

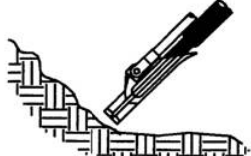





## INSTALLATION INSTRUCTIONS

### 1.0 Description

Manta Ray earth anchors are driven tipping plate soil anchors. These anchors are used with the standard power hub anchor rods (5/8" diameter for up to 16,000 lbs-force, 3/4" diameter for up to 23,000 lbs-force and 1" diameter for up to 36,000 lb-force). Deeper installations differ only by requiring additional anchor rods and more drive steel.

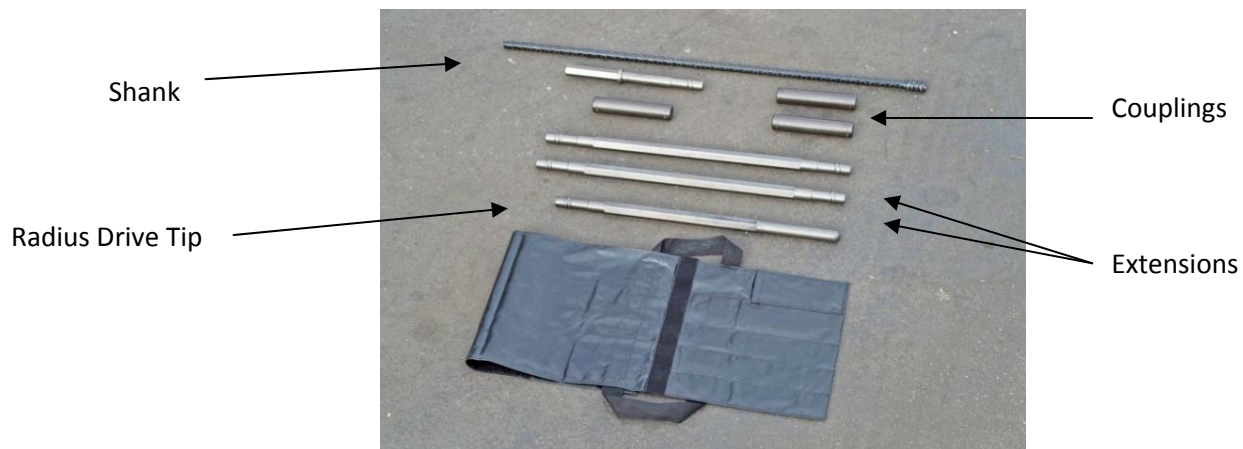
The Manta Ray anchor is designed to be driven into the ground with a 90 lb (41kg.) hydraulic jack hammer attached to a drive steel tool. After the anchor has been driven to the depth of the anchor rod, the driving tool (called drive steel) is removed. The anchor is then tipped from its edgewise-driving position to its "load locked" position. This is accomplished with a hydraulic jack called the Load Locker, and provides an immediate proof test of each anchor. The direct reading gauge on the Load Locker makes the proof test easy and fast. There is no guesswork; if the soil is too soft the installer immediately knows to install a second anchor, use a larger anchor, or install to a greater depth.

1.  THREAD ANCHOR ROD INTO MANTA RAY
2.  INSERT DRIVE STEEL INTO ANCHOR
3.  POSITION ANCHOR AT PROF LOCATION AND ANGLE
4.  DRIVE ANCHOR TO PROPER DEPTH
5.  REMOVE DRIVE STEEL
6.  USE LOAD LOCKER TO PROOF ANCHOR INTO LOAD LOCK POSITION

## 2.0 Required Tools

### 2.1 Drive steel

The drive steel (installing tool) is required and ordered from the MSI Distributor. The Manta Ray drive steel is a patented design made of high performance materials. It allows the anchor to be driven to depth in discrete increments to allow installation in tight spaces while the operators remain safely on the ground.



The SGC-14 Drive steel kit will install the drive Manta Ray anchors with one 7 ft length power hub anchor rod. Actual depth approximately 8'(2.4m) depth.

The following are the drive steel installing tool parts:

- Radius Drive Tip-- (SG-3) This piece is shaped to fit into the anchor on one end and threaded on the other end to accept a coupler
- Shank-- (SG-14) The shank (or striking bar) has a 1 ¼" hex x 6" (32mm hex x 152mm) shank configuration on one end to match the HB90-14 hammer chuck and is threaded on the other to accept a coupler
- Extension-- (SG-2) Extensions (33 inch length) are threaded on both ends to accept a coupler
- Coupler-- (SG-4) This piece is internally threaded to join shanks, radius tips and extensions together.

For additional depth, order extensions and couplers.

The SG drive steel uses a partial left hand thread that allows very efficient impact energy transfer from the jack hammer to the anchor. All joints should be lubricated with light oil or spray lubricant prior to assembly. After installing an anchor the drive steel joints should be cleaned of dirt which will enter the couplers during driving. Failure to clean and lubricate the drive steel and couplers will result in premature failure. Contact your MSI Distributor.

**2.2 Hydraulic Jackhammer:** A 90lb. (41kg.) hand held hydraulic jack hammer is required. Typical performance specifications are 1200 blows per minute at 8gpm and 1500 psi (30 lpm/140 bar). The HB90-14 anchor driving hammer with 1 ¼" hex x 6" (32mm x 152mm) chuck and HTMA flush face couplers is available from a MSI Distributor. Hydraulic jackhammers outperform the pneumatics for driving Manta Rays, especially in the harder soils.



Jack hammer

**2.3 Hydraulic Power Unit:** A line truck hydraulic system can be used to operate the jack hammer. Typical specifications are 18hp, 8gpm, 2000 psi (30 lpm/140 bar) with hydraulic oil cooler. As an alternate, the GPU18-8CE hydraulic power unit is available from a MSI Distributor.



Portable power  
supply

**2.4 Hydraulic Hoses:** Should be ½" (12.5mm) nominal size and 25' (7.6m) length with HTMA flush face couplers. Two (2) sets of hoses may be coupled together to provide a 50 foot (15.2m) reach from the power unit to the anchor installation. A maximum 50 ft hose length is recommended. HC-16-25 hydraulic hoses that meet all these requirements are available from a MSI Distributor.



Hydraulic hoses

## 2.5 Load Locker

The Manta Ray LL-1 Load Locker is required to load lock and proof test the anchor. It is a double acting hollow hydraulic jack with a base reaction plate and a direct reading gage. Use of this tool provides an immediate proof test of each Manta Ray anchor.

The Load Locker can be used with the same hydraulic from the line truck used to drive the jack hammer.

The portable GPU18-8CE hydraulic power unit that is used to power the HB90-14 anchor driving jack hammer can also be used.

The LL-1 uses quick release gripping jaws that grip an Adapter Setting Bar (ASB) that passes through the center of the jack. The ASB extends the anchor rod and precludes any damage to the anchor rod from the gripping jaws.

The base plate is designed for anchors that are installed at an angle to the ground: it has a large bearing surface and a small cross member. For angled guy anchors the shorter of the two cross members should be placed toward the tower and perpendicular to the axis of the anchor rod.

The Load locker and base are designed to self align to the actual angle between the anchor and the ground. The vertical legs of the Base cut into the soil during use to help keep the base from skidding.

When load locking angled anchors the knife edges of the Load Locker jack should engage the square tabs on the base that are closest to the short cross member.



Load Locker



Setting up the Load Locker

The LL-1 Load Locker kit includes adapter setting bar, gripping jaws, and metal box. It does not include the Hydraulic Power Unit.

### 3.0 Step-by-Step Installation Instructions

#### CAUTIONS:

**ALL SUBSURFACE UTILITY LOCATION PRECAUTIONS MUST BE OBSERVED PRIOR TO INSTALLATION. DO NOT DRIVE MANTA RAY ANCHORS WITHOUT AN UNDERGROUND UTILITY LOCATION REPORT.**

**PERSONNEL MUST USE SAFETY GEAR INCLUDING BUT NOT LIMITED TO: HARD HATS, GLOVES, STEEL TOE BOOTS, AND EYE AND HEARING PROTECTION.**

#### 3.1 Assemble the anchor



Thread the power hub screw anchor rod into the anchor shackle and tighten with a wrench. Place the anchor at the required location. For guy anchors the anchor should point away from the pole or tower and the anchor rod should point directly at the pole or tower.

Wrench tighten the power hub anchor rod to the clevis on the Manta Ray anchor (minimum 40 ft-lbs)

#### 3.2 Assemble the first section of drive steel

The shank, a coupler and the radius tip are threaded together. Lubricate the threads prior to assembly with light oil or spray lubricant

Note that the drive steel system has left handed partial threads. Make sure that the steel is fully threaded into the coupler, and that the coupler can "free float" once the steel is coupled together. Check this "free float" by moving the coupler back and forth on the drive steel. It should move freely 3/4 inches before stopping.

Always check for this free float. If the coupler is not completely threaded into the free float position it will break when the hammer is turned on.

Vibration during driving may cause anchor rods to loosen. Do not allow the anchor rod to completely un-thread from the anchor. Check the anchor rod after adding each tool section to be sure the power hub rod remains tight.



Shank

Coupler

Radius tip



### 3.3 Set up Jackhammer

Place the jackhammer on the ground behind the anchor and insert the drive steel shank into the hammer. Insert the radius tip into the back of the anchor. Position the anchor at the point of entry into the ground.



### 3.4 Make hydraulic power connections

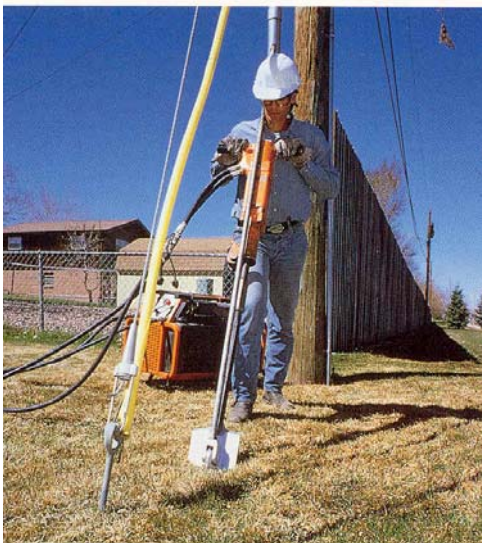
Connect the jackhammer to the hydraulic power unit with the hoses, start the power unit and turn the hydraulic circuit on.

**Caution:** When using a line truck or other hydraulic power source make sure the pressure and flow does not exceed the jackhammer capacity or the seals may burst. A flow control device may be required.

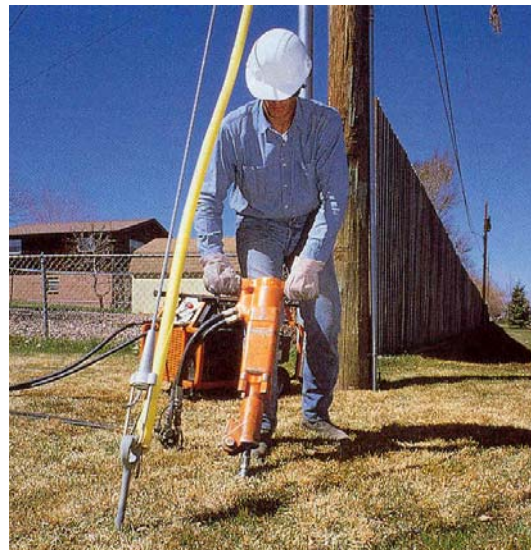
### 3.5 Drive the first section

Raise the jackhammer to the required guy angle and begin to drive the anchor. To avoid “skidding” at the start of angled drives, start closer to vertical, then lower the jackhammer to the proper angle as the anchor begins to penetrate the ground.

The installer must support the weight of the hammer. Do not let the weight of the hammer apply a side load on the drive steel or premature drive steel failure will occur. Drive the anchor until the first drive steel coupler is approximately at ground level.



Set-up and position to install the  
Manta Ray anchor



Drive steel coupler at ground

### 3.6 Add drive steel extensions

Open the jackhammer latch and remove the jackhammer from the shank, being careful not to remove the radius drive tip from the anchor.

**CAUTION: THE DRIVE STEEL, ESPECIALLY THE COUPLERS, CAN BE HOT. WEAR GLOVES.**

Remove the drive steel shank from the coupler. Remember the drive steel has a left hand partial thread. It helps to hold the coupler and pull upward on the shank while turning clockwise (as viewed from above) to get the partial threads to engage.

Place a drive steel extension and another coupler between the original tip and shank. Remember to lubricate the drive steel threaded parts prior to assembly.

Replace the hammer on the shank and continue driving the anchor until the second coupler is at ground level.

Repeat this step with the second drive steel extension.

If greater than 7 ft anchor rod depth is required, then add a power hub rod extension (with coupling) and add drive steel extensions to continue installation. There is no depth limit for installing the Manta Ray anchors.

Typically it takes approximately 6-8 minutes for an 8 foot depth in medium to soft soils, and longer in proportion to the hardness of the soil, up to a maximum of 15-20 minutes in extremely hard soils.

**NOTE:** If the anchor strikes an object and makes no further movement for five minutes, an object (either a rock, layer of rock, or other solid object) is probably in its path, and the anchor may not penetrate to the depth desired. At this stage the anchor can still be removed, as long as the drive steel is not removed from the anchor.

Retrieve the anchor with the Load Locker. This is done by removing the jackhammer from the drive steel but leaving the drive steel in the anchor. Then place the LL-1 Load locker over the anchor rod and use it to pull the anchor out.

Leaving the drive steel in the anchor prevents it from tipping and locking when the LL-1 pulls on the anchor rod.

Be careful to stop pulling when the anchor gets close to the bottom of the Load Locker. In most cases a bit of shovel work is required to retrieve the anchor. After retrieval try a slightly different location or angle with a new anchor to attempt to miss the object.

### 3.7 Complete the installation by attaching the Adapter Setting Bar (ASB) and countersink

When the top of the anchor rod is at ground level, stop driving and thread the Load Locker Adapter Setting Bar (ASB) onto the anchor rod. The purpose of the ASB is to extend the anchor rod so the Load Locker can grip it. Because the anchors pull back upward during load locking, some experience is required to properly estimate how far to drive the anchors to achieve the required minimum finished depth. A good rule of thumb is the anchor will pull back approximately 1 to 2 times its length.

Manta Ray Anchor	Anchor Length (inch)
MR-1	14.44
MR-2	14.44
MR-3	11.9
MR-SR	17.25

After threading on the ASB, drive the anchor until the top of the anchor rod is below grade by approximately the length of the anchor. This is called “countersinking the anchor”. The ability to estimate how much to countersink comes with experience. Softer soils and larger anchors require greater countersink. Some very soft soils will require the installer to countersink 18-36 inches (.45 – .9m). Harder soils require less if any countersink.



Top of anchor rod at grade, and Adapter Setting Bar (ASB) being installed.

### 3.8 Removing the drive steel

In most cases the drive steel is simply removed by an upward pull on the hammer. A very rapid upward pull usually breaks the drive steel free. After the drive steel is broken free, remove the jackhammer and pull the drive steel out of the hole by hand.

**CAUTION: THE DRIVE STEEL, ESPECIALLY THE COUPLERS, CAN BE HOT. WEAR GLOVES.**

If the steel does not break free easily, pull upward while operating the jackhammer to “vibrate” the steel free. After the steel has broken free, remove the jackhammer and pull the drive steel out of the hole by hand.

There are occasions when the drive steel will not manually break free. This can occur in dry, rocky soil when rocks fall into the hole made by driving the anchor and lodge against the drive steel.

This can also occur in very soft, wet (muddy) soil when the soft soil collapses around the drive steel during driving. The drive steel can also become stuck when anchors "steer" around small obstacles such as imbedded rocks. This "steering" can cause the drive steel to bow slightly which will bind it in the ground.

An "Extractor Bar" (SG-X) is included with each drive steel set, or may be purchased separately. If the drive steel does not manually break free, simply remove the jackhammer from the shank and screw the extractor bar into the coupler. Use the Load Locker to pull up on the "extractor bar" to break the drive steel free. Be careful as the drive steel is pulled out and removed to not allow portions of the drive steel to fall back down the hole. Usually there is some obstruction to removing the drive steel and once it is broken free with the Load Locker, the drive steel can easily be removed by hand.





Note: This illustrates the installer removing the drive steel by hand after it has broken free. It does not show the adapter Setting Bar (ASB) on the anchor rod, but normally it would be on the anchor rod as shown in the previous picture.

#### 4.0 Set up the Load Locker

The anchor must be tipped and proof tested (using the Load Locker) to the desired holding capacity.

The Load Locker consists of a base plate, hollow hydraulic jack, hydraulic control valve, a gauge, adapter setting bar, and tapered jaws to grab the adapter setting bar (ASB). The Load Locker requires hydraulic power supply with these requirements: 2000-2500 PSI maximum pressure, 2-8 GPM, open center.

The MANTA RAY® Load Locker is a custom designed hydraulic jack designed to read the force applied to the anchor directly in LBS or KN on the gauge. The Load Locker should be calibrated by a test lab using the same gauge. This calibration should be performed prior to the start of the job and any time a gauge is changed. MSI can provide load verification services or calibration instructions from independent test labs.

**Caution:** When using a line truck or other hydraulic power source make sure the pressure and flow does not exceed the Load Locker capacity or the seals may burst. A flow control device may be required.

**Caution:** The Load Locker can develop up to 25,000 lb-force.

- Wear proper safety attire including but not limited to: steel-toe shoes, gloves, hard hat and safety glasses.
- Ensure full engagement of threaded connections.
- DO NOT stand directly in line with the adapter setting bar or anchor rod during load locking. Stand off to the side.
- Set the by-pass pressure on the Load Locker to ensure that the maximum load applied does not exceed the strength rating of the anchor parts.

Place the base plate over the Adapter Setting Bar (ASB) with the shorter cross member toward the tower and perpendicular to the axis of the ASB.

Align and adjust the position of the base plate so that the ASB is even with the square steel tabs closest to the small cross member.

Slide the Load Locker jack over the ASB so the knifed edges on the jack engage the square tabs on the base.

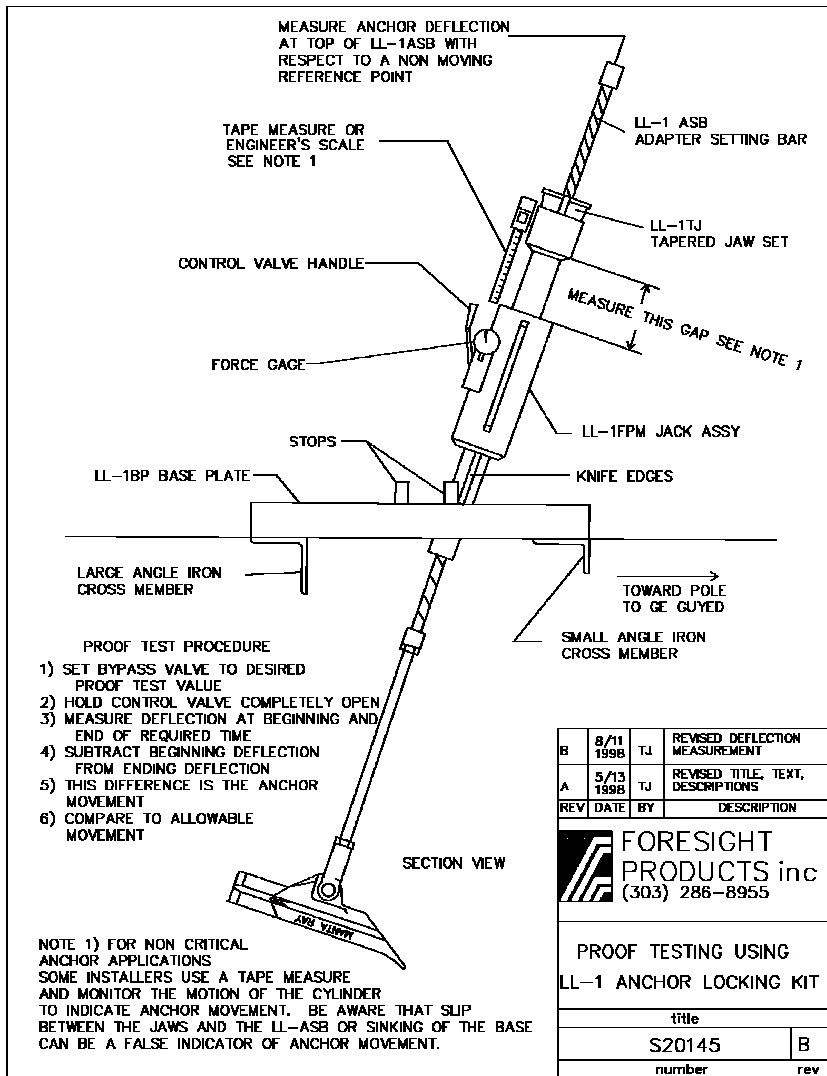
Place the gripping jaws around the ASB and into the tapered rod end of the jack. Use light oil or spray lubricant on the outside surfaces of the gripping jaws so it is easier to release. New jaws have a tendency to stick. Connect the hydraulic jack to the power unit and turn on the hydraulic circuit.

With the hydraulic circuit deactivated, attach the hydraulic hoses from the power source to the hoses on the control valve mounted on the jack.

Inserting Load Locker hydraulic cylinder over the ASB



Applying load to the Manta Ray anchor



## 5.0 Load Locking and Proof Loading

**5.1** After activating the hydraulic circuit, shift the valve so the jack extends and pulls the anchor back and rotating the anchor into the locked position. The operator can monitor the Load Locker gauge and determine the holding capacity at any time during the Load Locker cycle.

Up to three to four cycles could be required to set the anchor depending upon anchor size and soil conditions. Each time the jack is retracted the jaws must be re-set. New jaws have a tendency to stick. To release them retract the jack about halfway and give the ASB a very swift side to side jerk. This should release the jaws and the jack should fall back onto the base plate. Fully retract the jack and reset the jaws.

**5.2** Hold the load on the anchor as measured on the direct reading gage and monitor the movement of the anchor. If the anchor holds the required load for 1 minute with no more than  $\frac{1}{2}$ " (12.5mm) of movement then the anchor has passed the proof test. A common method to measure the movement of the anchor is to use a tape measure between the top of the cylinder portion of the Jack and the bottom of the tapered barrel that holds the gripping jaws.

To maintain a load, the operator must "feather" the control valve and monitor the pressure reading on the gauge or set the bypass valve on the Load Locker.

### 5.3 Recommended Proof Loads

Manta Ray Anchor	Power hub anchor rod size (inches)	PH rod ultimate tension rating lbs-force (kn)	Recommended Proof Load lbs-force (kn)
MR-1	$\frac{3}{4}$ "	23,000 (102.3kn)	11,500 (51.2kn)
MR-1	1"	36,000 (160.1 kn)	18,000 (80.1kn)
MR-2	$\frac{3}{4}$ "	23,000 (102.3kn)	11,500 (51.2kn)
MR-2	1"	36,000 (160.1 kn)	18,000 (80.1kn)
MR-3	$\frac{5}{8}$ "	16,000 (71.2kn)	8,000 (35.6kn)
MR-SR	$\frac{3}{4}$ "	23,000 (102.3kn)	11,500 (51.2kn)
MR-SR	1"	36,000 (160.1 kn)	18,000 (80.1kn)

In softer soil the base plate can be set on top of timbers for increased surface area so that any sinking tendency will be eliminated.



**5.4** After the Load Locker is removed, the appropriate eye nut is attached to the anchor rod and installation is complete, with an anchor that has been proof tested to the desired capacity.