INDEX

I. THE P-3C VIBROCORER. GENERAL DESCRIPTION.

The P-3C Modular Vibrocorer is the newest version of the original P-3 vibrocorer. It is designed for coring unconsolidated waterlogged sediments at sea, in lakes, rivers, harbors, ponds and wetlands. Its lightweight 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-3C indicates that the pressure housing is a solid casting. A cast housing eliminates all seams that requires welding. The original P-3 pressure housing was susceptible to weld fatigue.

The main components of the P-3C 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-3C pressure housing is rated for operation in ocean depths down to 600m (2,800 ft). Under proper voltage conditions the internal vibrator motor has 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-3C 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.

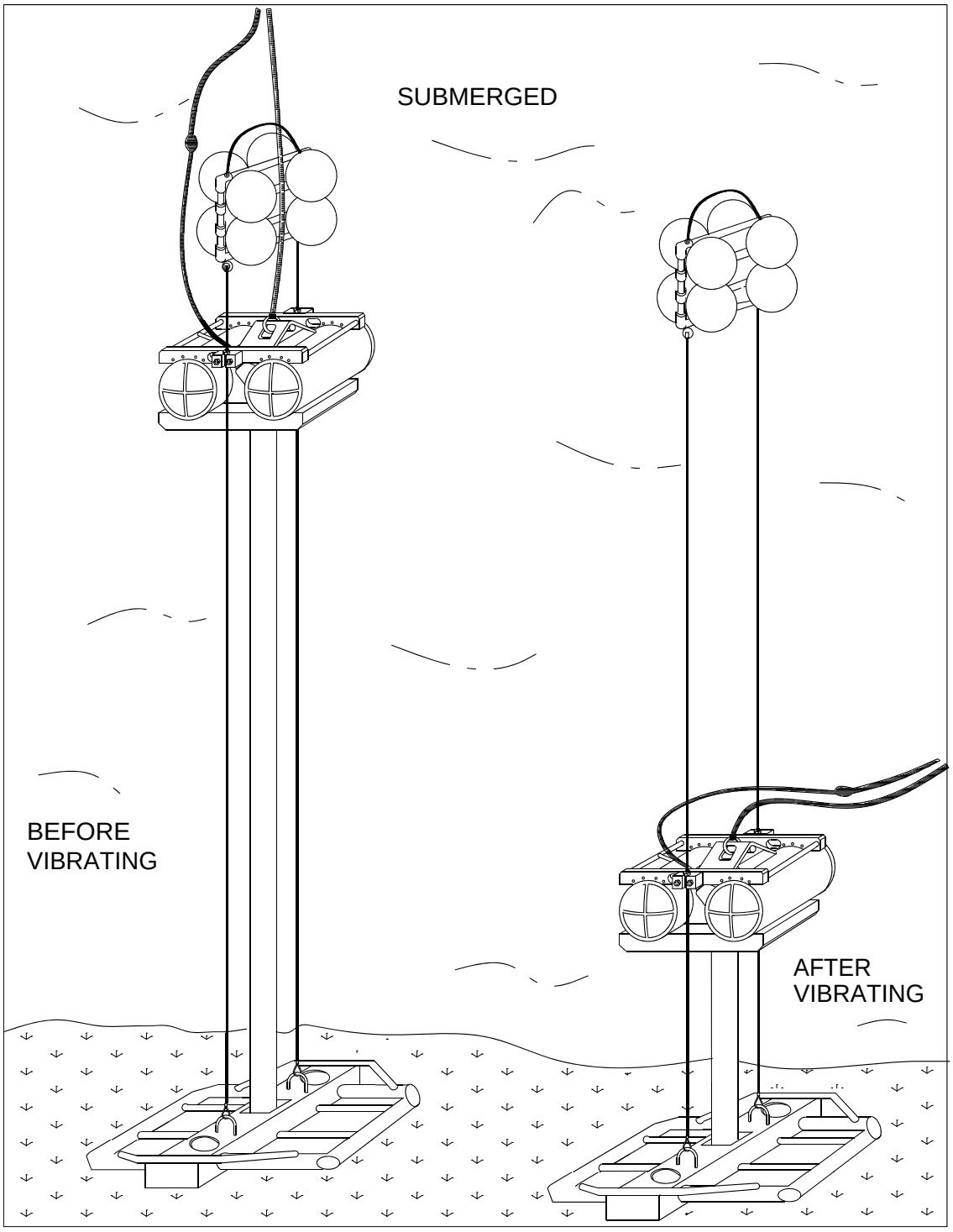
The unit can handle coretubes from 3" (76mm) to 5" (127mm) in diameter with appropriate clamps and clamp-adapters. However it comes normally equipped with a 4"(101.6mm) clamp for 4" diameter coretubes (100mm if requested).

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-3C 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-3C 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-3C vibrocorer using a 4"OD (101.6mm) coretube, we generally expect penetrations of 3 to 10 ft. (1 to 3m) in packed sands and 10 to 20ft. (3 to 6m) in mud, silt and some clays. 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. The P-3C operates in the same manner.


SUBMERGED
BEFORE
VIBRATING
AFTER
VIBRATING

II. MAIN VIBROCORER SPECIFICATIONS

✓ DEPTH CAPABILITY 600m (2,800 ft)

✓ OPERATING POWER REQUIREMENTS (**All 3-phase**) NOT STARTUP

230v, 50/60 Hz	(Low Setting =	4.0 kW, 7.5 amps,
	(Mid Setting =	5.0 kW, 8.0 amps,
	(High Setting =	6.0 kW, 9.0 amps,
440v, 50/60 Hz	(Low Setting =	4.0 kW, 3.5 amps,
	(Mid Setting =	5.0 kW, 4.0 amps,
	(High Setting =	6.0 kW, 4.5 amps,

✓ GENERATOR SIZE (minium) 10.5 KVA, 18 hp GAS ENGINE

CENTRIFUGAL FORCE		At 60Hz	At 50 Hz
(1 kN = 225 lbs)	Low Setting =	16.0 kN	10.9 kN
	Mid Setting =	20.0 kN	13.7 kN
	High Setting =	24.0 kN	16.4 kN

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

APPROXIMATE WEIGHT

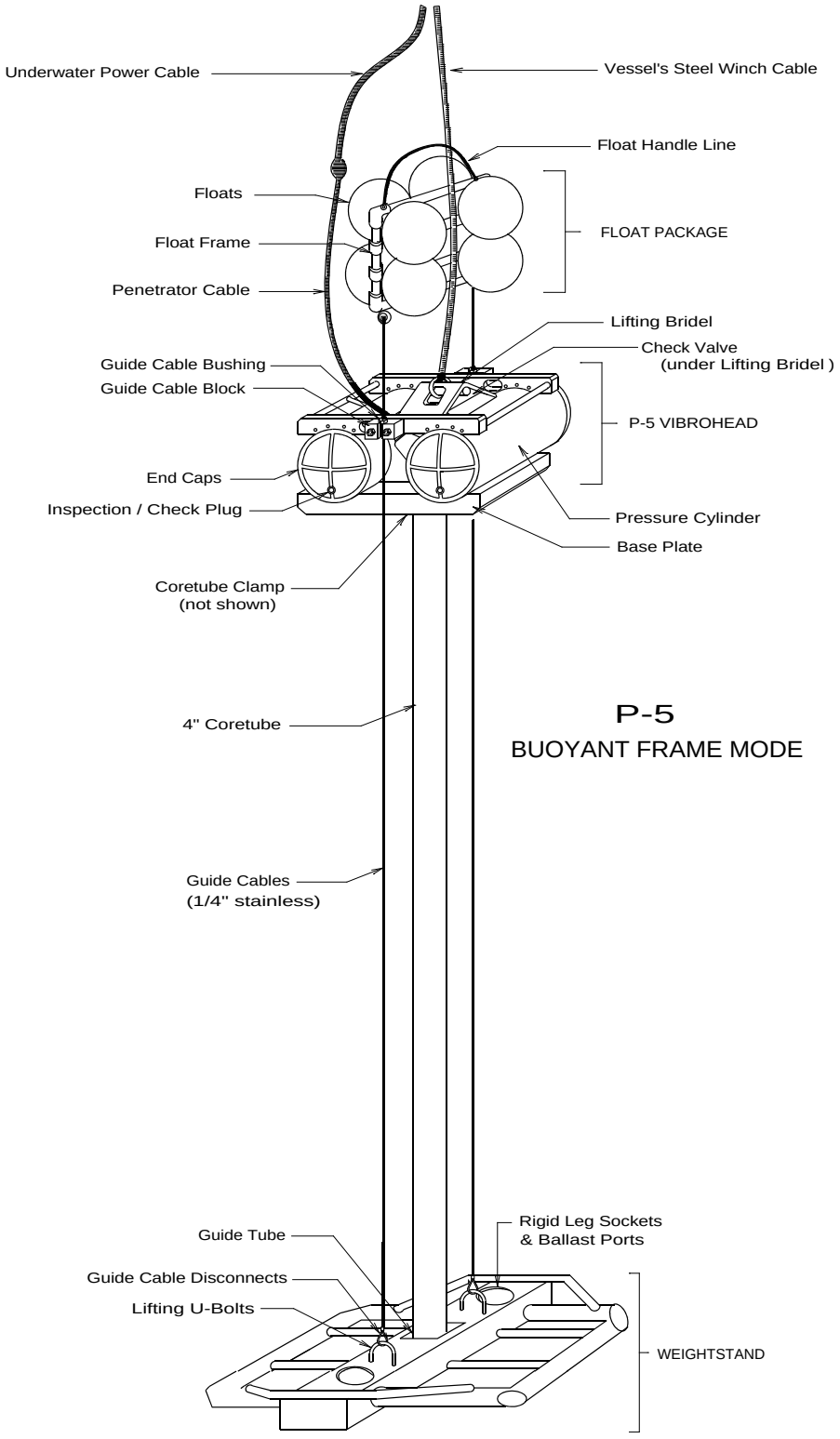
in air (w/o ballast & coretube)	150 lbs (68 Kg)
submerged (w/o ballast & coretube)	70 lbs (32 Kg)

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

TYPICAL CORETUBES, NOSES, and LINERS

4" ALUMINUM LINERLESS CORETUBES	O.D.	I.D.
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) (86.4mm)	4.00"	3.40"
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)

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



P-5
BUOYANT FRAME MODE

III. P-3C 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 P-3C has the same setup:

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 1/2-13 plated steel bolts and two 1/2-13 stainless steel fully threaded rods.

NOTE: When tightening the clamp around a coretube, first sung up all the "plated" steel nylock nuts six total (6). For final tightening, first do the four horizontal bolt drawing the jaws together and then the two vertical nuts on the threaded rods. 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. **NOTE**: The clamp uses a combination of stainless steel bolts and plated steel nuts. When ever possible, **DO NOT USE** stainless bolt and stainless nuts **together**. With repeated use, there is a possibility that the stainless nut will seize on the stainless bolt.

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".

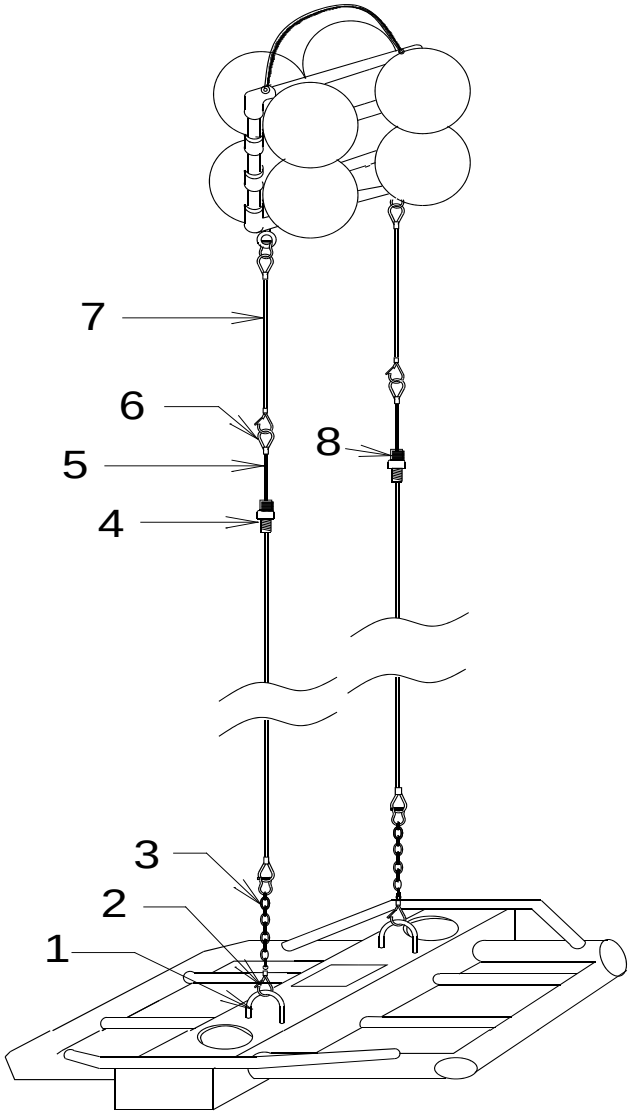
6. Add ballast to the weightstand. See page 12 "weightstand" for details on the ballast.

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 retrieval. 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 accessable 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

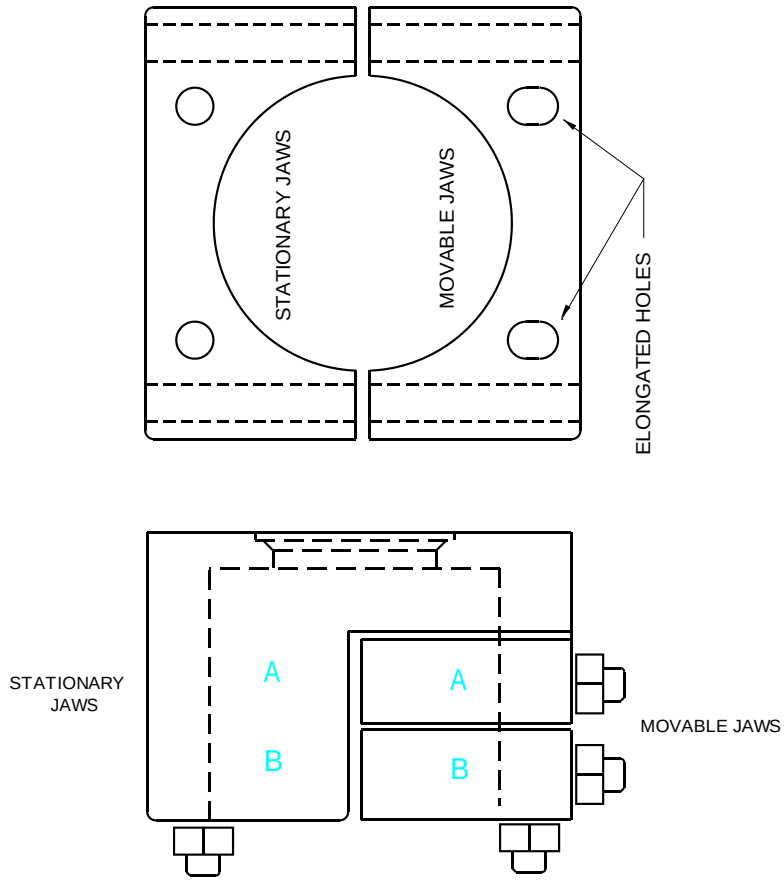
standing on the stern. At this point, clip the float package onto the guide-cable leaders and let the float package hang on the side of the vibrohead while lowering the unit the rest of the way into the water.

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-3C CORETUBE CLAMP

The P-3C clamp consists of three pieces: A Stationary Jaw, and two are the Moveable Jaws.



1. Mount the coretube-clamp to the underside of the vibrohead using the two 1/2-13 plated steel bolts and two 1/2-13 stainless steel fully threaded rods. The threaded rods are screwed completely into the base of the vibrocorer and then the "Stationary" main body of the clamp is then fitted over the threaded rods. Insert the two 1/4-20 bolts on the side of the clamp's body and tighten. This locks the threaded rod's rotation. Next, using the extended socket tool provided, install the two "thin" 1/2-13 stainless steel nuts onto the rods and tighten. The "Stationary" portion of the clamp never needs to be removed unless access to the ball valve is necessary.

2. Install the "Movable jaws. Put a flat washer over each threaded rod, place the first movable jaw over the rods and add another flat washer between the two jaws. Add the last flat washer and a Nylock nut onto the rods and draw the nuts up, but do not tighten them yet.

3. Insert the four horizontal bolts through the two sets of jaws connecting them to each other. Snug the four nuts on the bolts to secure the stationary jaws to the movable jaws. **NOTE**: The clamp uses a combination of stainless steel bolts and plated steel nuts. When ever possible, **DO NOT USE** stainless bolt and stainless nuts **together**. With repeated use, there is a possibility that the stainless nut will seize on the stainless bolt.

4. Insert a coretube into the clamp and into until the coretube stops at the 4"*ID* inside shoulder of the stationary jaw.

5. When tightening the clamp around a coretube, first sung up all the "plated" steel nylock nuts six total (6). For final tightening, first do the four horizontal bolt drawing the jaws together and then the two vertical nuts on the threaded rods. 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.

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. 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-3C 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" MSSG-4-BCR-PNA specially modified from the MSSG 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-3C 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.
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.

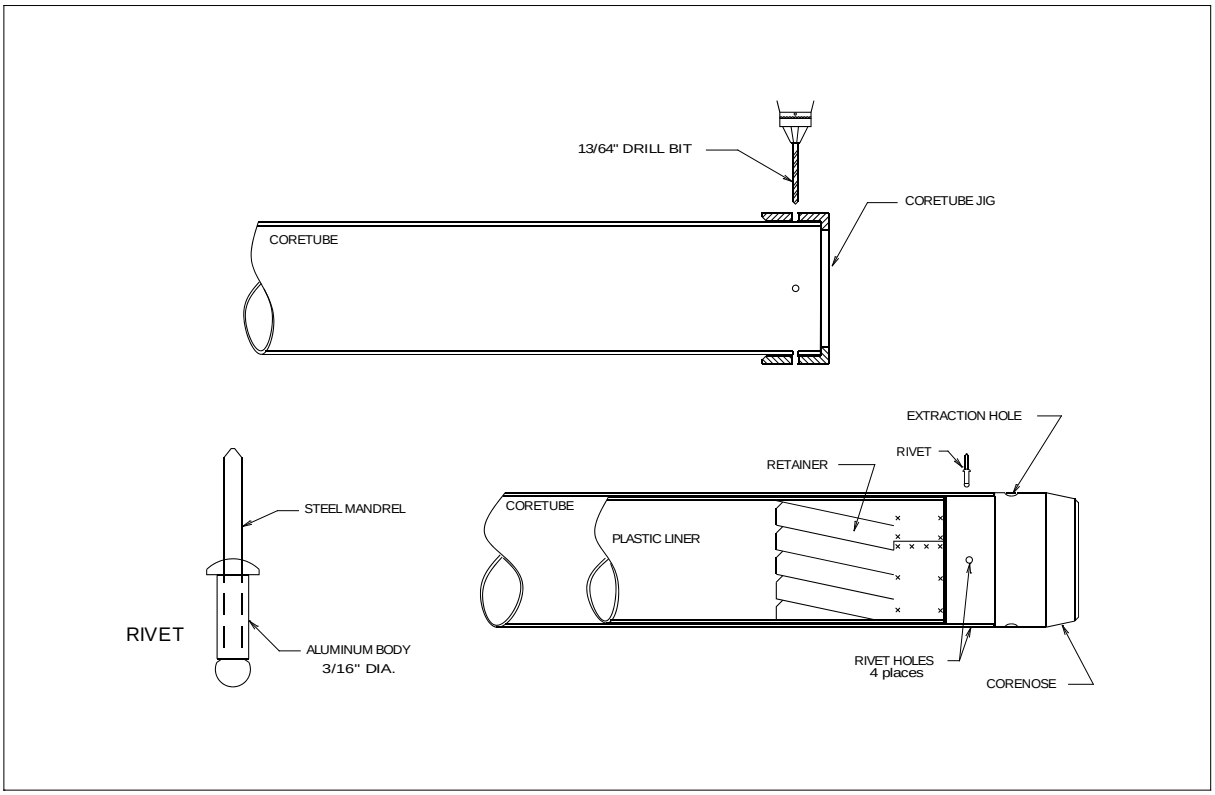
2. Use a file to remove any burrs or turned-over edges inside and outside of the coretube at each end.
3. Place the Coretube Jig over one end of the coretube and drill the first rivet hole. Insert a rivet into the hole through the jig and coretube to keep the jig from rotating while drilling the next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



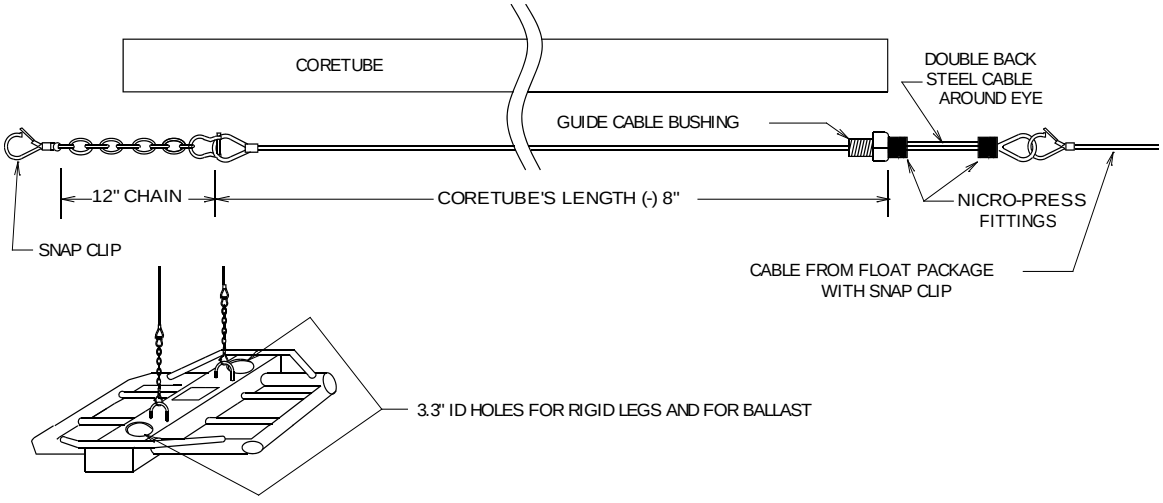
WEIGHTSTAND & GUIDE-CABLES

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 open channels 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.

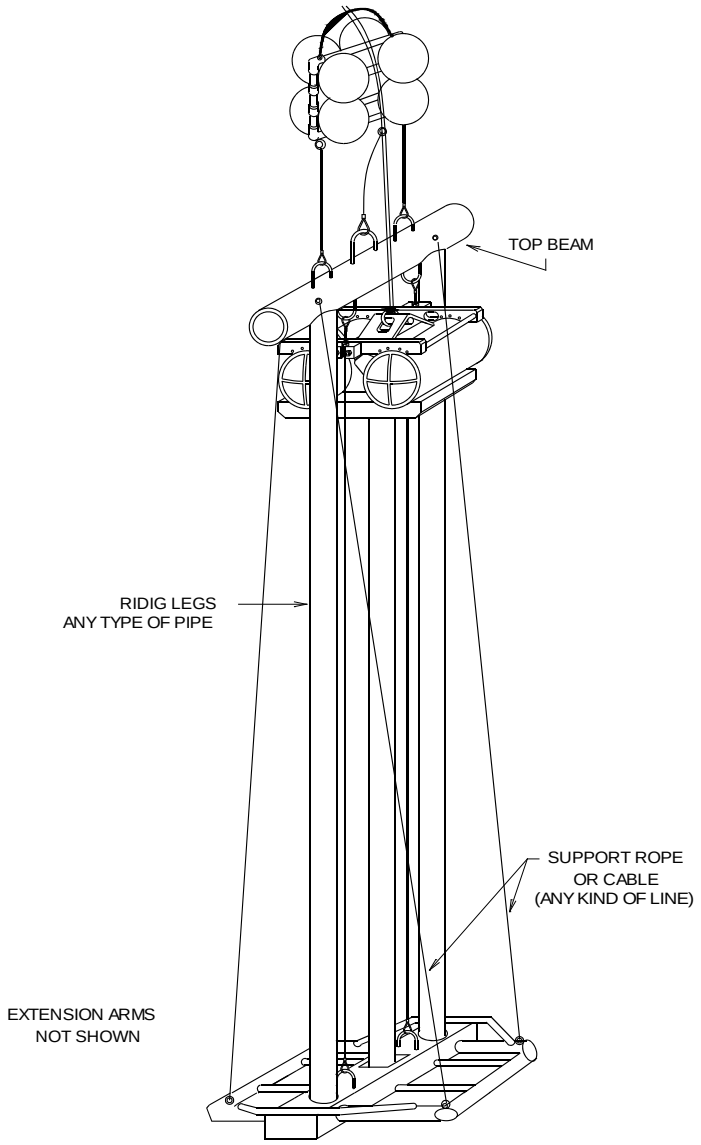
Follow the drawing below for the rigging.

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.



P5C shown

CONTROL BOX:

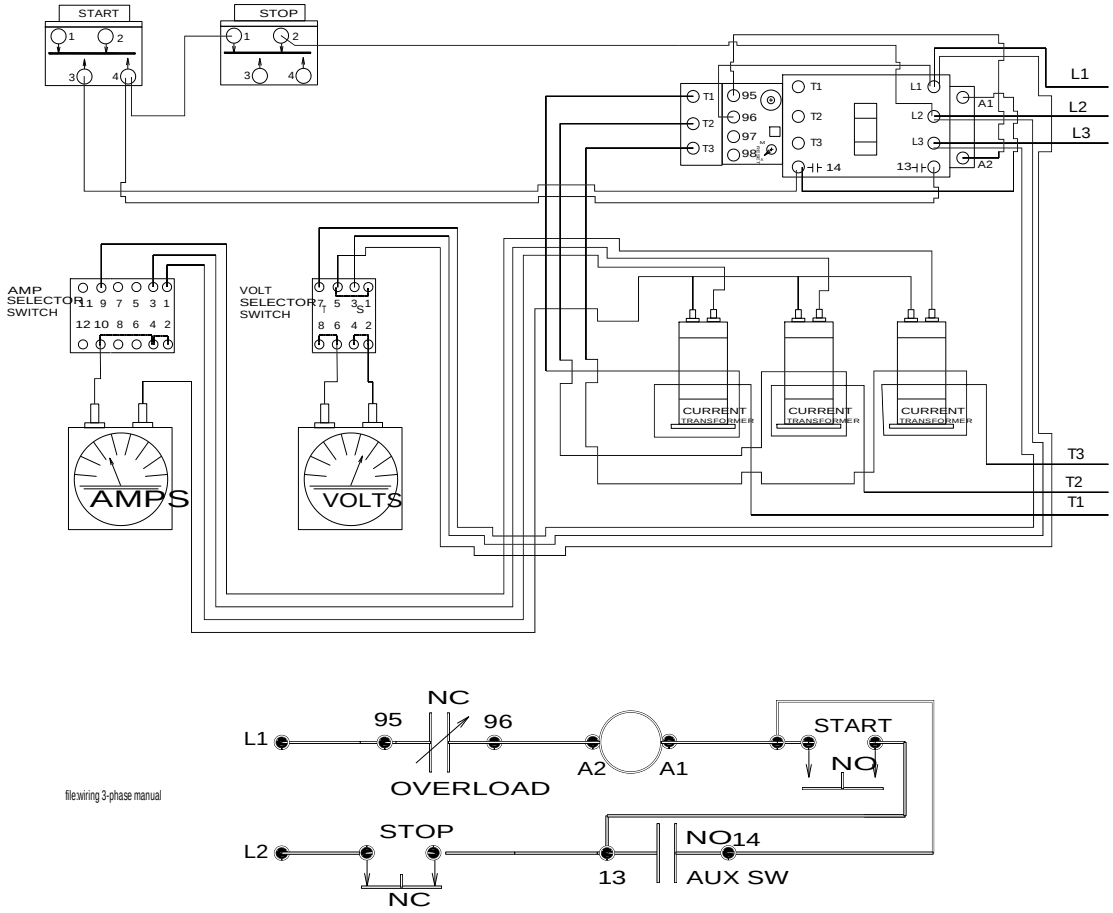
The control box (motor starter) is specially built for operating and monitoring the vibrocorer. Its components consist of the "Start" and "Stop" buttons, a selector switch for voltage, a selector switch for amperage, and the volt and amp meters.

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 phases, 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 trips 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!

Please note: Some customers become confused by the purpose of the voltmeter and the amperage meter and the two corresponding selector switches. These meters and the rotating selector switches do not *change* or *influence* the performance or operation of the vibrocore. Their purpose is to monitor the input line voltage from the power source and amount of power the vibrator motor is consuming through the amp meter. Only the "On" and "Off" buttons control the vibrocore. To check the power source (generator) for correct voltage, connect the control box to the power source and then read the voltage on the meter. By rotating the selector switch between the four positions each phase (each line voltage) of the three phase power can be read. Each phase should have the same voltage value. The amperage meter and selector switch operates in the same way, as does the voltage switch, however the amperage can only be view while the vibrocore is running. During operation rotate the amperage selector switch to view each leg of the three phase's line amperage consumption. They should all be the same value.

CONTROL BOX WIRING, 3-PHASE



file:wiring 3-phase manual

MOTOR WIRING AND COLOR CODES

The three phase motor has nine (9) winding leads. If a wire's identity is lost, it can be identified by the common resistance between pairs of wire. Common resistance is: (1 & 4), (2 & 5), (3 & 6), (7 & 8), (7 & 9), (8 & 9). The color code for the wires are:

1 = White, 2 = Red, 3 = Black, 4 = Orange, 5 = Purple, 6 = Yellow, 7 = Gray
8 = Blue, 9 = Pink, and Neutral or Ground = Green

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 16 ft. (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-3C 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 + 4 ft. (1.2m)

The additional 4 ft. 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 16 ft. coretube + 4 ft., 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 500 ft. Operations in water depths greater than 500 ft. special arrangements for an armored electro-mechanical and a winch system will be required.

Once again, for the P-3C Vibrocorers, the current required is:
220/240 volts, 3 phase, 7.5 amps, 50-60Hz or
440/480 volts, 3 phase, 5 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-3C VIBROCORING SYSTEM

The following describes the normal procedure for deploying and retrieving at sea the P-3C 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 & weightstand 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 two (2) End Caps are mounted with two types of O-Ring seals. One being a bore-seal type # 2-372 and the second being a groove compression-seal #2-175. 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 one (1) of the two end caps. It 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.

The vibrator motor has six (6) motor mount plugs, each with an O-Ring seal #2-118.

4. Correct Voltage and Current is a must:

The vibrator motor for the P-3C is 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-3C: Most electric motors operate on the industrial standard of 208 volts, where as a vibrator motor requires 230 volts. The P-3C vibrohead requires 230 volts for proper operations. At this voltage the vibrohead will use approximately 7.5 amps while operating depending upon the hardness of the sediment and depth of coretube's penetration.

The P-3C's vibrator motor 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-3C: Upon request, the P-3C Vibrohead can be wired for 440/480 Volts rather than 230 Volts. At this voltage the vibrohead will use approximately 3 amps while operating depending upon the hardness of the sediment and depth of coretube's penetration.

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-3C, 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-3C Vibrohead:

The vibrator motor is designed to be operated for a 50% duty cycle. This means that if the vibrohead is operated for a continuous period of 10 minutes the vibrator motor requires a 10 minute cool down before next use.

Under normal vibrocoring conditions, the P-3C vibrocorer will only require 2-5 minutes of operating time to completely core the sediment or encounter refusal, so the 50% duty cycle does not have to be observed in this case.

The vibrocorer requires active cooling in air. Do not run for more than 5 minutes on deck.

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) two O-rings Parker 2-372 (Piston-Seal) and (2) two 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.

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.

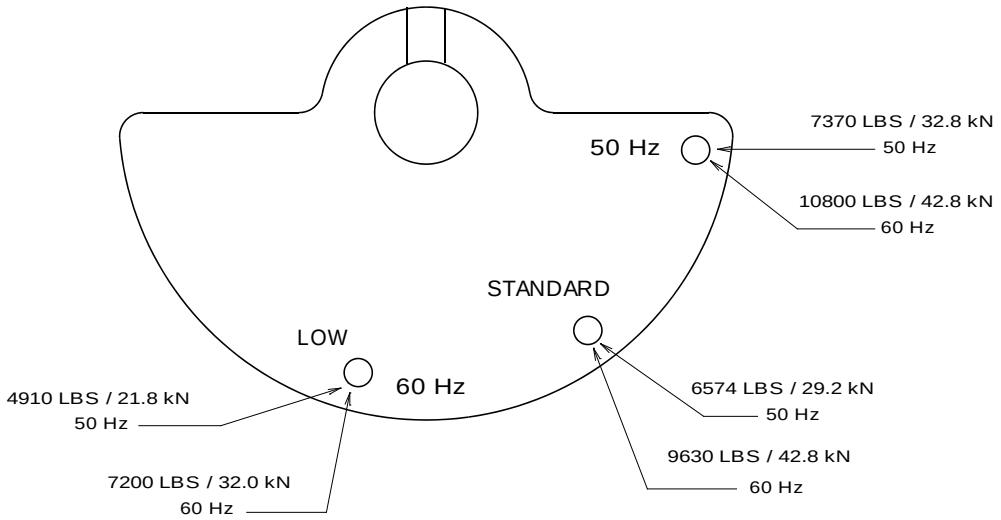
In summary, the following ratios will generally be satisfactory for most application:

☞ 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
MSSG-4-BCR-PNA	#2-017 & #2-023
XSL-4-CCR	#2-016
XSL-4-CCP	#2-017
Inspection port plug	#3-904 or 2-110
Motor mount plug	#2-118
Ball Check valve	#2-238 & 2-338

Replacing the P-3's Yellow Pigtail Assembly

Tools needed:

- 7/16" open-ended wrench
- 9/16" open-ended wrench
- 1-3/16" Thin open-ended or crescent wrench
- 3/16" Allen wrench
- Wire cutters
- Vacuum pump with 3/8" OD tubing
- Multi-meter to test continuity
- Electrical tape
- O-ring lubricant
- 3/8" Heat shrink tubing
- Stainless steel aircraft wire (seizing wire)
- Blue Loctite
- Rubbing alcohol
- Heat gun for heat shrink tubing.

Procedure for removal of the MSSG-4-BCR/PNA Pigtail

- Removing and replacing the yellow pigtail will be done through the Vibrohead's end cap closest to the pigtail.

- Remove the 10" dia. Voss band with the 7/16" wrench and the 3/16" Allen wrench.

- Cut and remove the SS seizing wire in the vacuum port plug on the 10" dia. End cap. Remove the single vacuum port plug with the 9/16" wrench.

- Pull off the end cap to expose the wiring bundle.

- Remove the electrical tape and foam rubber bundle covering the wiring bundle.

- Once the wires are exposed the following color pairs are visible; (orange-purple-yellow); (white-gray-white); (red-blue-white); (black-pink-white) and (green-white). The four slick white wires are from the yellow pigtail. Do nothing with the (orange-purple-yellow) bundle it will remain untouched.

- Cut the three pigtail wires (slick white) just below the wire nuts associated with the colored wire pairs (white-gray-white), (red-blue-white), (black-pink-white). Doing so will leave the color pairs together and help to minimize color combinations for the installation. Remove the wire nut on the (green-white) pair. The green wire is the grounding wire for the vibrator motor. Now the pigtail wire are free from the vibrator motor's wire.

- Remove the four ¼-20" bolts on the pigtail's hold down U-strap using the 7/16" wrench and remove the strap.

- Attach a small pull string to the end of the four pigtail wires with knots and electrical tape. This string will help to pull the new pigtail wires back into the housing during

installation, so don't pull the string completely though the housing when removing the pigtail.

- Now, the pigtail can be unscrewed. Use the 1-3/16" to unscrew the pigtail and take note of the four white wires inside the housing. Help the unscrewing by also rotating the four wires in concert with the pigtail body. Pull the pigtail body out of the housing along with the wires leaving the pull string inside the housing.

Installation of the MSSG-4-BCR/PNA Pigtail

- The Pigtail has four wires tagged 1 thru 4. Number three is usually the grounding wire. This will be the first wire to connect once the pigtail is installed.

- Remove the new pigtail from its bubble wrap bags and locate the two O- rings. Clean the stainless steel body, threads and O-ring grooves using rubbing alcohol and dry. Lubricate the two O-rings and slide them over the four wires into position on the pigtail's body. Tie and tape the pull string onto the end of the four wires.

- Feed the wires into and though the Vibrohead then rotate and install the new pigtail assembly. Take note of the two O-rings as they enter the housing to insure they are not pinched and seal correctly.

- Install the U-strap and the four ¼-20" bolts.

- Cut three length of 3/8" shrink tubing the same length as found on the old pigtail and one at a time slip over the pigtails four wires inside the housing pushing the shrink tubing up into the body of the housing. Use the heat gun to shrink the tubing and repeat two more time. This provides vibration wear protection to the pigtail wires.

- The next step is to confirm the ground or neutral wires are correct throughout the entire electrical system. This is done by connection the P-3's control box to the new pigtail. Locate the green conductor wire on the power input side of the control box and attach a tester lead of the multi-meter to it. Next, locate the pigtail's tagged #3 wire and attach the other tester lead to the multi-meter. The multi-meter should confirm continuity from the green wire outside the control box (power input) to the pigtail wire inside the P-3's housing. If the #3 wire does not have continuity check the other three pigtail wires until the correct wire is located. This wire is the one that will be connected with the green ground wire attached to the vibrator motor.

- Attach the confirmed pigtail's ground wire to the green vibrator motor wire using the wire nut and wrap with electrical tape. Again, check continuity from the control box to a clean exposed metal surface of the vibrator motor. A ring-tone should be heard. Once ground continuity is confirmed the other three pigtail wires can be connected to their colored wire bundles.

- At this point, there should be three loose (slick white) wires from the pigtail and three color wire pairs with cut off white wire ends from the old pigtail. The P-3 is a three-phase electrical system and each of the three pigtail wires represents a single phase of the three-phase system. It does not matter which single wire of the three pigtail wires are connected to the different color paired wire bundles, however the usual installation connection is as follows; #1 pigtail wire connects with the (white-gray), #2 connects with the (red-blue) and #4 connects with the #4 pigtail wire. Remove the wire nuts on the color wire above

color wire bundles and attach a single slick white pigtail wire using the wire nut and re-tape.

- Wrap the entire 14 wire into a large bundle with electrical tape and then cover with the foam padding and wrap again tightly with electrical tape to form a long protective bundle of wires. Push the wire bundle around and under the vibrator motor's end cap so is it held firmly between the P-3's housing and the vibrator motor. Now the installation of the end cap is ready.

Installation of the End cap

- Use the rubbing alcohol to clean the two large end cap O-rings and the O-ring on the vacuum port plug. Next clean the O-ring grooves on the end cap and the corresponding O-ring surface on the P-3's housing and the stainless steel vacuum port plug body. Dry everything. Next lubricate the three O-rings and positions them on the end cap and the plug.

- Position the end cap over the end of the P-3's housing using the small keyway notch in the end cap and on the house as an indicator for correct position. Press the end cap into the housing taking note not to pinch out the main, large and thick, O-ring. There is a possibility that the end cap will not press into the housing. If so, the vacuum pump will be needed to suck the end cap and O-rings into the housing. With the end cap in position on the housing insert the 3/8" OD vacuum tubing into the port plug hole and apply some electrical tape wrapped around the tubing to create a simple air seal. It does not need to be perfect seal, but just good enough to so the vacuum pump can pull the end cap and O-rings inward and onto the housing.

- Install the O-ring and vacuum port plug and secure using the seizing wire.

- Install the large Voss V-band and tightened down using the 3/16" Allen wrench and the 7/16" wench for the ¼-20 nut.

Complete