

# DIY small scale hand dredging understanding the basics

## Typical application for dredging.

Dredging for treasure or gold

Cleaning out boat slips that become too shallow for the boats to enter.

Increasing the size and depth of ponds.

Clearing out waterways for navigation and better water flow.

Rebuilding beaches.

Cleaning out golf course ponds.

Clearing out water intakes in lakes, dams, and ponds.

Removing invasive vegetation such as milfoil and other species.

Cleaning out fish ladders

Cleaning out above-ground and below-ground tanks.

Clearing out material for removing sunken vessels

Opening up underwater channels for cables and piping.

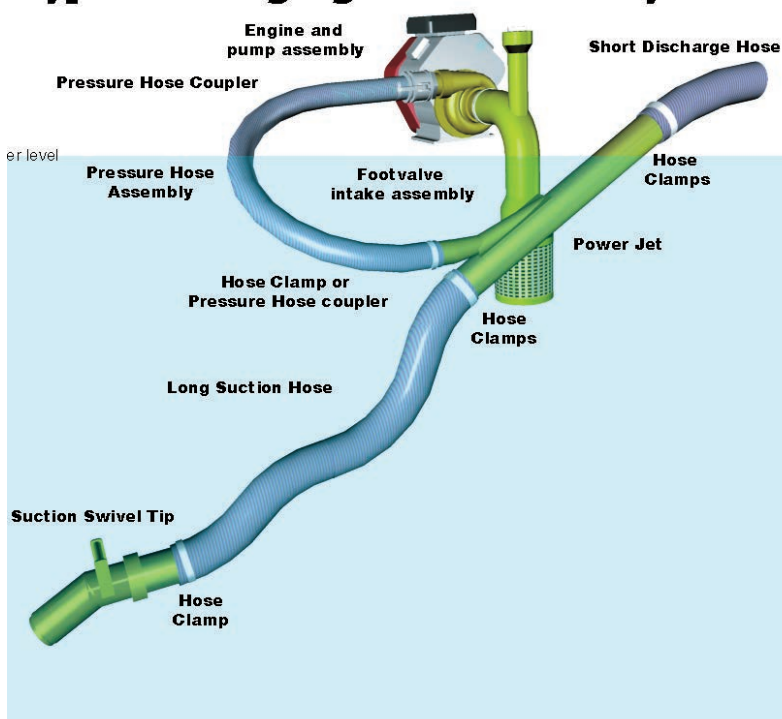
Typically the most popular system is a Venturi-type dredge system similar to a gold dredging system. This type of system is low cost, easy to operate, passes large particulate, and provides the best bang for your buck. It is important for you to understand the different types of components and how they work and the different types of pumps, and their best application. A basic understanding of fluid dynamics, such as head pressure, gallons per minute some simple formulas, can help you pick the best system for your needs. You need to know how to calculate your yards of material to be removed and some of basic formula behind it. I have tried to explain these basics in this document.

## The Venturi power jet

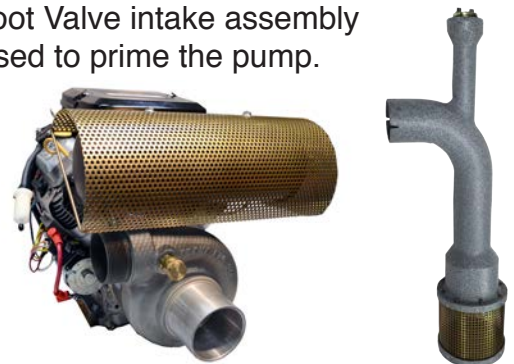
The power jet is one of the most important components in a dredge system. There is a balance of the right components proper jet design that matches the pump curve, clean pumping and when this all comes together you have serious gravel moving machine.

The power jet is typically located at the discharge end of the system if possible, creating the most effective transportation for longer distances.

## Typical Dredging Reclamation System



Foot Valve intake assembly  
Used to prime the pump.



Engine and pump assembly 23 hp  
with P350S pump



4" power jet with 3" pressure input  
with 5" discharge  
Suctions Swivel tip  
Vacuums up the  
sand gravel rocks.



### Typical 4" power jet layout



So let's use an example of the 4" power jet powered by a 23 hp motor driving our high-performance P350S pump. This pump can produce 600 GPM and up to 60 maximum psi. Let's say we use 50 feet suction hose located in the water and the power jet is located on the shore-line halfway in the water. The discharge side of the jet is connected to a 10-foot long 5 inch hose with a 5 foot lift above the water level.

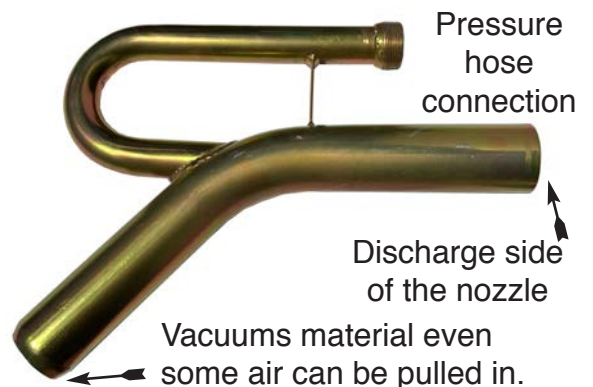
When the water enters through the 3" coupling on the side of the jets, it goes through a long taper, reducing down to approximately 1.5" id. This reduction increases velocity in the line and increases pressure to 40 PSI. So we are injecting 400 GPM at 40 PSI into the pressure side of the jet. The 50 feet of the hose should be pulling a .75 to 1 ratio. When injecting 400 GPM at 40 PSI into the jet, we should be pulling 300 GPM through the 50-foot of suction hose.

Once the two flows converge in the power jet, you will have a combined flow of 700 GPM discharging out of the 10 feet of 5" hose. This ratio changes dramatically based on many factors such as hose length, lift above the water and many more factors. The amazing thing about this jet is it can pull up to 3.90" sphere, vegetation, cans, ropes, sticks, sand, gravel rocks, etc. A high-powered machine like this should be able to produce up to 12 yards per hour.

We make all different size systems starting off with an ultra-light P90GH 19 pound motor and pump package to drive a 2". We make up to 8" systems driven by a 40-hp motor and pump package. The most common sizes are 3" and 4". The 3" and 4" are easy to handle and move around for the average homeowner.

### The Suction Nozzle

This is a different type of suction device called a suction nozzle. Suction nozzles perform best in extremely shallow water conditions and for short runs. They can even suck a little air and maintain suction. This feature can come in handy when cleaning small shallow small rocky ponds. Suction nozzles do not perform well with hose lengths greater than 30 feet. The suction nozzle typically requires a higher working pressure than the power jet style. This type of nozzle can be more cumbersome since you have two hoses connected to it. It does have its place in shallow water conditions.



Example 2.5" hose with a 2.5" suction nozzle powered by a six hp high-performance pump 250 GPM with a 60 psi. The pump injects roughly 120 GPM at 45 PSI into the nozzle providing a ratio of .75 to 1. So we are pulling through the nozzle intake 90 GPM with the material. We can move the material 30 feet with a one-foot lift. A small package like this should move up to 2 yards per hour

## The Suction Swivel tip

The suction swivel tip is a key component in any dredging operation. The tip provides two important functions. It is equipped with a comfortable handle and swivel joint that keeps the hose from binding up and allows the divers to rotate the tip with little to no fatigue. Another primary function is the intake ring; this reduces the size of rocks the tip can pull in and reduces the chances of rock jams. There are also a few other variations on the swivel tip. For the larger, higher-powered system, we use what is called a suction-breaking flap. The flap is pulled open to divert the suction and allows the stuck rocks to be removed. One other new variation we have a new high-flow bull nose tip that has some improved suction. We also offer the suction swivel tip with a removable handle so you can stand up and dredge in shallow water conditions.



Standard SST swivel



Suction swivel tip with suction breaking flap

Hi flow bull nose SST tip



SST with handle

## Pumps and Yardage Calculations

### Yardage Calculations

How to calculate how many yards you need to move. You take the length x width x the depth of the material you want to move. Example A boat dock that is too shallow to park the boat. 20 feet wide by 30 feet long with 3 feet of sand needing to be removed.  $20 \times 30 \times 3 = 1800$  cubic feet of material. There is 27 cubic feet in a cubic yard.  $1800 \text{ cubic feet} \div 27 = 66$  yards. So we need to remove 66 yards.

### Dealing with waste material

Every job has different requirements for disposing of waste material often referred to as spoils in the dredging world. When rebuilding beaches, we use many different techniques. If possible, we will bring the sand up and pump it into the low-lying areas. Sometimes we hold the material back with a combination of sandbags, hay bails, and even some cloth-based material to hold back the material and not the water. In some cases, we use Geobags or Geotube. These bags are designed to pump the slurry inside, and they hold back the material and allow the water to permeate the fabric and leave the bag. Always look for an opportunity to pump the material downhill if possible this can be a game changer.

### Basic pump calculations

In order to make a dredge work properly, you need a high-performance pump with a good balance of both pressure and volume. Typically, pump manufacturers will rate their pumps in several different ways.

Gallons per minute GPM. Gallons per hour GPH.

Maximum PSI. Pounds per square inch.

Maximum head lift. How high can the pump lift water?  $\text{Max head} / 2.3 = \text{PSI}$

Example: If you take a P180 pump with a 150-foot head, it is possible to attach the 2" hose and lift water 150 feet straight above the pump. The head is how high the pump can lift water.

### Keene High Performance Pumps

Typical Keene pumps run at about the 150-foot head range or maxes out around 65 PSI. Our high performance performance are manufactured with a closed-face impeller with tight tolerances and T6 heat-treated aluminum alloy for much longer life. The impellers are sized to match particular horsepower for optimum performance. All aspects of these pumps are designed for all-out performance. Keene pumps are lighter, more compact, and perform more reliably than similar pumps on the market. These pumps are specifically designed to accommodate a pulley between the back plate and the engine. Here at Keene, we put the absolute best customer support behind our pumps and will always have parts in stock so our clients experience little to no downtime. Made in the USA.

Below are a few examples of our pumps. Notice the snail-type housing design. Look at the closed impeller, all built for performance!!!

PHP160 pump Impeller



P90GH  
100 GPM  
160 Head  
19 lbs



PHP500  
400 GPM  
155 Head  
130 lbs



P3523  
600 GPM  
150 Head  
155 lbs.





## Semi-Trash and Trash Pumps

This type of pump is not designed to pump material; they are built to handle dirty environments such as the small amount of silt and sand and up to maybe a half inch particulate. I have seen these wear out in a few short hours before you blow through the side casing or destroy the impeller. Performance-wise, the Trash pump has an open-face impeller, sloppy tolerances, and an inferior housing design. The pump volume is fair, but the maximum PSI is typically very low at 40 PSI or 95-foot head. Customer service and spare parts are sketchy at best to nonexistent. It is impossible to add on a compressor, so do the due diligence before investing in this type of pump. Penny wise and pound foolish.



## Keene Gravel Pumps

This specialized pump is designed to pump sand, gravel, and rocks over long distances. They can pass large spheres, making them quite different from other pumps. 4" pumps can pass a 3.75" sphere, a 6" pump can pass a 5.75" sphere, and an 8" pump can pass up to a 7.5" sphere. Gravel pumps can pump an extremely high percentage of slurry, exceeding 30% of the material. The concentration of slurry means more material is pumped and less water. The weight of this pump ranges from 500 to 2000 pounds and requires 40 to 300 HP. Ideal for dredging lakes, ponds, marinas, and other waterways. Gravel pumps such as the 4" can pump up to 50 yards per hour, exceed 1500 feet in distance, and lift material 50 feet above the water. Contractors and larger companies are the typical customers for this type of pumping system—rough prices for just the pump range from \$12500.00 to 35K.



## Hookah diving

There are two ways to operate the dredge. They are utilizing an extended pole system to control the suction tip. The most common is a diver operated using a hookah system. The hookah system allows the diver to operate all day without refilling scuba tanks. A diver-operated system is more efficient than a pole-operated system. A lot easier on the back, and far less fatigue. There are two types of hookah systems, a Standalone compressor driven by an independent motor. The more common package is the combination package. One motor drives the water pump and the air compressor. They both have their place. The combination package is more straightforward since you only have one package to maintain. The advantage of the standalone has more versatility. However, you now have to keep an eye on both motors simultaneously.

## WARNING CARBON MONOXIDE GAS

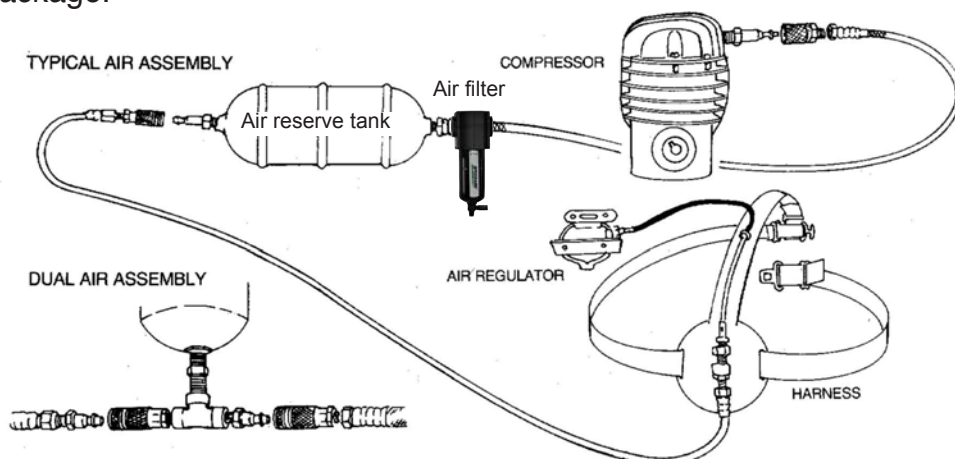
If you're considering diving with a "Hookah Compressor", It is most important that you become aware of the potential danger associated with exhaust emissions. Carbon Monoxide is an invisible, odorless gas that gives no warning of its presence. This can be deadly

Stand-alone package. Motor driving only the air compressor.



Over decades of dredging, we have found some simple methods to reduce the chance of carbon monoxide exposure greatly. We are using an air snorkel, relocating the air intake away from the exhaust and help. It is also essential to use an air filtration system with every package.

Motor and pump diving the pump air compressor

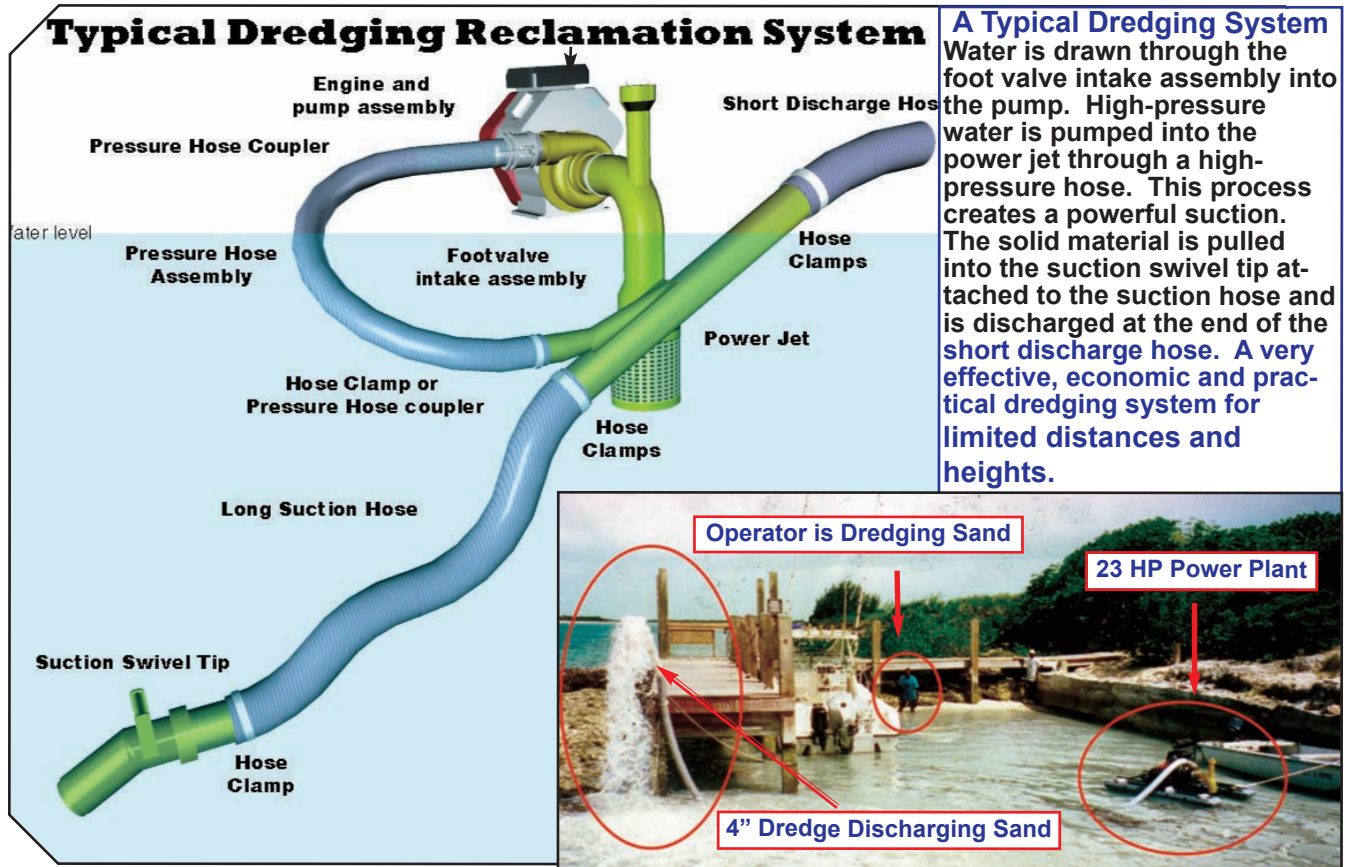




**KEENE ENGINEERING**

# Reclamation - Pollution Control Sand & Silt Removal Marine Plant Life - Fish Harvesting D.A.S.H Boat. Diver Assisted Suction Harvester Gravel pumps for pumping long distances

Portable and cost-effective venturi-operated dredge systems can transport slurries of rock, sand and gravel up to 150 feet away at the water level. Sizes range from 2 inches to 8 inches in diameter. High lift Systems are relatively low cost and utilize venturi suction components which can eliminate the need for costly gravel pumps. Our friendly engineering staff will be pleased to assist you with your custom requirements.

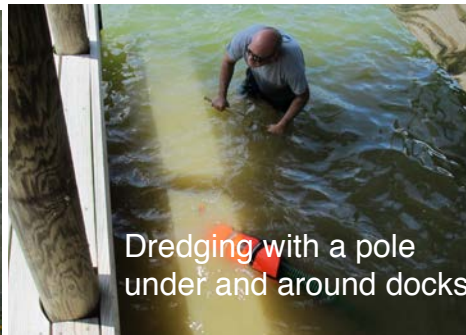


**High Lift Dredge System.** Shown above is a "High Lift Dredge System" powered by 23 hp engine. In most cases, it is more effective to operate the dredge with a diver and a hookah system (surface-supplied air). A diver can move approximately 3 times more material than an operator moving the suction tip with a pole or handle.

Honda GX290 driving a  
PHP500, mounted on dock

Dredging under and around  
docks clearing space for boats

Showing sand being dis-  
charged about 50 feet away





**We can help you set up your  
Diver Assisted Suction  
Harvester including surface  
supplied air and even under  
water communication gear**

### **Milfoil Dredge D.A.S.H.**



Weedb1  
Weed Box dewatering

**For optimum performance the pump hoses  
plumbing and jets must all work together**

4" power jet 5" Discharge



13 hp  
PHP500  
400 GPM



23 hp  
Vanguard  
P350S  
600 GPM

**We use the best motors and pump in the  
world. We manufacture a line of high  
performance tight tolerances pumps.  
Easy to repair and service**



### **Aquatic Species Control. Suction Harvesting or D.A.S.H., (Diver Assisted Suction Harvester)**

Removes evasive Aquatic plants such as Milfoil, Hydrilla, Fanwort, and many more. These types of plant species can be easily removed with a cost-effective setup or the use of a Diver Assisted Suction Harvester "D.A.S.H." This system uses a Keene Venturi suction system similar to what we use on a gold dredge. We have over 70 years of engineering experience in making all kinds of dredging equipment. Keene Engineering builds the best pumps, and venturi jets, in the world. We manufacture all components needed, such as high-performance pumps, swivel intake nozzles, hose assemblies, and accessories you need. We can help you build your own system as well. Everything we sell is proudly Made in America. We provide technical support and advice for all your harvesting needs.

The unique thing about a Keene venturi system, it provides very little impact on breaking up the plant and keeps fragmentation to a minimum reducing regrowth the next season. The vegetation is vacuumed through a suction hose and transported up to the Harvester platform for separation by a variety of ways, such as tables, bags, baskets, screens, etc. The best system is the Keene weed box separates and dewater the organic material from dredged material. Works with 3" 4" and 5" hoses. The material builds up on the aluminum punch plate, then it is dragged into the large opening and dropped into tubes bags etc. The 12 feet of large 8" water discharge hose on the bottom helps direct the waste water. The hose can even be dropped to the bottom to help control the turbidity and provide greater visibility for the divers. The 4 independent adjustable leg system allows the weed box to be set up on uneven surfaces like the banks of a lake or a floatation that does not sit flat and makes it easy for eluviation control. The Weed box comes with the aluminum 1/8" punch plate on top and 2 lower screens to greatly reduce the chance of any preceding or any particulate getting into the discharge flow. The dredge hopper is equipped with a rubber flap that eliminates the spray and helps keep the operator dry. We typically utilize 4" or 5" suction hoses depending on the customer's needs. The 4" hose is a little easier to handle, and the 5" hose can suck up larger clumps and move more material.

Most of the systems we provide are equipped with an air compressor that is powered off the main motor and pump system. We use a Hookah system, or surface-supplied air, for the divers. The air compressor pumps clean, fresh, filtered air into a stainless steel reserve tank and distributes it through a secondary filter to the divers. A 30-100' breathable air hose feeds air to a special low-pressure Hookah air regulator. This system allows the diver to work all day without any interruptions and with no tanks to fill. One motor supplies the power for the air and water pump. Underwater communication systems are available for a full face mask for constant contact from the diver to the surface operator.



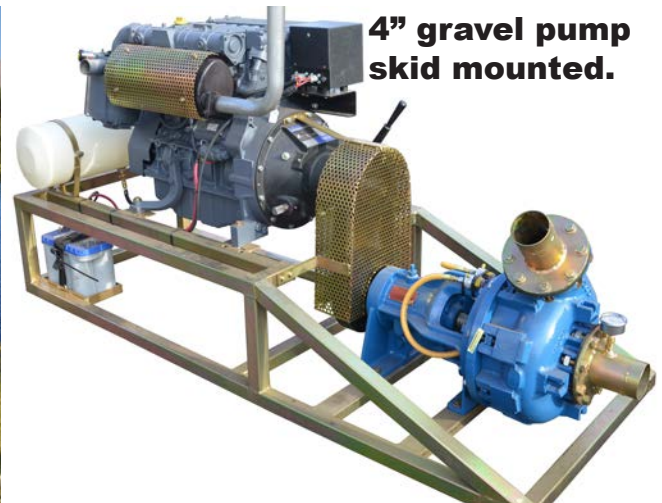
# High Production Gravel pumps for pumping heavy slurries for long distances.

**Lift material up to 100 feet in the air. Pump gravel 1500 feet away.**

We offer a very heavy-duty gravel pump system available in both 4 inch and 6 inch. Capable of reaching depths and heights of 100 feet, a capacity up to 50 cubic yards per hour, and as far as 1500 feet away! These unique pumps are capable of passing large spheres up to 3.75 inches on the 4-inch pump and up to 5.75 inches on the 6-inch pump. Powered by a variety of diesel engines with the clutch to drive the gravel pump. Constructed out of a Nihard steel, providing an extremely long life and is very reliable. The optional large decks are ideal for a dive platform and provide ample space for servicing equipment. This dredge is commonly used in the fields of Africa for diamond and gold recovery operations, pumping material from the depths of rivers or pits onto the shore or upper banks, where processing equipment and containment areas are based. Commonly used for diver operated reclamation projects that are too small to be cost effective for the larger cutter head dredge operations.



**4" Gravel pumping system improving fish habitat**



**4" gravel pump skid mounted.**

Another huge advantage when using a gravel pump is you have the capability to pump over 30 % solids. This is ideal when pumping into GEO bags and containment areas. Basically, more material and less water.

**Rebuilding beaches that have been wiped out from storms**



**6" Gravel pump system with a modern Tier 4 diesel engine**



**4" gravel pump system that pumps out golf course ponds**



Keene Engineering Inc.  
20201 Bahama Street  
Chatsworth Ca. 91311  
Tele 818 993 0411

Order line 800 392 GOLD  
Email. [mark@keeneeng.com](mailto:mark@keeneeng.com)  
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