Fig. 5

		Kips (1,000 lbs) 40	kN 178	Kips (1,000 lbs) 40	kN 178	Kips (1,000 lbs) 40	kN 178
Very Dense and / or Cemented Sands; Coarse Gravel and Cobbles	60-100+	-	-	-	-	20	89
		(5)		(5)		(1, 2)	
Dense Fine Compacted Sand; Very Hard Silts and Clays	45-60	-	-	20	89	20	89
		(5)		(2)		(3, 4)	
Dense Clays, Sands and Gravel; Hard Silts and Clays	35-50	20	89	20	89	15 - 18	67 - 80
		(3)		(3, 4)		(3, 4)	
Medium Dense Sandy Gravel; Very Stiff to Hard Silts and Clays	24-40	20	89	18 - 20	80 - 89	12 - 18	53 - 80
		(3, 4)		(3, 4)		(3, 4)	
Medium Dense Coarse Sand and Sandy Gravel; Stiff to Very Stiff Silts and Clays	14-25	18 - 20	80 - 89	15 - 18	67 - 80	9 - 12	40 - 53
		(3, 4)		(3, 4)		(3, 4)	
Loose to Medium Dense Fine to Coarse Sand; Firm to Stiff Clays and Silts	7-14	14 - 18	62 - 80	10 - 15	45 - 67	7 - 10	31 - 45
		(3, 4)		(3, 4)		(3, 4)	
Loose Fine Sand; Alluvium, Soft-Firm Clays; Varied Clays; Fill, Fine Saturated Silty Sand	4-8	9 - 14	40 - 62	8 - 12	36 - 53	-	-
		(3, 4)		(3, 4)		(5)	
Peat, Organic Silts; Inundated Silts, Fly Ash	0-5	4 - 12	18 - 53	-	-	-	-
		(3, 4)		(5)		(5)	

NOTE:

(1) Drilled hole required to install.

(2) Installation may be difficult. Pilot hole may be required.

(3) Holding capacity limited by soil failure.

(4) Wide variation in soil properties reduces prediction accuracy. Pre construction field test recommended.

(5) Not recommended in these soils.

* Measured capacity in kips (1,000 lbs) and kN after anchor locking with no significant movement.

CAUTION:

When installing **MANTA RAY** anchors, follow all standard safety practices used by every contractor including but not limited to proper clothing. All underground work requires location procedures. Do not install an anchor until you know what is below the substrate / sea bed. All anchors must be fully anchor locked before being put into service. Use this chart for estimation only. Actual capacity must be tested with anchor locker.

Predicted ultimate holding capacities are based on results of extensive Foresight Products, LLC testing and interpretation and are offered as an application guide only. They do not represent a guarantee of holding capacity in any particular soil class. A user must factor in their individual appropriate safety factor.

Unconditional guarantee for free replacement if any **MANTA RAY** anchor breaks during installation using the manufacturer's recommended equipment and procedures. Foresight Products warrants all its installation equipment: drive steel, and anchor lockers. No other anchoring system offers this complete guarantee and warranty protection. **MANTA RAY** anchors are made of galvanized ductile iron. When the manufacturer's recommended equipment and procedures are followed, **MANTA RAY** anchors are replacement guaranteed against breakage during installation. In order for the **MANTA RAY** anchors to be effective, it is important to have knowledge of the type of soils the anchors are going to be placed. A soil probe test will give you that information and once known, it is relatively easy to determine which size anchors to choose to meet the holding capacity required.

Installation Instructions

The holding capacities of the **MANTA RAY** Anchor is dependent on:

- Soil Type
- Depth of installation
- Size of Anchor
- What is being anchored (moorings, floating dock, pipe, sea wall, retaining wall, etc.)

Driving The Anchor

1. For underwater: Pre-assemble anchor, swivel eye, and anchor rod attachment topside **(Fig. A)**

Fig. A

Apply several drops of Locktite 2760 to the threads on one end of the rod, thread on swivel eye, and tighten.

Apply several drops of Locktite 2760 to threads on the other end of the rod, thread on anchor shackle, and tighten.

Allow the assembly to cure for 24 hours to achieve full strength.

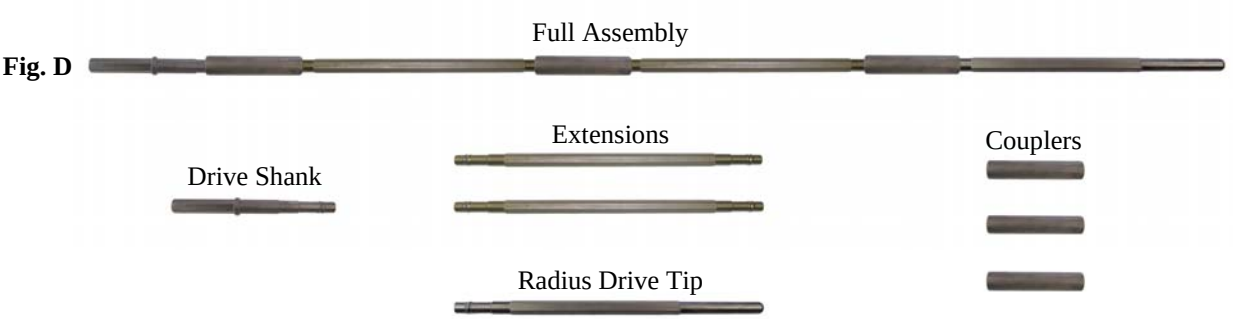
2. Lower equipment to diver **(Fig. B)**

3. The diver then assembles the shank, coupler, and radius tip drive steel sections together **(Fig C, D)**. Make sure the coupler moves freely after connecting. This allows the two pieces of drive steel to strike each other. The couplers function merely keeps the drive steel pieces from disconnecting.

Fig. B

Fig. C

Fig. D



4. Connect hoses topside to hydraulic jack hammer and power source. **(Fig. E)** Turn the power unit on and switch the tool lever to the "on" position, "charging" the jack hammer so it is ready to operate before lowering to the diver. An optional two-way valve set-up can be used to connect both the jack hammer and the Anchor Locker together. This valve can then be switched by the diver to operate either tool while underwater.

5. The diver then inserts the assembled drive steel into the chuck of the jack hammer, then inserts the radius tip into the anchor **(Fig. F)**, and begins driving the **MANTA RAY** Anchor **(Fig. G)** at the desired angle to the proper depth, adding additional drive steel sections as needed.

6. After reaching the desired depth, attach the anchor setting bar to the top of the terminus and continue driving to countersink the anchor 8 to 12 inches (20 to 30 mm). **(Fig. H, I)**

7. Remove drive steel assembly from the anchor. If the steel does not break free immediately from the anchor, pulling up on the jack hammer while engaging the trigger lever will usually do so**. (Fig. J)** In the very rare occasion when this method fails to break the drive steel free, the Anchor Locker can be placed over the drive steel and the drive steel extraction bar (included in SGC drive steel kit) screwed into the threaded coupler. An upward pull on the Anchor Locker ram will break the drive steel free

Fig. E

Fig. F

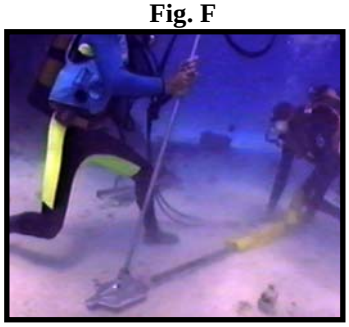


Fig. G

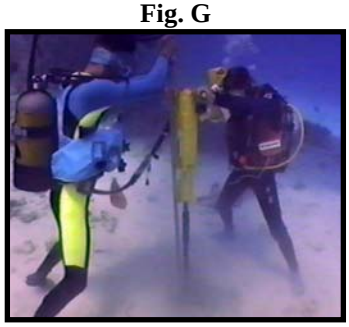


Fig. H

Fig. I

Fig. J

NOTE: If the anchor strikes an object and makes no further movement for approximately five minutes, the anchor may not penetrate to the desired depth. At this point of refusal, the anchor can still be removed as long as the drive steel *is not removed* from the anchor. The Anchor Locker can be used to remove the anchor assembly by pulling up on the anchor rod, again only if the drive steel is not removed, or the anchor will begin to rotate into locked position otherwise. The diver can then reuse the anchor in a slightly different location to achieve installation.

Anchor Locking the Anchor

1. The anchor *must* be proof tested with the Anchor Locker (LL-1M) or an in-line dynamometer to the desired holding capacity needed. The Anchor Locker (LL-1M) consists of a base, hydraulic center hole ram, hydraulic valve, gauge, an anchor-setting adapter bar, and tapered jaws to grab the setting bar. The Anchor Locker operates from the same hydraulic power source as the jack hammer. **(Fig. 1)**

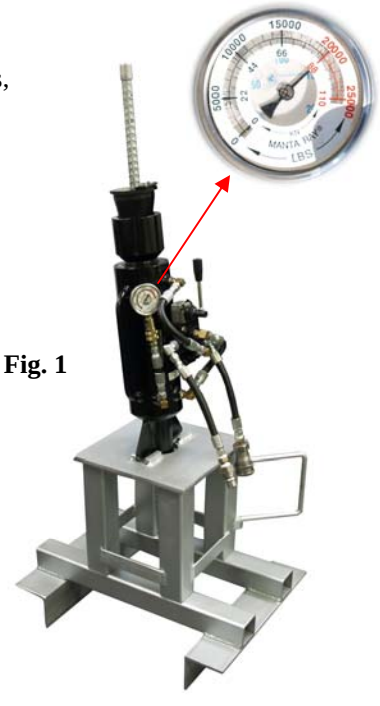


Fig. 1

2. After removing the drive steel, place the base over the top of the setting bar and down on the substrate/sea bed **(Fig. 2)**

3. Next, place the hydraulic ram over the setting bar and slide it down to the base **(Fig. 3)**

4. Secure the tapered jaws around the setting bar and into the top "cup" of the retracted ram **(Fig. 4)**

WARNING! Keep fingers clear of the jaws when activating the valve lever!

5. Activating the hydraulic valve lever pushes the cylinder upward, thereby pulling the anchor up which rotates it into the locked position **(Fig. 5)**

6. By watching the gauge, the diver can read the load capacity at any time during the ram cycles **(Fig. 6)**
Up to two or three cycles usually are required (which equates to approximately the length of the anchor) to rotate the anchor

There are occasions when water turbidity prevents the diver from reading the attached Anchor Locker gauge. This gauge can be run remotely to the surface for the support crew to read or a simple in-line dynamometer attached to the anchor rod will suffice.

Note: Foresight Products, LLC cannot be held liable for any anchors not set and tested with the Anchor Locker (LL-1M) or approved alternate.

7. Upon completion of the installation, attach retrieval line or float bag to return equipment **(Fig. 7)**

Fig. 2

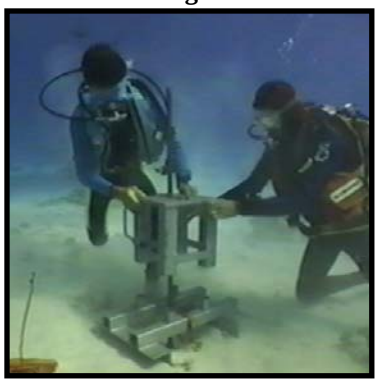


Fig. 3

Fig. 4

Fig. 5

Fig. 6

Fig. 7

Many underwater anchor applications will require some modifications to these procedures and Foresight Products, LLC will be happy to discuss any varied techniques needed to meet the different situations.

MANTA RAY® EARTH ANCHOR SYSTEMS
DUCKBILL® EARTH ANCHORS
STING RAY® EARTH ANCHOR SYSTEMS

FORESIGHT® PRODUCTS, LLC
6430 East 49th Drive
Commerce City, Colorado 80022
Toll Free: 1-800-325-5360
Local: 303-286-8955
Website: www.earthanchor.com
E-Mail: sales@earthanchor.com