

Hydraulic Boat Lift Overview

SHORESTATION® HYDRAULIC PILING & BOAT HOUSE LIFT

U.S. Patent No. 8,777,513

**Models: LTPM408HS, LTPM608HS, LTPM808HS, LTPM10010HS, LTPM10016HS, LTPM15010HS,
LTPM15016HS, LTPM20010HS, LTPM20016HS**



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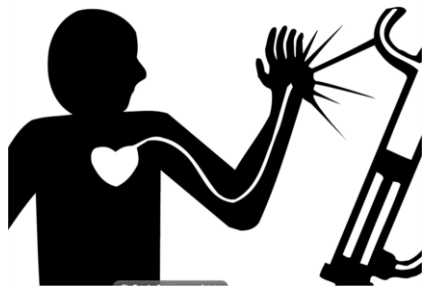
Safety Instructions

Working with electrical equipment and installations over the water present many potential hazards to the installer. Every installation presents unique conditions that the installer should evaluate before installing or servicing the equipment. The following instructions must be followed, but may not encompass all potential hazards:

⚠ WARNING

- Never use this equipment to lift people. People must exit the boat prior to lifting it out of the water.
- Never use this equipment to lift overhead. Install the cradle so it remains at or below the dock level.
- This equipment is designed to lift boats. Never use it to lift other items.
- Do not allow children to operate or play on the equipment.
- Do not install or use the lift if there are any signs of damage.
- The wireless control system should only be operated if the operator has clear vision of the lift equipment and its surrounding location.
- Never install or work on the equipment without first verifying that the A/C power supply (if present) is protected by a functioning Ground Fault Circuit Interrupt (GFCI) in accordance with National Electric Code section 210.8 and any additional local code requirements.
- Review all operating instructions with the user(s) before allowing them to operate the lift. Disable the lift by disconnecting the battery power to the motor until you have an opportunity to train the user.
- Disconnect all A/C power from the dock before installing or working on the equipment.
- Do not exceed the recommended capacity of the equipment.
- Do not modify the equipment unless you have received direct written approval from the manufacturer (ShoreStation).
- Remove any metallic objects from your person before working with DC or AC electrical components.
- Always wear proper personal protective equipment such as safety glasses, gloves, hardhats, and clothing.
- Installation may require entering the water. Never enter the water without a proper personal floatation device. Disconnect any power to the lift and dock before entering the water.
- Never work alone and observe safe lifting practices such as team lifting and proper lifting posture.

⚠ DANGER



DO NOT GO NEAR LEAKS!

- **High pressure oil easily punctures skin causing serious injury, gangrene or death.**
- **If injured, seek emergency medical help. Immediate surgery is required to remove oil.**
- **Do not use finger or skin to check for leaks.**
- **Lower load or relieve hydraulic pressure before loosening fittings.**

Introduction

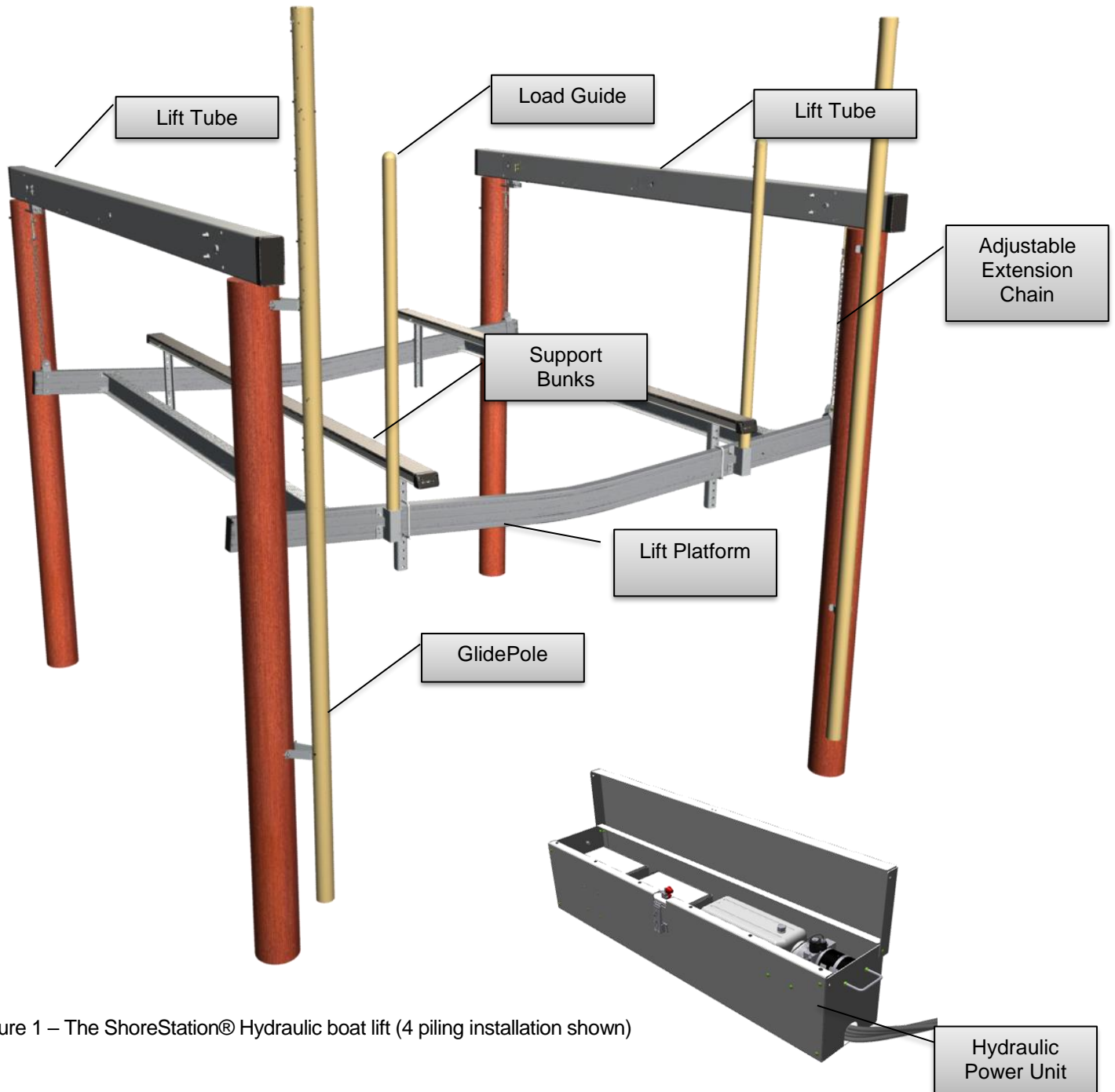
ShoreStation's Hydraulic boat lift is the safest & most reliable on the market. The intention of this document is to provide dealers and installers an overview of the system and components.

The ShoreStation® Hydraulic Boat Lift has key features that add value for the owner and end-user:

- **Speed** - The hydraulic system can lift 8' in less than one minute. This is 4-5 times faster than gear-plate systems on the market. This speed is accomplished without requiring large modifications to existing electrical circuits with the unique hydraulic system.
- **Cable Life** – There is no winch, so the cable is not being wound. The most common cause of cable failure is fatigue caused by winching and wear caused by the cable rubbing together during winching. With the ShoreStation Hydraulic system, the cables are pulled by hydraulic cylinders. Large cable sheaves ensure that very little (if any) fatigue will occur. This statement is backed by our 15-year warranty that includes cables.
- **DC Power** - This 24V DC system provides maximum power to the lift without costly electrical installations or modifications. The owner can use an existing 120V, 50 or 60 Hz, A/C circuits to supply the system or opt for the 20W, 24V DC solar panel. DC systems have their own list of advantages:
 - **Maximum motor life** – DC motors can deliver instantaneous torque without causing nuisance tripping of breakers and are not prone to long term damaged caused by low voltage A/C conditions common in the long electrical runs that feed boat lift installations.
 - **Safety** – A/C Power can be eliminated from the dock when using the solar option. DC power is safe and reliable.
 - **Power when you need it** – The battery bank can supply over 10 full lifts with one charge giving you power even if the supply is disrupted.
- **Simple Operation** - Hydraulics can deliver power over large distances through hydraulic hoses. This eliminates the requirement to have multiple motors and eliminates the need to run electric power under water. The unique hydraulic pump mechanically ties two hydraulic pumps to one motor, forcing equal volume to each side of the lift. This forces the system to stay level even if the load is not balanced on the lift, eliminating the need for the user to balance multiple motors.

System Overview

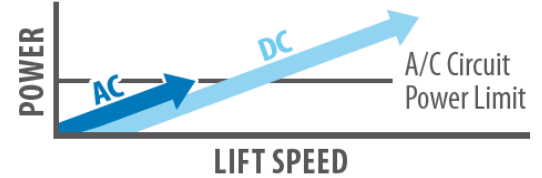
This section provides insight into how the hydraulic system works. The ShoreStation® Hydraulic Boat House Lift consists of the components shown in Figure 1. We will discuss each component's role in the operation of the boat lift.



The ShoreStation® Control System

This System is the result of providing hydraulic and winch driven boat lifts to the marine market for over 15 years. The design of this system is the result of this experience and is the fastest, most robust lift system on the market. By design, it is immune to many of the conditions that exist in the harsh marine environment.

The ShoreStation® Hydraulic system consists of a 24V DC hydraulic power unit, battery bank, power supply, and controller. The system can be powered by either a 20W, 24V solar panel or an A/C power supply. This flexibility in power supply eliminates costly changes to existing A/C circuits or it can totally eliminate the need to provide A/C power on the dock.



The system's speed is the result of the battery's ability to deliver large bursts of power to the power unit without creating a large demand on the power supply. Traditional A/C systems simply cannot reliably produce this speed without large, expensive A/C circuits.

The A/C supply option uses the existing dock circuit to power a Battery Tender that constantly monitors the battery state and applies the appropriate charging method. This system can supply full power even if the A/C circuit voltage drops to 90V A/C. The A/C circuit is buffered from the surge of power required by the hydraulic system and reduces nuisance tripping of breakers and GFCIs caused by the power demands of a boat lift.

The solar option supplies power to the battery via 20W solar panel. This panel will easily restore power to the lift using the sun's energy. It will typically take 1/3 of a day (assuming full sun) to replenish the power consumed by 1 full lift. The lift battery bank stores enough power to perform at least 10 full lifts. Solar is a great option for most users who use the lift heavily on the weekend, but sparingly during the week.

Regardless of the power supply, the 24V DC hydraulic system will provide safe, reliable operation in conditions where traditional A/C systems fail. When the storms knock out the dock circuit, the ShoreStation® boat lift will still operate.

Lift Tubes

The two lift tubes create lifting action by retracting the lift cylinder (Figure 2). The rod of each lift cylinder pulls a pulley block and creates cable movement. This lifting principle creates a few key advantages:

- The lift cylinder retracts to lift the boat. This causes the rod surface to be retracted into the cylinder when the boat is lifted. The polished rod surface is protected from exposure to the harsh marine environment.
- Pulling the cables instead of winching dramatically increases the lifespan of the cables. This in combination with the stainless material used ensures that the cable life will match the life of the lift.
- The system cannot be over-winded or back-wound, which is a common problem for plate-gear and winch type systems. If the system is run too far, the hydraulic cylinders will bottom-out and the hydraulic flow is relieved through the pump.

The lift tubes ship from the ShoreStation factory with the cables pre-strung. There are no cables for the installer to modify or install in the field. This makes installation of the lift tubes very simple.

Each lift cylinder has a counter-balance valve built in. This valve 'locks' the fluid flow when there is no pressure. This ensures that the hydraulics cannot move, even if the hydraulic hoses are cut. The cylinders can only move if the system pressure has opened the counter-balance.

The lift motion is stopped by a limit switch on the end of each lift tube. This limit switch will stop the lift when both lift tubes have hit the switch lever. This will correct any out-of-level and ensure the system shuts down at the end of the lift.

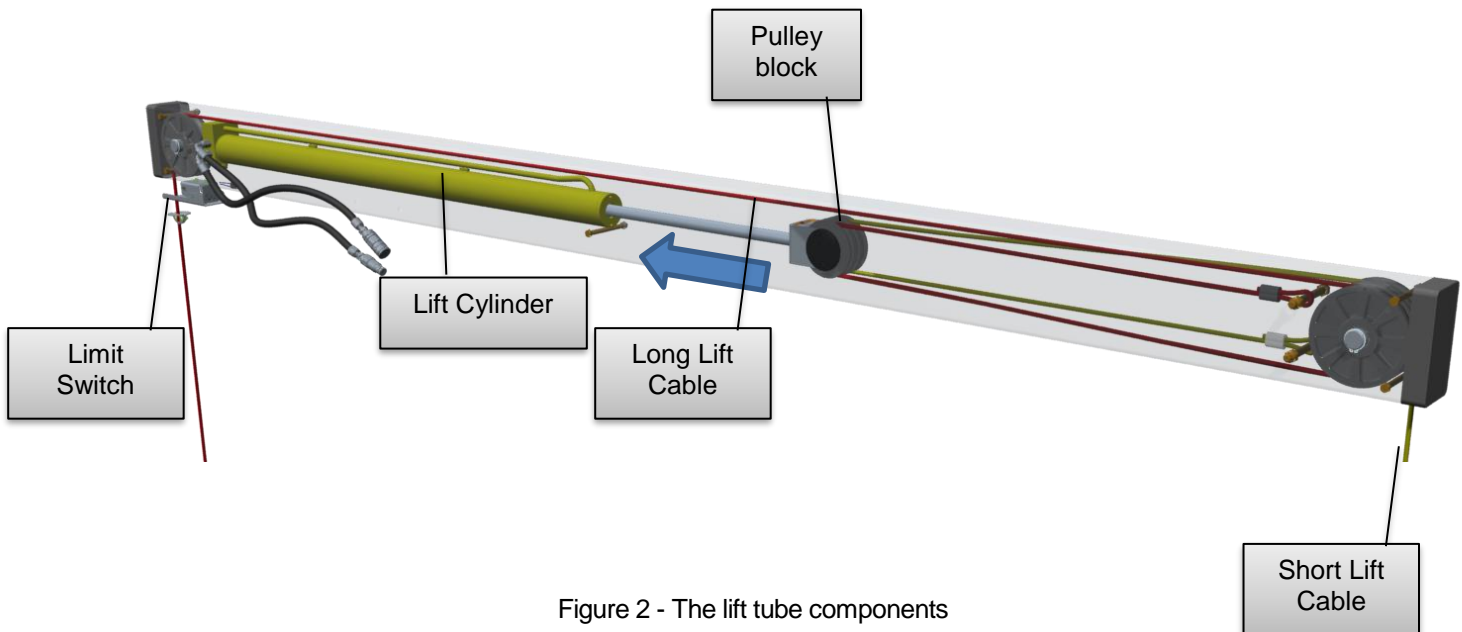


Figure 2 - The lift tube components

Lift Tube Mounting & Support

ShoreStation's lift tube design can accommodate a variety of mounting conditions. Mounting conditions vary greatly between installations. It is important that the sizing and installation of pilings, beams, and other structures is performed by qualified installers who are able to ensure the dock structure is capable of safely supporting the load of the lift and boat. Because of the large variety of dock structures, it is impossible for ShoreStation to provide guidance on sizing, installation, and design of the dock structure.

Lift tubes must be supported within 18" of the end pins. The support beams or pilings can be positioned above, below, inside or outside the end pins. This allows for 'hidden' installations above the support beams in the ceiling or under the dock.

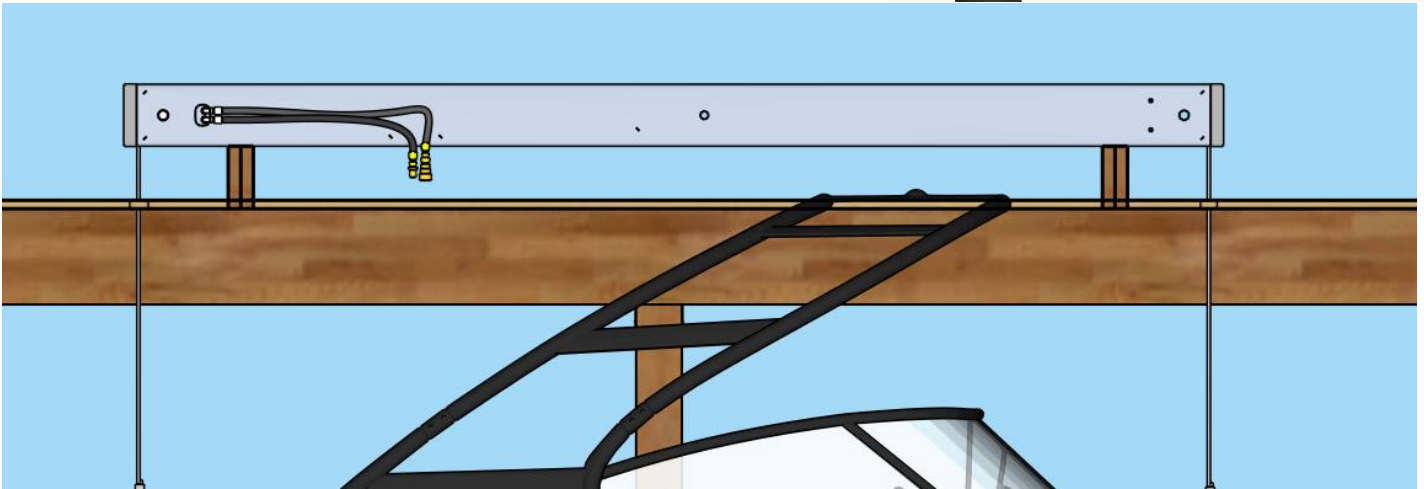
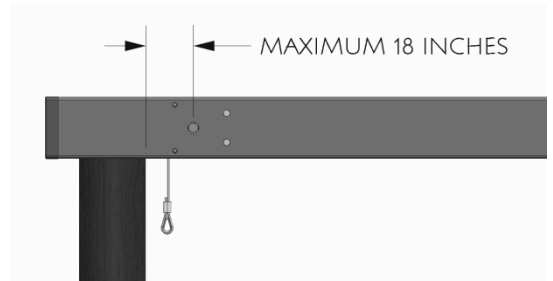


Figure 3 - LTPM above the beam to hide above a finished ceiling

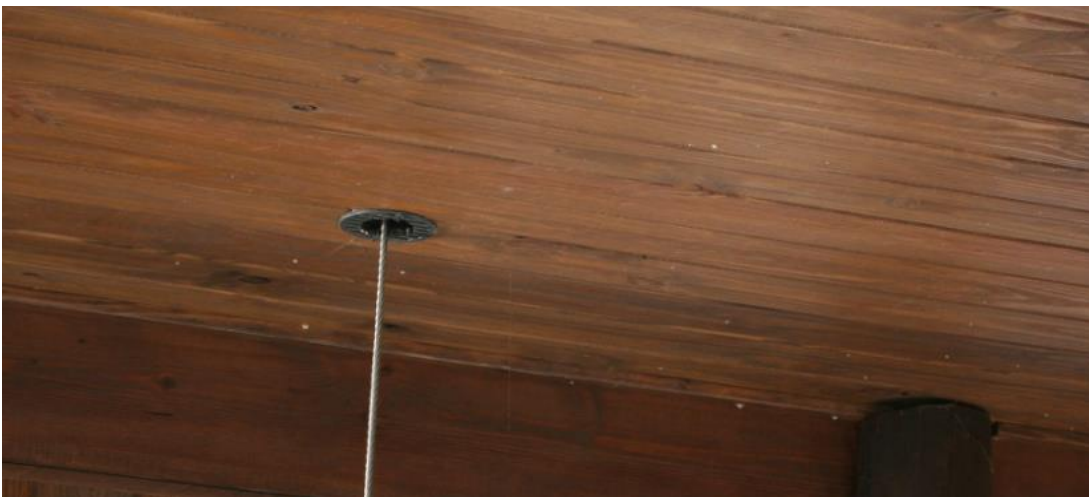


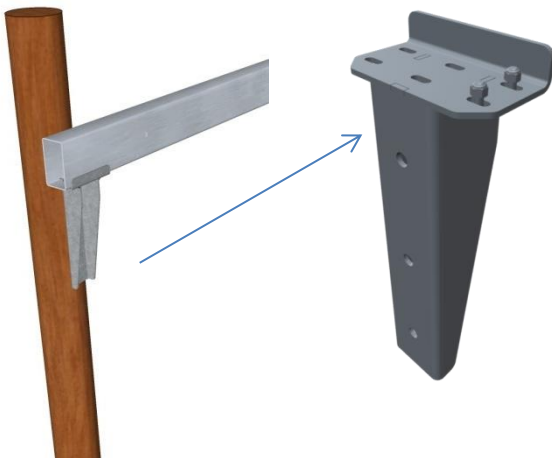
Figure 4 - Lift cable coming through finished boat house ceiling

Mounting Brackets

ShoreStation has three mounting brackets styles available: Boat House, Piling, and Side Mount. The brackets are designed for common beam or piling mounted installations. In some cases contractors will need to design custom brackets. Again, it is important that you consult a qualified engineer and installer when customizing installations.

Boat house brackets (HK-BH) are design to attach the lift tubes to the top or bottom of a beam.

Side-mount brackets (HK-PLSM06 shown) allow the lift tube to be supported inside a piling and allow the cradle to clear partially finished pilings where the dock would interfere with the piling



setup.

Piling brackets (included) allow the lift tubes to be connected on top of the piling. The brackets are design to be through-bolted to the piling. Please note, the though bolts are not included with the lift tubes. **Be sure to place a plastic barrier material between any treaded wood and the aluminum components to protect from corrosion.**



Hydraulic Power Units

The hydraulic power unit is the 'heartbeat' of the system. The power unit contains two hydraulic pumps connected to a single motor shaft. This mechanical connection forces the same volume of hydraulic fluid to each lift tube and keeps each side synchronized. A wireless controller or wired dock-side switch activates the motor solenoid and initiates the fluid flow.

The fluid is delivered to each lift tube through hoses. The pressure from each set of hoses opens a built-in counter-balance valve on each lift cylinder and moves the hydraulic cylinders inside each tube.

ShoreStation Hydraulic power units are available in two models: HPU300 and HPU400. Both systems are mounted in an all-aluminum 'dock box' style enclosure that is coated with a white baked powder paint finish. The dock box enclosure houses the hydraulic power unit, batteries, wireless control receiver, and optional battery tender. The HPU300 is a single motor, tandem pump power unit. The HPU400 is a double motor, double tandem pump power unit. The HPU400 will deliver roughly twice the speed.

ShoreStation recommends a group 27, marine deep cycle battery for use with the power units. The HPU300 requires 2 batteries. The HPU400 requires 4 batteries. Batteries are NOT included with the system from the factory.

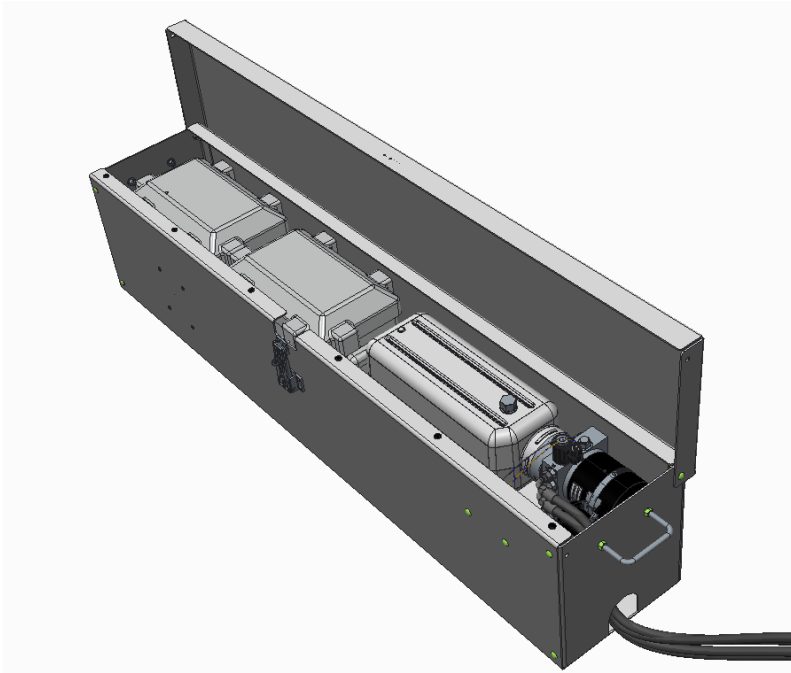


Figure 5 - HPU300 Dock Box Power Unit

The power units (Figure 10) come pre-assembled from the factory (batteries are not included). The power unit and batteries are mounted inside aluminum box that is powder coated white. 4' hose assemblies are connected to the power unit allowing easy disconnection and storage of the system in the offseason and during a storm or flood.

The power units can be mounted directly to the lift tube using the HK-PULTM hardware kit (Figure 11). Power units can be mounted virtually anywhere up to 40ft away from the lift using extension hoses. When selecting the location for the power unit location, make sure the location is not in flooding danger or in an isolated location that will make it difficult to receive a wireless signal.

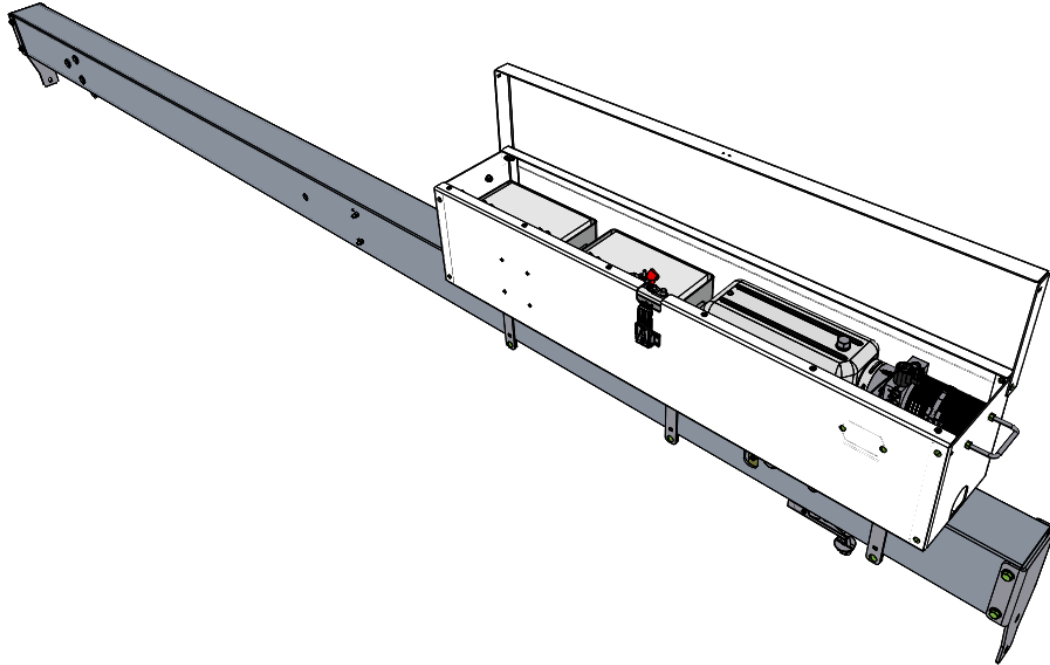


Figure 7 – HPU300 mounted on to the lift tube using the HK-PULTM hardware kit.

All power units come with the ShoreStation wireless control module. This control system allows the lift to be controlled with the two included water proof wireless remotes or using the included dock-side rocker switch. The rocker switch includes a key switch that locks the system (both rocker switch and wireless) and a level switch to allow you to adjust the cradle tilt. This unique control system is enclosed in a sealed enclosure that provides protection from exposure to the marine environment.



Figure 9 - Wireless Remote (2 included)

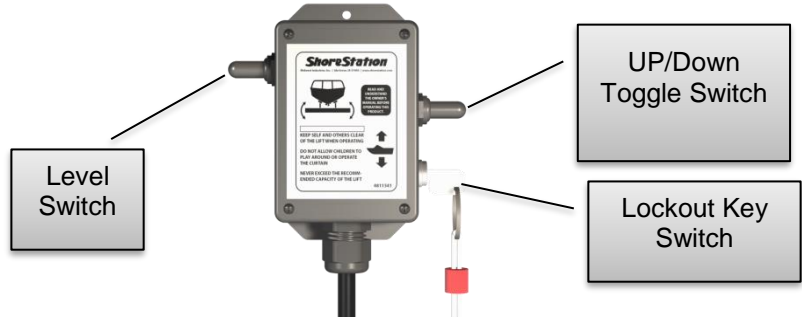


Figure 8 - Dock-side Rocker Switch and Lockout

Hydraulic Extension Hoses

Hydraulic extension hoses are required to connect the lift tubes to the hydraulic power unit. Each lift tube has a short (4 foot) hose set from the factory. All hoses in the system are designed for high abrasion resistance and constant submersion in salt water. They also feature stainless end fittings and quick couplings. Installers may elect to have custom hose sets made. If you elect to do this, be sure to 'bleed' all hose sets before connecting to the system. **All hose sets sent from ShoreStation are pre-bleed and ready for connection.** Hoses also should have a minimum rating of 3000 PSI.

ShoreStation offers extension hoses in 5, 10, 15, 20, 40, and 60 feet lengths. The extension hoses come pre-filled with fluid and have quick-couples for quick attachment to the lift tubes. Extension hoses can be connected together to for situations requiring hose lengths greater than 60 feet. ShoreStation recommends that the installer place the power unit so hose lengths are minimized.

Extension Hose Selection

At least one pair of extension hoses is required in all installations. To determine the correct length of hose, you will need to determine:

- What style of power unit are you going to use (dock box or lift tube mounted)?
- If you are using the dock box, where will the dock box be placed?
- Where are the lift tubes going to be mounted?
- Do you plan to run hoses around the front of the slip, through the roof, or underwater?

Example #1: A boat house lift will be installed on a dock (Figure 15) using an HPU300 power unit mounted in the ceiling on the port side of the slip. The included 4' long hoses on the port lift tube will be long enough to reach the HPU300 power unit, but extension hoses will be required to reach the starboard lift tube. The installer plans to use the nearest support

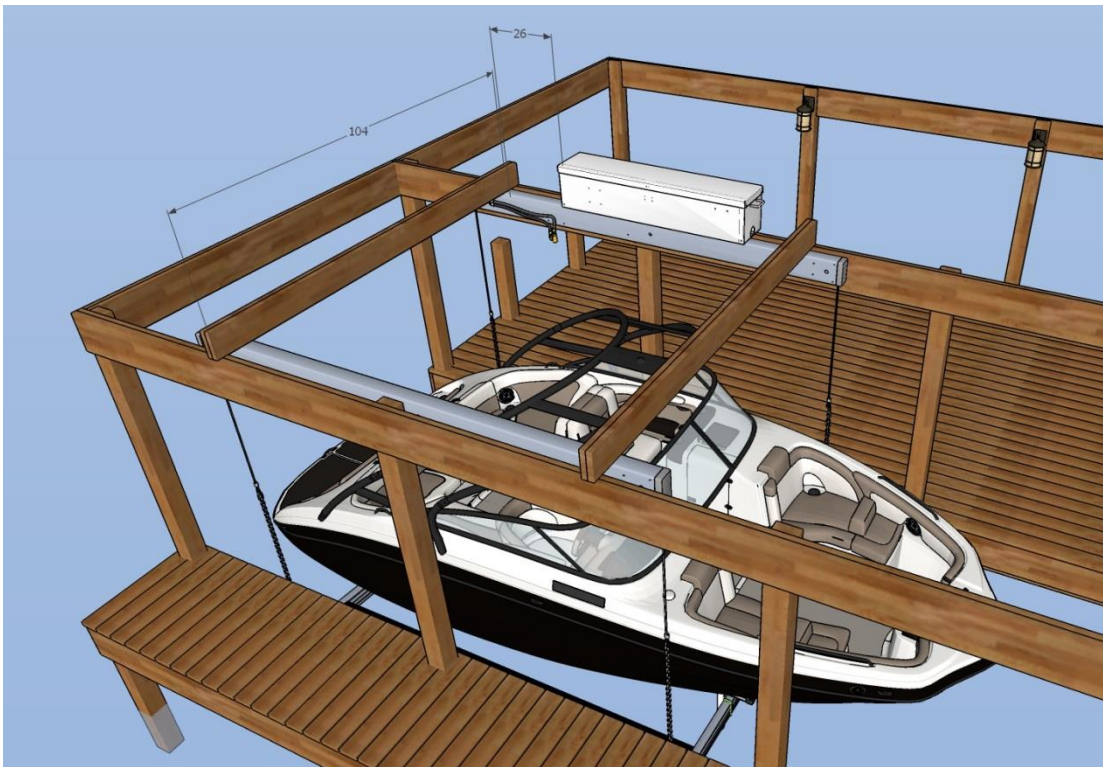


Figure 10 - Measurement for starboard side lift tube extension hoses.

beam to attach the extension hoses. The measurement from the HPU300 to the beam is 26 inches. The measurement across the beam to the starboard lift tube is 104 inches. The 4' hoses included with the starboard lift tube will be long enough to reach the beam, so the required minimum extension hose length is 130 inches (104+26) or about 11'. In this example, the installer ordered the HK-HEX15 (15 foot) extension hose set for the starboard lift tube.

Example #2: A piling lift will be installed next to a dock with the lift tubes close to the dock height. The installer plans to use the HPU300 dock box power unit at the front of the slip (Figure 16). The HPU300 comes with short hoses that extend out of one side of the box. The starboard side measurements to the dock box in this example are 10'-3 1/4" + 6'-11" for a total of 17' 3/4". The port side measurement total is 12' 8". The installer in this example orders a 20' set of extension hoses (HK-HEX20) for the starboard side and 15' set (HK-HEX15) for the port side. The installer could have ordered two 20' sets if more flexibility was required for the power unit location.

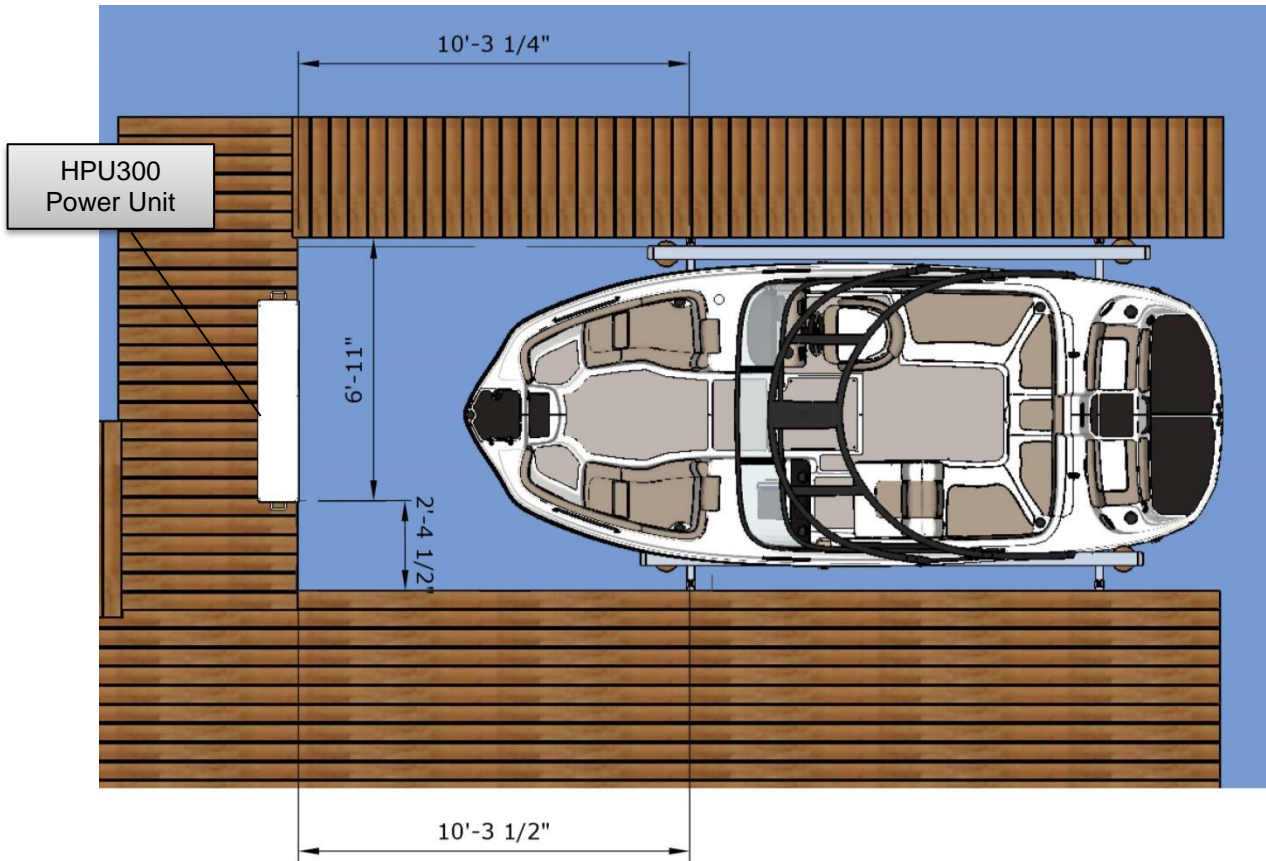


Figure 11 - Piling installation with HPU300 Dock Box

Example #3: A piling lift will be installed along the side of a dock. There is no dock structure around the slip. In this case, the installer plans to run the hydraulic lines underwater under the lift to the starboard side lift tube. The port side lift tube will be close enough to the power unit to connect directly with the included 4' hoses in this example. The 4000 lbs. piling lift tubes (LTPM408HS) have 8' of cradle travel. The installer plans to add 2' of extension chain to allow the cradle position to match the dock height. The installer also plans to have the port-starboard piling dimension to be 108 inches. In this example, the extension hoses will need to be long enough to run down the piling far enough to be below the lowest cradle level. The cradle travel (8') plus the extension chain length (2') creates a total 10' (120 inches). The installer adds 1' to this for additional clearance for a total of 132 inches from the top of the piling to the lowest point. The total extension hose length is the distance down the near piling, across the slip, and back up the far piling to the lift tube. In this example, the measurements are $132'' + 108'' + 132'' = 372''$ (31'). The installer selects the 40' extension hose (HK-HEX40).

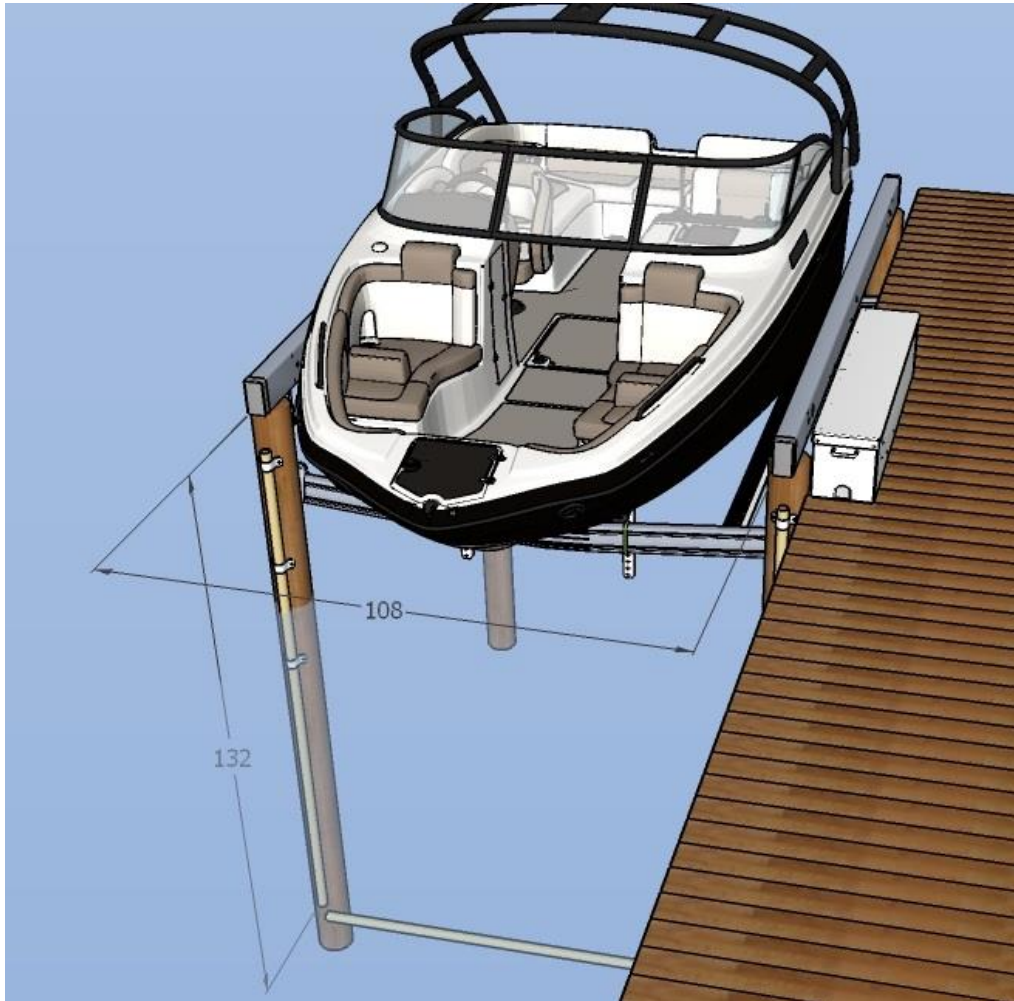


Figure 12 - Piling lift installation with no surrounding dock structure

Lift Cradles

The lift cradle is specifically designed for use with the ShoreStation® Hydraulic Lift. The aluminum construction, aluminum brackets, and stainless fasteners ensure the components will withstand the harsh marine environment. Cradles are available in different widths and lengths, depending on the matching lift tubes and the overall slip width requirements. **Be sure to match the cradle length to the cable spacing of the lift tube.** 4000 & 6000 lbs. lift tubes have 128" (325 cm) cable spacing. A cradle kit ending with 128 (example: PLF138-128) must be selected. 10,000lbs lift tubes have a 164" (401 cm) spacing. A cradle ending with 164 (example: PLF156-164) must be selected.



The lift tube cross members have an extruded t-slot that is used to fasten the hanger brackets and spacer beams. This allows the cross members to be modified to exactly match the slip width requirements. Installers can simply cut off the excess length with no additional drilling required.

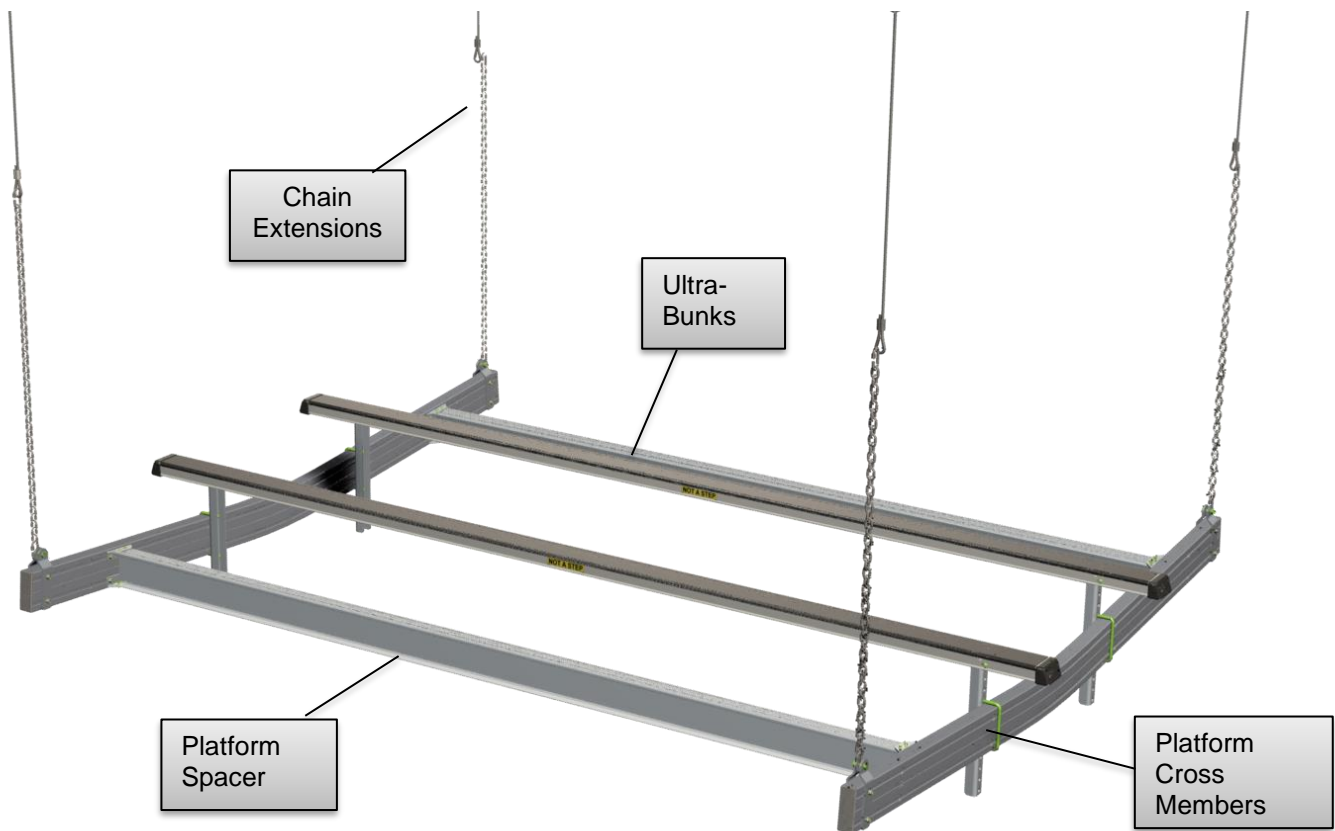


Figure 13 - Lift Platform Components

Refer to individual specification documents for each cradle for additional dimensions and specifications.

The unique Ultra Bunks are made from aluminum and plastic and eliminates the need for any wood on the lift cradle for boat support. This bunk system is specifically designed to conform to the shape of the boat hull. The system is also completely adjustable to match the width of the boat house. ShoreStation offers support systems for traditional boats, pontoons and tri-toon hulls.

The stainless steel chain extension creates the adjustment for the cradle distance. The distance from the lift tubes to the cradle will vary in every boat and boat lift installation. The chains provide 4' of adjustment for this variation.

Lift Configuration

The price list provided by your ShoreStation representative is organized to help configure the full lift together. Basically you work down the list to select components based on your application. Your ShoreStation rep is eager to help with the configuration. The configuration categories and a brief description are below:

Required Equipment:

- **HYDRAULIC LIFT TUBES** – the selection of the lift tube is based on the required lifting capacity and the vertical cradle travel. The lift tubes are sold in pairs and included 4 ft. long extension hoses.
- **HYDRAULIC POWER UNITS** – The hydraulic power unit is the box mounted hydraulic motor and battery box (batteries not included).
- **BATTERY CHARGERS** – The battery charger (solar or AC) is required to maintain the battery bank in the power unit.
- **HYDRAULIC EXTENSION HOSES** – At least one set of extension hoses are required to span the distance from the power unit to the farthest lift tube. Refer to the Hydraulic Extension Hoses section of this document for guidance.
- **ALUMINUM CRADLE PLATFORMS** – The aluminum cradle selection is based on the lift tube selection. The specification drawing for the individual cradle kits have dimensions so you can select the cradle based on the width of the slip you are creating, the capacity of the lift tubes, and the cable spread on the tubes.
- **POLY ALUMINUM BUNKS** – The bunk supports are selected based on the cradle you selected and the type of hull you are supporting.

Optional Equipment

- **LIFT TUBE HANGER KITS** – The hanger kits provide for lift tube mounting applications that are not the standard ‘top of piling’ mounting.
- **ACCESSORIES** – Accessories are listed for additional lift features. Boat Guides, Boat Stops and other accessories make landing the boat in the lift easier.

Details are available for each component on ShoreStation’s PartSmart system. PartSmart can be found at <http://shorestation.com/parts/PartSmart.htm>. Just type in one of the model numbers to find part illustrations, specifications, and literature.

ShoreStation provides SketchUp® CAD models of the lift components to designers. These models are part of SketchUp’s 3D Warehouse and are compatible with SketchUp 2014 and later. You can find the models by searching for the appropriate model number in the warehouse. The models are dimensionally accurate and allow you to create professional designs and documentation.

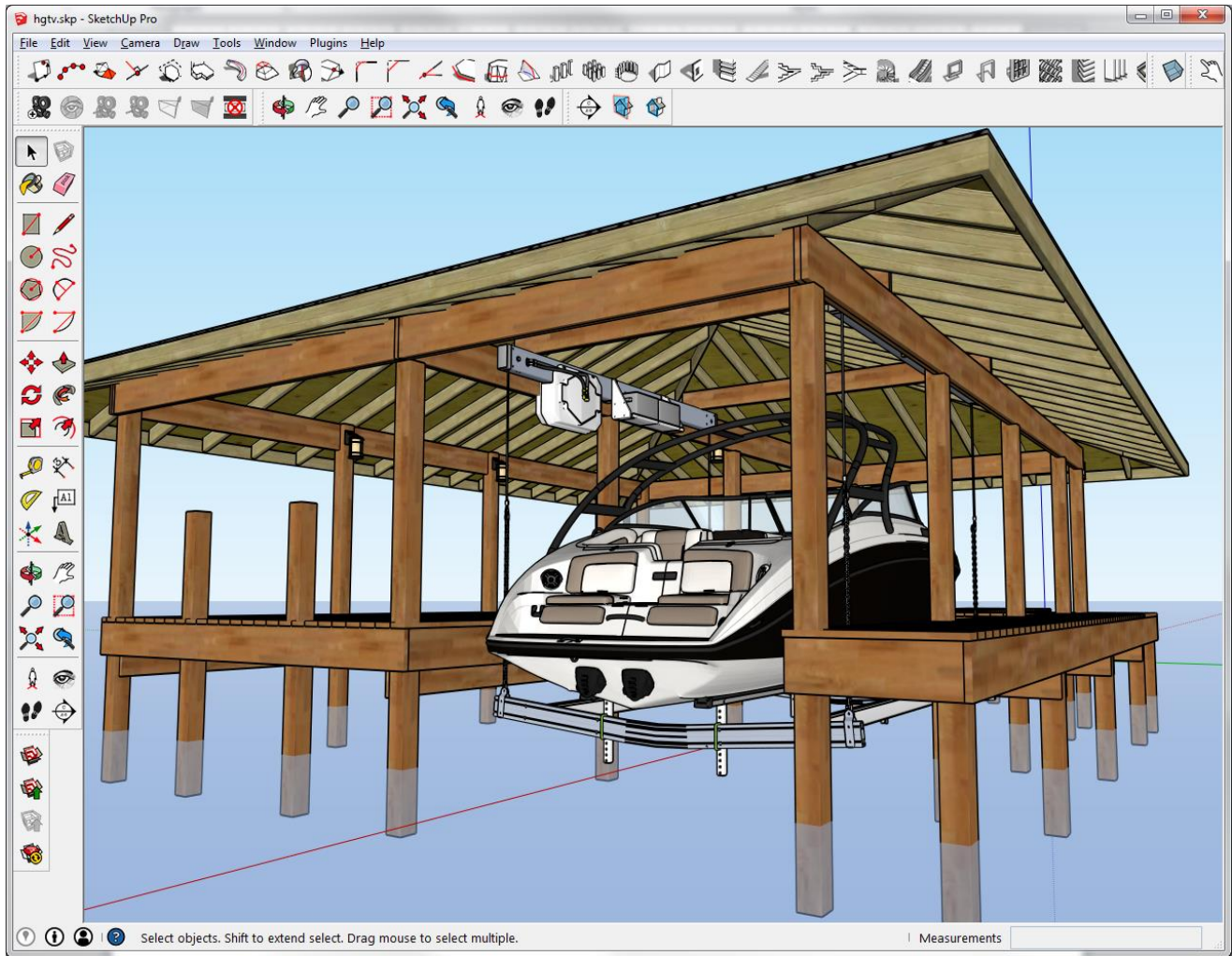


Figure 14 – SketchUp Design Software