. Aluminum survey cap (special combination compression fit/threaded cap)
5. DISC-LOCK vibration-proof lock washers (pair)
6. BMAC Access Cover (BMAC-5 for 5" PVC pipe)
7. PVC Pipe (5", Schedule 40)
8. Steel Stamp Set (for marking information on survey cap)
9. Concrete mix
10. Water
11. Trowel
12. Eclectic® UV-6800 Adhesive
13. Caulking gun for UV-6800 Adhesive

14. Fine-grained washed or play sand
15. Installation tools
16. Reciprocating driver (*Pionjar 120, Cobra 148, or Wacker BHB 25*)
 - a) Driving Adapter (MDA with sledge hammer, PDA with reciprocating driver)
 - b) DPA Steel Drive Pin
 - c) Lubricating oil for driving adapter and stainless drive pin
 - d) Vise grip pliers (2) OR Pipe Wrench (two 6" wrenches)
 - e) Hacksaw
 - f) File
 - g) Post Hole Digger or Auger
 - h) Shovel
 - i) Work gloves and proper eye protection and clothing

INSTALLATION

1. THE TIME REQUIRED TO SET AN AVERAGE MARK USING THESE PROCEDURES IS 30 TO 45 MINUTES.
2. Using the Eclectic UV-6800 adhesive, glue BMAC Access Cover to a 24-inch long section of PVC pipe. This will allow the glue to set while continuing with the following setting procedures.
3. **IMPORTANT: Use proper eye and ear protection!** Using a post hole digger, auger, or shovel, dig or drill a hole in the ground at your site, approximately 12 inches in diameter and 36 inches deep.
4. Attach the spiral drive point to one end of the aluminum rod section with a stainless steel thread. On the opposite end of the aluminum rod attach the Stainless Steel Drive Pin (hand tighten both the drive point and the SS Drive Pin). The SS Drive Pin will be used as the impact point for the Driving Adapter in driving the rod into the ground. Drive this section of the rod with a reciprocating driver (*Pionjar 120, Cobra 148, Wacker BHB 25*). Be certain that the reciprocating driver is in the BREAKER position for driving the rod (see owner's manual for setting). Drive the rod section until the Driving Adapter is within approximately 1-inch of ground level e., with approximately 4-inches of rod showing above ground.
5. Remove Driving Adapter and Stainless Steel Drive Pin from installed rod section. Attach another section of aluminum rod. Tighten securely using DISC- LOCK washers with two pipe wrenches to rod section already installed. Attach SS Drive Pin and Driving Adapter to top of rod section and continue driving rod sections (see STEP 4) until installation of rod sections slows to the REFUSAL rate (*defined as a driving rate of more than 1 minute to drive the rod 1 foot in the ground*). **IMPORTANT NOTE: TO MEET NGS REQUIREMENTS FOR "REFUSAL" YOU MUST ONLY USE A RECIPROCATING DRIVER.** Rod should be driven completely into the ground (and 3 inches below ground level).
6. The last section of rod should now be marked for removal (so the top of the last rod section will be 3 inches below ground level) from the top of the monument assembly. Remove the rod by attaching a pipe wrench on either side of the common joint with the next lower rod section and carefully untighten the top rod from this assembly. **IF YOU WERE ABLE TO DRIVE THE LAST SECTION ROD 3 INCHES BELOW GROUND LEVEL, YOU CAN SIMPLY REPLACE THIS ROD SECTION WITH A COMPLETE TOP SECURITY ROD SECTION - GO TO STEP 9.**
7. Take the rod section you removed in STEP 6 and place it next to a Top Security™ rod section. Using a hacksaw, cut off the portion of Top Security rod section marked. When this is completed, remove approximately 3 inches of the "fins" from cut end of Top Security rod section. Recommended procedure is to use a vise grip pliers and "peel" the fins (take the vise grip pliers and peel the fins and break them off the remaining rod portion by coming down from the top of the rod and bending each fin "back and forth" until the fin is removed). This is best done in 1-inch sections.
8. Use a file to remove any burrs from cut end (and slightly BEVEL the cut end of the Top Security rod

section). GO TO STEP 10.

9. IF YOU DID NOT NEED TO CUT LAST SECTION OF ROD IN STEP 6 AND HAVE REPLACED THIS ROD WITH A TOP SECURITY ROD, you can use the Threaded Insert to attach the survey cap to the rod assembly. To do this take the SS Drive Pin, attach it to the Treaded Insert, and then drive the Threaded Insert into the socket of the survey cap. Be certain that the Threaded Insert has been driven completely into the socket. Take the completed survey cap, remove the SS Drive Pin, and using the DISC-LOCK washer (composed of two washers mated together so the beveled sides are placed together to form a "ratchet" appearance) attach the survey disk to the Top Security rod section by screwing the cap down onto the Top Security rod section. Tighten firmly and securely using a wrench. Go to STEP 11.
10. IF THE TOP SECURITY ROD SECTION NEEDS TO BE CUT, use the compression-fit survey cap (with socket) to attached to the Top Security rod. Make a mark approximately 1-inch from the top of the rod (this is where the bottom of the survey cap socket should be driven to). Taking the compression- fit cap, carefully tap the cap onto the Top Security rod using a rubber or urethane- faced hammer and driving the cap completely onto the rod until it reaches the mark on the rod. Be sure the cap is "square" on the rod.
11. Backfill and pack with fine-grained washed or play sand around rod section (sand should be filled to about 20 inches below ground level). Place the PVC pipe and BMAC Access Cover assembly over and around the rod. Tamp BMAC assembly so it is flush with the ground. The survey cap on the rod should be 3 inches below the BMAC Access Cover.
12. Prepare and place the concrete mix around the outside of the PVC pipe and around the BMAC Access Cover, up to the top of the Cover. Trowel the concrete until a smooth and neat finish is produced. Make certain that the concrete has not "seeped" into the Cover or Cover screw. Remove the Access Cover Lid from the Cover Frame and using water, rinse the frame and screw areas to insure no concrete mix residue remains in these areas.
13. Continue to backfill and pack with sand inside the PVC pipe around the rod to about 6 inches below ground level.
14. Remove all debris and excess dirt to leave area in original condition.
15. *IMPORTANT: Whenever opening the BMAC Access Cover, protect the threaded opening of the Access Cover Frame by using a piece of duct or masking tape to cover this opening, when exposed, to prevent foreign objects from falling into it. Take care in reinstalling the Access Cover Lid to prevent foreign objects from falling into the threaded opening while tightening screw of Access Cover Lid into Access Cover Frame.*

MONUMENT GPS/GNSS POSITIONING REQUIREMENTS

The County of Monroe requires this work to be performed by, or under the direction of and certified by a Professional Land Surveyor who is licensed and registered to practice in New York State.

The horizontal datum shall be NAD 83 (2011), New York State Plane Coordinate System, Western Zone and the vertical datum shall be NAVD 88.

The NAD 83 (2011) geodetic position of each monument shall be determined by employing GPS/GNSS survey techniques in combination with Conventional Theodolite or Total Station terrestrial survey (TPS) techniques. The sequence of geodetic monuments shall be directly measured between by employing Conventional Theodolite or Total Station terrestrial survey techniques, performed in accordance with the procedures specified below.

GPS/GNSS surveys shall be static surveys performed by 15 minute minimum occupations with separate observations under differing satellite configurations only on monuments that provide quality direct GPS/GNSS observation.

Conventional Theodolite or Total Station terrestrial surveys (TPS) shall be performed with either an Electronic Distance Measuring Instrument (EDM) (rated with an internal uncertainty of no more than 0.003 m and scale of no more than 2 parts-per-million (ppm)). The EDM distance measurements shall be corrected for both temperature and pressure as necessary. The angulation shall be performed with a directional theodolite or total station that has an internal least count of no more than 2 seconds. A minimum of two positions on the circle (both direct and reverse) and an EDM distance shall be taken along with each angle measurement. Any of the individual angles shall differ from the mean of all angles by no more than 5 seconds and individual distances shall differ from the mean of all distances by no more than 0.01 feet and 2 parts per million (ppm).

GEODEIC MONUMENT ORTHOMETRIC HEIGHT REQUIREMENTS

Conventional terrestrial differential leveling techniques shall be employed and shall close within $0.033 \text{ feet} \cdot \text{SQRT}(s)$ where s is equal to the length of the level run in miles.

LEAST SQUARES ADJUSTMENT OF DATA

Adjustment of the combined GPS/GNSS survey data, Conventional Theodolite or Total Station terrestrial (TPS) survey data and conventional terrestrial differential leveling data shall be completed by a single minimally constrained least squares adjustment of the combined data. From the least squares adjustment the maximum allowable Network Horizontal Positional Accuracy (at two sigma, 95% confidence level) shall not exceed 0.02 feet or a precision of 1 part in 50,000 parts (1:50,000).

GEODEIC MONUMENT POSITIONING & HEIGHT REPORTING REQUIREMENTS

The Licensed Land Surveyor shall submit copies of a certified, signed and sealed report to the Monroe County Surveyors Office for review and acceptance by the Monroe County Surveyors Office. The report shall contain the following and follow the format of an example report provided by the County Surveyors Office:

- A summary of survey field operations.

- GPS/GNSS post processing report when performed.
- GPS/GNSS OPUS Extended report when utilized.
- Angle sets report (Rounds Report, Direct-Reverse Report), record of field notes, reduction of field data and raw data file for TPS survey.
- Differential leveling summary report.
- Measurement results report comparing the horizontal distances and orthometric heights derived by GPS positioning with the direct TPS and differential leveling measurements.
- Least squares adjustment report with a final adjusted grid coordinate listing.
- Certified Monument Record Sheet.