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I. THE P-5C VIBROCORER. GENERAL DESCRIPTION.

The P-5C Modular Vibrocorer is the newest version of the original P-5 vibrocorer. It is designed for coring unconsolidated waterlogged sediments at sea, in lakes, rivers and harbors. Its light weight enhances its vibratory performances and facilitates its delivery and operation in sites hard-to-reach. It is adaptable to various coring requirements through its modular components and it is well suited for hazardous environments as it is fully encapsulated without external moving parts.

The letter "C" in P-5C indicates that the pressure housing is a solid casting. A cast housing eliminates all seams that requires welding. The original P-5 pressure housing was susceptible to weld fatigue.

The main components of the P-5C Vibrocoring System are:

- ➔ the vibrohead.
- ➔ the "buoyant frame" with its float-package and its weightstand.
- ➔ a coretube, equipped with or without a plastic liner.
- ➔ the underwater electrical cable coming from the surface support platform to the vibrohead.
- ➔ the control box located between the underwater cable and the power source.

The P-5C vibrohead consists of a pressure housing incorporating two contra-rotating motors of 3HP each provided with eccentrics. These eccentrics enter into spontaneous synchronization and the force being delivered is null when they are in horizontal opposition and maximum when they reach the same vertical position, alternately directed up and down, completing close to 3600 cycles every minute (3000 cycles on 50Hz).

The P-5C pressure housing is rated for operation in ocean depths down to 1,200m (4,000 ft). Under proper voltage conditions the internal vibrator motors have a 1,000 hour operating time before requiring service and lubrication. As a rule of thumb, at 2-3 minutes per core, this means some 20,000 cores.

The patented "buoyant frame" allows handling of the overall system with ease and with limited drawworks and deck space. It consists of two thin cables held taut underwater between a weightstand and a float package and guiding vertically the vibrocorer. The weightstand has provisions to accommodate an extension arms and two rigid vertical legs topped with a cross-beam transforming the frame into a conventional rigid support unit for special situations, such as shallow swift waters. The P-5C can be implemented with or

without the "buoyant frame". Usually, no frame is needed in calm waters to, say, 20m (65ft) depths with an anchored platform.

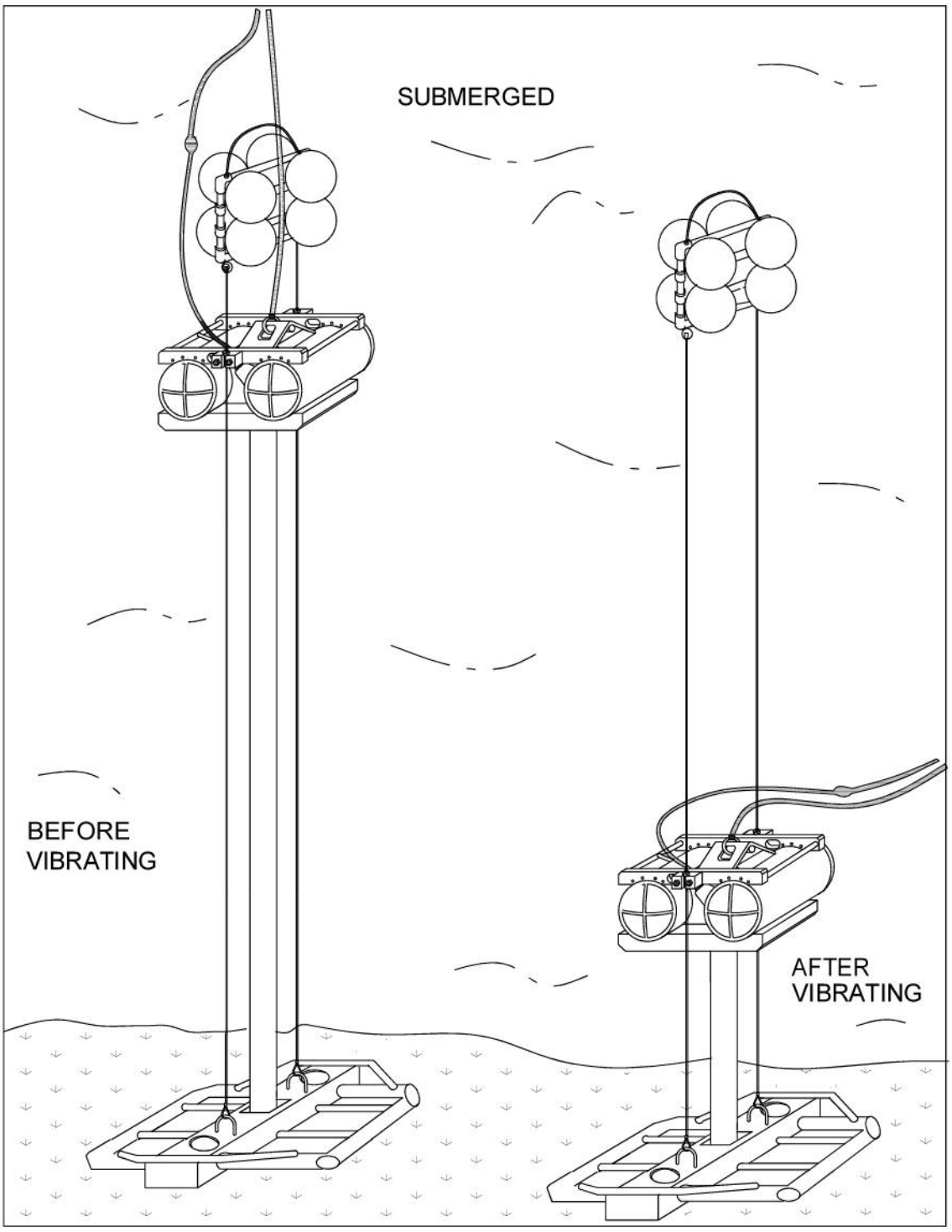
The unit can handle coretubes from 3" (76mm) to 5" (127mm) diameter with appropriate clamps and clamp-adapters. However it comes normally equipped with a 4"(101.6mm) clamp for 4" diameter coretubes (100mm if requested).

Standard 4" coretubes are of steel with a wall thickness of 0.083" to 0.125" (2.1mm to 3.1mm), equipped with expendable liners of clear plastic (cellulose butyrate or polycarbonate). Aluminum thinwall 4" coretubes with a 0.120" wall thickness can be used for shorter cores of 14 ft. (4m) or less, equipped or not with liners.

The P-5C eccentric settings can be modified to a low, medium or maximum setting. The medium setting is recommended for 60Hz current and the maximum setting for the 50Hz current (see next section "Specifications"). Regardless of the customer's power source, every P-5C is shipped from the factory with the eccentrics set on medium.

The depth of penetration of the coretube depends upon the force of the vibrohead, the characteristics of the coretube (material, length, wall thickness) and the characteristics of the sediment. With the P-5C vibrocorer using a 4"OD (101.6mm) coretube, we generally expect penetrations of 6 to 15ft. (2 to 4.5m) in packed sands and 10 to 20ft. (3 to 6m) in mud, silt and some clays. Cores to 35ft (12m) have been obtained with the original P-5 series. Note that the 20ft length often used as a standard for coretubes also corresponds to the common dimension of the off-the-shelf tubes or pipes and to the maximum dimension generally accepted for international airfreight.

The general vibrocoring operation of the P-5C is illustrated in the following page.


SUBMERGED
BEFORE
VIBRATING
AFTER
VIBRATING

II. MAIN VIBROCORER SPECIFICATIONS

☞ DEPTH CAPABILITY * 1,200m (4,000 ft)

☞ POWER REQUIREMENTS (**All 3-phase**)

230v, 50/60 Hz	(Low Setting =	8.5 kW, 10 amps,
	(Mid Setting =	9.0 kW, 12 amps,
	(High Setting =	10.0 kW, 16 amps,
440v, 50/60 Hz	(Low Setting =	8.5 kW, 4 amps,
	(Mid Setting =	9.0 kW, 6 amps,
	(High Setting =	10.0 kW, 9 amps,

☞ CENTRIFUGAL FORCE (1 kN = 225 lbs)

	At 60Hz	At 50 Hz
Low Setting =	32.0 kN	21.8 kN
Mid Setting =	40.0 kN	27.3 kN
High Setting =	48.0 kN	32.8 kN

☞ VIBRATIONS PER MINUTE 3,450vpm @ 60Hz or 2,850vpm @ 50Hz

☞ APPROXIMATE WEIGHT

in air (w/o ballast & coretube)	450 lbs (210 Kg)
submerged (w/o ballast & coretube)	220 lbs (100 Kg)

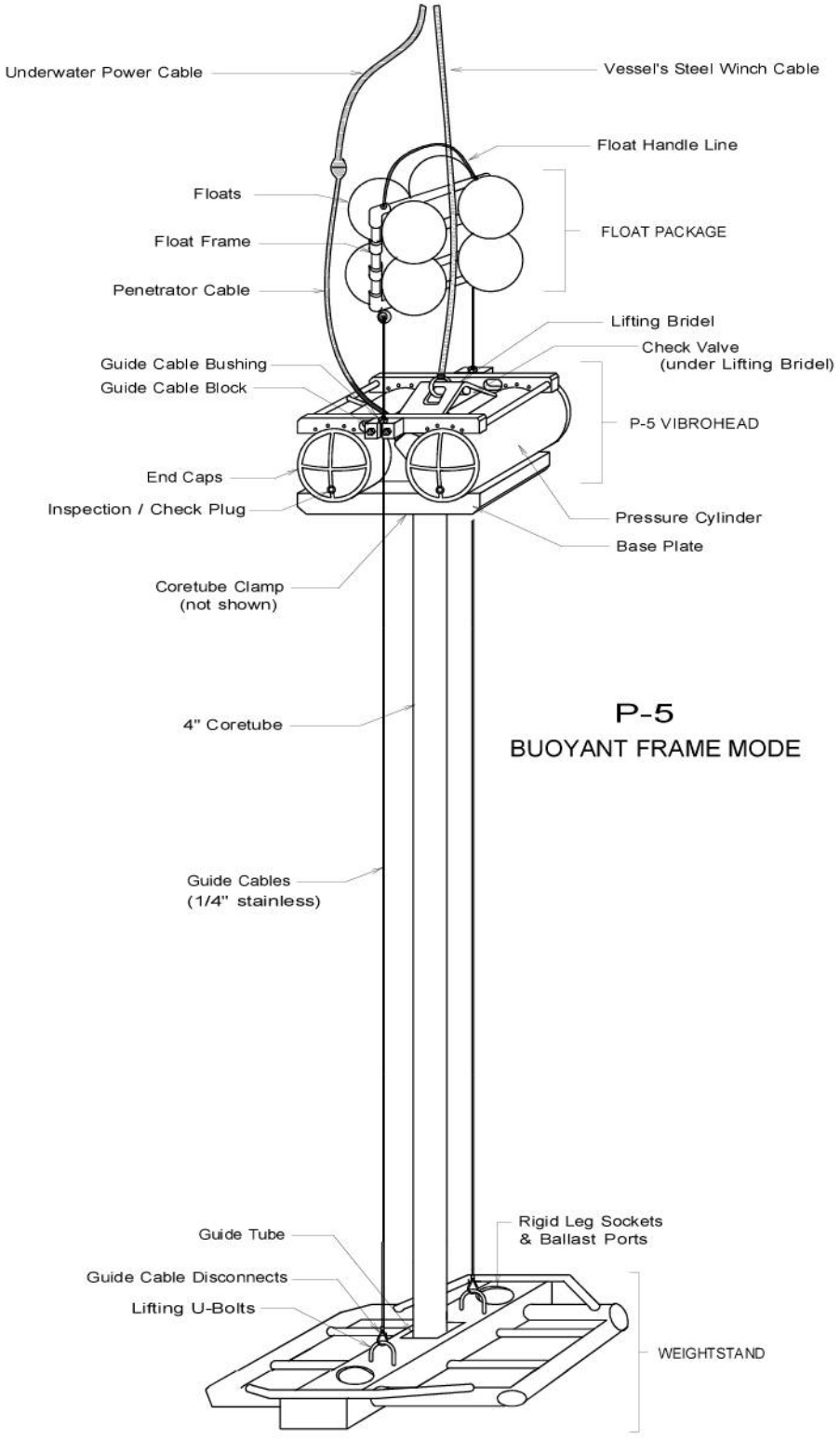
☞ RECOMMENDED BALLAST (lead, scrap metal, etc.) 100 lbs (45 Kg)

TYPICAL CORETUBES, NOSES, and LINERS

	O.D.	I.D.
☞ 4" ALUMINUM LINERLESS CORETUBES		
4" Thin Wall (0.125" wall) aluminum, 1.75 lbs/ft.	4.00" (101.6mm)	3.750" (95.2mm)
Rivetable Corenose (with incorporated retainer)	4.00"	3.55" (90.1mm)
☞ 4" STANDARD CORETUBE FOR LINERS		
4" Thin Wall (0.083" wall) carbon steel, 3.47 lbs/ft,	4.00" (101.6mm)	3.834" (97.4mm)
Clear Liner** , 1/16" wall,	3.75" (95.3mm)	3.63" (92.2mm)
Rivetable Corenose (with incorporated retainer)	4.00"	3.40" (86.4mm)
4" Thick Wall (.120" wall) carbon steel, 4.97 lbs/ft.	4.00" (101.6mm)	3.760" (95.5mm)
Clear Liner** , 1/16" wall,	3.62" (92.0mm)	3.50" (88.8mm)
Rivetable Corenose (with incorporated retainer)	4.00"	3.37" (85.6mm)

* A Deep-Version of the P-5 and VT-6 is available for operating depths to 3,000m (10,000 ft.) under the name of DO-5 and DO-6. Its mechanical and electrical specifications are generally the same as the P-5C except for the heavier weight. Also, it requires an Electro-mechanical and winch to provide the proper voltage and lifting capacity to the system.

** Standard clear liners are CAB (cellulose-acetate butyrate) and polycarbonate (Lexan).


Underwater Power Cable
Vessel's Steel Winch Cable
Float Handle Line
Floats
Float Frame
FLOAT PACKAGE
Penetrator Cable
Lifting Bridel
Check Valve
(under Lifting Bridel)
Guide Cable Bushing
Guide Cable Block
P-5 VIBROHEAD
End Caps
Inspection / Check Plug
Pressure Cylinder
Base Plate
Coretube Clamp
(not shown)
4" Coretube
P-5
BUOYANT FRAME MODE
Guide Cables
(1/4" stainless)
Guide Tube
Rigid Leg Sockets
& Ballast Ports
Guide Cable Disconnects
Lifting U-Bolts
WEIGHTSTAND

III. P-5C ASSEMBLY, MAIN COMPONENTS AND HANDLING.

GENERAL ASSEMBLY

The general drawing of the previous page illustrates the essential components of the P-5C modular vibrocorer in its buoyant frame mode. The unit is easily assembled:

1. The new vibrohead is shipped with the check valve already properly mounted in place. A periodic inspection to insure that this unit remain tightly fastened to the vibrohead is recommended.

2. Insert and screw the guide-cable bushings, one on each side of the vibrohead, into the guide-cable threaded slot with the hex-head on the top side of the guide-cable slot. The 1/4" stainless steel guide-cable will pass through the center of the guide-cable bushing and have stainless steel eyes nicro-pressed onto each end of the wire cable. **NOTE:** Each set of guide-cables are intended to be used with a specific length of coretube. Extra guide-cable bushings would be required to make various length cable sets. Measuring the proper length of stainless steel cable to make a guide-cable assembly is covered on page 13.

3. Mount the coretube-clamp to the underside of the vibrohead using the two double 1/2-13 stainless steel bolts each welded to a half circle plate. These double bolt unit pass from the top side of the base plate to the under side of the vibrohead. Use a flat washer and nylock nut on each bolt. Do not tighten the nuts until a coretube has been inserted through the coretube-clamp and into the hub of the vibrohead. This will insure proper alignment of the coretube-clamp with the hub. Now tighten the nylock nuts to secure the coretube-clamp to the hub.

NOTE: When tightening, first sung up all the nylock nuts eight total (8). For final tightening, first do the four horizontal bolt drawing the jaws together and then the four vertical bolts welded to the half circle plates. Do not over tighten! Apply 60 to 90 ft.lb./in. Use a 1/2” drive ratchet only. Do not use an extension bar or breaker bar.

4. Connect the underwater power cable to the vibrohead and to the power source. See page 5, "Specifications" for the proper voltage and current and page 10, "Connecting the Underwater Power Cable".

5. Attach the corenose to the end of the coretube. See page 11, "Corenose".

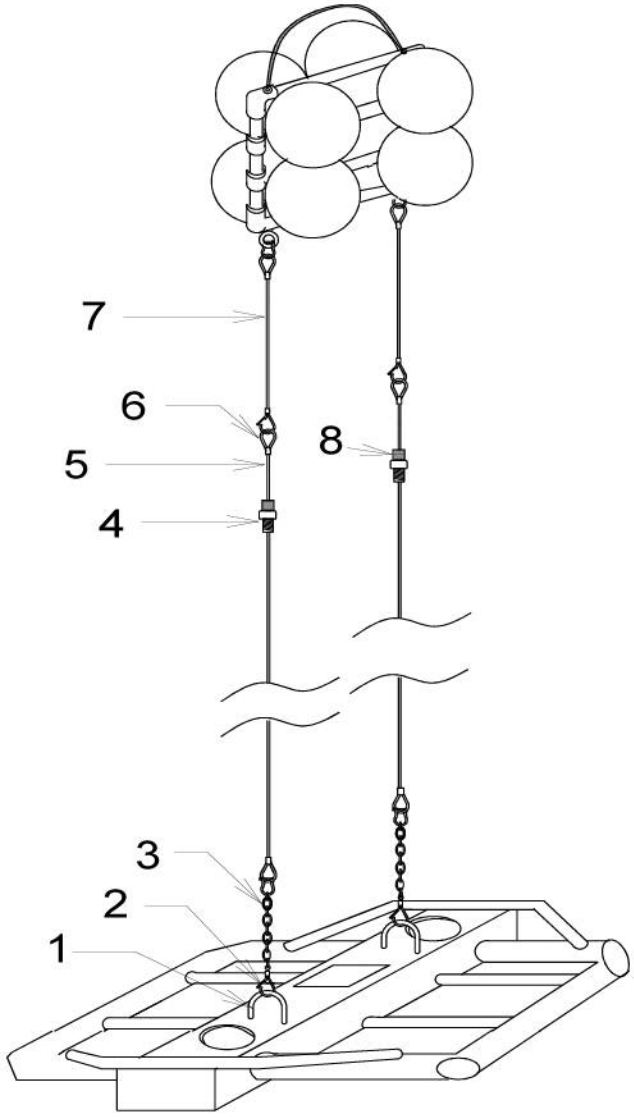
6. Add ballast to the weightstand. See page 12 "weightstand" for details on the ballast.

7. Attach the vessel's winch cable to the vibrohead.

Lifting Shackles. **NOTE:** To prevent the loss the vibrocoring system during deployments and operations, the attachment shackles the vibrohead and the winch cable MUST have seizing wire locking the shackle-pin into the shackle's body. This connection must be checked on a regular basis.

BUOYANCY FRAME AND FLOAT PACKAGE:

The buoyancy frame consists of the weightstand, two guide-cables and the float package. The guide-cables are constructed using 1/4" stainless steel cable passed through the guide-cable bushings (4) with a nicro-press fitting and eye on both ends. Shackled on the lower end of the guide-cable there is an 8" to 12" section of 1/4" galvanized chain (3) with a stainless steel, heavy duty clip (2). These clip the guide-cables to the weightstand's U-Bolts (1) during deployment and retrieveal. The chain allows the guide-cable length can be adjusted several inches to accommodate different length corenoses or to correct an incorrectly made guide-cable length.



A 12" leader section (5) allows the top of the guide-cable to be accessible during deployment and retrieval to attach the float package's Leader cable (7). At the lower end of the 12" leader section is a nicro-press fitting crimped into place acting as a stopper (8).

The distance between the stopper and the U-Bolt should be equal to the length of the coretube. Any minor adjustments can be made with chain by adding or removing a chain link. **NOTE:** It is very important to adjust the length of the guide-cables so the corenose on the end of the coretube is captured inside the weightstand's guide tube (See pg.4) by 2"-3" when the vibrohead and buoyant frame system in hanging in air.

For deployment at sea, the most practical procedure is to deploy the Vibrocorer clipped with the guide-cables and weightstand, but without the float package. Lower this unit until the Vibrohead is level with a person's chest standing on the stern. At this point, clip the float fackage onto the guide-cable leaders and

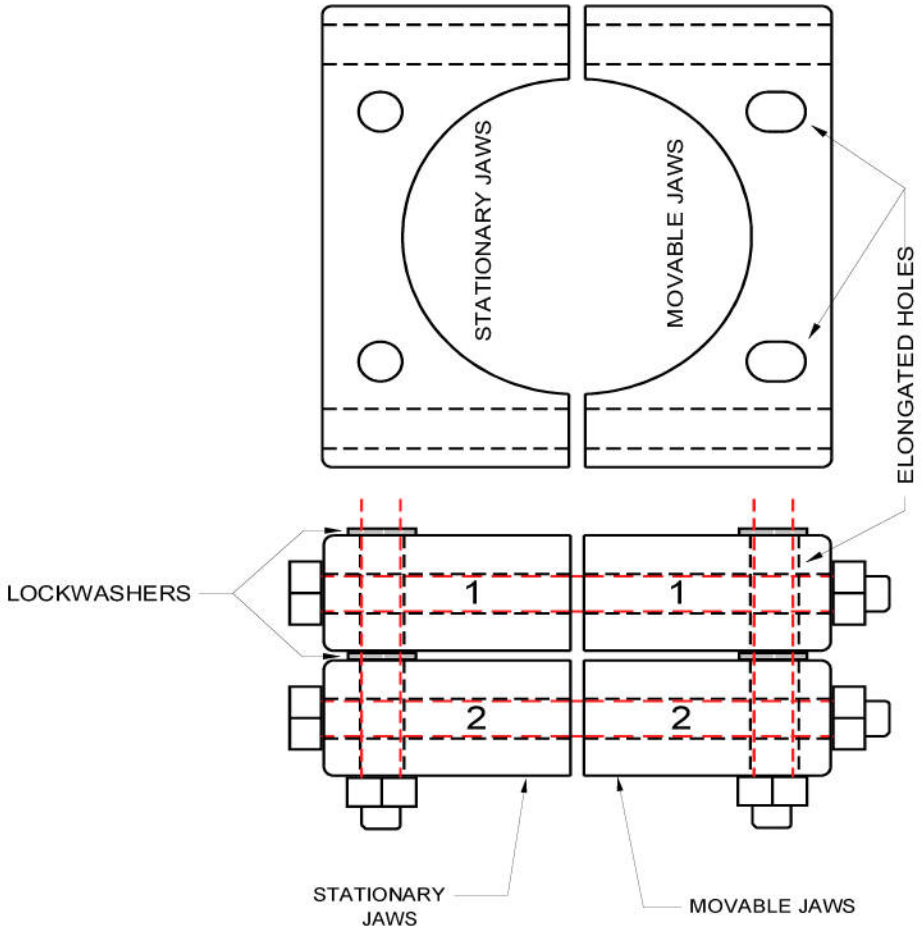
let the float package hang on the side of the vibrohead while lowering the unit the rest of the way into the water.

When submerged, the float package will flip right-side up into the proper position. The stern technician can guide the Float Package into this position by hanging on to the float Package's hand rope located on top to the floats.

NOTE: On one side of the float package there is a gap of approximately 3" between the floats (See drawing on page 4&5). The vessel's winch cable should positioned in this gap along with the Underwater Power Cable if possible during decent to the sea floor. When the vibrocorer reaches the sea floor the winch cable and power cable will fall sideways and not bear upon unit tilting it.

USING THE P-5C CORETUBE CLAMP

The P-5C clamp consists of four pieces: two are the Fixed Jaws, and two are the Moveable Jaws.



1. First, place four sets of one stainless steel flat washer and one lock washer over the four 1/2-13 stainless steel studs on the underside of the vibrohead. Next, install the two fixed jaws onto the vibrohead over the studs by aliening the two holes of the jaws and slide them over the studs. Put a flat washer over each stud between the jaws. Add the last flat washer and a Nylock nut onto the studs and draw the nuts up, but do not tighten them yet.

2. Do the same procedure for the two movable jaws as above. The movable jaws have the two elongated holes.

3. Insert a coretube through the clamp and into the Hub of the vibrohead until the coretube stops at the 4"*ID* inside shoulder in the vibrohead's base.

4. Insert the four horizontal bolts through the two sets of jaws connecting them to each other. Snug the four nut on the bolts to secure the fixed jaws to the movable jaws.

5. Now with the coretube inserted and the clamp aligned over the coretube hole in the vibrohead's base, tighten the fix jaws two nuts on the studs securing them to the vibrohead. This portion of the clamp does not have to be loosened to remove the coretube.

6. Tighten evenly the four 1/2-13 nuts on the horizontal bolts to secure the coretube into the clamp.

7. Tighten the last two nuts on the movable jaw studs securing the jaw to the vibrohead. The coretube is now securely fixed into the vibrohead for coring.

NOTE: 1. If any of the nuts & bolts associated with the coretube clamp are loosened during vibration, problems may arise: (1) The coretube may be damaged and break below the clamp, staying in the ground. (2) The amperage draw may raise and exceed the limits of the power source preventing the operation of the Vibrohead. Also, never use a stainless nut on a stainless bolt for the coretube clamp. Under repeated use the bolts and nuts may seize. Always use a softer steel nut on a stainless bolt.

CONNECTING THE UNDERWATER POWER CABLE

The Underwater Power Cable's (UPC) length, style, and manufacture is the decision of each individual customer. However, one aspect that is common with any UPC is the ability to mate the connector properly to form a watertight seal. If water should enter the mated connectors, even a single drop, damage will result causing the replacement of the connector(s) and even a section of the UPC.

The P-5C Vibrohead Terminal Connector Assembly mounted on the pressure housing includes a Penetrator, a cable lead and a CCP Connector. The penetrator, supplied by Impulse Enterprise, San Diego, is a stainless steel penetrator style "bulkhead connector"

MSSK-4-BCR-PNA specially modified from the MSSK series to provide the additional bore-seal O-Ring. Internally, this single penetrator is connected to both vibrator motors inside the vibrohead. Externally it is molded to a Kevlar reinforced, 12 gauge, 4 conductor neoprene cable which in turn is molded to a Impulse Epoxy XSL-4-CCP connector.

The XSL-4-CCP is the connector that the UPC will mate with. The UPC must have be terminated with an XSL-4-CCR connector to mate correctly with XSL-4-CCP on the P-5C Vibrohead. (See Appendix B).

Assemble the connector using only a dielectric silicone O-Ring lubricant. (Refer to the below section pertaining to inspection of the O-Rings). After screwing the XSL's locking ring into place, it is recommended to wrap electrical tape around the connection to prevent any sediment from entering the small gaps and to prevent any accidental unscrewing of the connectors while under vibration.

MAINTAINING THE CONNECTORS AND O-RINGS

WARNING: Do not drop a connector onto a hard surface such as the deck of a ship, steel, concrete, etc. Such an impact on the connector could cause small cracks in the epoxy body or damage the tightening rings. If a small crack is visual, replace the connector. Under pressure, water can be forced through the smallest fracture and short out the system.

1. Inspect each O-Ring for damage or deformation. Replace the O-Ring if it dose not look new. The MSSK O-ring numbers are: 2-021 for the bore and 2-029 for the face seal. The XSL O-ring numbers are: 2-016 for the CCP connector and 2-017 for the CCR connector.
2. Clean and lubricate each O-Ring before each assembly.
3. Inspect and clean the insides of the mating connectors. Remove any debris, water moisture and dirt.
4. During storage, protect each connector with a strong cover, such as a piece of PVC pipe.
5. Do not over tighten the connectors when mated. A firm hand-twisted connection is all that is required.
6. A damaged O-Ring only cost pennies, a new connector and cable cost hundreds of dollars not to mention valuable down-time.

FITTING THE CORENOSE (CORETUBES WITH LINERS):

The standard corenose (see drawing next page) is designed to be attached to the coretube by four (4) 3/16" diameter pop-rivets. These rivets are considered expendable for each core. The liner will slide over the first shoulder on the corenose.

Preparing the Coretube:

1. The coretube may need to be cut to the required length.

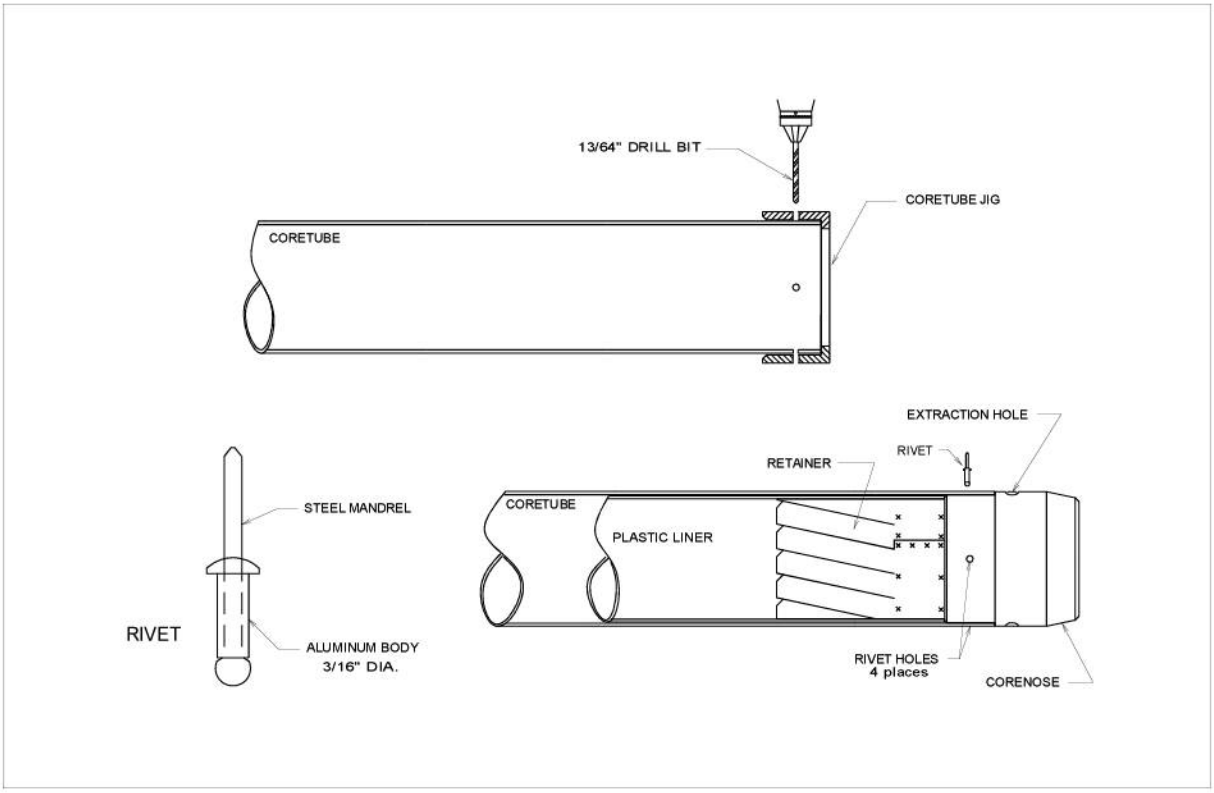
2. Use a file to remove any burrs or turned-over edges inside and outside of the coretube at each end.
3. Place the Coretube Jig over one end of the coretube and drill the first rivet hole. Insert a rivet into the hole through the jig and coretube to keep the jig from rotating while drilling the next three holes. Drill the remaining holes. Remove the Coretube Jig.
4. File the burrs from the drills holes inside and outside.

Assembling the Coretube, Liner and Corenose:

1. Measure and cut the liner to the same length as the coretube. Insert the liner into the coretube. The liner should be 1.5" inside the coretube's end.
2. Insert the corenose into the liner and coretube.
3. Rotate the corenose to line up the coretube and corenose rivet holes.
4. Insert the four rivets and fasten.

Removing of the Corenose and Liner:

1. Chisel off the rivet's aluminum head and then tap the mandrel out with a punch.
2. Insert the 3/8" steel rod (using it as a lever) through the extraction holes on the end of the corenose and rotate the corenose back and forth while pulling it out of the coretube.



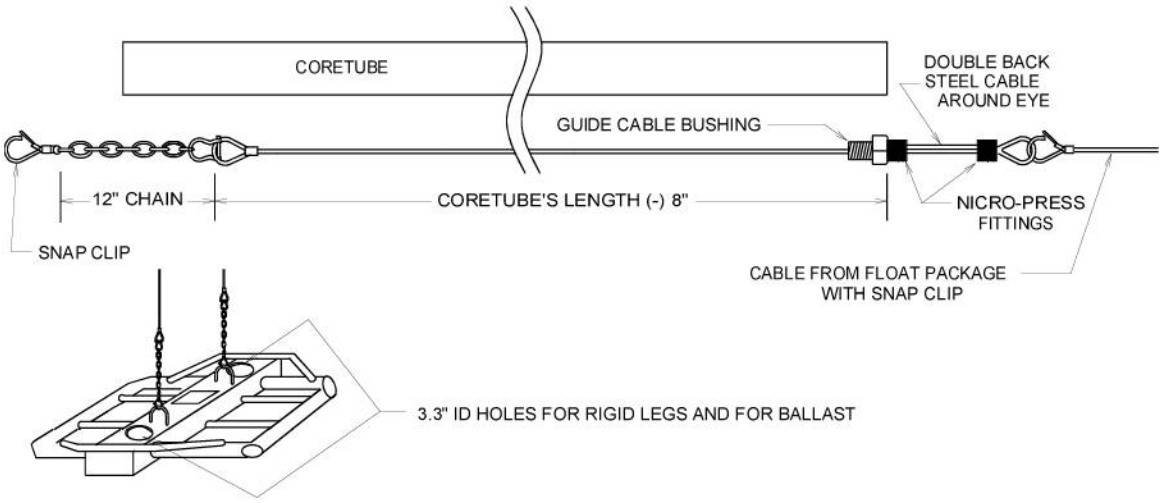
WEIGHTSTAND & GUIDE-CABLES

1. The Weightstand is designed to maintain a fixed position on the sea floor, to guide the coretube into the sediment and to stabilize the vibrohead in a vertical attitude with the assistance of the float package.

2. The weightstand has two openings to accept about 45 kilos (100 lbs - weight in water) of additional ballast. This enables the user to add extra weight when in operation and then to remove the extra weight for transportation. Scrap iron / steel may be used, such as chain, lead weights, etc.

3. The two stainless steel guide cable attach to the U-bolts on top of the weightstand by means of the snap clips on each cable. The guide cables, which pass through the vibrohead by way of the two guide cable bushings and to which the float package is attached, should be about the same length as the coretube being used.

4. To make a proper set of guide cables, the actual length of the stainless steel cable will be measured from the outside lip of each "eye" on each end of the cable. This measurement should be 8" shorter than the length of the coretube. At one end of the cable a 12" long section of 1/4" chain will be attached with a large snap clip. The chain will allow for cable length adjustments if the size (length) of corenoses are changed, or the next coretube may not be exactly the same length as the previous coretube.



5. When the guide cables are properly adjusted, the corenose on the end of the coretube when mounted in the vibrohead should be captive inside the guide tube of the weightstand by approximately 2-3" from the top. The corenose does not protrude under the weightstand.

RIGID LEG AND TOP BEAM ASSEMBLY:

This setup is for conditions where either a current is to swift or water may be to shallow and the vessel's drawworks are to short. The weightstand is provided with two sockets (3.5"ID) for setting two rigid legs (standard 3.5"OD pipes) for the Rigid Leg Assembly.

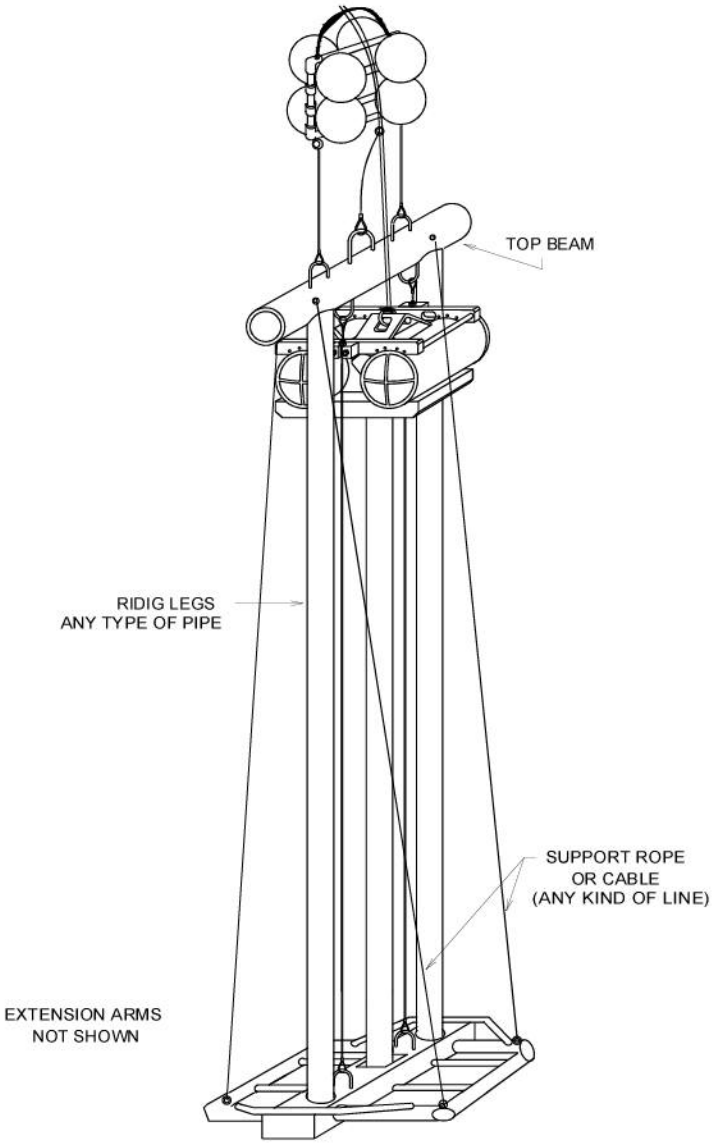
Follow the drawing below for the rigging.

1. The best way to assemble this setup is to lay the vibrohead and captive coretube on deck with the guide wires all rigged. Have the weightstand supported on its side at its proper position at the end of the coretube. This will allow for proper measuring for the leg dimensions and support lines.

2. Remove the guide wire and floats. **NOTE:** The legs must be cut to a length placing the top beam one foot or more above the vibrohead. Measure and cut two legs and insert them into the weightstand. Pin them into place. Place the top beam over the legs above the vibrohead.

3. The 1/2-13 stainless steel threaded rod and two eye-nuts will pin each leg into the top beam. When the legs are positioned in the top beam use a 1/2" drill bit to enlarge the pin holes on the top beam while drilling into the leg. Do this from both sides of the beam. Insert the 1/2" rod into the hole and screw the eye-nuts into place. Now the legs are captivated in the assembly.

4. Make the support lines from any strong line or cable. Fasten or tie the line from an eye-nuts on the top beam down to each corner of the weightstand. Do this for each corner. The assembly is complete. Deploy as usual.



JETTING:

The P-5C has two jetting ports on the top side of the vibrohead's base plate. These two ports are threaded for pipe. A jetting water pump with a capacity of 200 psi at water depth and a large volume of water is necessary for any success. Jetting is not very efficient, however in some cases can improve core penetration.

To jet water through the vibrohead and through the coretube the check valve and nylon ball on the underside of the vibrohead must be removed. One or two the top ports can be use for jetting. Screw the water supply hose into the ports using Teflon tape and attach the supply hose to the vessel's winch line attached to the vibrohead.

Turn both the vibrocorer and water pump on at the same time and deploy as usual until the desired depth is achieved. Turn both the pump and vibrocorer off. When the flow of water has stopped resume the vibration for the new core penetration.

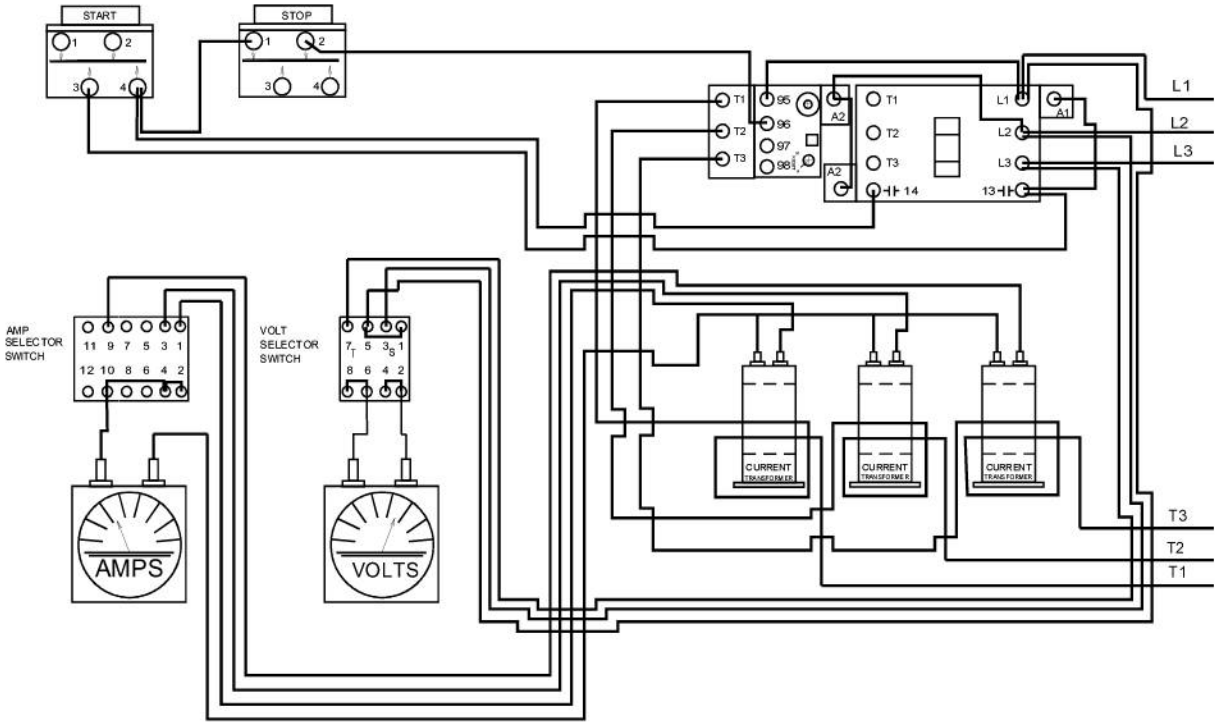
CONTROL BOX:

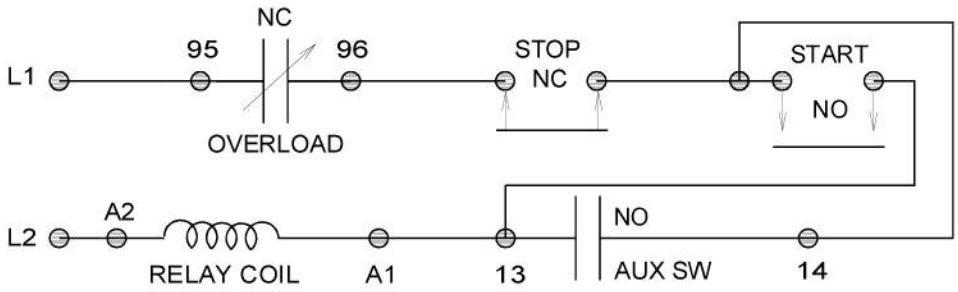
The control box (motor starter) is specially built for operating and monitoring the vibrocorer. Its components consist of the "Start" and "Stop" buttons, a selector switch for voltage, a selector switch for amperage, and the volt and amp meters.

1. Wire the control box to a 3 phase power supply and to the vibrohead. Before pushing the "start" button monitor each phase of the incoming current. Use the voltage selector switch to switch between a pair of current phases. These values are between two phased, not between a single phase and neutral, and should be at least as high as the minimum voltage required to operate the vibrocorer. **NOTE:** Remember that there will be a current loss over the power cable, so if the vibrocorer is to operate on 230 volts the incoming power to the control box should be above 230 volts.

2. The amperage meter is to monitor the current draw across each phase. All three phases should be drawing the same value at all times. If one phase is less than the other two a bad power cable may be the cause or a damaged vibrator motor. Get to know what the amperage should be during operation. If a high amperage is read on all three legs, check to see if the coretube is loose or breaking at the coretube clamp. Also, inspect the vibrator motor mount bolts for looseness. Excessive high amperage means that the vibrohead and motors are unbalanced, flopping around. When the overload protector trip off do not just reset it. Stop coring and figure out what was the cause, correct it, then continue coring. The overload is to protect your investment. Do not ignore it!

P-5C CONTROL BOX





IV. SOME POINTS TO CONSIDER BEFORE AN OPERATION

Three critical areas have to be considered before operating the Vibrocorer, and they are:

1. The selection and procurement of the coretubes and liners.
2. The support platform (barge or vessel) and its ancillaries (drawworks).
3. The power source and electrical cable.

I. CORETUBES AND LINERS:

Selection and Availability: First, a decision has to be made whether to use a steel coretube with liner or a bare aluminum coretube. This decision is in part a function of what is locally available. For overseas work, due to the fragility and bulkiness of liners, the best is to see if liners can be found locally off-the-shelf or can be locally extruded to custom specs then to look for the corresponding the coretubes, bearing in mind that the diameter clearance between the coretube's ID and the liner's OD should be in the order of 1-2mm (0.030-0.060"). Air shipment of a few adequate steel tubes and corenoses to fit the liners is not an expensive proposition. See Appendix A "Selection of Locally Available Coretubes and Liners".

Second, a sample of the chosen coretube and liner to adapt and, if needed, fabricate matching clamps and corenoses.

Length of Coretubes vs. length of sample: If a 15ft. (4.5m) core sample is required, the coretube needs to be 16ft. (4.8m). This is because some 6" are lost when inserting the coretube into the vibrohead and another 6" are lost with the attachment of the corenose and retainer.

II. VESSEL CHARACTERISTICS:

The size of the vessel does not have as much relevance as does its maneuverability, although it must be large enough to support an A-frame of adequate size along with working deck space.

Taking a core with P-5C is a relatively fast, but not an instantaneous operation. Due to the difference of piston or dart corers, the Vibrocorer has to stand on the sea floor for a minimum time allowing for full penetration. Two to three minutes is the average duration. Therefore the vessel must be able to maintain its position over the core site and remain on position while the vibrocorer is deployed and coring. The vibrocorer is coupled to the vessel via the winch cable and the vibrocorer's underwater electrical cable. If the vessel drifts away from the vibrocorer while it is operating on the sea floor, the tension on the winch cable can pull the vibrocorer over or the underwater electrical cable may not have sufficient length and may snap. This will damage the connectors and could cause an electrical short or damage the vibrocorer's motors.

Also, if the vessel drifts or swings on its anchor chain, the vessel will not be over the unit during the extraction of the coretube from the sediment resulting in the winch cable being off the vertical and pulling the vibrocorer sideways. This can make the recovery process very difficult. Bent coretubes, loss of coretubes and samples can be expected.

Consequently it is essential that the vessel have either the ability to deploy several anchors to maintain position or, in the case of deep water coring, a good real time maneuverability.

Nighttime operation: During the evening hours the working area on the deck must be well lit and with lights on top of the A-frame to cover the work area behind the stern.

A-frame size and load capacity: 1. Height of A-frame ("Deck Clearance"). To determine the necessary height above the deck needed for a vibrocoring operation, use the following figure:

Length of coretube + 4ft. (1.2m)

The additional 4ft will cover the height of the vibrohead and its lifting bridle plus the shackle and lifting eye at the end of the winch cable. (Terminal eyes are often made with three cable clamps, for a total of about 10-12 inches long that will not pass through the sheave under load). Note that we endeavored to minimize the height of the vibrohead, so we recommend to minimize the height of the terminal cable hook-up for the best use of the A-frame.

This measurement is made below the sheave hanging from the A-frame. Example: If a 15 ft. core sample is needed, use a 16ft. coretube + 4ft., thus a total of 20 ft. working height is required. Please note that if a pivoting A-frame is used, the working height is measured not when the A-frame is vertical over the deck, but rather when it is tilting over the stern clearing the deck.

2. Type of A-frame or crane: A pivoting A-frame is preferred. If a fixed A-frame is used, the vessel must provide a second winch to pull the vibrocorer aboard the vessel. If a sea crane is to be used, it must be able to work at sea with the roll of the vessel not affecting the boom's position or length and it must have its own winch, not a winch at some other location.

3. Load Capacity. Both the drawworks and the winch and wire cable must be able to handle a minimum working load of 2 tons. If sand is expected, a 3 ton system should be used.

4. Winch Wire Type. The steel wire cable on the vessel's winch should be of a non-rotating type. During deployment and recovery, the vibrocorer has both the winch cable and the UPC attached to it and because the winch cable has the tendency to rotate when un-spooled these two cables will become entangled. The deeper the water the more this becomes a problem.

III. UNDERWATER POWER CABLE & POWER REQUIREMENTS:

Rossfelder Corp. will provide (upon request) a Standard Neoprene Underwater Power Cable for operations in water depths of less than 500ft. Operations in water depths greater than 500ft. special arrangements for an armored electro-mechanical and a winch system will be required.

Once again, for the P-5C Vibrocorers, the current required is:
220/240 volts, 3 phase, 15 amps, 50-60Hz or
440/480 volts, 3 phase, 10 amps, 50-60Hz.
This is the voltage at the vibrohead. A voltage loss will occur over a long cable, i.e. 700 ft.+ and this loss should be considered and corrected by acting at the source to remain at the end of the cable within -5% and +15% of the specified figures. Open the control box and match the rated voltage of the coil to the power source.

V. DEPLOYMENT OF THE P-5C VIBROCORING SYSTEM

The following describes the normal procedure for deploying and retrieving at sea the P-5C vibrocoring system equipped with the buoyant frame.

1. Orient the vibrohead under the vessel's A-Frame with the coretube facing the bow of the vessel. Place the weightstand next to the Vibrohead on the stern under the A-Frame along with the float package.

2. Lift the vibrohead off the deck into the air while one person handles the far end of the coretube until the entire coretube is hanging under the vibrohead off the deck by one foot. Slide the weightstand under the vibrohead and lower the vibrohead & coretube while guiding the coretube into the guide tube of the weightstand until the coretube touches the deck.

3. Clip the guide-cables onto the U-Bolts of the weightstand than slowly lift the entire system off the deck. **NOTE:** The coretube / corenose should remain captivated within the guide-tube. If not, the guide-cables are to long and require shorting.

4. Deploy the vibrohead & weigthstand over the stern of the vessel and lower it partially into the water, stopping when the vibrohead becomes level with a persons waist.

5. Place the float package on the edge of the stern next to the vibrohead and clip the float package's attachments to the top of the guide-cables.

6. Continue to lower the system into the water and drop the float package into the water.

7. As the vibrocoring system is continued to be lowered to the sea floor try to maintain the UPC from becoming wrapped around the winch cable.

8. When sea floor contact is made, than turn on the vibrocorer and let it operate for 2 minutes than turn off the electricity. Allow the vibrator motors to slow and stop rotating before pulling the coretube out of the sediment.

9. Reverse steps 1 through 6 as the system is being retrieved and placed on deck. Now remove the corenose and sediment sample.

MISCELLANEOUS NOTES:

FLOAT PACKAGE AND CORETUBE TILT:

The float package providing a buoyancy of about 160 lbs (Heavy Duty Floats) can generally maintain the tilt of a 20ft. coretube within 5° from the vertical in currents up to 0.30 ft/sec (10 cm/sec).

By increasing buoyancy with additional floats, the verticality of the coretube in swifter currents can be significantly improved, for example the tilt will remain within the same 5° from vertical:

with 250 lbs buoyancy, currents up to .55 ft/sec (17cm/sec)
with 400 lbs buoyancy, currents up to 1.5 ft/sec (45cm/sec)
with 600 lbs buoyancy, currents up to 2.2 ft/sec (67cm/sec)

However, increased buoyancy will in turn require an increased ballasting of the weightstand. It is therefore generally more practical in swift current areas to revert to the Rigid Frame Mode.

MEASUREMENT OF THE RATE OF PENETRATION:

The lowering, landing, penetration and pull-out of the Vibrocorer can be clearly monitored and recorded with an echo-sounder placed over the stern of the vessel. The float package, vibrohead and the weightstand are excellent reflectors. In particular, it is generally possible to directly obtain from the echo-sounder a graphic record of the penetration vs. time, yielding a penetration rate which, in turn, documents the variable resistance of the recorded layers.

VI. REMARKS AND RECOMMENDATIONS.

1. Do not take the vibrohead apart:

The electric vibrohead is delivered fully assembled and closed, ready for use. The stainless steel bulkhead penetrator connector is mounted with Loctite and is internally connected with the electric vibrators. The penetrator should not, under any circumstances, be unscrewed without risk of damaging the electrical wires and breaking its O-Ring seals.

The penetrator has two O-Rings sealing it to the vibrohead. One being a bore-seal type and the second being a facial compression-seal.

The four (4) End Caps are mounted with two types of O-Ring seals. One being a bore-seal type and the second being a groove compression-seal. The end caps are held in place with stainless V-groove bands. The end caps should not be removed, but for exceptional circumstances. In this case, follow the procedure indicated in #6 below.

An inspection check port plug is provided on two (2) of the four end caps, one plug for each vibrator's pressure cylinder. They can be used, in case of malfunction, to check if moisture has penetrated into a pressure cylinder. The vibrohead is delivered with the vibrator's pressure cylinder under vacuum.

When removing the inspection check port plug the sound of in-rushing air should be heard indicating the O-Ring seal's integrity. When replacing the inspection check port plug, inspect its single O-Ring, #3-904 for any damage and be sure to secure the plug with seizing wire, as it was when delivered. In case of vibrohead malfunction, communicate with us first. **This inspection should be done after each coring project, every several days, to insure that the housing is still maintaining integrity. Tilt the housing so the plug is lower than the housing and allow any moisture to drain. No moisture should be found. If moisture is present than the housing needs to be inspected for a failed O-ring and serviced. Do not continue to operate the vibrocorer with a bad O-ring.**

2. Avoid connecting the Underwater Electrical Cable connections in moist or wet conditions:

Moisture (marine spray, rain) can be easily introduced by accident into the connection of the vibrohead to the UPC. This can result into major problems: the blowing up of the penetrator connector or the Underwater Power Cable connector, with subsequent need for completely disassembling and reconnecting a new penetrator, or even the flooding of the vibrohead itself damaging the vibrators.

Try to keep the connectors mated while at sea during operations.

If by some accident, e.g. breakage or short resulting from moisture, the XSL-4-CCP from the vibrohead terminal connector assembly is damaged and need emergency repair at sea, do not try to open the housing and to remove the bulkhead connector in order to replace the entire terminal connector assembly. But rather cut the damaged XSL-4-CCP and splice a new one.

This terminal assembly was designed this way to allow for such an emergency splicing. To this effect, it is recommended to have spare connectors with pigtails and splicing kits.

3. Avoid the removal of any of the twelve (12) Vibrator Motor Mount Plugs.

Each vibrator motor has six (6) motor mount plugs, each with an O-Ring seal. All twelve (12) Plugs have seizing wire locking them into place in addition to Loctite.

4. Correct Voltage and Current is a must:

The vibrator motors for the P-5C are U.S. made but designed to operate on both U.S. current (60Hz) and Foreign current (50Hz), 230 volts or 440 volts. Unlike most other motors, a Vibrator motor has to work harder due to the fact that an eccentrics weight is directly attached to the motor's "Rotor". This translates to the vibrator motor requiring a higher voltage for start-up.

230 Volt 60Hz version of the P-5C: Most electric motors operate on the industrial standard of 208 volts, where as a vibrator motor requires 230 volts. The P-5C vibrohead requires 230 volts for proper operations. At this voltage the vibrohead will use approximately 8-12 amps while operating depending upon the hardness of the sediment and depth of coretube's penetration.

The P-5C's vibrator motors can tolerate a variance of +15% to -5% voltage change, i.e., 265-218 volts.

If a 208 voltage system is to be used, we recommend to install a "Buck & Boost Transformer" on the output side of the power source before the Vibrohead to increase the voltage to 230 volts. Please consult your electrician.

440 Volt 50Hz or 480 volts 60Hz version of the P-5C: Upon request, the P-5C Vibrohead can be wired for 440/480 Volts rather than 230 Volts. At this voltage the vibrohead will use approximately 4-6 amps while operating depending upon the hardness of the sediment and depth of coretube's penetration.

The P-5C's vibrator motors can tolerate a variance of +15% to -5% voltage change, i.e., 265-215v for the 230v setting and 505-418 volts for 440v. The major risk is with a low voltage (defective power source, excess cable losses) which could rapidly burn the motors.

If the power source is 50Hz than the voltage sould be
THESE VOLTAGES ARE MEASURED AT THE VIBROHEAD AFTER THE CURRENT HAS PASSED THROUGH THE UNDERWATER POWER CABLE. THE INPUT VOLTAGE INTO THE UNDERWATER POWER CABLE MAY NEED TO BE INCREASED TO COMPENSATE FOR VOLTAGE LOSS OVER A LONG CABLE, - typically 500 ft. (150m) or greater.

50 Hz vs. 60 Hz Current: The P-5C, as previously mentioned, can operate on either 50 or 60 Hz current, however the performance will change because the circular velocity and resulting centrifugal forces, function of the square of this velocity, will be significantly different. From 60Hz to 50Hz the force drops by 30%. This is compensated in part by changing the eccentrics settings from medium to high.

5. Duration of Operating Time for the P-5C Vibrohead 30/30:

The vibrator motors are designed to be operated for a 30 minute duty cycle, 30/30. This means that if the vibrohead is operated for a continuos period of 30 minutes the vibrator motors require a 30 minute cool down before more use. However, under normal vibrocoring conditions, the P-5C vibrocorer will only require 2-5 minutes of operating time to completely core the sediment or encounter refusal, so the 30/30 duty cycle does not have to be observed in this case.

6. If you do have to remove the End-Caps:

If you do have to remove the end-caps for some exceptional reason, for example readjusting the setting of the eccentrics in response to changing the voltage frequency of the power source, note that the end-caps should be mounted by putting the pressure housing under vacuum and that the O-Ring should be discarded and replaced by new ones because they may have been pressed into a different shape and may not provide a good round sealing section the next time around.

So, before removing the end-caps, make sure to have on hand: (1) a hand-held vacuum pump with hose to fit the Inspection Port and (2) 4 pairs of O-rings Parker 2-372 (Piston-Seal) and 2-175 (Crush Seal) and some silicone grease.

By placing the end-caps in close contact to the seal seats and starting to vacuum the housing, they should move inward then suddenly close. Note that the two cylinders of the pressure housing communicate and that the 4 End-Caps should be placed and maintained against their seats at the same time.

WARNING: PROTECT THE O-RING SEAL SEATS OF THE CYLINDER WHEN OPEN. ANY SCRATCH WILL RESULT IN A LEAK FLOODING THE VIBROHEAD AND CANNOT BE REPAIRED EXCEPT BY REMACHINING THE SEAT AND MACHINING A NEW END-CAP TO FIT THE INCREASED DIAMETER.

APPENDIX A .

SELECTION OF LOCALLY AVAILABLE
CORETUBES AND LINERS.

The costs of shipping over long distances the consumable tubular goods, particularly plastic liners or thinwall aluminum coretubes, could be prohibitive despite their light weight because of the need for a strong protective crate and the penalty for their bulkiness.

The selection of locally available thinwall linerless expendable coretubes is relatively simple with a wall thickness from about 3% of the outside diameter for stainless or "aluminized" carbon steel, to 5% to 6% for aluminum.

The selection of locally available metallic coretubes along with the plastic liners to fit them is more constrained, There is a strict clearance requirement between the outside diameter for the liner and the inside diameter of the reusable coretube that it fits. As a rule of thumb this clearance should be 3%, i.e., Liner's OD = 0.97 of the Coretube's ID. To use locally available coretubes and liners, there generally are only two alternatives:

⇨ Either select an off-the-shelf coretube size and have the liners custom-made,
⇨ Or select an off-the-shelf liner size and endeavor to locate a matching coretube, either in Metric or in English Units, considering that, in this case, the coretube will be able, thus the smaller number of coretubes required could usually support the import costs from abroad.

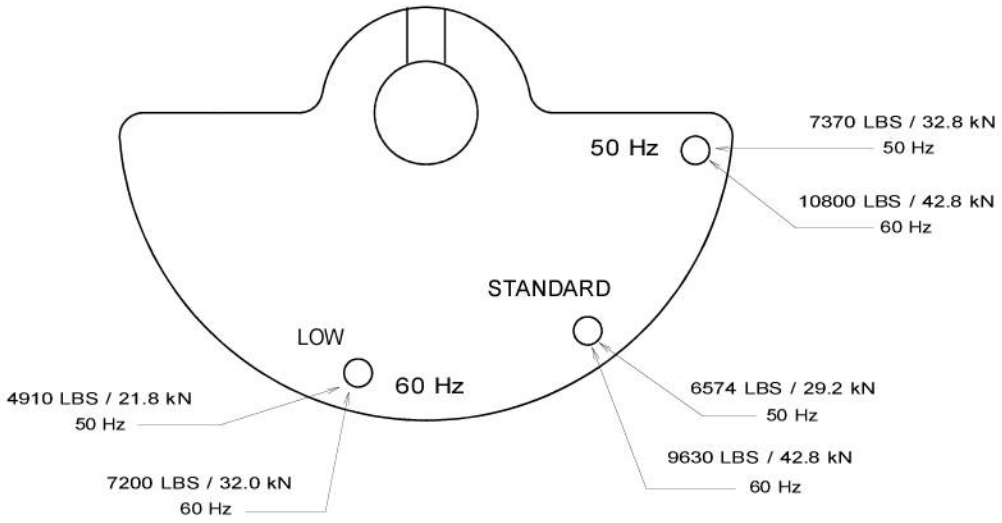
In summary, the following ratios will generally be satisfactory for most application:

⇨ Reusable coretube to be provided with liner:
Wall thickness (steel) = 5% to 6% of the outside diameter.
Wall thickness (aluminum) = 5% to 6.5% of the outside diameter.

⇨ Liners for above (e.g., clear butyrate):
Wall thickness = 1.5% to 2% of liner's OD.
Outside diameter = 97% of the coretube's ID.

⇨ The corenoses will then have to be adjusted:
For expendable linerless thinwall coretube, to the ID and OD of the coretube.
For coretubes with liners, to the ID of the liner and the OD of the coretube.

ECCENTRIC'S FORCE SETTINGS



O-RING PART NUMBERS (ALL PARKER)

End cap bore seal	#2-372
End cap compression	#2-175
MSSK-4-BCR-PNA	#2-021 & #2-029
XSL-4-CCR	#2-016
XSL-4-CCP	#2-017
Inspection port plug	#3-904 or 2-110
Motor mount plug	#2-118