

3400 PORTABLE SUB-BOTTOM SYSTEM

USER HARDWARE MANUAL

0021270_REV_E

11/16/2021



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ATTENTION – READ THIS FIRST!

All personnel involved with the installation, operation, or maintenance of the equipment described in this manual should read and understand the warnings and cautions provided below.

CAUTION! This equipment contains devices that are extremely sensitive to static electricity. Therefore, extreme care should be taken when handling them. Normal handling precautions involve the use of anti-static protection materials and grounding straps for personnel.

WARNING! High Voltage may be present in all parts of the system. Severe injury or death could occur if the equipment is mishandled. Therefore, use caution when the electronics are removed from their containers for servicing.

CAUTION! Operation with improper line voltage may cause serious damage to the equipment. Always ensure the proper line voltage is used.

Warnings, Cautions, and Notes

Where applicable, warnings, cautions, and notes are provided in this manual as follows:

WARNING! Identifies a potential hazard that could cause injury or death.

CAUTION! Identifies a potential hazard that could damage equipment or data.

NOTE: Recommendations or general information that is particular to the material being presented.

HARDWARE VARIATIONS AND COMPATIBILITY

The 3400 Portable Sub-bottom System contains both standard and proprietary hardware. At times, EdgeTech may change the standard components due to their availability or performance improvements. Although the component manufacturers and their models and styles may vary from unit to unit, replacement parts will generally be interchangeable.

EdgeTech will make every effort to see that replacement components are interchangeable and use the same software drivers (if applicable). At times, however, direct replacements may not exist. When this happens, EdgeTech will provide the necessary drivers with the replacement part, if applicable.

EdgeTech may also change certain hardware per customer requirements. Therefore, portions of this manual, such as parts lists and test features, are subject to change. These sections should be used for reference only. When changes are made that affect system operation, they will be explicitly noted. Also, some options and features may not be active in the customer's unit at the time of delivery. Upgrades will be made available when these features are implemented.

Contact [EDGE TECH CUSTOMER SERVICE](#) with any questions relating to compatibility.

ABOUT THIS DOCUMENT

We, the employees at EdgeTech, would like to thank you for purchasing the 3400. At EdgeTech, our policy is to provide high-quality, cost-effective products and support services that meet or exceed your requirements. We also strive to deliver them on time and to look for ways to improve them. We take pride in the products we manufacture and want you to be entirely satisfied with your equipment.

Purpose of this Manual

The purpose of this manual is to provide the user with information on the setup and use of EdgeTech's 3400. Although this manual encompasses the latest operational features of the 3400, some features may be periodically upgraded. Therefore, the information in this manual is subject to change and should be used for reference only.

Liability

EdgeTech has made every effort to document the 3400 system wholly and accurately in this manual. However, EdgeTech assumes no liability for errors or any damages resulting from the use of this manual or the equipment it documents. EdgeTech reserves the right to upgrade this equipment's features and make changes to this manual without notice at any time.

Revision History

REVISION	DESCRIPTION	DATE	APPROVAL
A	Release to Production	1/23/2020	TS
B	Diagram Reformatting, Text Updates	4/20/2020	TS
C	Towfish and Pole Mount Updates	11/02/2020	JP
D	3400 OTS (Over-The-Side) Option Added	3/23/2021	AP
E	3400 OTS Light and Ultra-Light Added	11/16/2021	CM

WARRANTY STATEMENT

All equipment manufactured by EdgeTech is warranted against defective components and workmanship for a period of one year after shipment. Warranty repair will be done by EdgeTech free of charge.

Shipping costs are to be borne by the customer. Malfunction due to improper use is not covered in the warranty, and EdgeTech disclaims any liability for consequential damage resulting from defects in the performance of the equipment. No product is warranted as being fit for a particular purpose, and there is no warranty of merchantability. This warranty applies only if:

- i. The items are used solely under the operating conditions and in the manner recommended in the Seller's instruction manual, specifications, or other literature.
- ii. The items have not been misused or abused in any manner, nor have repairs been attempted thereon without EdgeTech Customer Service's approval.
- iii. Written notice of the failure within the warranty period is forwarded to the Seller, and the directions received for properly identifying items returned under warranty are followed.
- iv. The return notice authorizes the Seller to examine and disassemble returned products to the extent Seller deems necessary to ascertain the cause for failure.

The warranties expressed herein are exclusive. There are no other warranties, either expressed or implied, beyond those set forth herein, and the Seller does not assume any other obligation or liability in connection with the sale or use of said products. Any product or service repaired under this warranty shall only be warranted for the remaining portion of the original warranty period.

Equipment not manufactured by EdgeTech is supported only to the extent of the original manufacturer's warranties.

SOFTWARE SERVICE OVERVIEW

EdgeTech provides software services free of charge. This software agreement does not address customer-specified modifications or enhancements. These services may be ordered separately. Furthermore, EdgeTech software upgrades are meant for the sole use of EdgeTech customers. Any reproduction of EdgeTech-supplied software or file sharing is strictly prohibited.

Software Updates and Enhancements

EdgeTech customers can download new software releases with all modifications and enhancements from the [EDGE TECH WEBSITE](#). Major software issues, should they occur, will be reported directly to the customer. New software releases consist of the following:

- Software enhancements that are not on the price list
- Software fixes and changes
- Product integration
- Documentation updates to online help
- Tests for compatibility with other modules

Software patches consist of software that has undergone the following:

- Minor software enhancements
- Software fixes and changes
- Software Telephone, Facsimile, and E-mail Support

EdgeTech customers are entitled to contact [EDGE TECH CUSTOMER SERVICE](#) to report a difficulty, discuss a problem, or receive advice on the best way to perform a task. When contacted, EdgeTech Customer Service will do the following:

- Respond within 24 hours by telephone, facsimile, or e-mail
- Immediately attend to serious problems affecting operations
- Attempt to find an immediate workaround

RETURNED MATERIAL AUTHORIZATION

Prior to returning any equipment to EdgeTech, a Returned Material Authorization (RMA) Number must be obtained from **CUSTOMER SERVICE**.

RMA Purpose

The RMA Number identifies returned equipment when it arrives at our receiving dock and enables tracking while at our facility. Refer to the RMA number on all documentation and correspondences.

All returned materials must be shipped prepaid. Freight collect shipments will not be accepted. All equipment should be adequately insured for shipping, but equipment belonging to EdgeTech must be insured for full value.

If there is more than one item per consignment, include a packing with the shipment. An invoice can double as a packing slip only when the contents are clearly numbered and identified on the invoice.

CAUTION! Never attempt to ship a Portable Topside in its Storm Case™ alone. Although rugged, these cases are not intended to be used as shipping containers, and the delicate internal components could be damaged. Shipping in this manner will void any warranties.

NOTE: All shipping charges shall be the customer's responsibility, unless under warranty, as EdgeTech will pay for return shipping.

NOTE: For International Shipments valued over \$1000, the following Shipper's oath must be sent with the invoice.

Shipper's Oath:

"I, _____, declare that the articles herein specified are the growth, produce, or manufacture of the United States; that they were exported from the United States from the port of _____, on or about _____; that they are returned without having been advanced in value or improved in condition by any process of manufacture or any other means; and that no drawback, or allowance has been paid or admitted hereof."

Signed _____

CUSTOMER SERVICE

Customer service personnel at EdgeTech are always eager to hear from users of our products. Your feedback is welcome and a valuable source of information that we use to improve these products. Therefore, we encourage you to contact EdgeTech Customer Service to offer any suggestions or to request technical support:

E-mail: service@edgetech.com

Mail: 4 Little Brook Road
West Wareham, MA 02576

Telephone: (508) 291-0057

Facsimile: (508) 291-2491

**24-Hour Emergency
Technical Support Line:** (508) 942-8043

NOTE: Please have your system Serial Number available when contacting Customer Service.

For more information, please go to WWW.EDGETECH.COM.

COMPANY BACKGROUND

EdgeTech (formerly EG&G Marine Instruments) traces its history in underwater data acquisition and processing back to 1966. EdgeTech has designed, developed, and manufactured products, instruments, and systems — for the acquisition of underwater data, including marine, estuarine, and coastal applications — for over 50 years.

EdgeTech responds to the scientific, naval, and offshore communities' needs by providing industry-leading equipment — such as sub-bottom profilers, side scan sonar, acoustic releases, USBL positioning systems, and bathymetric systems — that have become standards in the industry.

EdgeTech consistently anticipates and responds to future needs with an active research and development program. Current efforts are focused on adopting new cutting-edge acoustic technology.

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1.0 OVERVIEW

The EdgeTech 3400 Sub-Bottom Profiler System is a wideband frequency modulated (FM) sub-bottom profiler utilizing EdgeTech's proprietary Full Spectrum CHIRP technology to generate high-resolution images of the sub-bottom stratigraphy in oceans, lakes, and rivers and provide excellent penetration of various bottom types. This system provides for standard sub-bottom profiling operations, including real-time reflection coefficient measurement or a unique "Pipeliner" mode that provides for optimal location and imaging of buried pipelines. These unique capabilities allow surveyors to collect complex analytic data using linear system architecture to measure sediment reflection and analyze sediment type determination. Additionally, the system has discrete transmit and receive channels allowing for continuous data collection resulting in a high ping rate that is particularly important for construction and pipeline surveys. The system includes one of several 3400 vehicle types, cable, and a topside processor (portable or rack-mounted topside) running EdgeTech's Discover 3400 sub-bottom acquisition and processing software.

The 3400 is available in four variants. They are:

3400 Sub-Bottom Profiler: This hydrodynamic configuration comes with a dual 2-16 kHz transducer and PVDF receiver array configuration. The system is designed to be towed or can be pole-mounted off the side of a vessel with the purchase of a pole-mounting kit.

3400 OTS LF Sub-Bottom Profiler: This over-the-side configuration is designed to be pole-mounted off the side of a vessel. It consists of a dual 1-10 kHz transducer and PVDF receiver array configuration. It provides for deeper water operations than the towed 3400 Sub-Bottom profiler.

3400 OTS Light Sub-Bottom Profiler: This shallow-water configuration comes with a single 2-16 kHz transducer and PVDF receiver array configuration that offers deeper penetration than the Ultra-Light 3400. It is designed to be pole-mounted and can be used on small vessels.

3400 OTS Ultra-Light Sub-Bottom Profiler: This shallow water configuration comes with a single 4-24 kHz transducer and PVDF receiver array configuration. It is designed to be pole-mounted and can be used on small vessels.

1.1 Key Features of the 3400 Sub-Bottom Profiling System

- CHIRP Transmission
- Dual (Wideband) Transmitters (3400 and 3400 OTS LF Sub-Bottom Profilers)
- Dual Frequency Transmission
- Enhanced Sub-Bottom Multi-Channel PVDF Receivers
- Reflection Coefficient Calculation
- Sub-Bottom Pipeliner Mode
- Surface Echo Attenuation
- Pulse Library Tailored For Different Survey Applications
- Built-in Motion, Pitch, Roll, Heave, and Depth Sensors

1.1.1 CHIRP Transmission

The 3400 leverages compressed high-intensity radar pulse (CHIRP) transmission technology to process and display detailed sub-bottom sonar imagery. CHIRP technology accomplishes this by transmitting wideband sound pulses that are linearly swept over a full-spectrum frequency range. Different frequencies compensate for the inconsistencies in the way different layers, objects, and materials reflect sonar pulses providing more penetration and more detailed data.

1.1.1.1 Advantages of Full Spectrum CHIRP Technology

EdgeTech's Full Spectrum CHIRP technology has several distinct advantages over conventional sub-bottom profiling systems:

- Separate acoustic projectors and receivers that allow for simultaneous transmission and reception of acoustic signals.
- High repeatability of the transmitted signals to enable sediment classification,
- High signal-to-noise ratio (SNR) for improved acoustic imagery
- High resolution for measurement of fine sediment layering
- Additional processing gain for energy efficiency
- Gaussian-shaped amplitude spectrum of the outgoing pulse to preserve resolution with sediment penetration
- Reduction of side lobes for minimal destructive signal scattering caused by the sediment when profiling near the bottom

All these advantages are discussed in detail below.

Separate Acoustic Projectors and Receivers

The 3400 Sub-Bottom Profiling System uses acoustic projectors and receivers mounted in a towed vehicle to transmit and receive acoustic FM pulse signals. The projectors are wideband piston-type transducers, and the receivers are hydrophone arrays composed of polyvinylidene difluoride (PVDF) hydrophones. The transducers are mounted in the forward section of the tow vehicle, and the hydrophone arrays are mounted aft, which are designed for profiling at ship speeds up to seven knots.

The use of separate transmitting transducers and receiving hydrophone arrays preserves linearity and allows the simultaneous transmission and reception of the acoustic signals. The transducers and hydrophone arrays are mounted beneath acoustic baffles, which minimize direct path, tow vehicle, and surface reflections. A digital preamplifier in the tow vehicle amplifies and converts the analog signal into a digital bitstream. The digitally received signals are transmitted through a tow cable to the surface.

High Repeatability

The FM pulses are generated by a digital-to-analog (D/A) converter with a wide dynamic range and a transmitter with linear components. This allows the energy and amplitude characteristics of the acoustic pulses to be precisely controlled. This precision produces the high repeatability and signal definition required for sediment classification.

The frequency range of operation is determined by the acoustic characteristics of the transmitter transducers and receiving hydrophone arrays mounted on the tow vehicle. Each tow vehicle transmits acoustic pulses with different center frequencies and bandwidths. The operator makes the pulse selection while profiling to achieve the best imagery.

High Signal-to-Noise Ratio

High SNR (signal-to-noise) is critical to providing world-class quality sub-bottom imagery. To that end, EdgeTech optimizes all aspects of sub-bottom systems to achieve the best possible quality. These optimizations include the use of (A) wide bandwidth and high power amplifiers to optimize power in the water; (B) wide bandwidth transmitters and hydrophone arrays; (C) baffling of receive hydrophones to suppress surface reflections; (D) PVDF large aperture hydrophones to make receive sensitivity more directional and suppress noise by rejecting signals from undesired angles of arrival; (E) conventional chirp pulses and proprietary variants which optimize SNR, reduce sidelobes, enhance system resolution; (F) electronics optimized to theoretical Johnson Thermal Noise limits (receive signals are digitized at the towfish).

High Resolution

EdgeTech pulse processing capabilities result in a high temporal resolution. This high resolution enables the measurement of fine layering in the sediment, an important factor in sediment classification, as it provides a more realistic picture of the true geologic variability of the seafloor and an accurate determination of the depositional processes.

Additional Processing Gain

EdgeTech CHIRP technology achieves a signal processing gain over the background noise. This gain is approximately ten times the log of the time-bandwidth product. This improvement is due to the signal having a time duration longer than the inverse of the bandwidth, thus increasing signal energy without increasing the power of the outgoing pulse. To equal the typical performance of the full spectrum sonar pulse, conventional pulse sonar would have to operate at a peak pulse power of 100 times greater than a full spectrum pulse with a time-bandwidth product of 100.

Gaussian Shaped Amplitude Spectrum Outgoing Pulse

Another important feature of Full Spectrum CHIRP technology is that the signal processing optimizes the system's performance. The sonar contains many components, each with a unique dynamic range and linearity characteristic, which are frequency dependent.

In addition to this characteristic, the outgoing pulse's amplitude spectrum is chosen to be approximately Gaussian in shape to limit the sidelobe level and temporal resolution losses due to attenuation. As a wavelet with a Gaussian-shaped spectrum is attenuated by the sediment, energy is lost, but its bandwidth

is nearly preserved. Therefore, even after being attenuated by sand, the acoustic pulse has approximately the same resolution as an unattenuated pulse.

Reduction of Side Lobes

The use of Full Spectrum CHIRP technology reduces the side lobes in the effective transducer aperture. The sweep frequency's wide bandwidth has the effect of smearing the transducer's side lobes and thus achieving a beam pattern with virtually no side lobes. The effective spatial beam width obtained after processing a full spectrum 2–10 kHz signal, for example, is 20 degrees measured at the -3db points.

1.1.2 Dual Wideband Transmitters (3400 and 3400 OTS LF Sub-Bottom Profilers)

The EdgeTech 3400 and 3400 OTS LF Sub Bottom Profilers come standard in a dual transducer configuration that provides an increased source level and beam pattern.

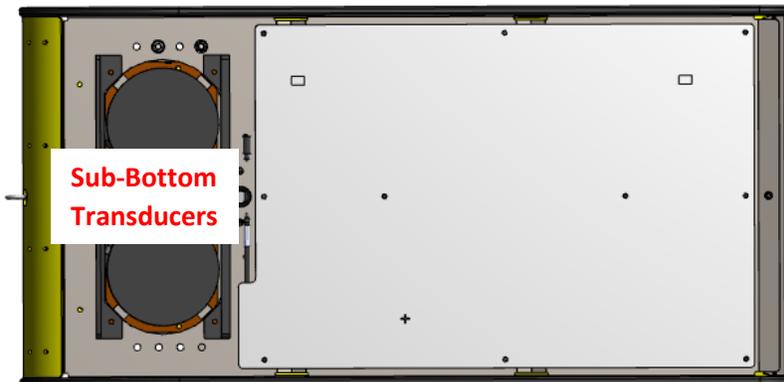


Figure 1-1: 3400 Sub-Bottom Transducers

1.1.3 Dual Frequency Transmission

Dual alternating pulse technology allows users to transmit two different sub-bottom pulses over the same survey line in a single pass.

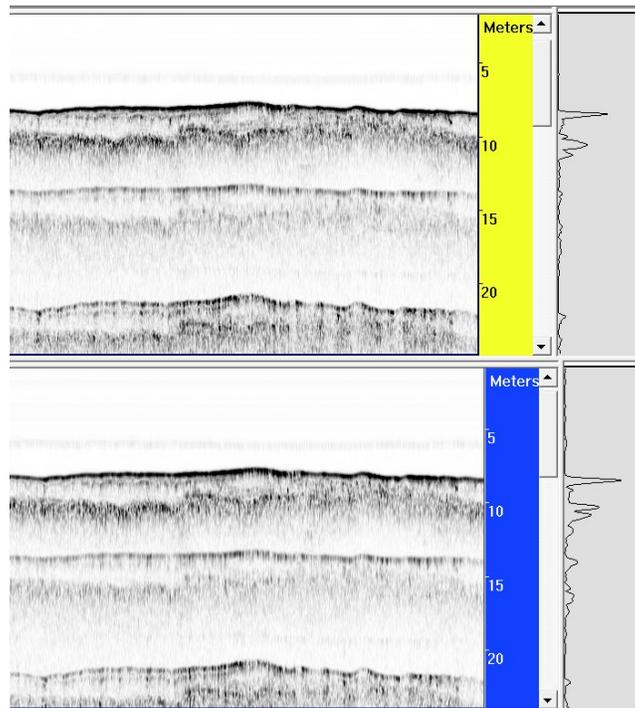


Figure 1-2: Discover 3400 High (Yellow) and Low (Blue) Sub-Bottom Displays

1.1.4 Enhanced Sub-Bottom Multi-Channel PVDF Receiver

EdgeTech's PVDF (polyvinylidene fluoride) receivers have advantages over other systems. The segmented arrays provide different modes of operation from sub-bottom profiling to very specific applications like Pipeliner Mode. The receivers provide greater sensitivity, a better beam pattern with sidelobes, greater spatial acoustic rejection over other receivers. They also exhibit a flat sensitivity response over a wide bandwidth.

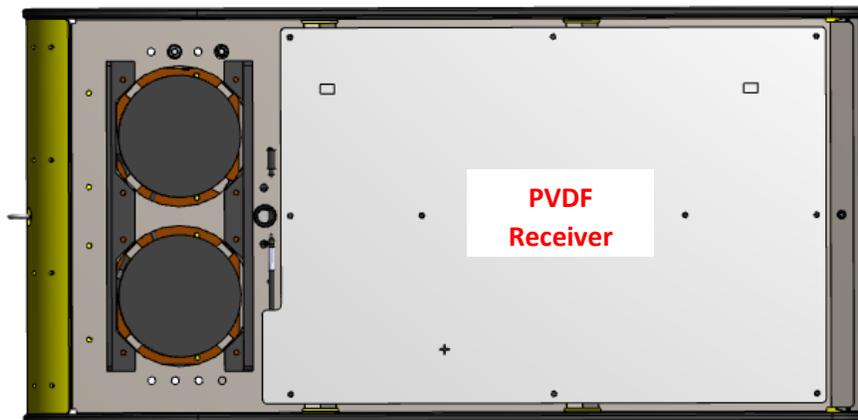


Figure 1-3 3400 PVDF Receiver

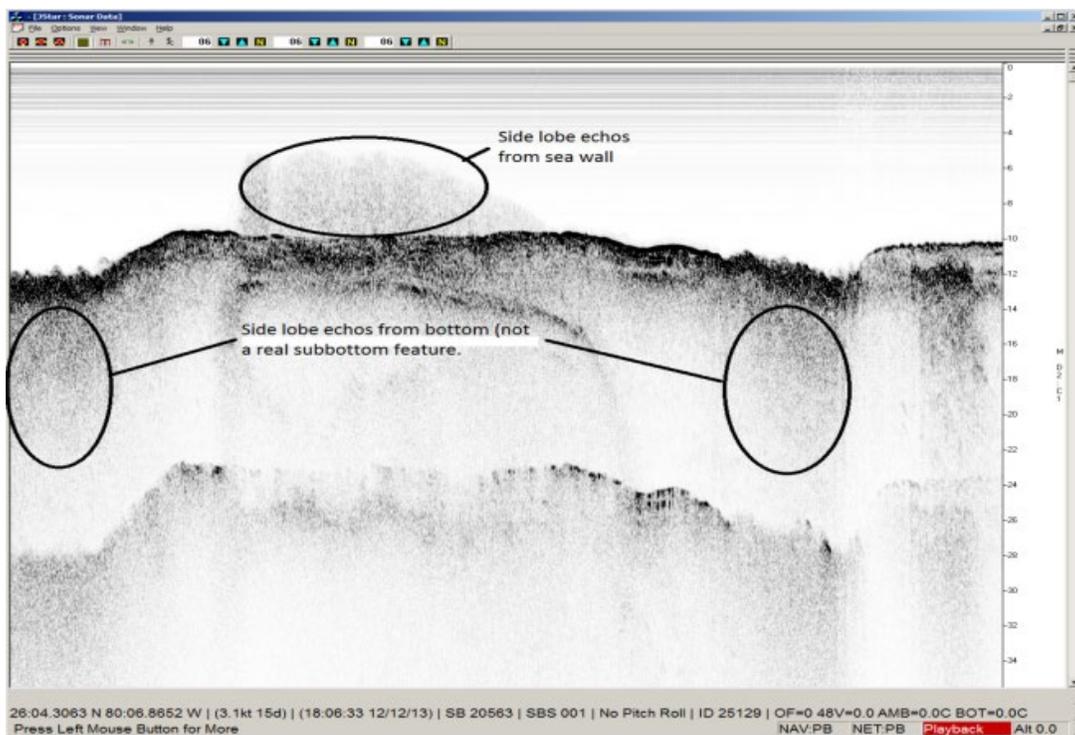


Figure 1-4: Traditional Hydrophone with Side-Lob Echoes

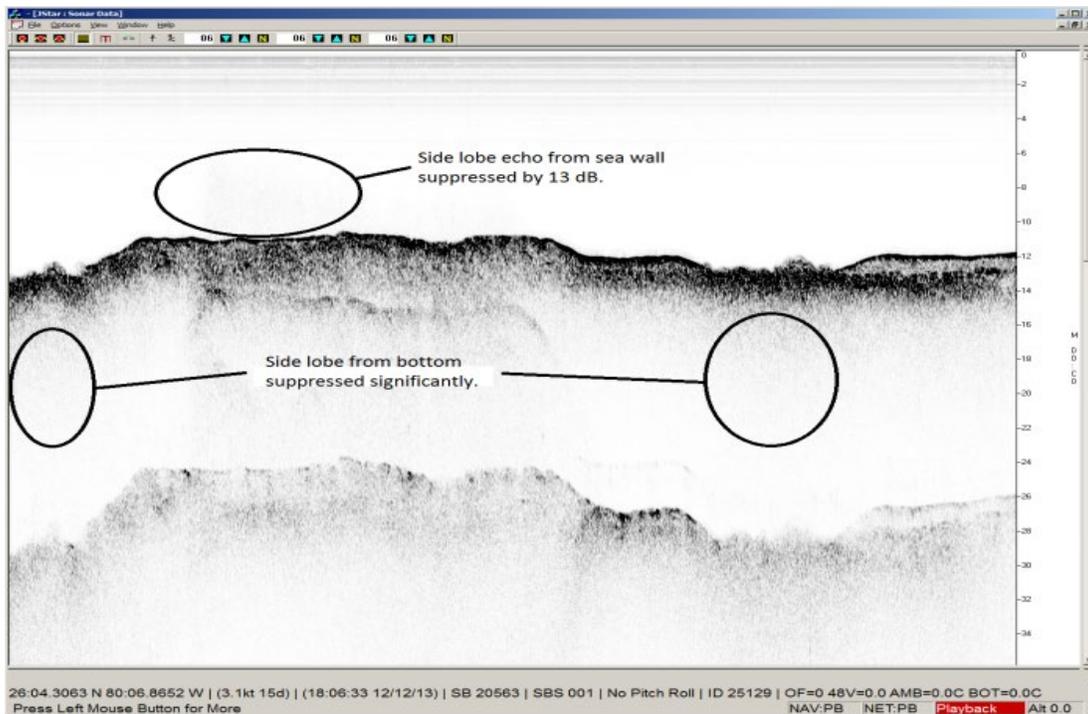


Figure 1-5: 3400 PVDF Imagery Side Lobes with Reduced Echoes

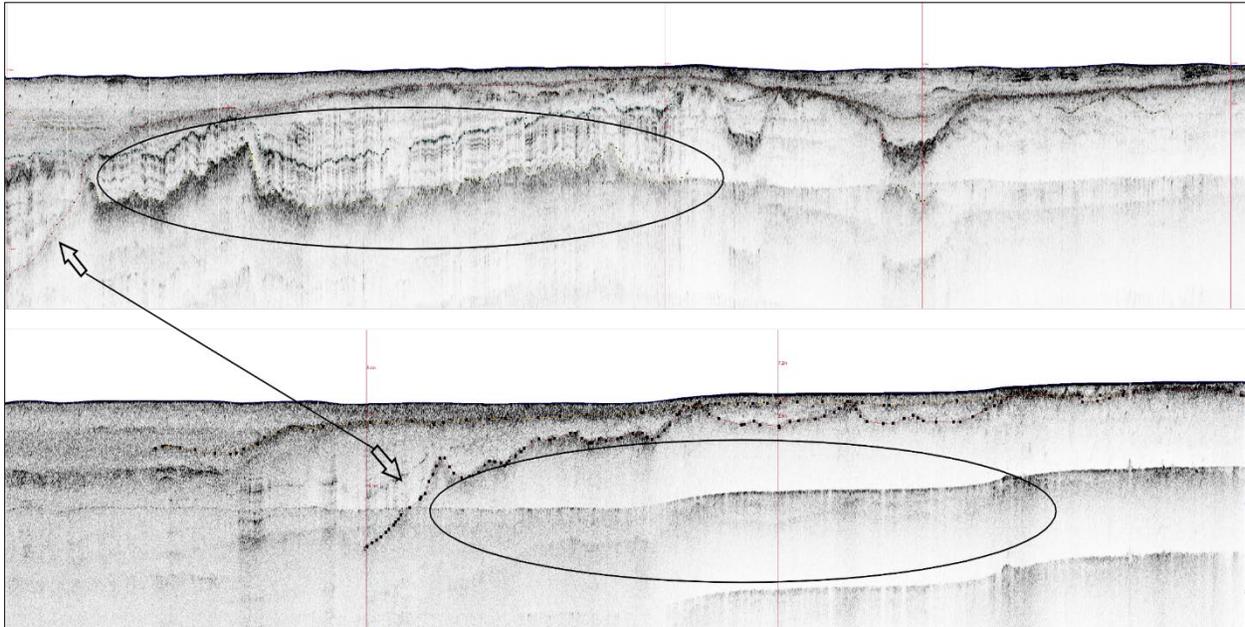


Figure 1-6: Comparison of 3400 Vs. Traditional Line Arrays Over Same Survey Line

1.1.5 Reflection Coefficient Calculation

Discover 3400 Sub-Bottom Software can calculate reflection coefficients that aid in bottom sediment classification. The configuration procedure to do this adjusts the system gain constant so that the reflection coefficient provides an estimate of the ratio between the pressure amplitude of the pulse striking the seafloor and the amplitude of the reflected pulse. These values can then be compared with the known values of the local seafloor to classify the composition of the surveyed area. Detailed instructions on reflection coefficient calculation are found in the [3400 SOFTWARE MANUAL](#).

1.1.6 Sub-Bottom “Pipeliner” Mode

The 3400 Sub-Bottom Profiler has a unique feature that seamlessly changes the sonar beam to accentuate the diffraction hyperbolas in the echo data and significantly increases the probability of detecting shallow water buried pipes and cables. In older models, the surveyor had to manually switch the vehicle's hydrophones' position to achieve the wide-beam configuration suitable for pipeline detection. In conventional configurations, two hydrophone arrays are mounted in the along-track direction, which gives a narrow along-track beamwidth and a wider across-track beamwidth. In EdgeTech's new pipeline detection configuration, a single transverse hydrophone array gives a wide along-track beamwidth, accentuating the pipeline's parabola. The 3400 Sub-Bottom Profiler uses a large, multi-channel hydrophone with integrated software to control the beam shape.

Pipeline and cable detection surveys and Depth-Of-Burial (DOB) surveys seek to visually identify the signature hyperbolas, indicating the presence of a cylindrical object at the cross point between the cable route and the survey track. Narrow-beam systems may miss target pipes or cables in heterogeneous environments. In shallow coastal areas, pipelines and cables are buried into the seabed to avoid damage by ship traffic, anchors, fisherman, and other impacts. The burial depth is typically less than three meters. EdgeTech's Discover Sub-Bottom software allows the surveyor to change the aperture of the large multi-channel receive hydrophone array on the 3400 while switching to a transmit pulse designed to provide a very high ping rate (up to 30 Hz) for better detection and measurement of the shallow buried pipe/cable.

The Pipeline Mode feature of the 3400 can also be used to detect boulders, UXO, buried hazards, or other debris for site clearance and route surveys.

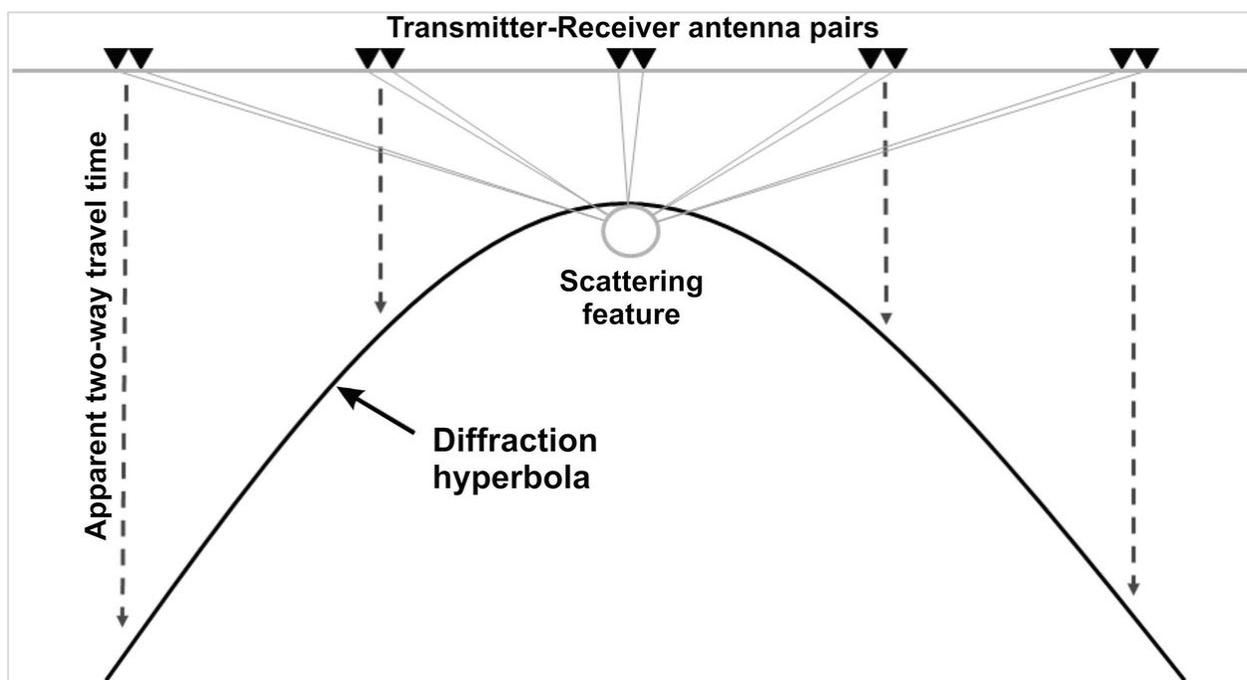


Figure 1-7: Pipeliner Mode Diffraction

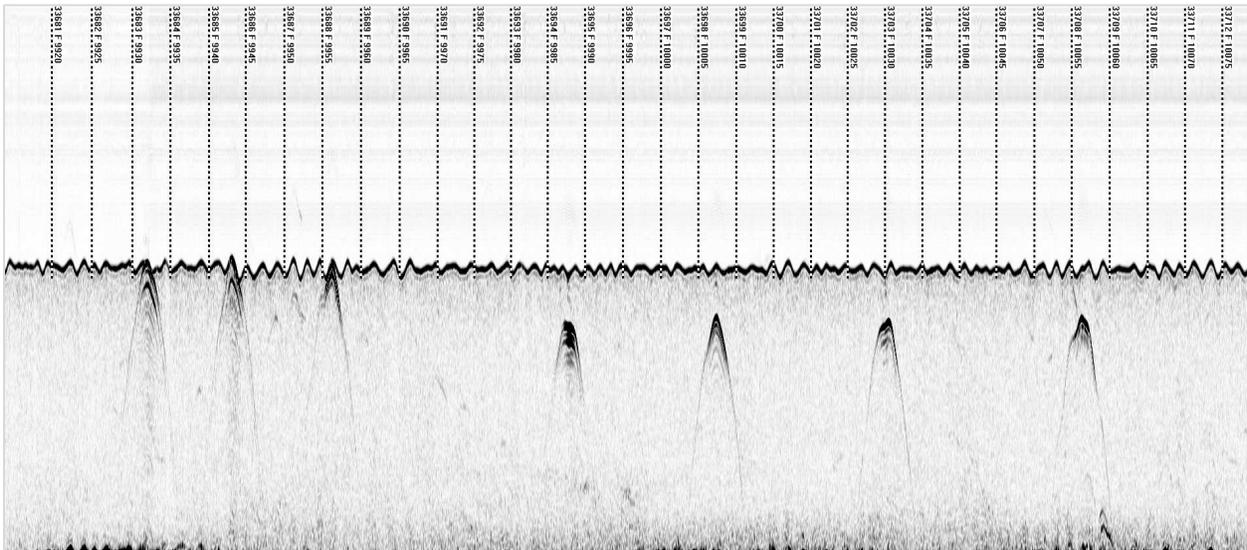


Figure 1-8: Diffraction Hyperbolas in the Echo Data

The diffraction hyperbolas in the echo data are generated by running survey lines close to perpendicular to the pipe/cable crossings. Multiple crossings might be necessary to meet the survey requirement of along-track data density. Higher pipeline position accuracy is achieved by having the sonar close to the seafloor (2-5 meters).

Configuration for Pipeliner mode doesn't require hardware configuration and is described in full in the [3400 SOFTWARE MANUAL](#).

1.1.7 Surface Echo Attenuation

The towfish is designed to mitigate surface reflections leading to cleaner data sets. This is achieved through physical and material design and testing.

1.1.8 Pulse Library Tailored for Most Survey Applications

The 3400 pulse library includes both FM and BOOST pulses to collect the best datasets on the various seafloor types. BOOST pulses emphasize the low end of the bandwidth that should exhibit better performance in deeper water than standard FM pulses.

1.1.9 Built-in Motion, Pitch, Roll, Heave, and Depth Sensors

The towfish comes standard with an SBG compass that provides heave, pitch, and roll to the system. These values are displayed and updated in real-time in Discover. Heave values are applied in real-time in Discover.

1.2 3400 Applications

Applications of the 3400 Sub-Bottom Profiling System include:

- Geological surveys
- Environmental site investigations
- Sediment classification
- Buried pipeline & cable surveys
- Archeological surveys
- Mining/dredging surveys
- Map, measure & classify sediment layers within the seafloor
- Windfarm surveys

1.3 Main System Components

The 3400 system consists of three primary components: a rack-mounted 3400 topside with a connected laptop, a 3400 vehicle, and a customer-supplied tow cable to connect the two.

1.3.1 3400 Rack Mounted Topside in Case and Ruggedized Laptop

The standard 3400 Rack-Mounted Topside is composed of an EdgeTech 3400 Topside and a ruggedized laptop computer. The 3400 Rack-Mounted Topside is installed in a rugged weatherproof case. The computer and 3400 Topside provide power and communications to the towfish, support sonar and sensor display, collect data, and control the vehicle's various sonars and sensors. This system is controlled by EdgeTech's Discover 3400 Software and operated by the laptop's keyboard, mouse, and video display. Optionally, customers can use their PCs with Discover 3400 installed as well.



Figure 1-9: Deployed 3400 Rackmount System

1.3.2 3400 Cable

The 3400 towfish is connected and towed by a Light Kevlar tow cable. The tow cable is attached to the rugged U-Hinged bridle with a cable grip and plugged into the towfish.

Contact [EDGE TECH CUSTOMER SERVICE](#) for details.



Figure 1-10: Tow Cable

1.3.3 3400 Sub-Bottom Profiler Vehicle

The 3400 Sub-Bottom Profiler vehicle is a hydrodynamic towfish designed to carry dual 2-16 kHz transducers and a large segmented PVDF array for sub-bottom surveys. The vehicle is stable, durable, and portable enough to be easily maneuvered on deck and in the water. A hinged U-framed tow bridle is used for towing, and the tow point location can be adjusted to accommodate different towing speeds and depths.



*Figure 1-11: 3400 Sub-Bottom Profiler Towfish
Forward View*



*Figure 1-12: 3400 Sub-Bottom Profiler
Towfish Aft View*



Figure 1-13: 3400 Sub-Bottom Profiler Towfish Port View

The 3400 Tow Vehicle is available in two different configurations: a towed configuration with bridle installed and a pole-mounted configuration. Both configurations can be used with the 3400 Sub-Bottom Profiler System with the addition of a pole-mounting kit. Instructions for switching between configurations are found in the **POLE MOUNTING** and **U-HINGE TOW BRIDLE** sections of this manual.

1.3.3.1 3400 Sub-Bottom Profiler Tow Vehicle Pole Mounting Kit Option

The **3400 SBP POLE MOUNT KIT** is necessary to mount the towfish to a customer's pole mount. The 3400 pole mounting kit is delivered with a pole mount flange plate, kevlar deck cable, and tool kit. The included EdgeTech designed mounting plate attaches to a user-supplied pole and matching plate. Users must further secure a pole-mounted system to their vessel using taut safety lines and the vehicle's auxiliary tow points.

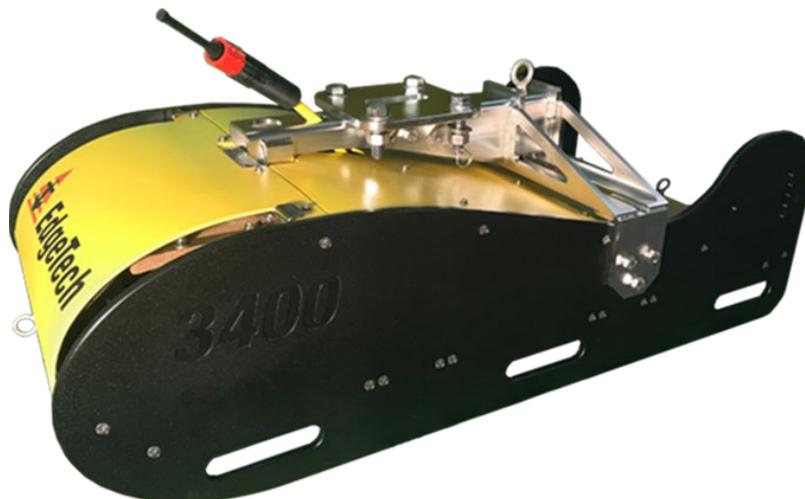


Figure 1-14: 3400 Sub-Bottom Profiler Towfish with Pole Mounting Flange Installed

1.3.4 3400 OTS LF Sub-Bottom Profiler Vehicle

The 3400 OTS (Over-The-Side) LF (Low Frequency) vehicle configuration provides the body form and hardware for pole mounting the vehicle over a vessel's side and provides for a dual 1-10 kHz transducer and PVDF receiver configuration for deeper water operations, including windfarm applications.



Figure 1-15: Side View of 3400 OTS-LF Vehicle Configuration Option

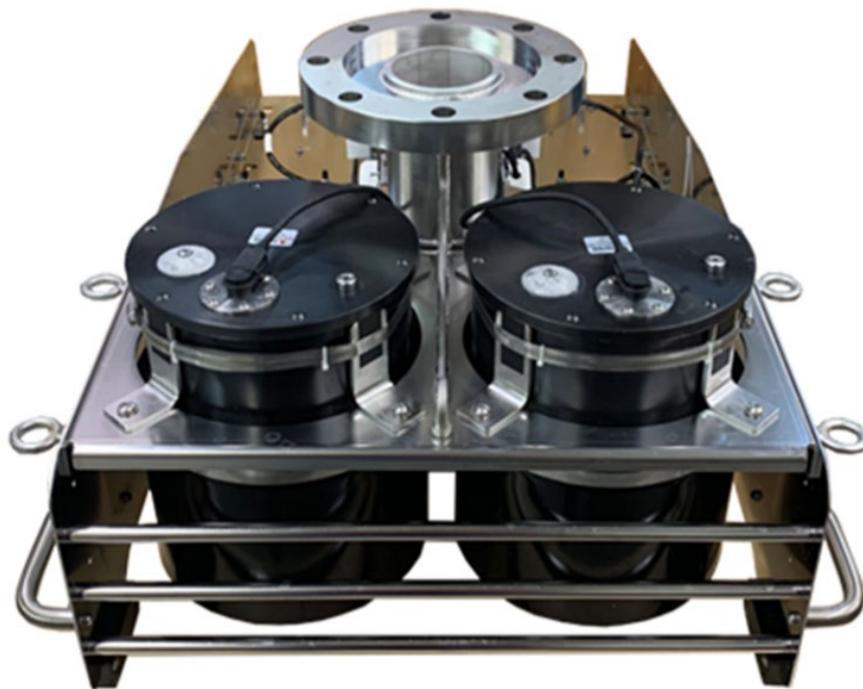


Figure 1-16: Forward View of 3400 OTS-LF Vehicle Configuration Option

1.3.4.1 3400 OTS-LF Amplifier Option

It is recommended to use an optional high-power amplifier to increase the Signal to Noise Ratio (SNR) and effectively improve the acoustic images generated by the sonar for surveys in water depth greater than 100 meters. EdgeTech provides a high-power amplifier option that comes in a stand-alone case and is easily connected by cable to the 3400 Topside. Amplifiers are currently available for the 3400 OTS-LF only.



Figure 1-17: 3400 System with Amplifier in Cases



Figure 1-18: Amplifier in Case

1.3.5 3400 OTS Light and Ultra-Light Sub-Bottom Profiler Vehicles

The 3400 Over-The-Side Light and Ultra-Light Mount configuration options provide the body form and hardware for pole mounting the vehicle over a vessel's side and provide single transducer options for shallow water operations. Both are small enough to be used from the smallest vessels, and an optional Flat-Plate Pole-Mounting Adaptor Flange can be purchased to assist in pole mounting.



Figure 1-19: 3400 OTS Light and Ultra-Light Sub-Bottom Profiler Aft View



Figure 1-20: 3400 OTS Light and Ultra-Light Sub-Bottom Profiler Forward View



Figure 1-21: 3400 OTS Light and Ultra-Light Sub-Bottom Profiler Side View

1.3.5.1 3400 OTS Light and Ultra-Light Sub-Bottom Profiler Pole-Mounting Adaptor Flange Option

EdgeTech offers an optional flat plate pole mount adaptor flange designed to be mated with the 3400 vehicle's Schedule-160 (pipe) pole mounting and a customer's matching flange to provide further stability to 3400 vehicles. Further details and instructions can be found in the **3400 LIGHT AND ULTRA-LIGHT POLE-MOUNTING USING THE OPTIONAL 3400 OTS LIGHT AND ULTRA-LIGHT FLAT PLATE POLE MOUNTING ADAPTOR FLANGE** section of this manual.



Figure 1-22: 3400 OTS Light and Ultra-Light Sub-Bottom Profiler With Optional Adaptor Flange

2.0 SPECIFICATIONS

The 3400 Sub-Bottom Profiling System specifications include electrical, mechanical, and environmental characteristics for the Portable Topside Processor, Laptop, 3400 Tow Vehicle, and the 50 Meter Tow Cable.

2.1 3400 Vehicle Specifications

2.1.1 3400 Sonar Specifications

2.1.1.1 3400 Sub-Bottom Profiler 2-16 kHz Sonar Specifications

SONAR SPECIFICATIONS	VALUE
Frequency Range	2-16 kHz
Vertical Resolution	6-10 cm. (3-4 in.)
<u>Penetration (Typical)</u>	
In Coarse Calcareous Sand	6 m (20 ft.)
In Clay	80 m (262 ft.)
Modulation	Full-spectrum CHIRP frequency-modulated pulses with amplitude weighting

Table 2-1: 3400 Sub-Bottom Profiler Sonar Specifications

2.1.1.2 3400 OTS LF Sub-Bottom Profiler 1-10 kHz Sonar Specifications

SONAR SPECIFICATIONS	VALUE
Frequency Range	1-10 kHz
Vertical Resolution	8-12 cm (3-5 in.)
<u>Penetration (Typical)</u>	
In Coarse Calcareous Sand	20 m (65.6 ft.)
In Clay	200 m (656 ft.)
Modulation	Full-spectrum CHIRP frequency-modulated pulses with amplitude weighting

Table 2-2: 3400 OTS LF Sub-Bottom Profiler Sonar Specifications

2.1.1.3 3400 OTS Light 2-16 kHz Sub Bottom Profiler Sonar Specifications

SONAR SPECIFICATIONS	VALUE
Frequency Range	2-16 kHz
Vertical Resolution	6-10 cm (2-4 in.)
<u>Penetration (Typical)</u>	
In Coarse Calcareous Sand	6 m (19.7 ft.)
In Clay	80 m (262.5 ft.)
Modulation	Full-spectrum CHIRP frequency-modulated pulses with amplitude weighting

Table 2-3: 3400 OTS Light Sonar Specifications

2.1.1.4 3400 OTS Ultra-Light 4-24 kHz Sub Bottom Profiler Sonar Specifications

SONAR SPECIFICATIONS	VALUE
Frequency Range	4-24 kHz
Vertical Resolution	4-8 cm (1-3 in.)
<u>Penetration (Typical)</u>	
In Coarse Calcareous Sand	2 m (6.6 ft.)
In Clay	40 m (131.2 ft.)
Modulation	Full-spectrum CHIRP frequency-modulated pulses with amplitude weighting

Table 2-4: 3400 OTS Ultra-Light Sonar Specifications

2.1.2 3400 Vehicle Physical Specifications

2.1.2.1 3400 Towed or Pole-Mounted Sub-Bottom Profiler

SPECIFICATION	VALUES
Size (Length x Width x Height):	<u>Pole Mount Configuration</u> 115.81 cm x 55.46 cm x 43.13 cm (45.59 in. x 21.84 in. x 16.98 in.)
	<u>Towing Configuration (Bridle Stowed)</u> 115.81 cm x 55.46 cm x 33.3 cm (45.59 in. x 21.84 in. x 13.13 in.)
Weight in air:	<u>Pole Mount Configuration</u> 83.7 kg (184.5 lb.)
	<u>Towing Configuration</u> 90.1 kg (198.6 lb.)
Weight in saltwater:	<u>Pole Mount Configuration</u> 46.9 kg (103.3 lb.)
	<u>Towing Configuration</u> 52.5 kg (115.8 lb.)
Maximum Cable Length:	75 m (246.1 ft.)
Shipping Container Size	127 cm x 78.7 cm x 60.7 cm (50 in. x 31 in. x 24 in.)
Shipping Container Weight	145.2 kg (320 lb.)
Depth Rating:	100m (329 ft.)
Digital Link	4 Mbits/sec (typical), 2 channels of sub-bottom data plus sensor data

Table 2-5: 3400 Standard Towfish Specifications

2.1.2.2 3400 OTS LF Sub-Bottom Profiler Specifications

SPECIFICATION	VALUES
Size (Length x Width x Height):	116.84 cm x 74.88 cm x 50.55 cm (46 in. x 29.48 in. x 17.9 in.)
Weight in air:	145 kg (320 lb.)
Weight in saltwater:	107 kg (235 lb.)
Maximum Cable Length:	75 m (246.1 ft.)
Shipping Container Size	129.54 cm x 88.9 cm x 73.6 cm (51 in. x 35 in. x 29 in.)
Shipping Container Weight	203 kg (448 lb.)
Depth Rating:	100m (329 ft.)
Digital Link	4 Mbits/sec (typical), 2 channels of sub-bottom data plus sensor data

Table 2-6: 3400 LF OTS Vehicle Specifications

2.1.2.3 3400 OTS Light Sub-Bottom Profiler Specifications

SPECIFICATION	VALUES
Size (Length x Width x Height):	<u>Pole Mount Adaptor Flange Installed</u> 70.02 cm x 37.32 cm x 40.39 cm (27.57 in. x 14.69 in. x 15.90 in.)
	<u>Without Pole Mount Adaptor Flange</u> 70.02 cm x 37.32 cm x 36.20 cm (27.57 in. x 14.69 in. x 14.25 in.)
Weight in air:	<u>Pole Mount Adaptor Flange Installed</u> 33 kg (72 lb.)
	<u>Without Pole Mounting Flange</u> 26 kg (58 lb.)
Weight in saltwater:	<u>Pole Mount Adaptor Flange Installed</u> 19 kg (41 lb.)
	<u>Without Pole Mounting Flange</u> 13 kg (29 lb.)
Maximum Cable Length:	50 m (164.04 ft)
Shipping Container Size	86.36 cm x 60.96 cm x 50.80 cm (34 in. x 24 in. x 20 in.)
Shipping Container Weight	54.43 kg (120 lb.)
Depth Rating:	100m (329 ft.)
Digital Link	4 Mbits/sec (typical), 2 channels of sub-bottom data plus sensor data

Table 2-7: 3400 OTS Light Specifications

2.1.2.4 3400 OTS Ultra-Light Sub-Bottom Profiler Specifications

SPECIFICATION	VALUES
Size (Length x Width x Height):	<u>Pole Mount Adaptor Flange Installed</u> 70.02 cm x 37.32 cm x 40.39 cm (27.57 in. x 14.69 in. x 15.90 in.)
	<u>Without Pole Mount Adaptor Flange</u> 70.02 cm x 37.32 cm x 36.20 cm (27.57 in. x 14.69 in. x 14.25 in.)
Weight in air:	<u>Pole Mount Adaptor Flange Installed</u> 27 kg (61 lb.)
	<u>Without Pole Mount Adaptor Flange</u> 21 kg (47 lb.)
Weight in saltwater:	<u>Pole Mount Adaptor Flange Installed</u> 16 kg (36 lb.)
	<u>Without Pole Mount Adaptor Flange</u> 11 kg (24 lb.)
Maximum Cable Length:	50 m (164.04 ft.)
Shipping Container Size	86.36 cm x 60.96 cm x 50.80 cm (34 in. x 24 in. x 20 in.)
Shipping Container Weight	48.08 kg (106 lb.)
Depth Rating:	100m (329 ft.)
Digital Link	4 Mbits/sec (typical),
	2 channels of sub-bottom data plus sensor data

Table 2-8: 3400 OTS Ultra-Light Specifications

2.2 3400 Topside Specifications

2.2.1.1 3400 Topside Physical Specifications

SPECIFICATION TYPE	VALUE
Size (Length x Width x Height)	<u>3400 In Case</u> 57.58 cm x 36.8 cm x 23.99 cm (22.7 in. x 14.5 in. x 9.4 in.)
	<u>3400 Rackmount</u> 42.85 cm x 31.2 cm x 8.3 cm (16.9 in. x 12.3 in. x 3.3 in.)
Weight	<u>3400 In Case</u> 13.2 kg (29 lb.)
	<u>3400 Rackmount</u> 5.9 kg (13 lb.)
Case construction	Plastic
Shipping Container Type	Box
Shipping Container Size (Length x Width x Height)	58.42 cm x 38.1 cm x 25.4 (23 in. x 15 in. x 10 in.)
Shipping Container Weight	14.5 kg (32 lb.)
Operating Temp.	0–45°C (32–113° F)
Storage Temp.	-30–70°C (-22–158° F)
Operating relative humidity	0-95% (non-condensing)

Table 2-9: 3400 Topside General Specifications

2.2.1.2 3400 Topside Electrical Specifications

SPECIFICATION TYPE	VALUE
Input Voltage	120/240 VAC, 50/60 Hz, auto-switching
Input Power	Typical 42 W, Peak 54 W
Power to Vehicle	44 VDC
I/O Ports	(1) Ethernet Port (2) Input and Output Trigger Ports (1) PPS Trigger Port (2) Serial Ports (1) Sea Cable Connector
Serial Port Pin Configuration	Pin 2= Transmit data to PC. Pin 3= Receive data from PC. Pin 5=Ground
<ul style="list-style-type: none"> Use a straight cable to connect to the PC. All serial ports are wired as DCE except port #1 that is wired as DTE. 	

Table 2-10: 3400 Topside Specifications

2.2.1.3 EdgeTech Laptop Computer Specifications

SPECIFICATION TYPE	VALUE
Input Voltage	120/240 VAC, 50/60 Hz, auto-switching
Processor	1.8GHz G2 Intel Core i7-855U Pro
Memory	8GB
Data Storage	512GB SSD
Display	Sunlight Readable (Full HD IPS+Touchscreen)
Keyboard	Yes
Pointing Device	Mousepad
I/O Ports	RS232, VGA, SD Card Reader
Operating System	Windows® 10

Table 2-11: Topside Computer Specifications

2.2.1.4 Amplifier Option Physical Specifications

SPECIFICATION TYPE	VALUE
Size(HxWxD)	28.71 cm x 67.32 cm x 56.9 cm (11.3 in. x 26.5 in. x 22.4 in.)
Weight	24.5 kg (54 lb.)
Case construction	Plastic
Operating Temp.	0–45°C (32–113° F)
Storage Temp.	-30–70°C (-22–158° F)
Operating relative humidity	0-95% (non-condensing)

Table 2-12: Amplifier Option Physical Specifications

2.2.1.5 Amplifier Option Electrical Specifications

SPECIFICATION TYPE	VALUE
Input Voltage	100-240VAC, 50/60Hz, auto-switching
Input Power	20AMP
Power to Vehicle	To Be Determined
I/O Ports	Amplifier Interface cable 0022676 3400 OTS Interface Cable between 3400 Sea Cable Port and the 3400 Amplifier Interface Panel.

Table 2-13: Amplifier Option Electrical Specifications

2.2.2 3400 Kevlar Tow Cable Specifications

SPECIFICATION	VALUE
Construction	Mylar, Kaptamid, Telethane, Polypropylene, Aluminium, Copper
Maximum Length	50 m (164 ft.); (75m Max)
Weight In Air	94 kg/100 m (207 lb./1000 ft.)
Breaking Strength	544.3 kg (1200 lb.) minimum
Maximum Working Load	300 kg (660 lb.)
Minimum Bend Radius (Dynamic)	14.9 cm (5.87 in.) minimum
Capacitance	13.5 pF/ft
Impedance	100 OHMS \pm 15 OHMS @ 100MHz
Velocity of Propagation	68%
Twisted-shielded wire pairs	(1) # 26 AWG (2) # 26 AWG
Power Conductor	(1) # 14 AWG (2) # 14 AWG
Voltage Rating	300 volts

Table 2-14: 50-Meter Tow Cable Specification

NOTE: Cables do not come standard with the system and must be specified upon purchase. For more information about cable options, contact **EDGETECH CUSTOMER SERVICE**.

2.2.3.2 3400 Standard Towfish with Pole Mounting Hardware

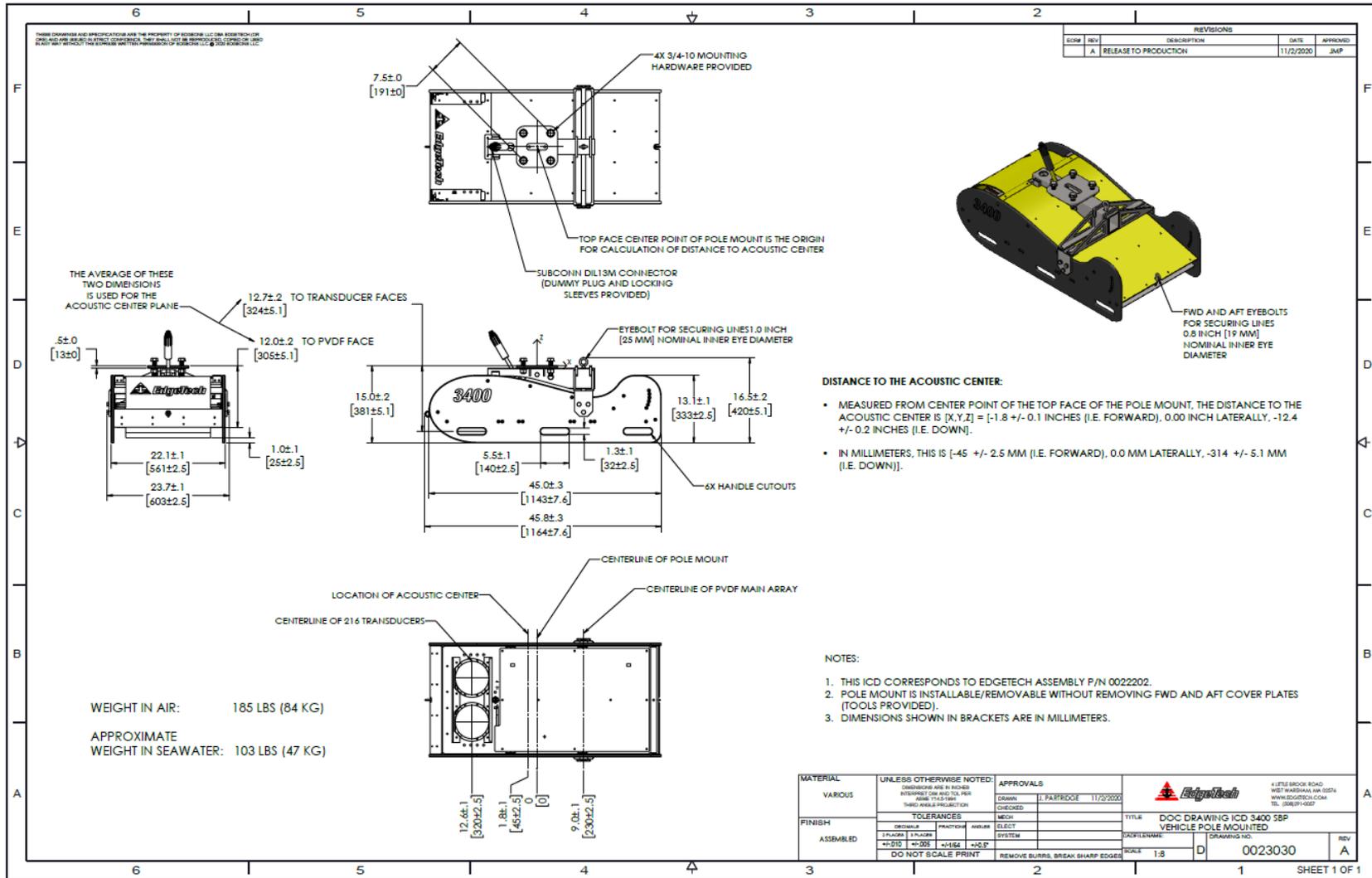


Figure 2-2: 3400 Sub-Bottom Towfish Vehicle With Pole Mounting Hardware ICD

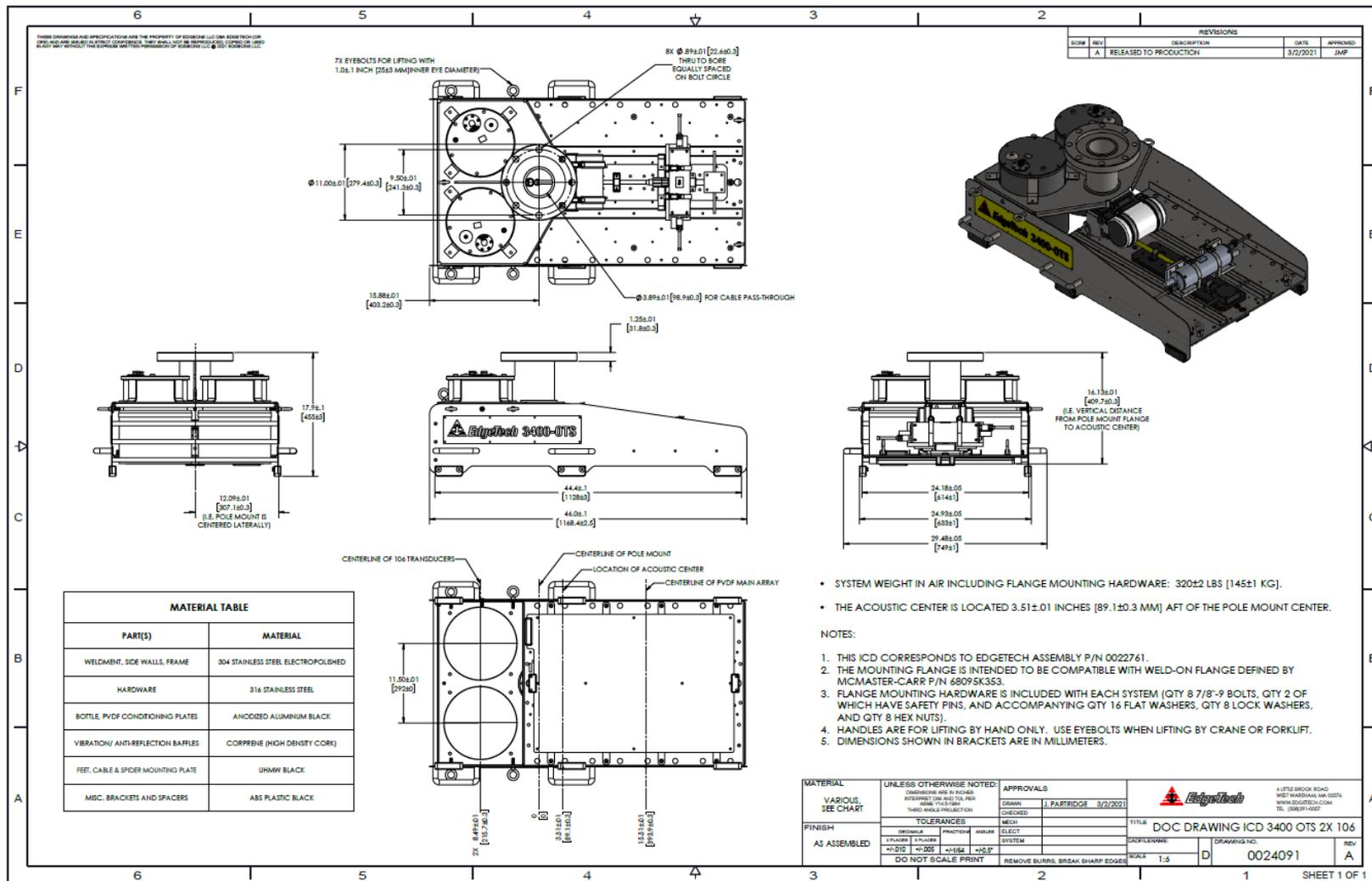


Figure 2-3: 3400 OTS LF Sub-Bottom Profiler Vehicle ICD

2.2.3.3 3400 OTS Light SB-216 and Ultra-Light SB-424 Vehicles ICD

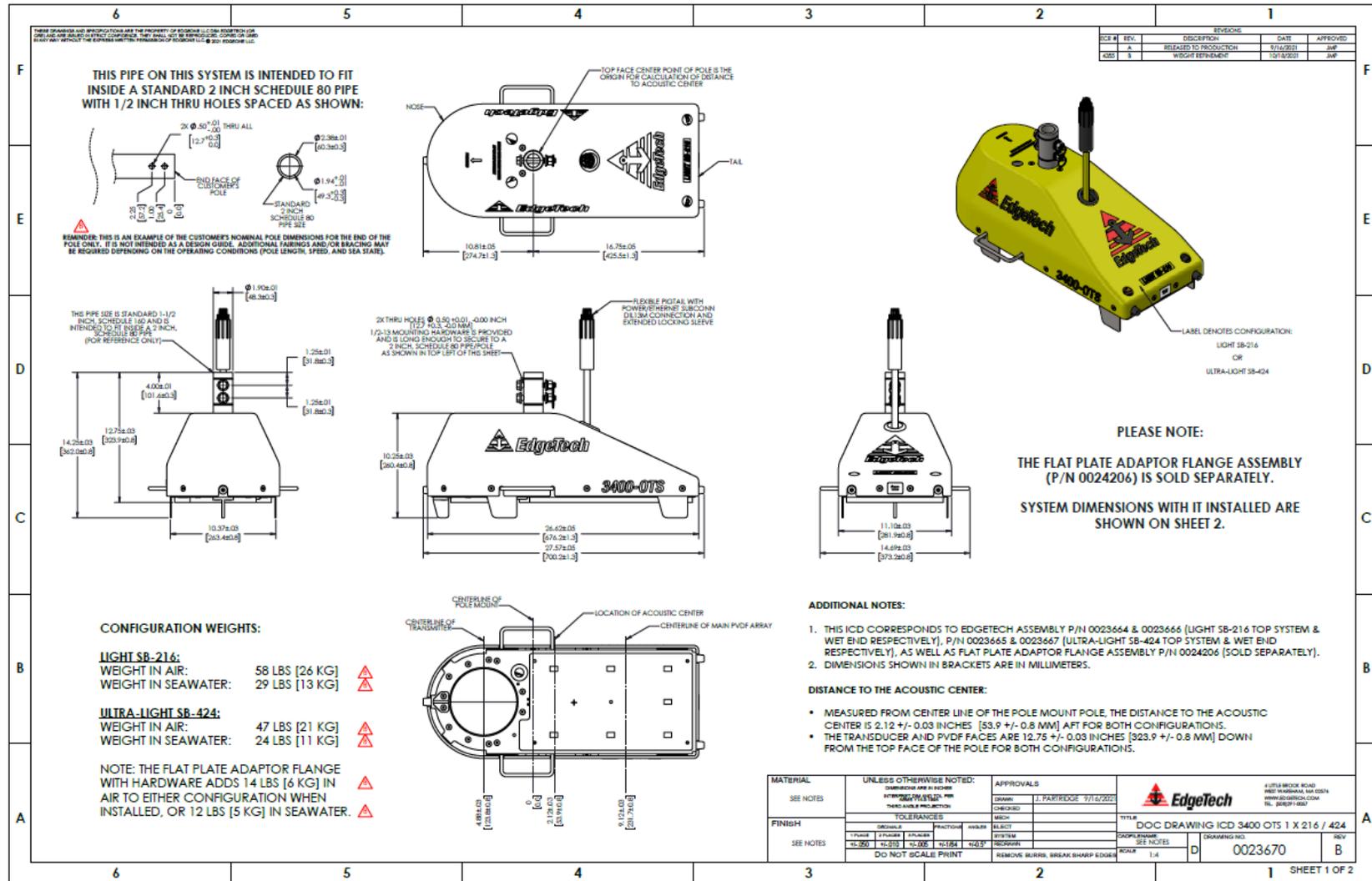


Figure 2-4: 3400 OTS Light and Ultra-Light Vehicle ICD Page 1

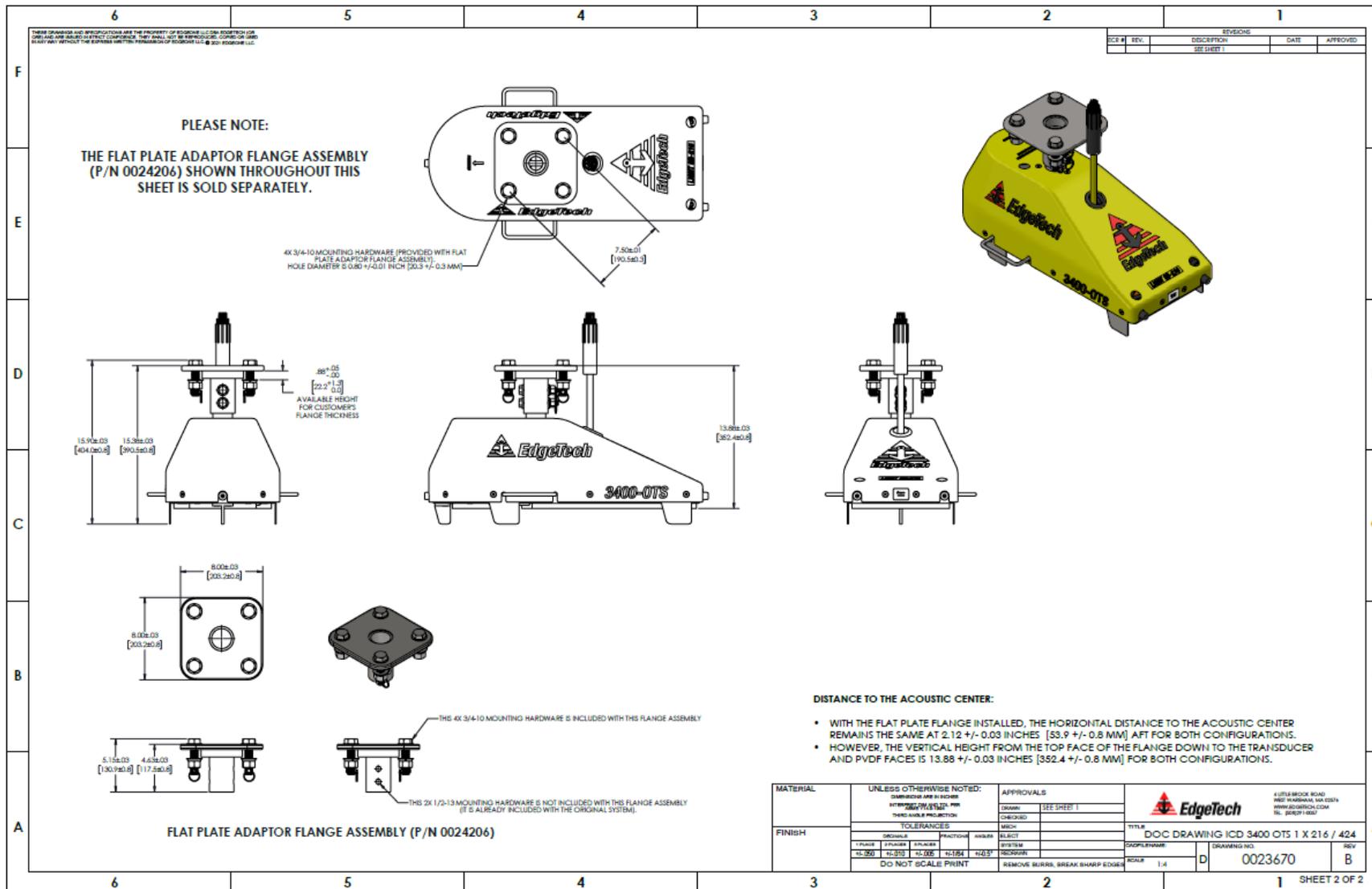


Figure 2-5: 3400 OTS Light and Ultra-Light Sub-Bottom Profiler Vehicle with Mounting Flange ICD Page 2

2.2.3.4 3400 Topside ICD

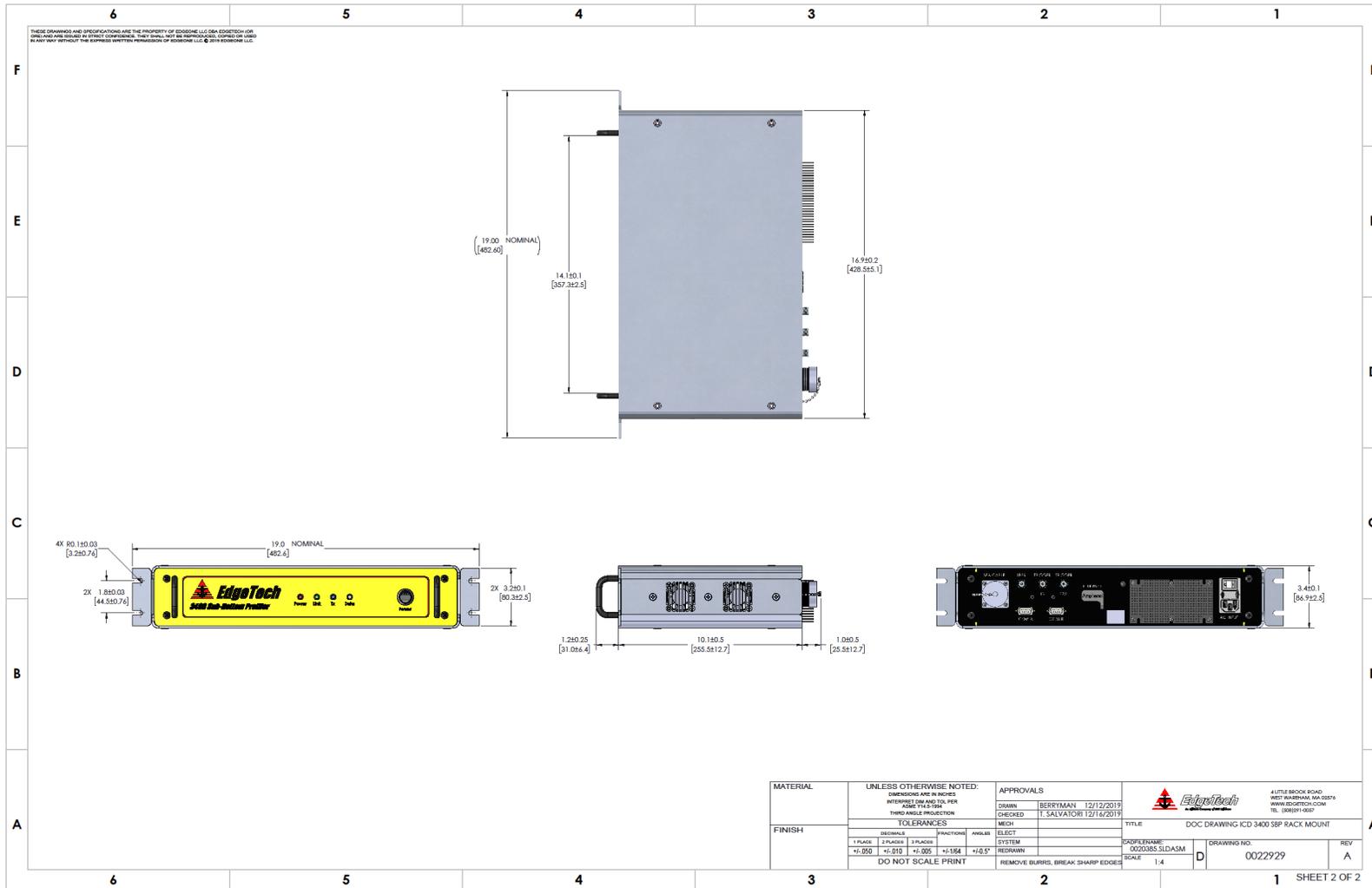


Figure 2-6: 3400 Topside ICD

2.2.3.5 3400 Topside Case ICD

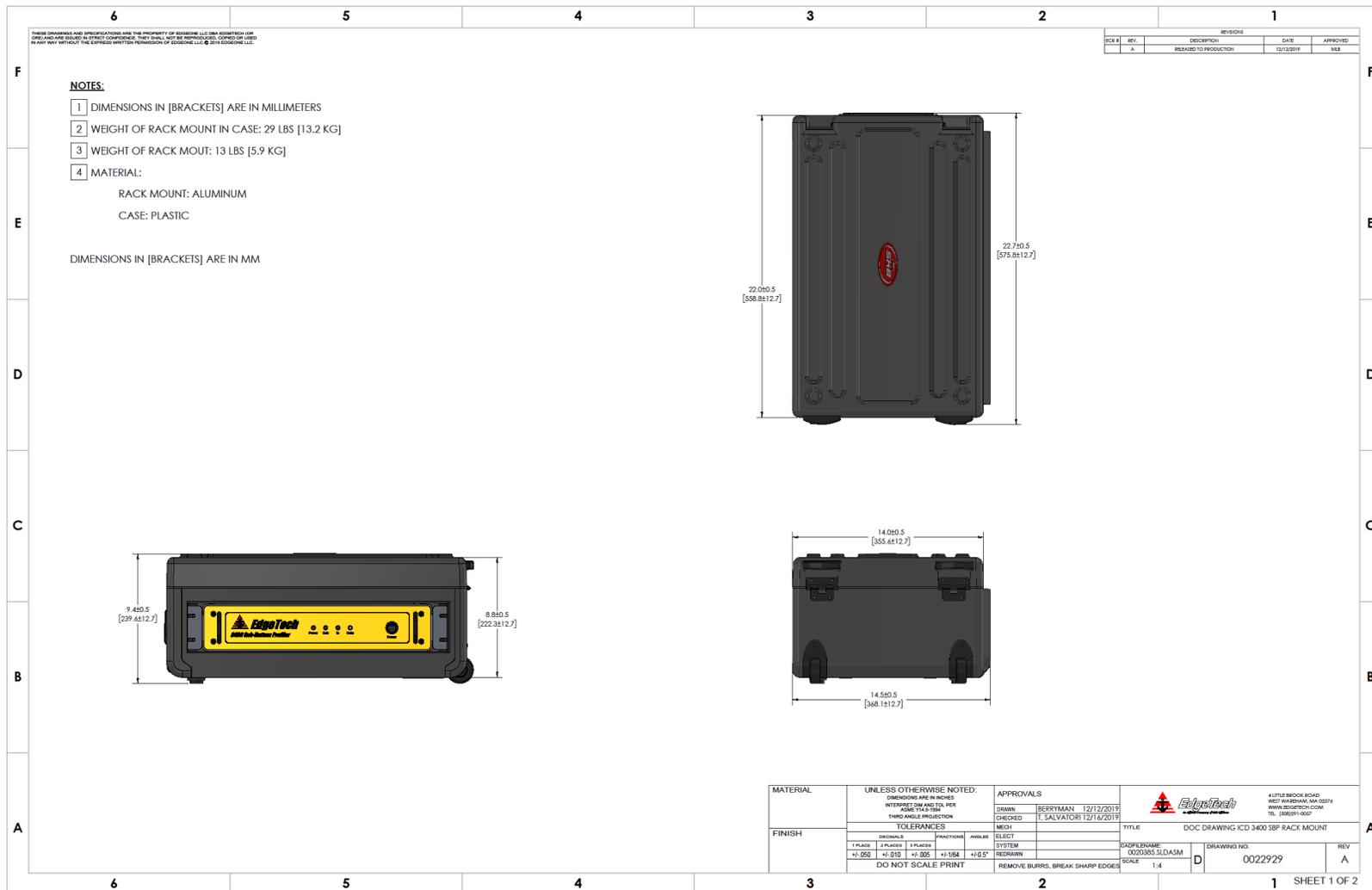


Figure 2-7 3400 Topside Case ICD

2.2.3.6 3400 Pole Mount Plate ICD

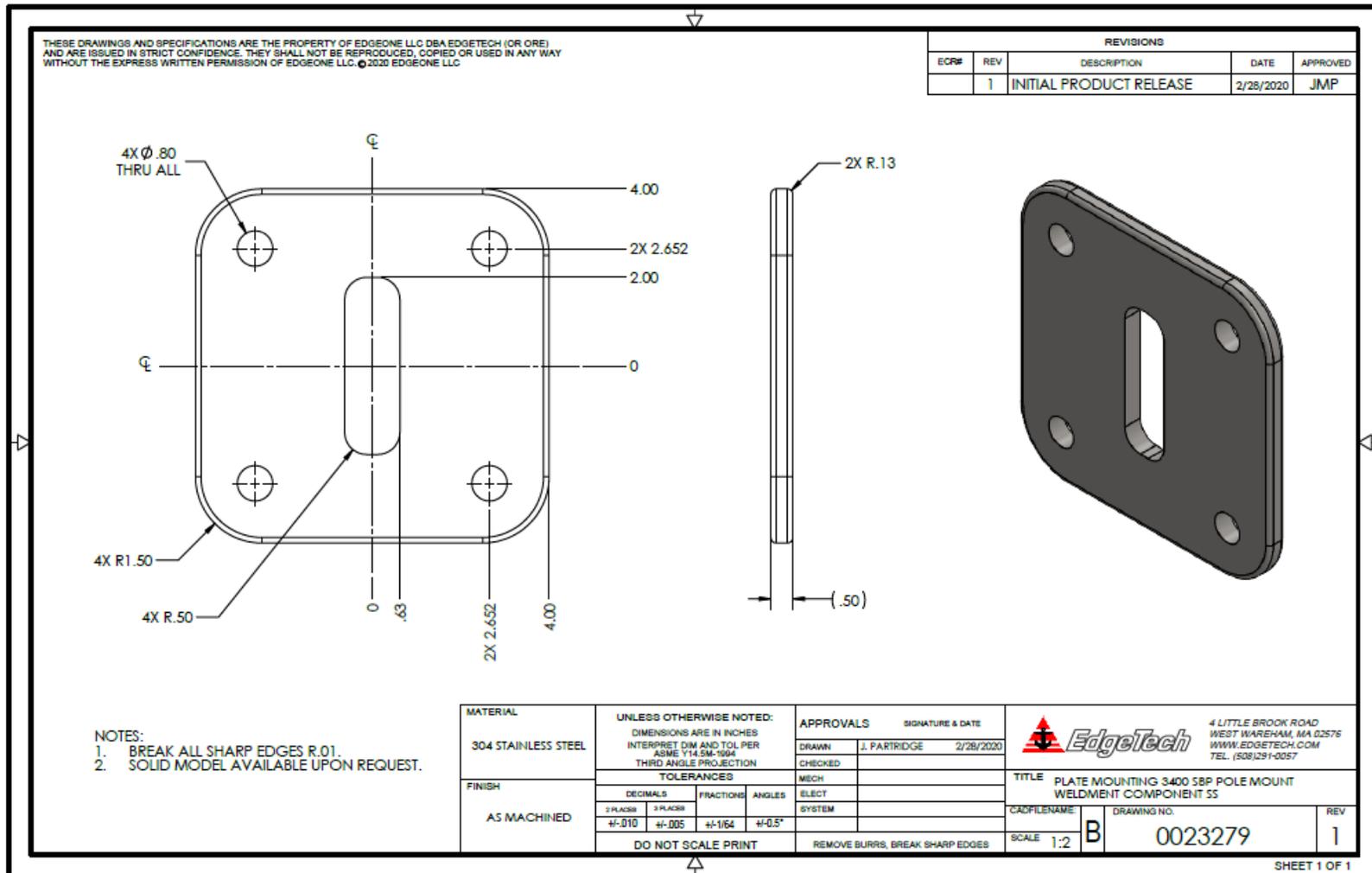


Figure 2-8: 3400 Sub-Bottom Profiler Pole Mounting Plate ICD

2.2.3.7 3400 OTS Mounting Flange ICD

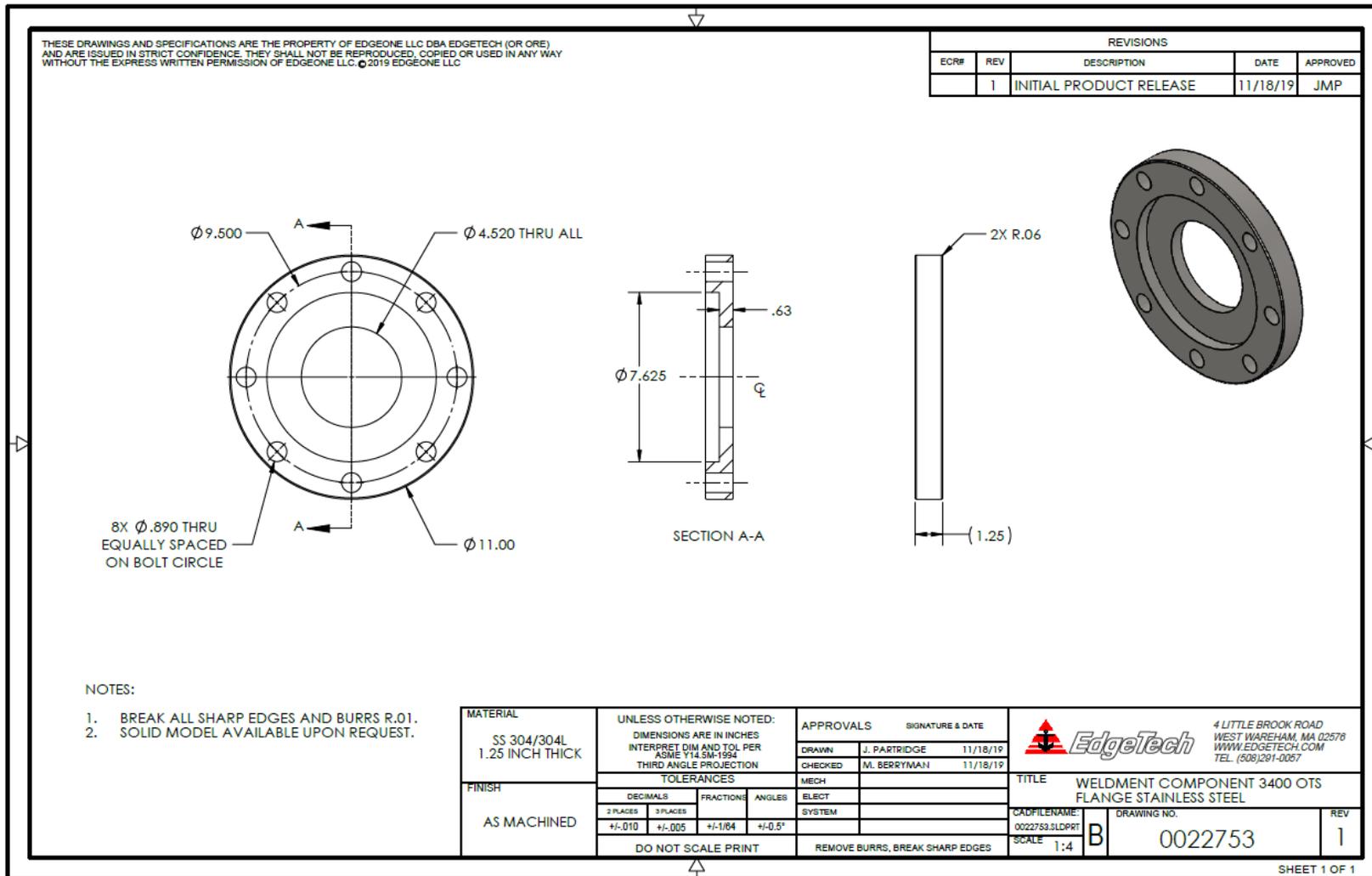


Figure 2-9: 3400 OTS LF Vehicle Mounting Flange

2.2.3.8 3400 OTS and Ultra-Light Flat Plate Pole Mount Adaptor Flange

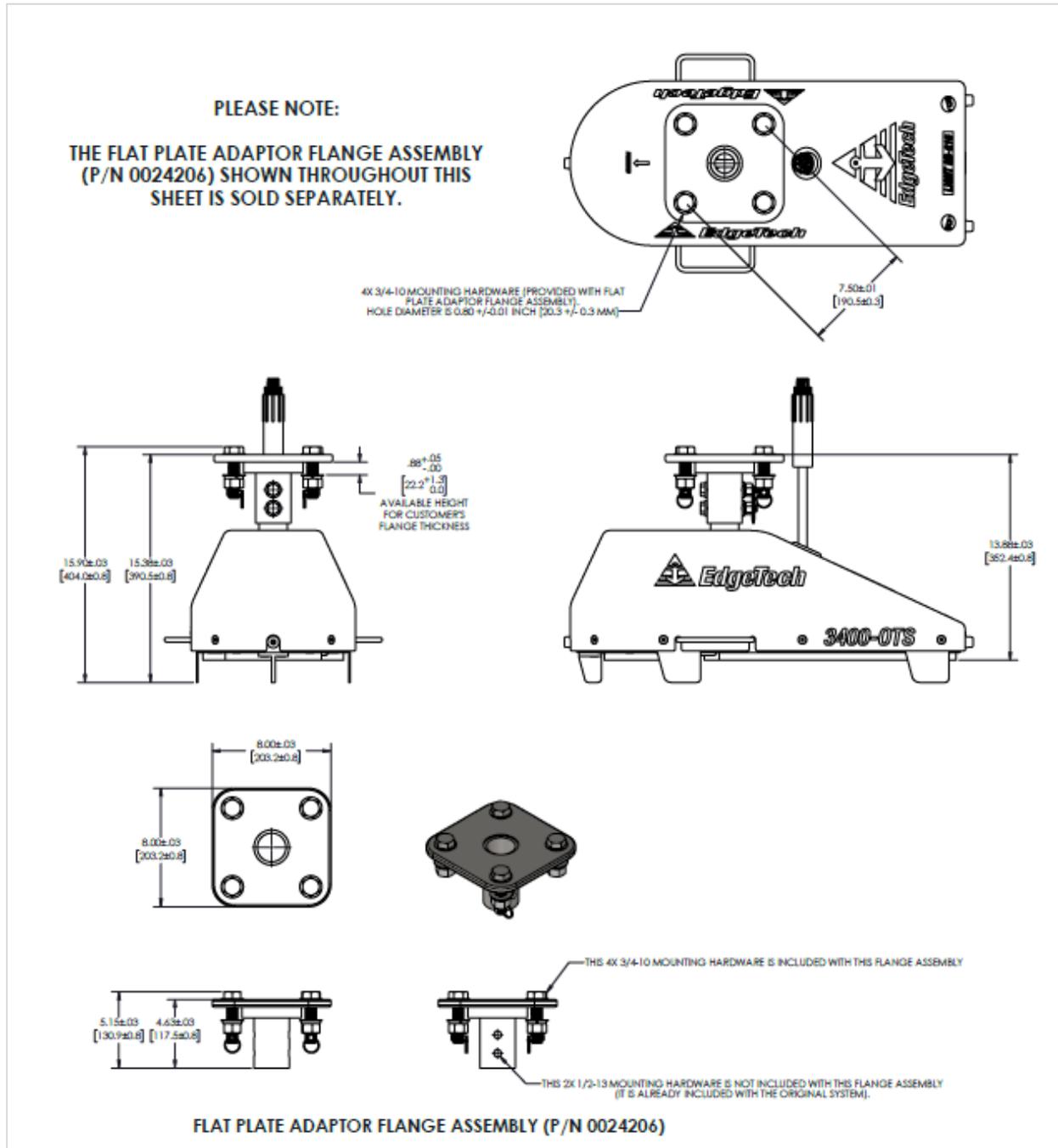


Figure 2-10: 3400 OTS Light and Ultra-Light Flat Plate Pole Mount Adaptor Flange

3.0 3400 TECHNICAL DESCRIPTIONS

This section of the manual describes the various internal and external interfaces, connections, and displays of a system. The configuration described is standard, but yours may differ based on the options chosen at purchase. Please contact EdgeTech **CUSTOMER SERVICE** if you cannot find technical information specific to your system configuration.

3.1 3400 Sub-Bottom Profiler Technical Description

The 3400 Sub-Bottom Profiler is designed to support a default configuration of two 2-16 kHz vertically oriented sub-bottom transducers, a PVDF (polyvinylidene fluoride) sub-bottom receiver, and an internal sonar processor. The towfish receives power and data from a tow cable connected to the 3400 Topside on a survey vessel. Sonar signal is generated by the transducers, received by the PVDF receiver, amplified, digitized, and combined with towfish sensor data before being sent to the 3400 Topside Processor.

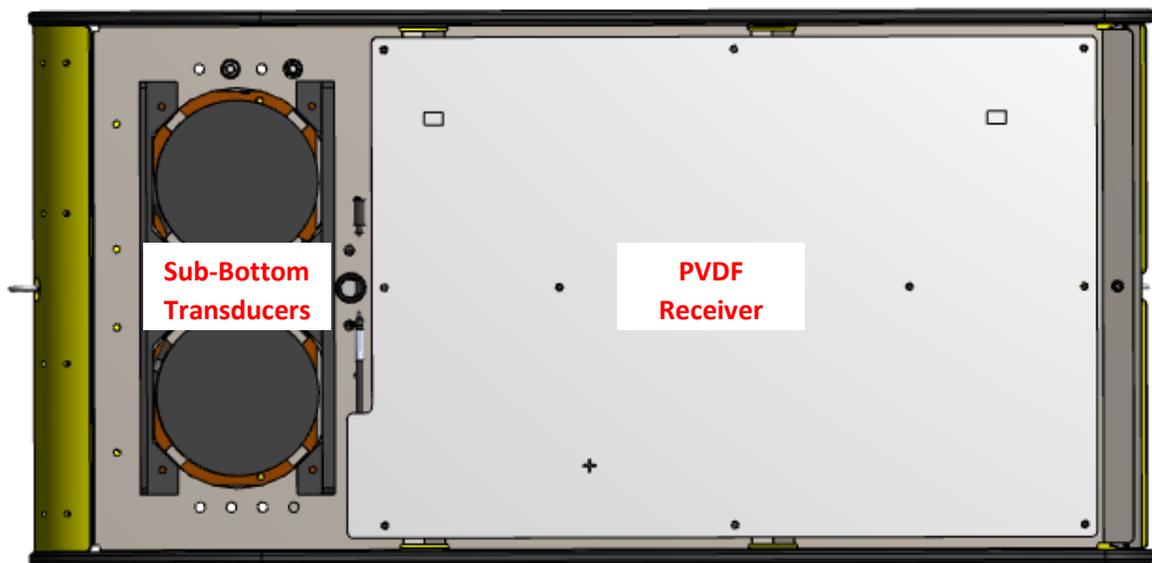


Figure 3-1: Bottom of 3400 Sub-Bottom Profiler

3.1.1 3400 Sub-Bottom Profiler System Connection Diagram

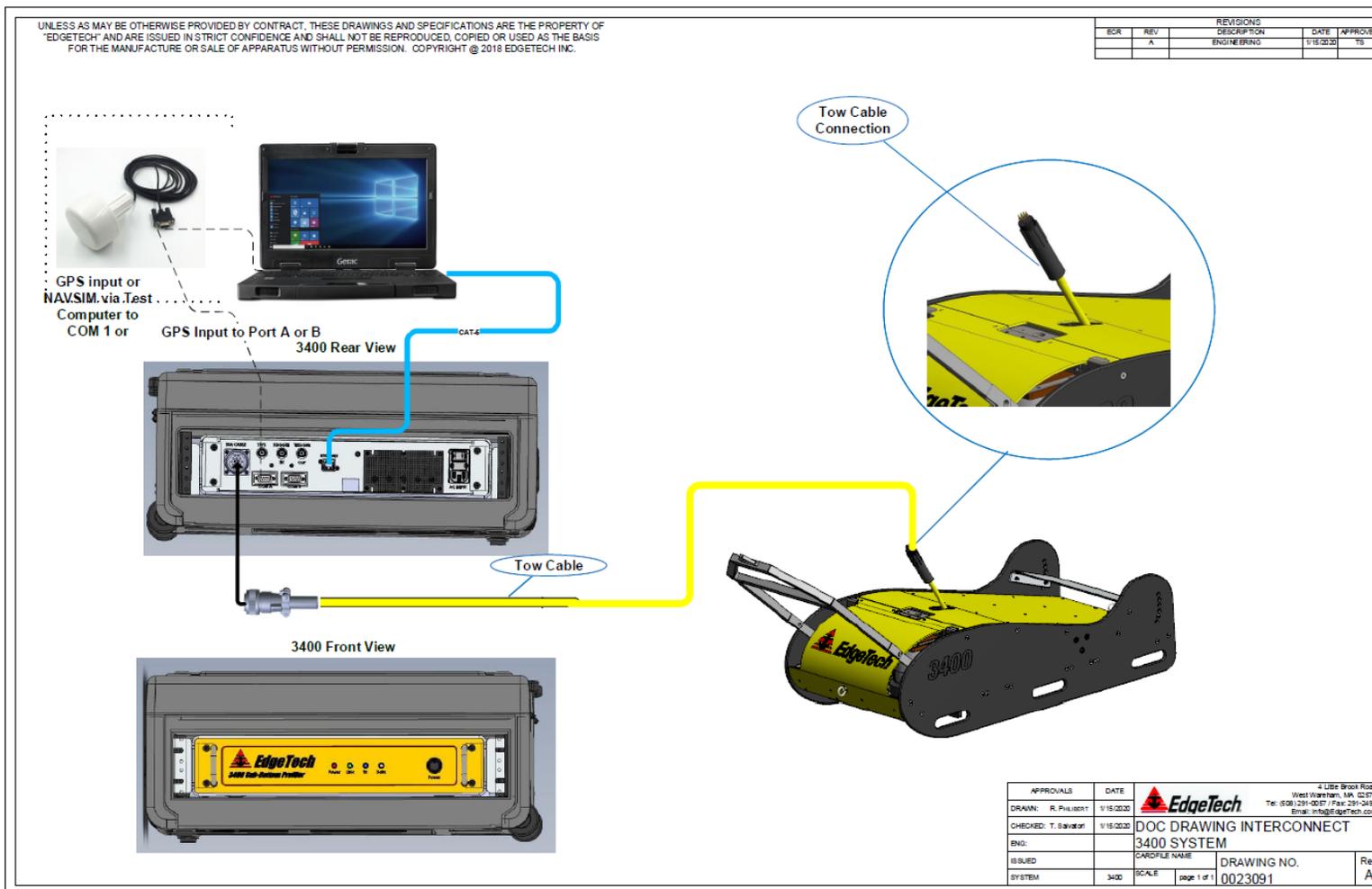


Figure 3-2: 3400 Sub-Bottom Profiler System Connection Diagram

3.1.2 3400 Sub-Bottom Profiler Electronics Bottle and End Cap Diagrams

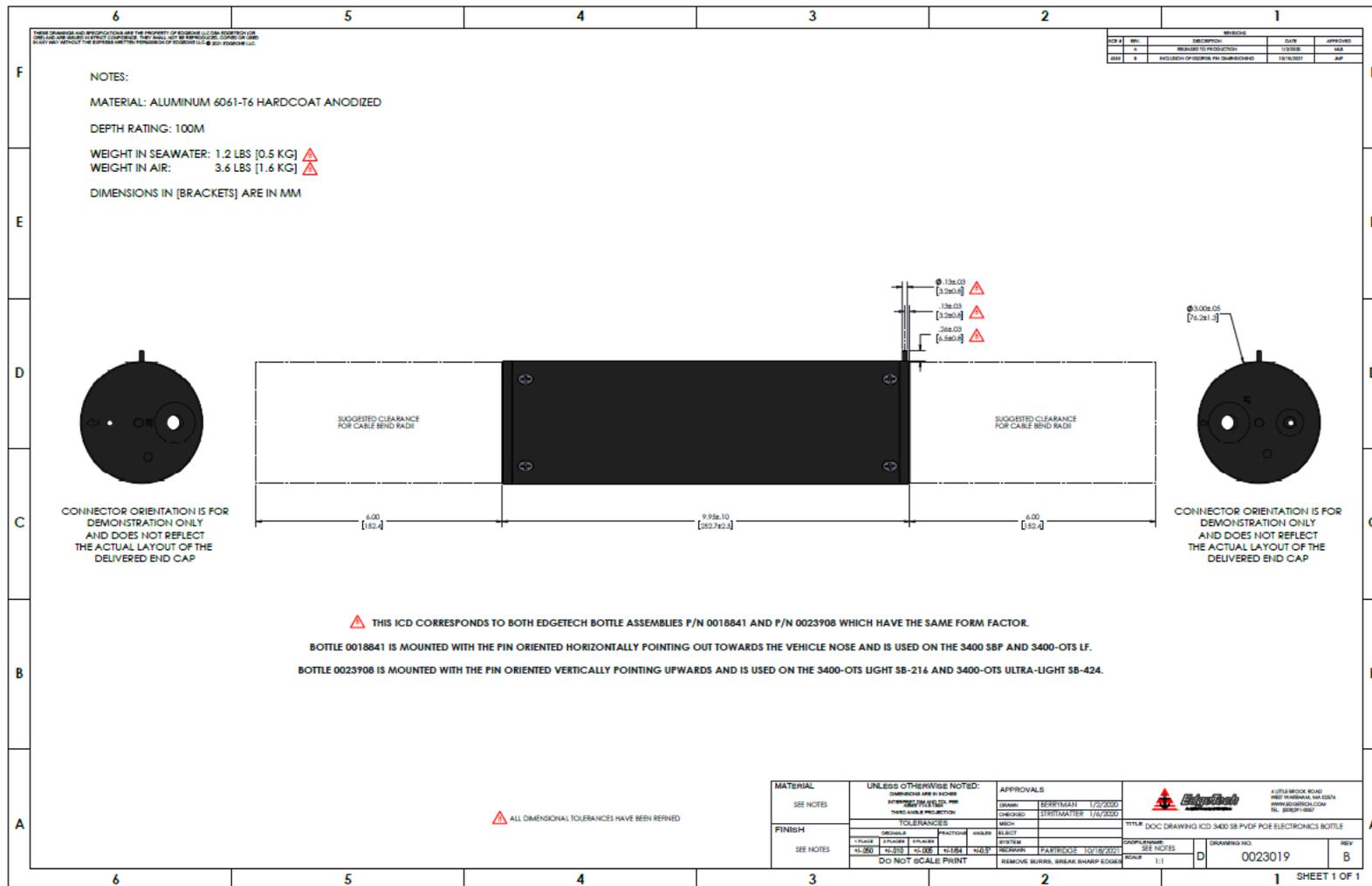
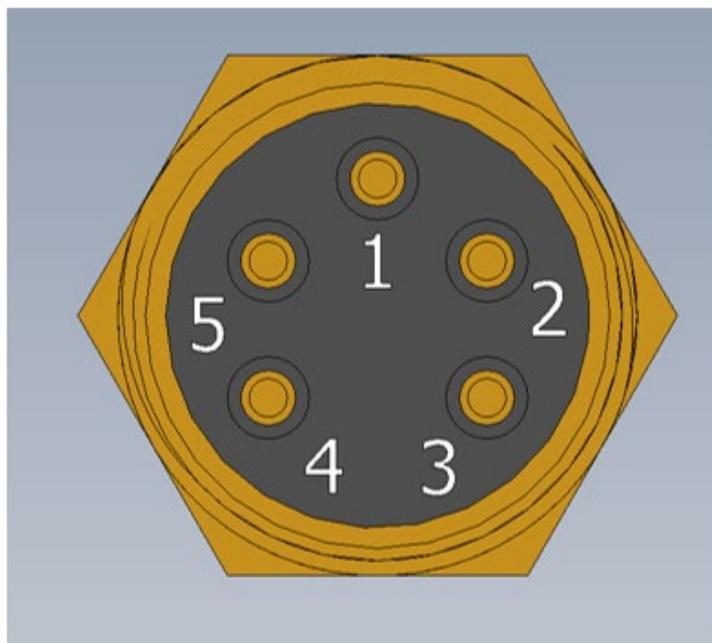
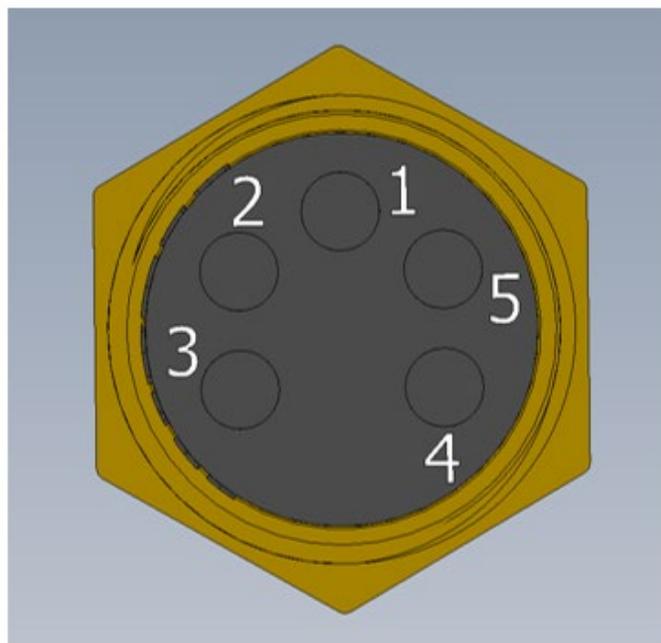


Figure 3-3: 3400 Sub-Bottom Profiler Electronics Bottle ICD



MCBH5M
PIN 1 Shield
PIN 2 PVDF-
PIN 3 PVDF +
PIN 4 RPVDF-
PIN 5 RPVDF+



MCBH5F
PIN 1 Shield
PIN 2 POE RX_N
PIN 3 POE RX_P
PIN 4 POE TX_N
PIN 5 POE TX_P

Figure 3-5: 3400 Sub-Bottom Profiler Electronics Bottle Pinouts

3.1.3 3400 Sub-Bottom Profiler Cable and Connector Diagrams

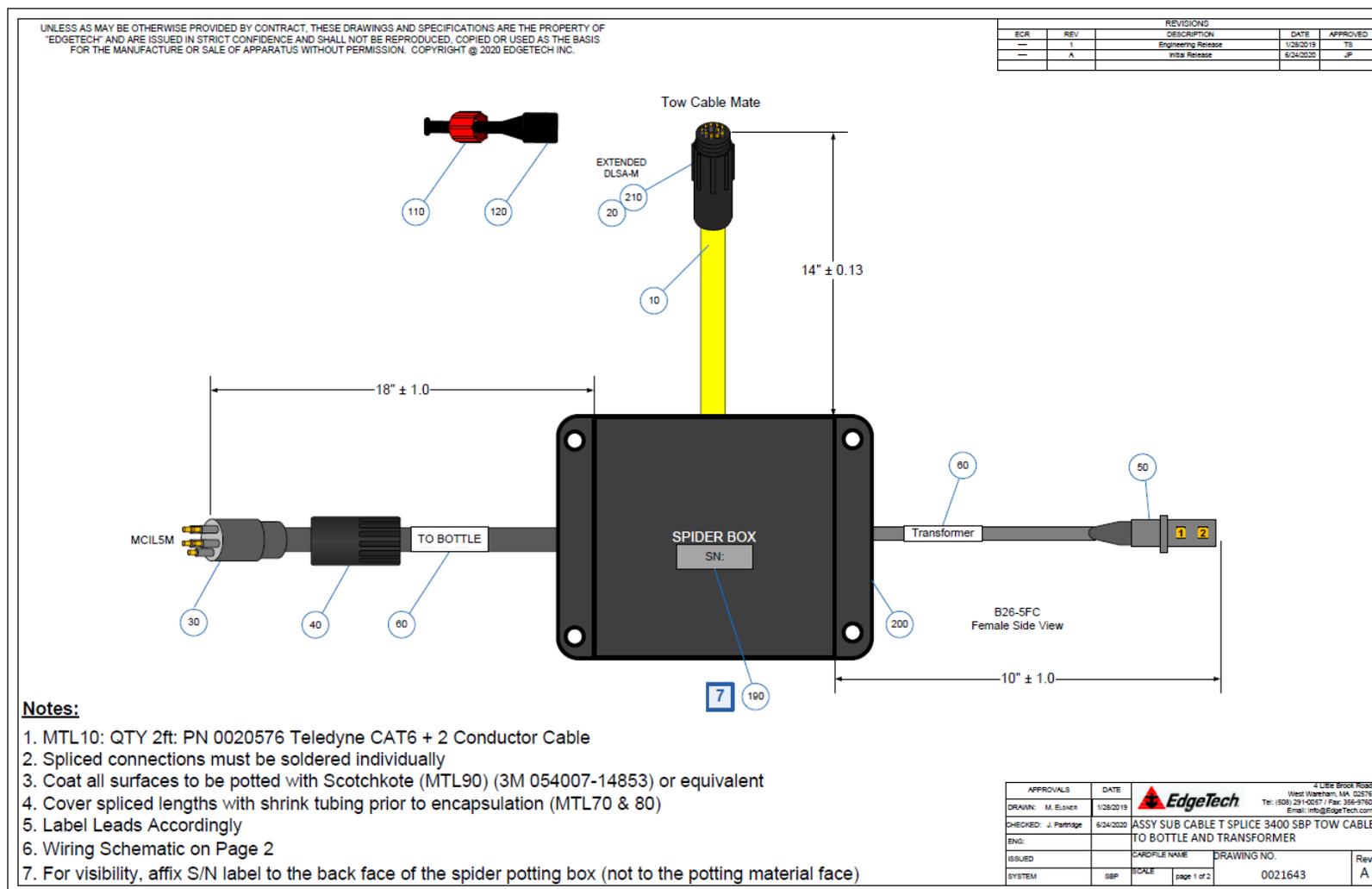


Figure 3-6: Sub Cable T Splice 3400 SBP Tow Cable to Bottle, Transformer, and Tow Cable

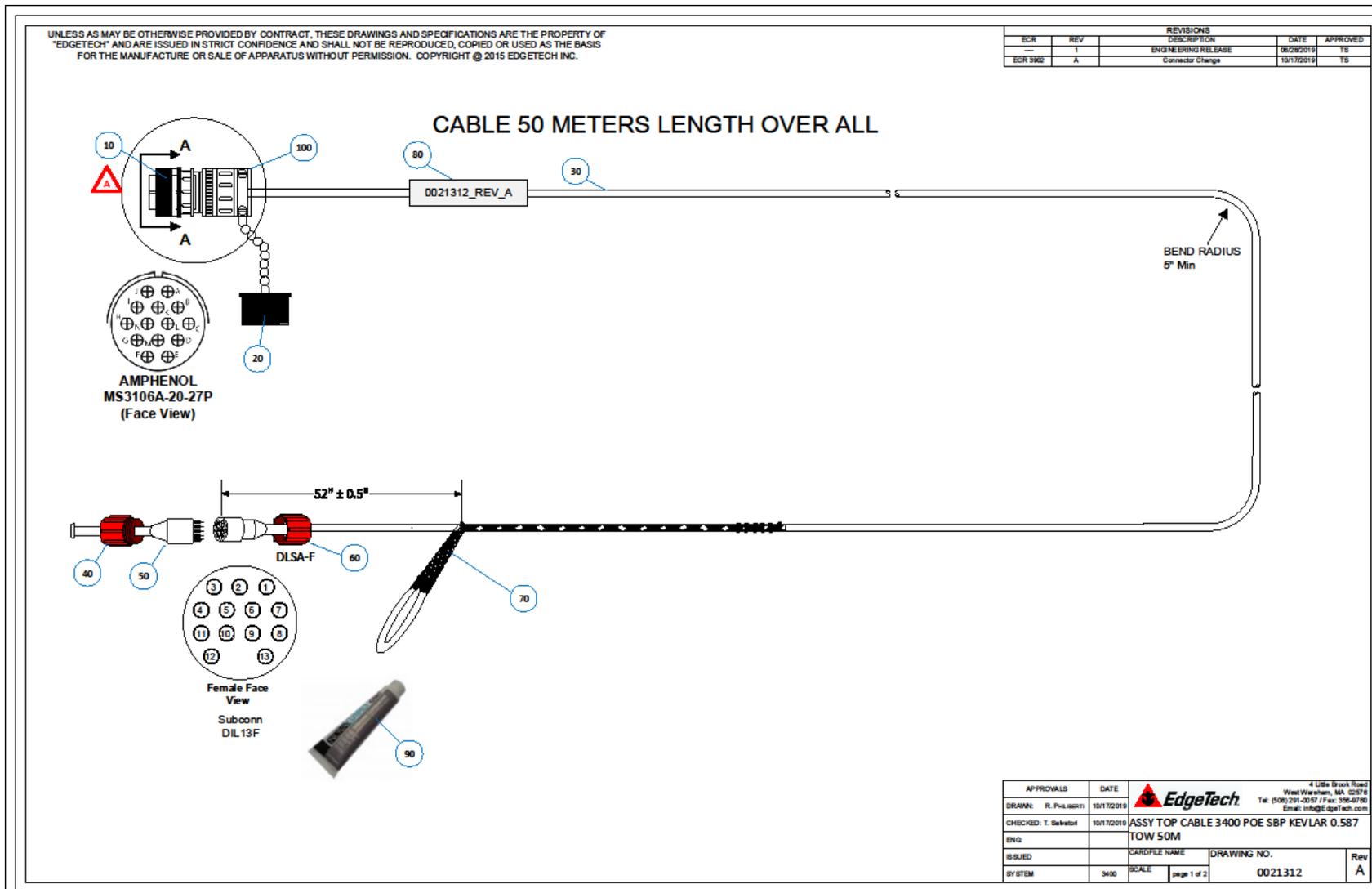


Figure 3-7: 3400 SBP 50 Meter Tow Cable Page 1

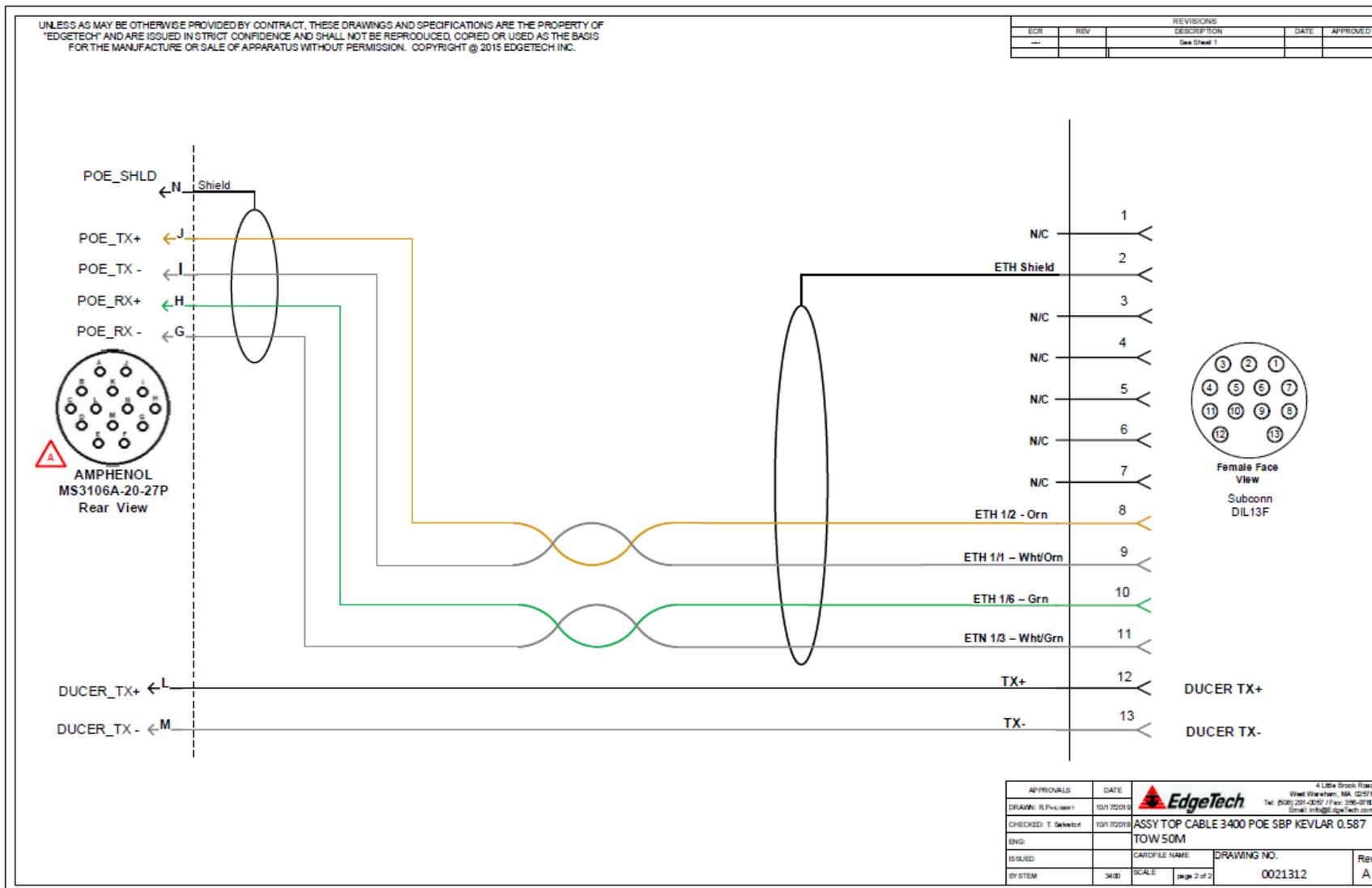
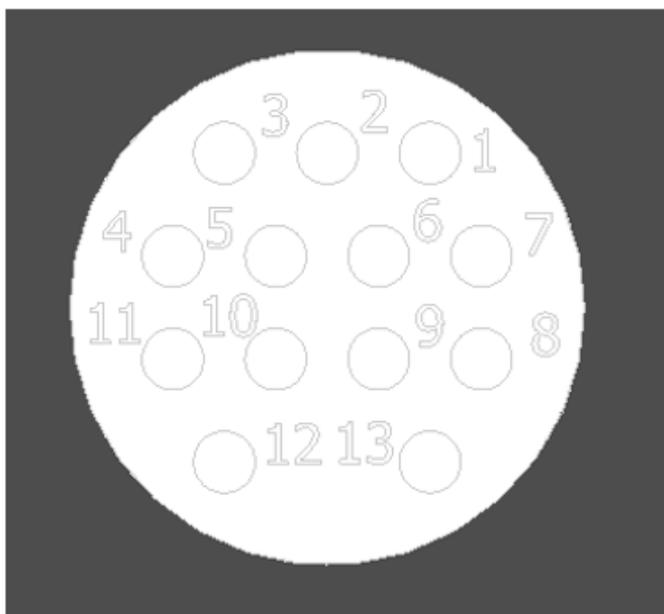
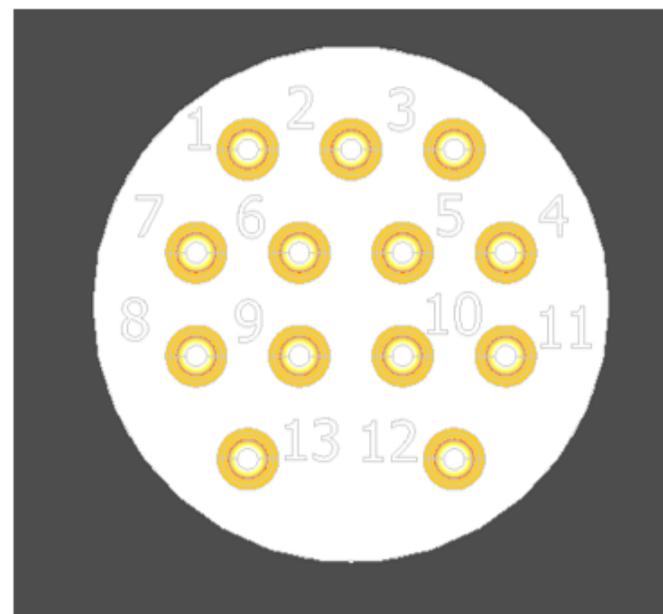


Figure 3-8: 3400 SBP 50 Meter Tow Cable Page 2



TOW CABLE WET END DIL13F

PIN 8 POE_TX+
 PIN 9 POE_TX-
 PIN 10 POE_RX+
 PIN 11 POE_RX-
 PIN 12 Transducer TX+
 PIN 13 Transducer TX-



TOW FISH WET END DIL13M

PIN 8 POE_TX+
 PIN 9 POE_TX-
 PIN 10 POE_RX+
 PIN 11 POE_RX-
 PIN 12 Transducer TX+
 PIN 13 Transducer TX-

Figure 3-9: 3400 SBP Tow Cable to Tow Fish Pinouts (Wet End)

3.2 3400 Portable Topside Technical Description

The 3400 portable topside provides power to the towfish while acting as a digital link between the towfish and a topside computer with the Discover application installed on it to process and record sonar data. The digital link also provides input connections for supporting survey and navigation devices, and triggers.

3.2.1 3400 Topside Controls, Indicators, and Connectors

FRONT PANEL 3400	
Power Switch and Light	Rocker switch that turns the system on and off. Red Indicator LED is illuminated when the topside is receiving power.
Power Indicator Light	A red indicator LED. It is illuminated when both the 3400 Topside and 3400 vehicle power are on.
Link Indicator Light	A green indicator LED. It flashes while the 3400 Topside is establishing a reliable communications link with the sub-bottom sonar. Illuminates continuously when a reliable communications link with the sonar is established.
Tx Indicator Light	The blue LED lights up during startup to show system initialization, then shuts off. Once the system begins pinging, the LED blinks continuously or is illuminated continuously based on pulses.
Data Indicator Light	A Tri-color indicator LED. The initial color is red and then yellow as the sonar processor receives data packets. Finally, the LED will turn green when the sonar processor verifies good data packet integrity. If the signal degrades, the LED will turn yellow and then red.

Table 3-1: 3400 Topside Front Panel Indicator Light and Switch Descriptions



Figure 3-10: 3400 Topside Front Panel

BACK PANEL 3400	
Line VAC Connector	Connection for AC power cord.
Line Power Switch	Rocker switch that switches AC power to the POWER switch on the front panel of the 3400 Topside.
Sea Cable Connector	A sub conn female connector that connects the vehicle sea cable to the topside. If an amplifier is utilized, this connector is connected to the J1 3400 I/O Connector on the amplifier with the amplifier interface cable.
AC Fuse	AC fuse. (PN #0014581)
1 PPS Connector	Pulse per second trigger connector

BACK PANEL 3400

Trigger Connectors (2)	Optional Input and output trigger ports.
Network Ethernet Connector (1)	RJ-45 Standard ethernet connection for connecting to the topside computer.
COM A Port Connector	RS-232 Serial port that connects to a navigation device.
COM B Port Connector	RS-232 Serial port that connects to a navigation device.

Table 3-2: 3400 Topside Back Panel Switches and Connections



Figure 3-11: 3400 Topside Rear Panel

3.3 3400 Amplifier Option Technical Description

The 3400 Amplifier option integrates an amplifier into the 3400 system providing increased power to the vehicle transducers, which is suggested for deeper water (greater than 100 meters) performance.



Figure 3-12: Amplifier Front Panel

FRONT PANEL POWER AMPLIFIER

Activation Button	Pressing this button activates the amplifier's connection to the 3400 system. The amplifier is on when the 3400 system is powered.
Power Indicator Light	Blue LED indicates the amplifier has been turned on, and AC power is available. The LED will flash when the AC line voltage is 10% above or below the nominal rate.
Bridge Indicator Light	Amber LED illuminates when the amplifier is set to Bridge-Mono mode.
Data Indicator Light	Yellow LED indicates network data activity. Data indicator flashes only when the amplifier is polled for data or is polled to see if it is online.
CH1 Gain Control Knob	Disabled.

FRONT PANEL POWER AMPLIFIER

CH1 Ready Indicator Light	Green LED. Bright green is ready. Dim Green is the onset of compression, and Off is thermal failure.
CH1 Signal Indicator Light	Green LED. A solid Green input signal is above -40 dBu. Flashing green is the channel's output signal has reached the onset of audible clipping.
CH2 Gain Control Knob	Disabled.
CH2 Ready Indicator Light	Green LED. Bright green is ready. Dim Green is the onset of compression, and Off is thermal failure.
CH2 Signal Indicator Light	Green LED. A solid Green input signal is above -40 dBu. Flashing green is the channel's output signal has reached the onset of audible clipping.

Table 3-3: Amplifier Front Panel Controls and Indicator Lights



Figure 3-13: Back Panel Amplifier and Connector Panel

BACK CONNECTOR PANEL

J1 3400 I/O Connector	A pin-out MS3102A-20-27P connector connects the amplifier to the 3400 topside Sea Cable port using the amplifier interface cable.
J2 Sea Cable Connector	A pin-in MS3102A-20-27S connector that connects to the vehicle sea cable.

Table 3-4: Amplifier Connector Panel Connections

BACK PANEL AMPLIFIER

CH1 In	CH1 3-pin DLR Connector
CH2 In	CH2 3-pin DLR Connector
Output Connector	2 Pair high current 60A color-coded 5-way binding posts
Line VAC Connector	Connection for AC Power Cord

Table 3-5: Back Panel Amplifier Connections

3.3.1 Amplifier Rack Mount

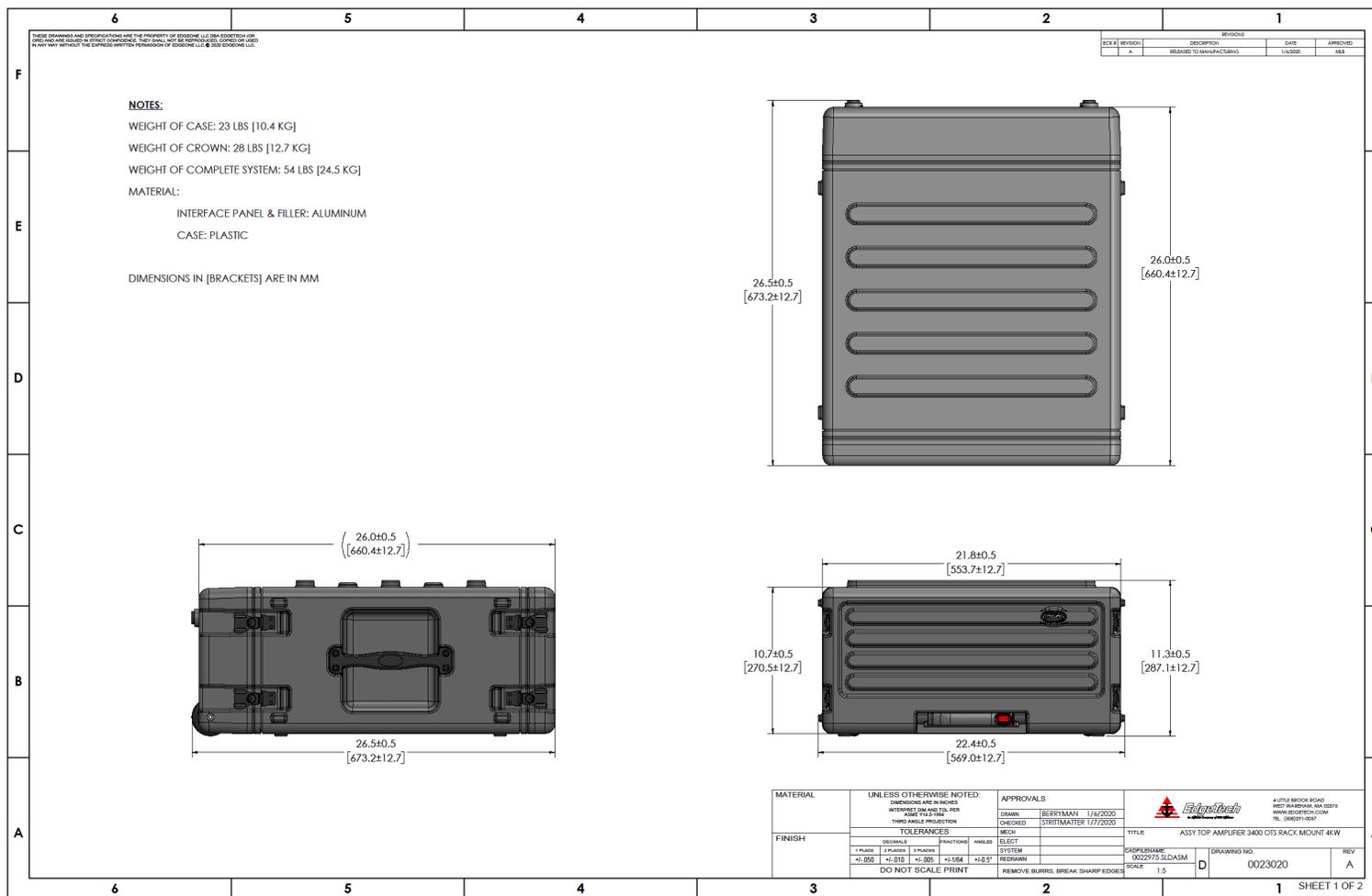
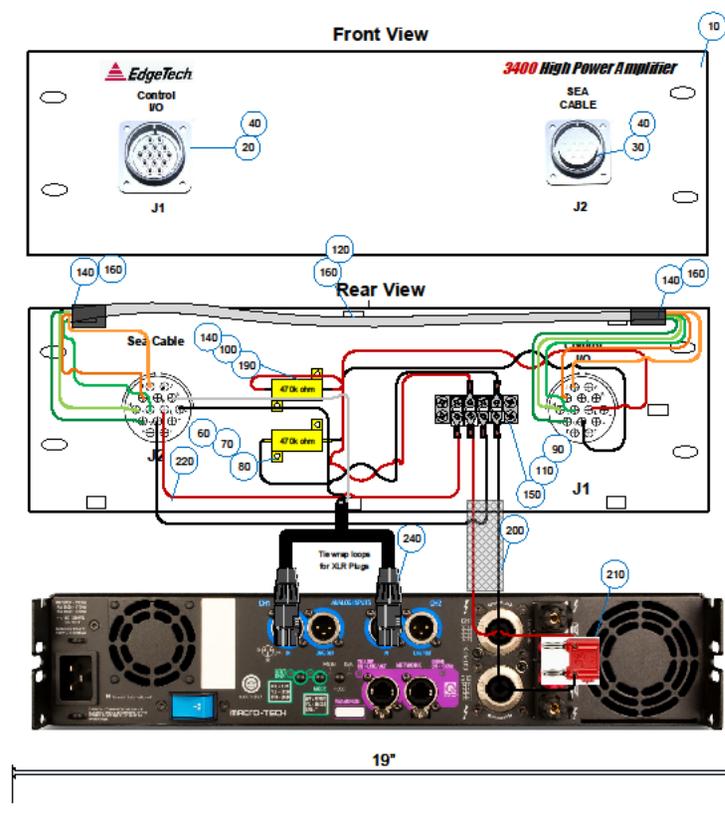


Figure 3-14: Amplifier Rack Mount ICD

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REVISIONS				
ECR	REV	DESCRIPTION	DATE	APPROVED
	A	Initial Release	1/13/2020	TS

**PANEL REAR 3400 INTERFACE 19 INCH RACK
2U AL**



APPROVALS	DATE	EdgeTech		4 Little Brook Road West Wareham, MA 02576 Tel: (508) 291-0037 / Fax: 291-2451 Email: info@edgetech.com
DRAWN: PULLBATT	1/13/2020	ASSY TOP PANEL 3400 INTERFACE 2U		
CHECKED: T. Sakurai	1/13/2020			
ENG:				
ISSUED:				
SYSTEM	3400 OTS	CARDFILE NAME	DRAWING NO.	Rev
		SCALE	page 1 of 2	A

Figure 3-15: Amplifier Back Panel Interface to 3400

3.3.2 Amplifier Connection Diagram

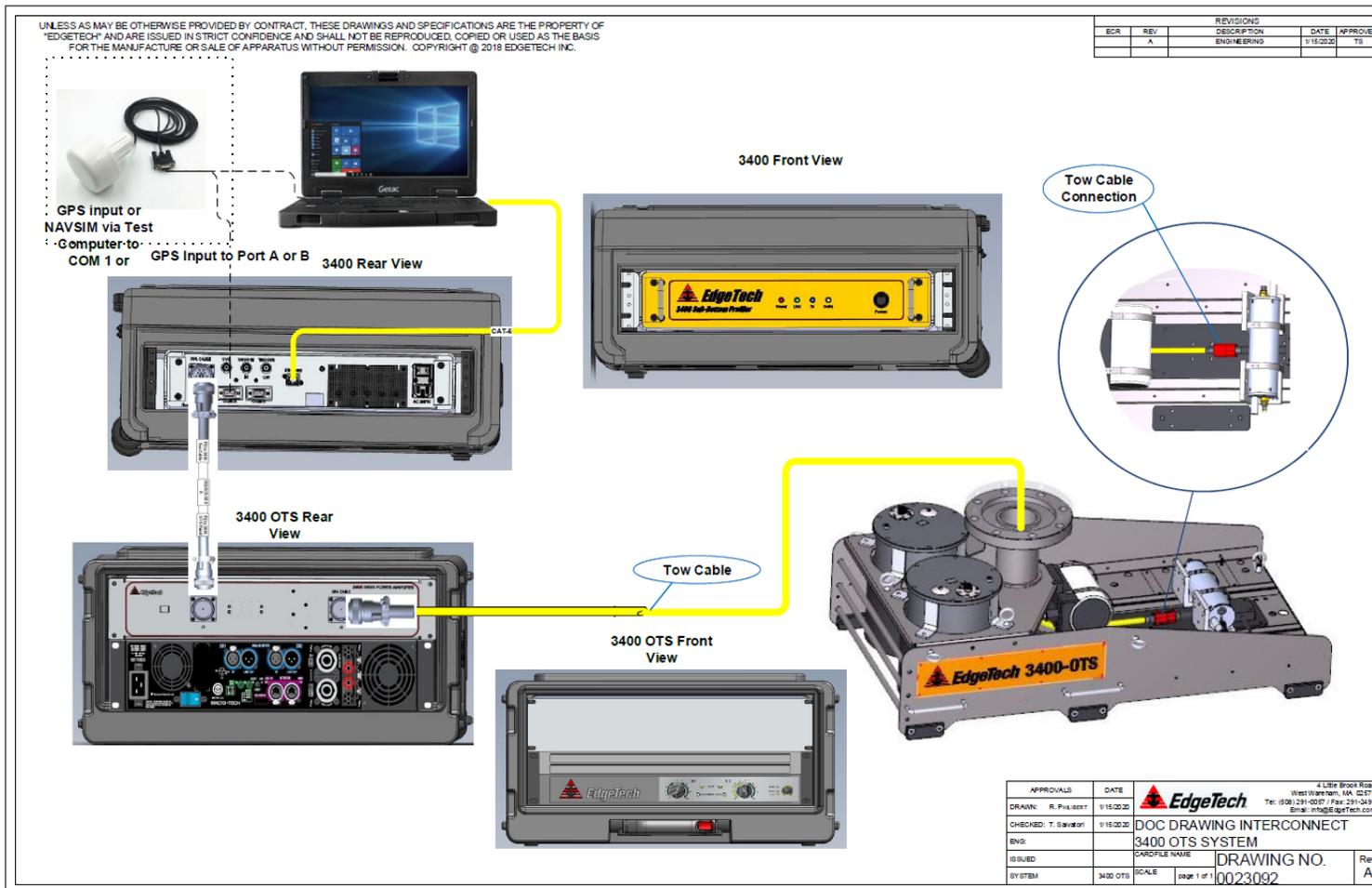


Figure 3-16: Amplifier Connection Diagram (3400 OTS LF Vehicle Depicted - Connections Are The Same Regardless of Variant)

3.3.3 Amplifier Cable Diagram

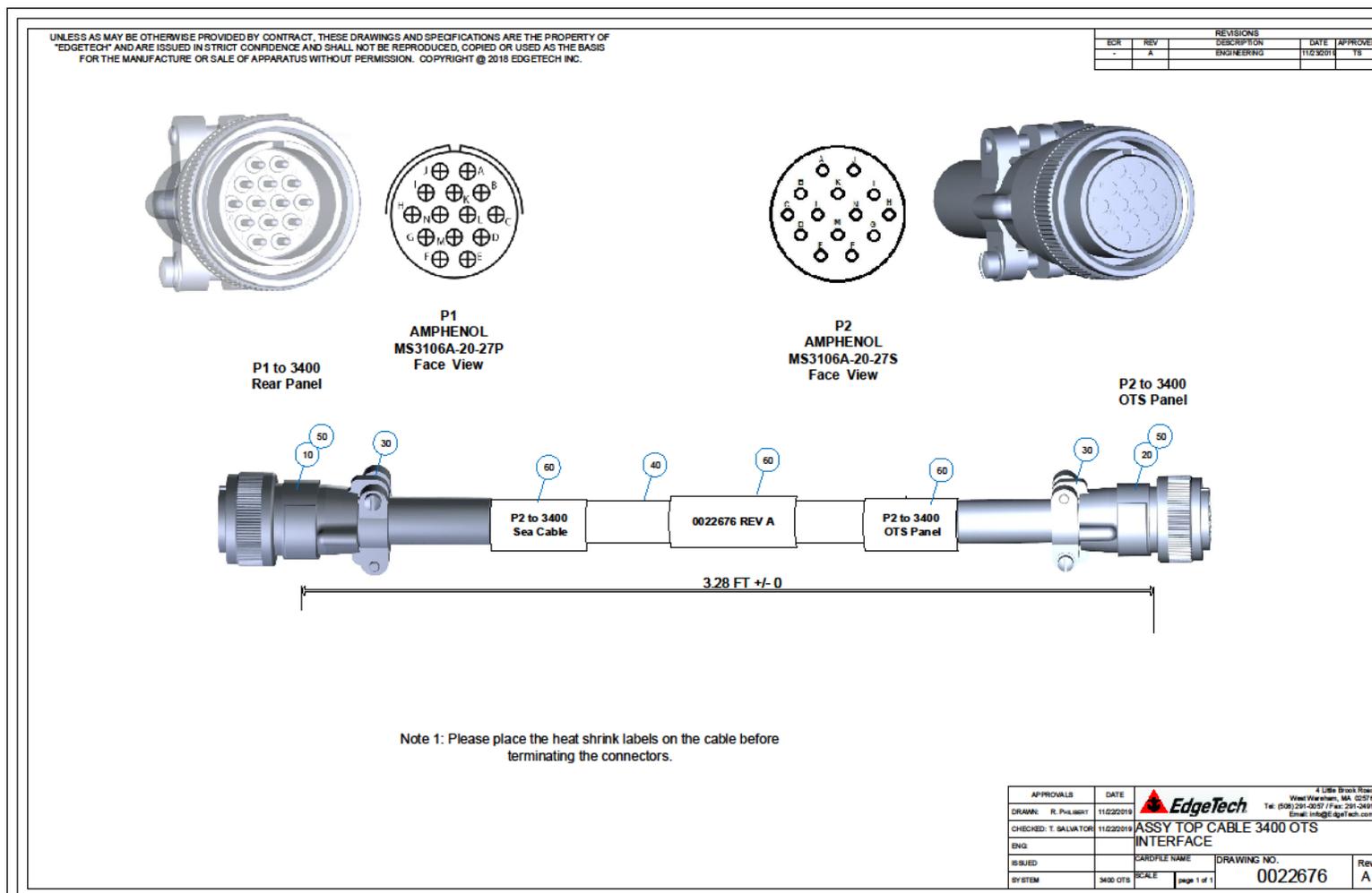


Figure 3-17: Amplifier to 3400 Topside Interface Cable

3.4 3400 OTS (Over-The-Side) Low-Frequency Sub-Bottom Profiler Technical Description

The 3400 OTS (Over-The-Side) LF (low-frequency) sub-bottom profiler system is designed to be a stable pole-mounted vehicle that allows for more transducer options. The vehicle supports two vertically oriented 1-10 kHz sub-bottom transducers, a PVDF (polyvinylidene fluoride) sub-bottom receiver, and an internal sonar processor in its default configuration. The vehicle receives power and data from a tow cable connected to the 3400 Topside on a survey vessel. Sonar signal is generated by the transducers, received by the PVDF receiver, amplified, digitized, and combined with vehicle sensor data before being sent to the 3400 topside processor.

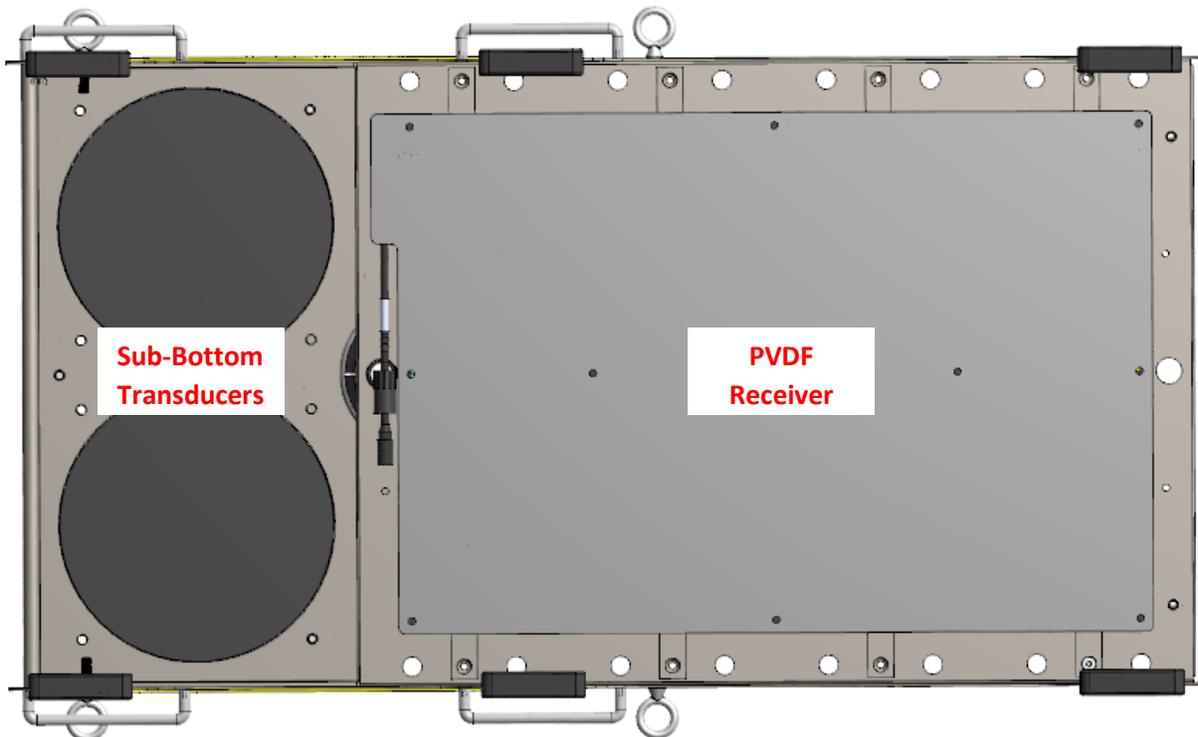


Figure 3-18: Bottom of 3400 OTS Vehicle

3.4.1 3400 OTS LF Sub-Bottom Profiler Option Connection Diagram

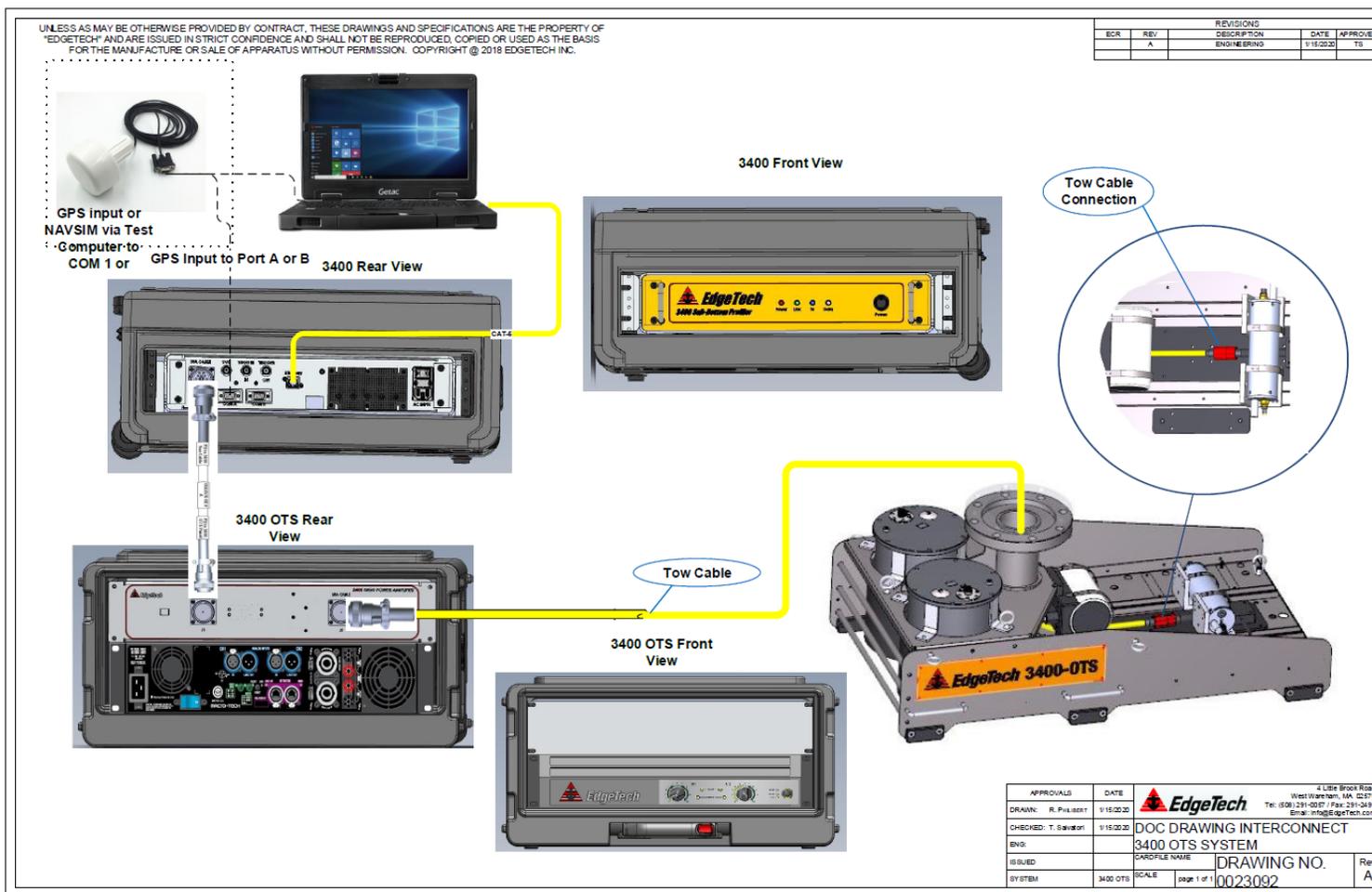


Figure 3-19: 3400 OTS LF Sub-Bottom Profiler Connection Diagram

3.4.2 3400 OTS LF Sub-Bottom Profiler Electronics Bottle

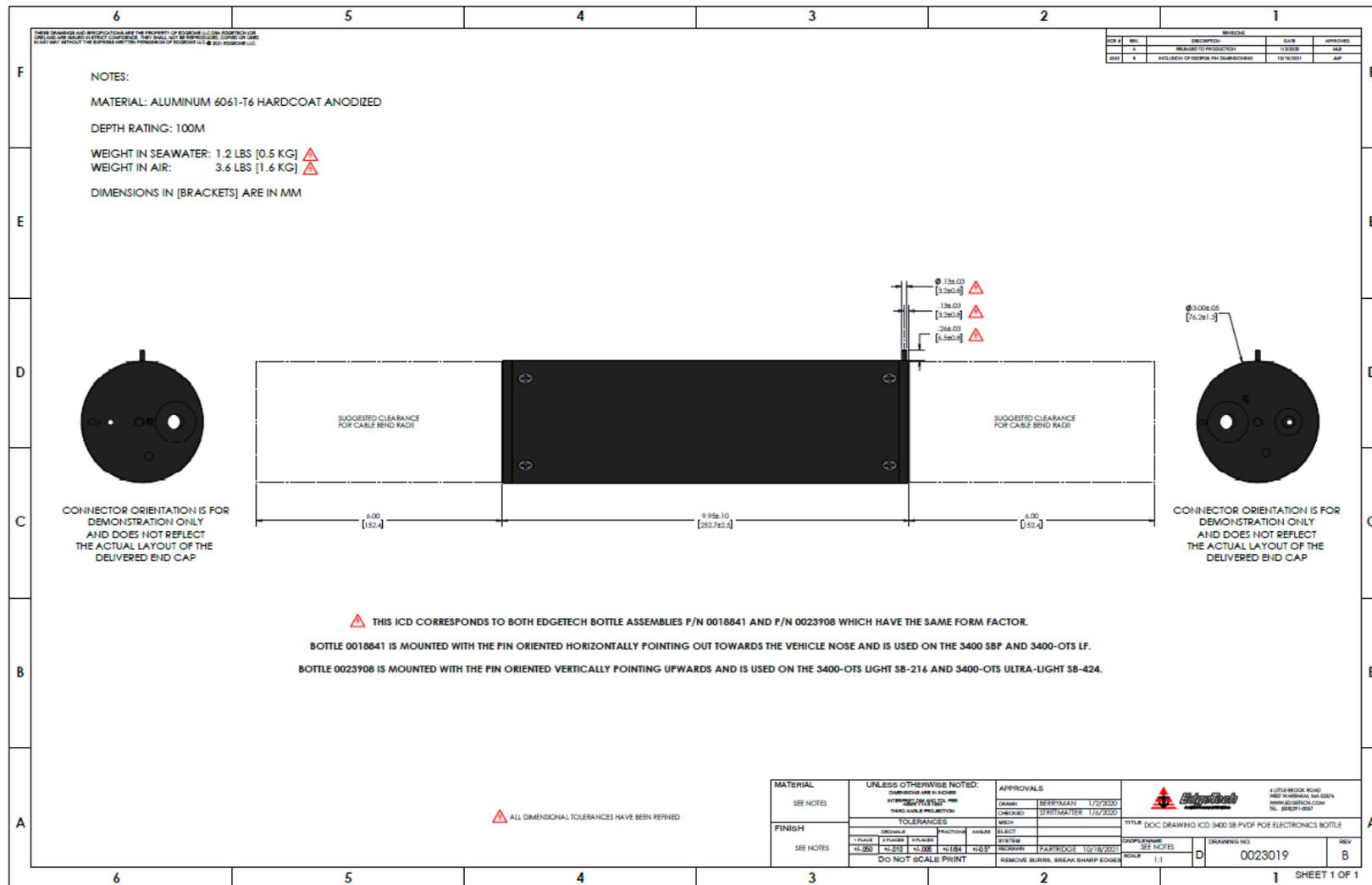


Figure 3-20: 3400 OTS LF Sub-Bottom Profiler Electronics Bottle

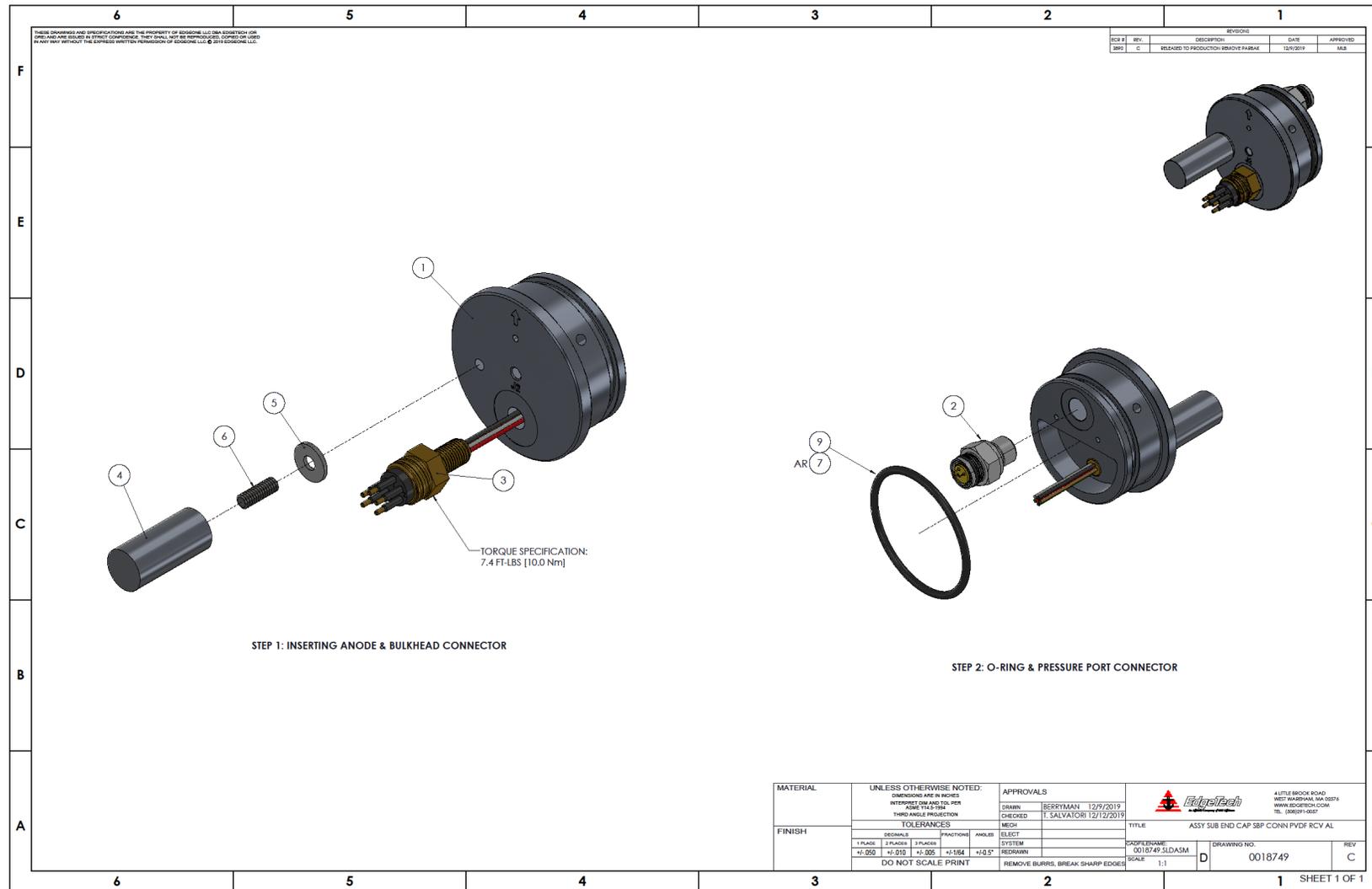
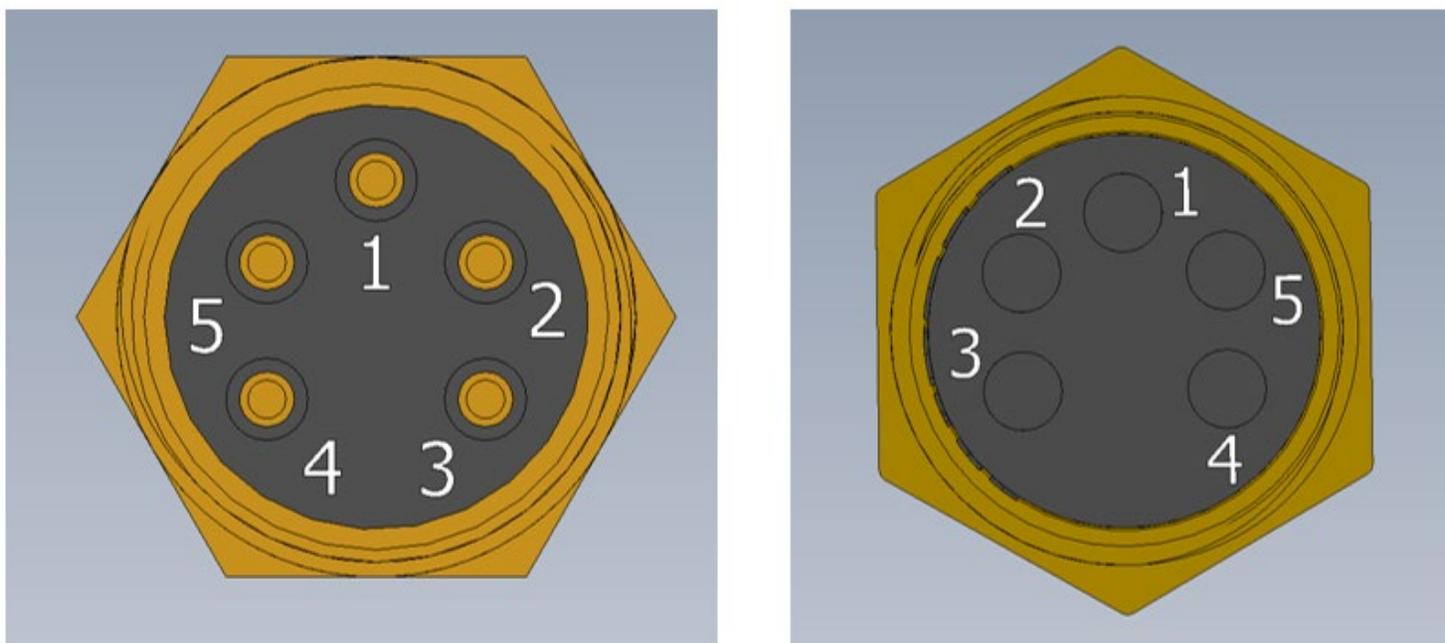


Figure 3-21: 3400 OTS LF Sub-Bottom Profiler Electronics Bottle Endcap



MCBH5M
PIN 1 Shield
PIN 2 PVDF-
PIN 3 PVDF +
PIN 4 RPVDF-
PIN 5 RPVDF+

MCBH5F
PIN 1 Shield
PIN 2 POE RX_N
PIN 3 POE RX_P
PIN 4 POE TX_N
PIN 5 POE TX_P

Figure 3-22: 3400 OTS LF Sub-Bottom Profiler Pinouts

3.4.3 3400 OTS LF Sub-Bottom Profiler Vehicle Cable and Connector Diagrams

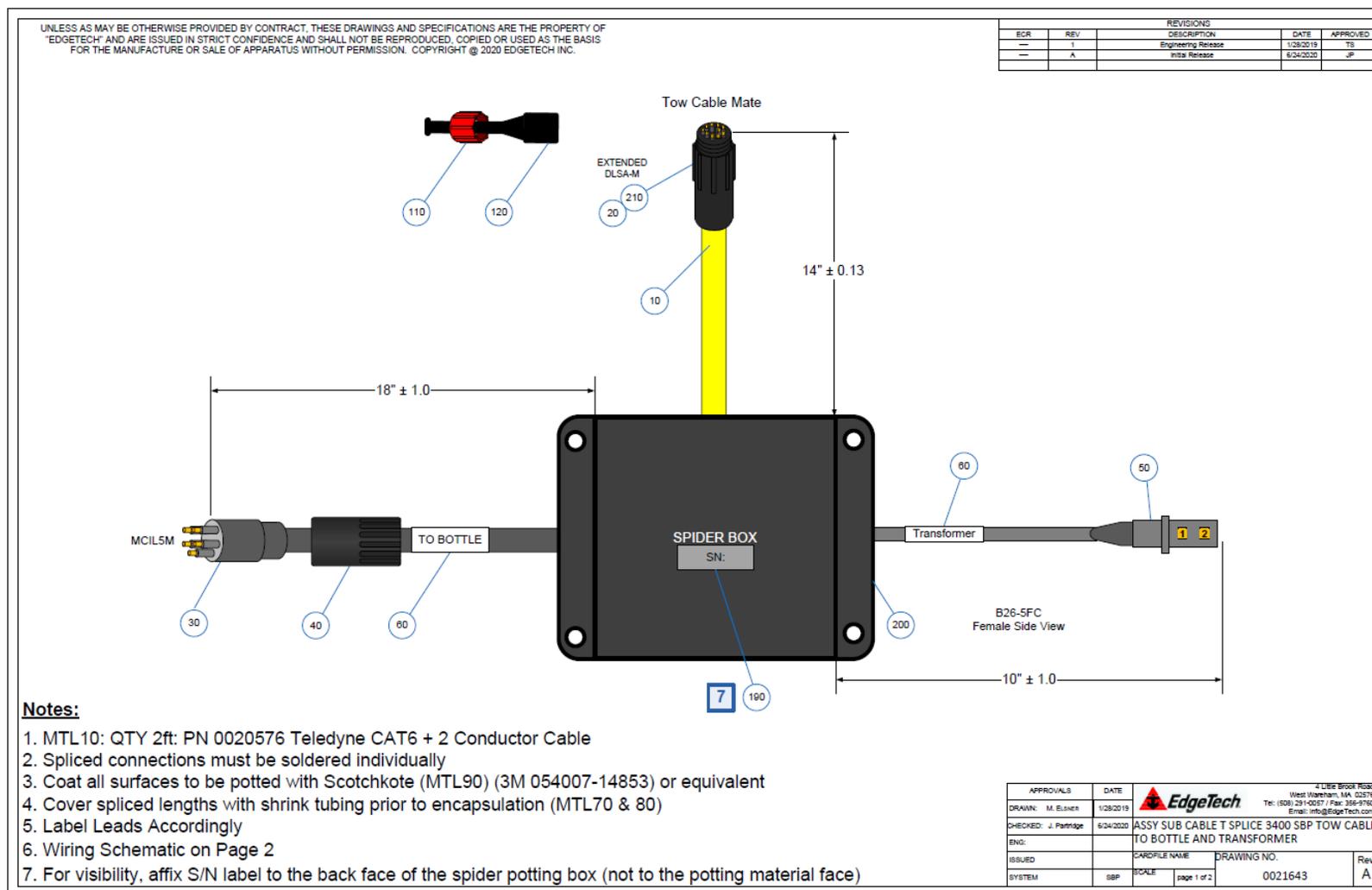


Figure 3-23: Sub Cable T Splice 3400 OTS LF Tow Cable to Bottle, Transformer, and Tow Cable

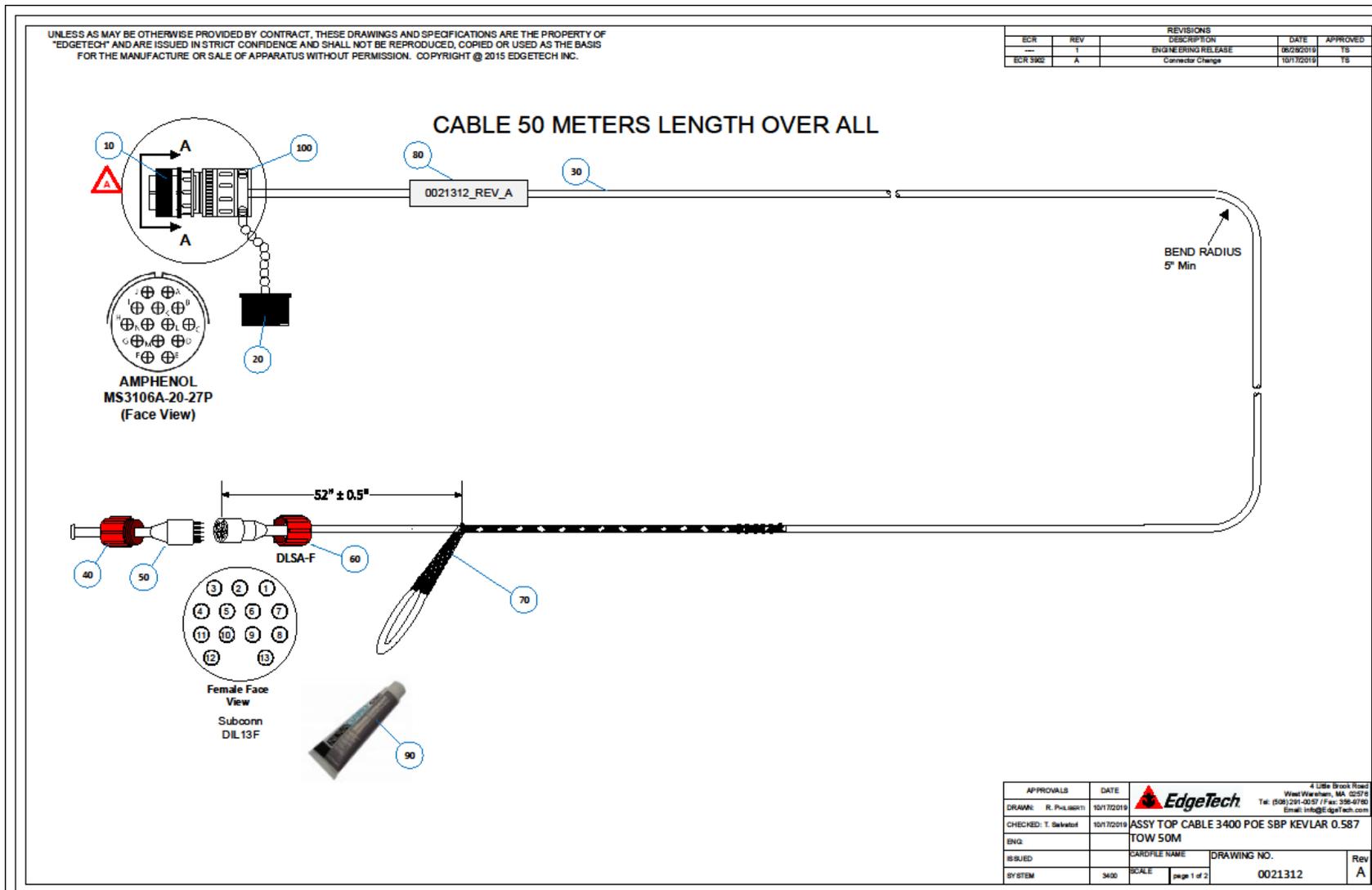


Figure 3-24: 3400 OTS LF Sub-Bottom Profiler 50-Meter Tow Cable Page 1

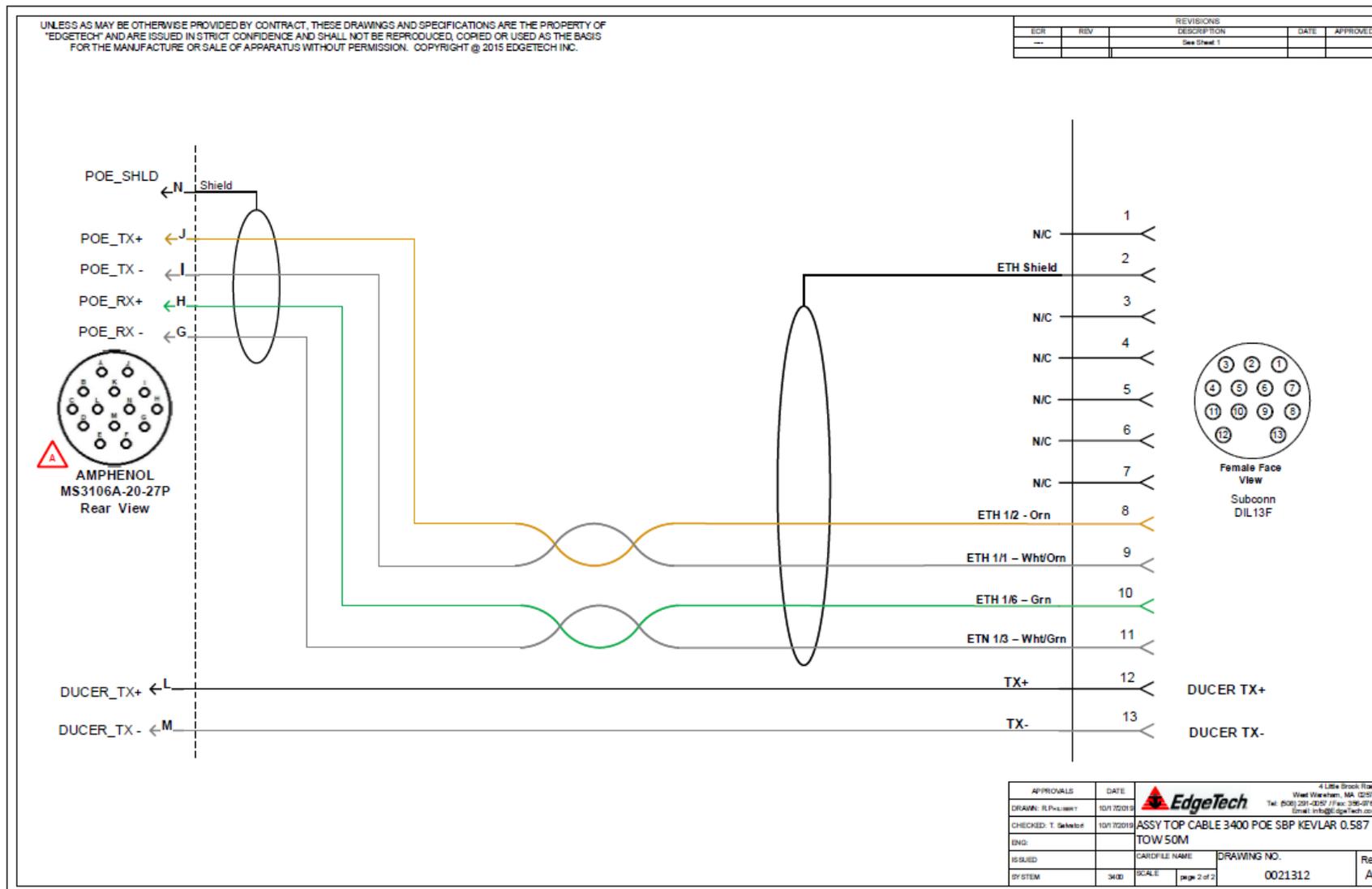
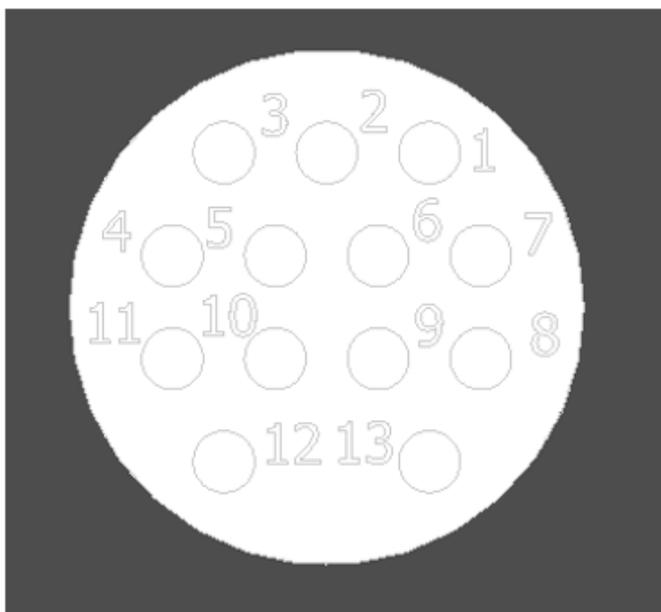
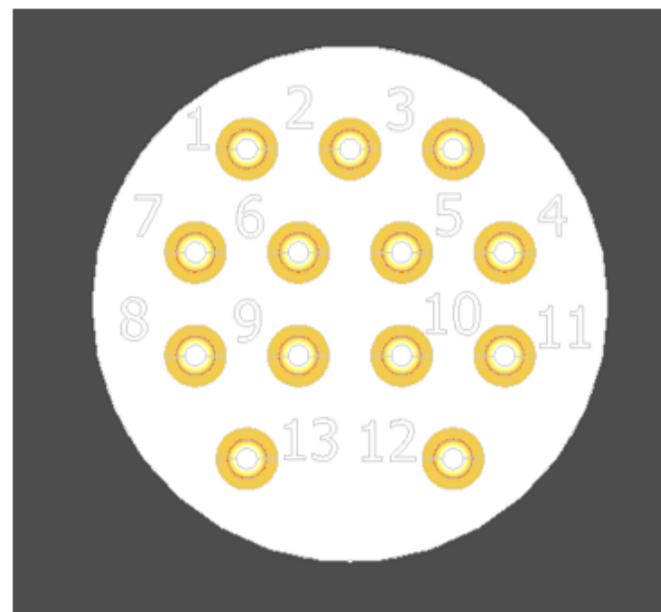


Figure 3-25: 3400 OTS LF Sub-Bottom Profiler 50-Meter Tow Cable Page 2



TOW CABLE WET END DIL13F

PIN 8 POE_TX+
 PIN 9 POE_TX-
 PIN 10 POE_RX+
 PIN 11 POE_RX-
 PIN 12 Transducer TX+
 PIN 13 Transducer TX-



TOW FISH WET END DIL13M

PIN 8 POE_TX+
 PIN 9 POE_TX-
 PIN 10 POE_RX+
 PIN 11 POE_RX-
 PIN 12 Transducer TX+
 PIN 13 Transducer TX-

Figure 3-26: 3400 OTS LF Sub-Bottom Profiler Tow Cable to Tow Fish Pinouts (Wet End)

3.5 3400 OTS Light and Ultra-Light Sub-Bottom Profiler Systems

The 3400 OTS (Over-The-Side) Light and Ultra-Light sub-bottom systems are designed to be stable pole-mounted vehicles designed for shallow water operations that can be operated from smaller vessels. The vehicles consist of one vertically oriented 2-16 kHz (Light OTS) or 4-24 kHz (Ultra-Light OTS) transducer, a PVDF sub-bottom receiver, and an internal sonar processor in its default configuration. The Light OTS provides greater penetration and vertical resolution than the Ultra-Light OTS vehicle. The vehicles receive power and data from a tow cable connected to the 3400 Topside on a survey vessel. Sonar signal is generated by the transducer, received by the PVDF receiver, amplified, digitized, and combined with vehicle sensor data before being sent to the 3400 topside processor.

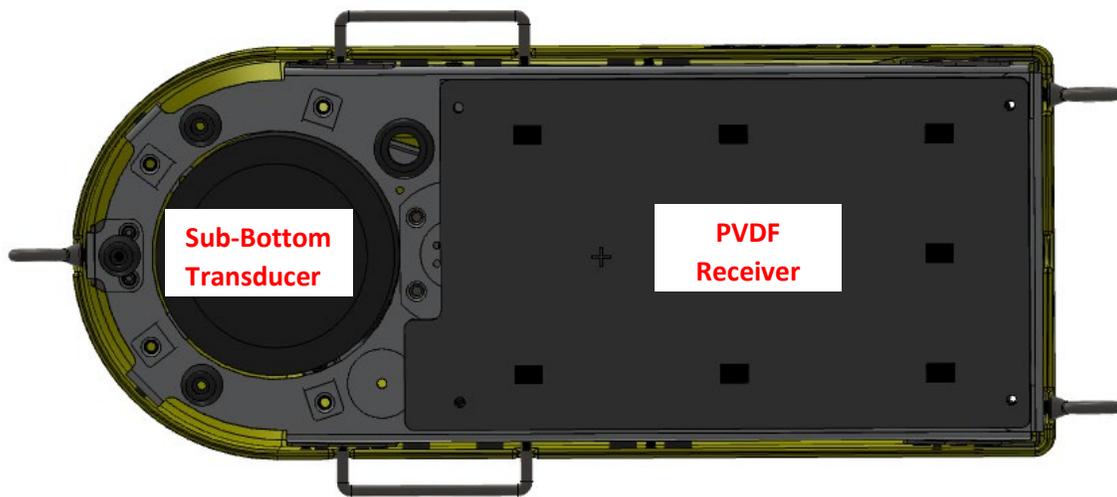


Figure 3-27: Bottom of 3400 OTS Light and Ultra-Light Sub-Bottom Profiler System

3.5.1 3400 OTS Light and Ultra-Light Sub-Bottom Profiler Connection Diagram

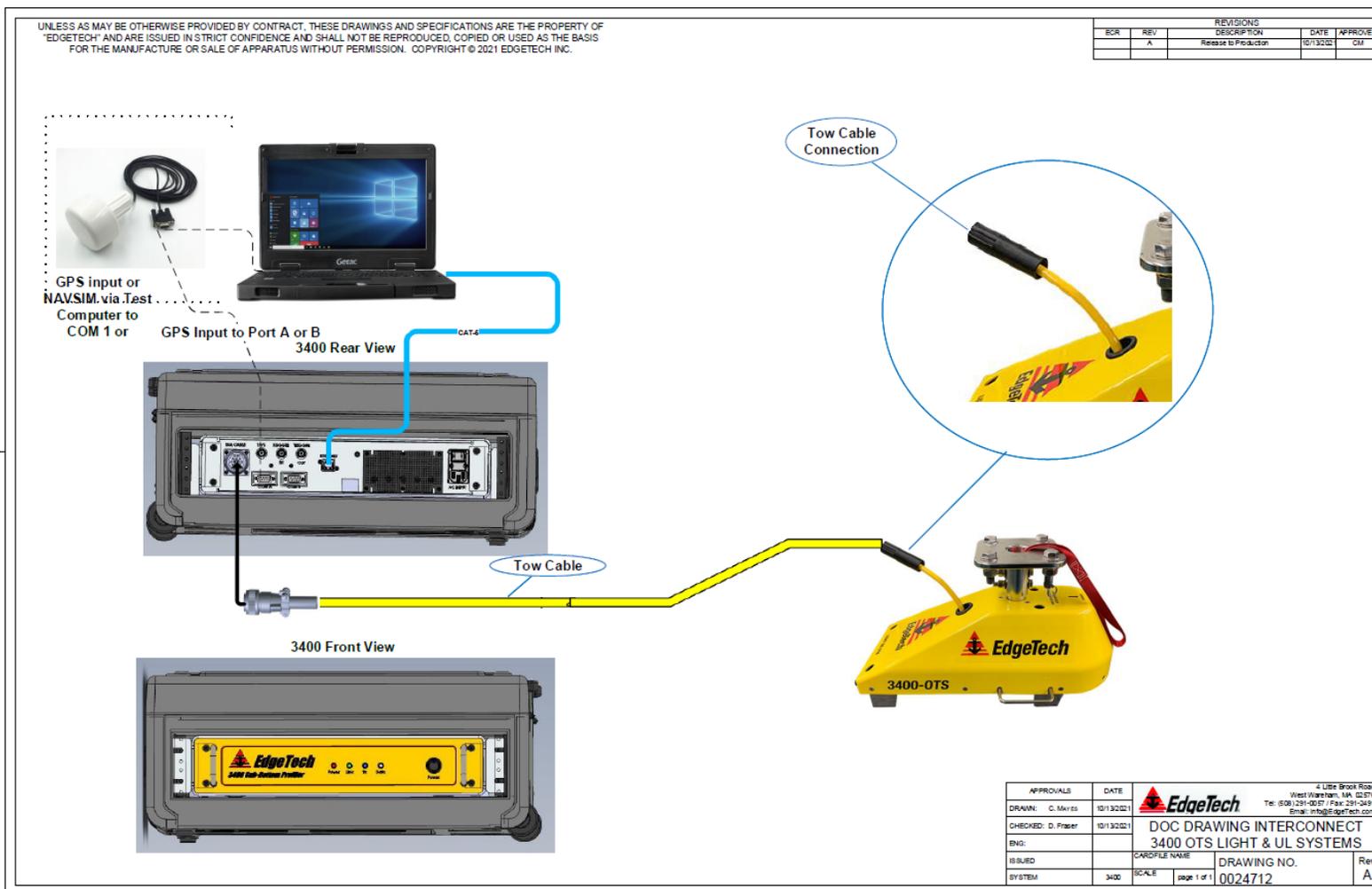


Figure 3-28: 3400 OTS Light and Ultra-Light System Connection Diagram

3.5.2 3400 OTS Light and Ultra-Light Sub-Bottom Profiler Electronics Bottle and End Cap Diagrams

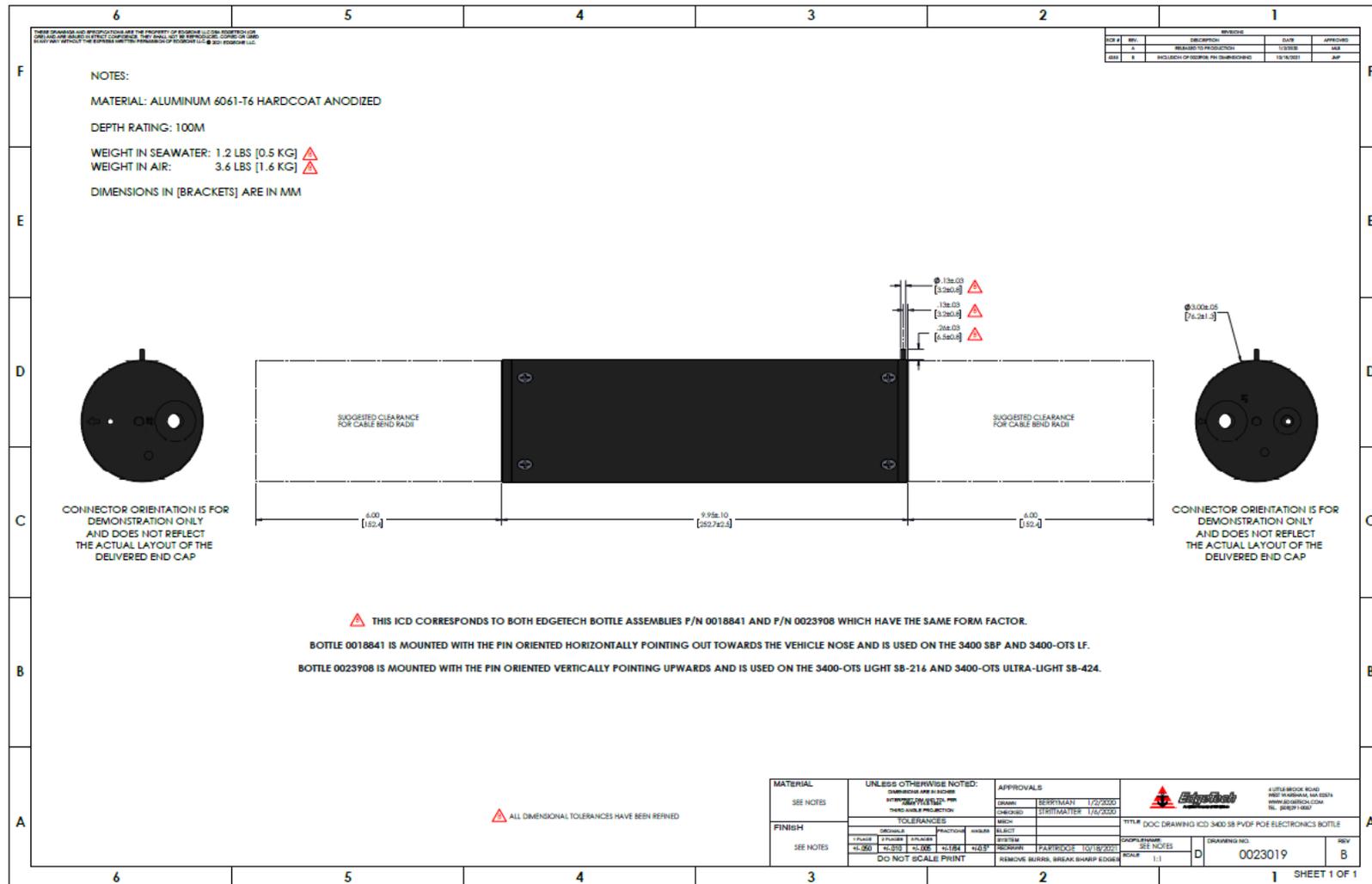


Figure 3-29: 3400 OTS Light and Ultra-Light Weight Electronics Bottle ICD

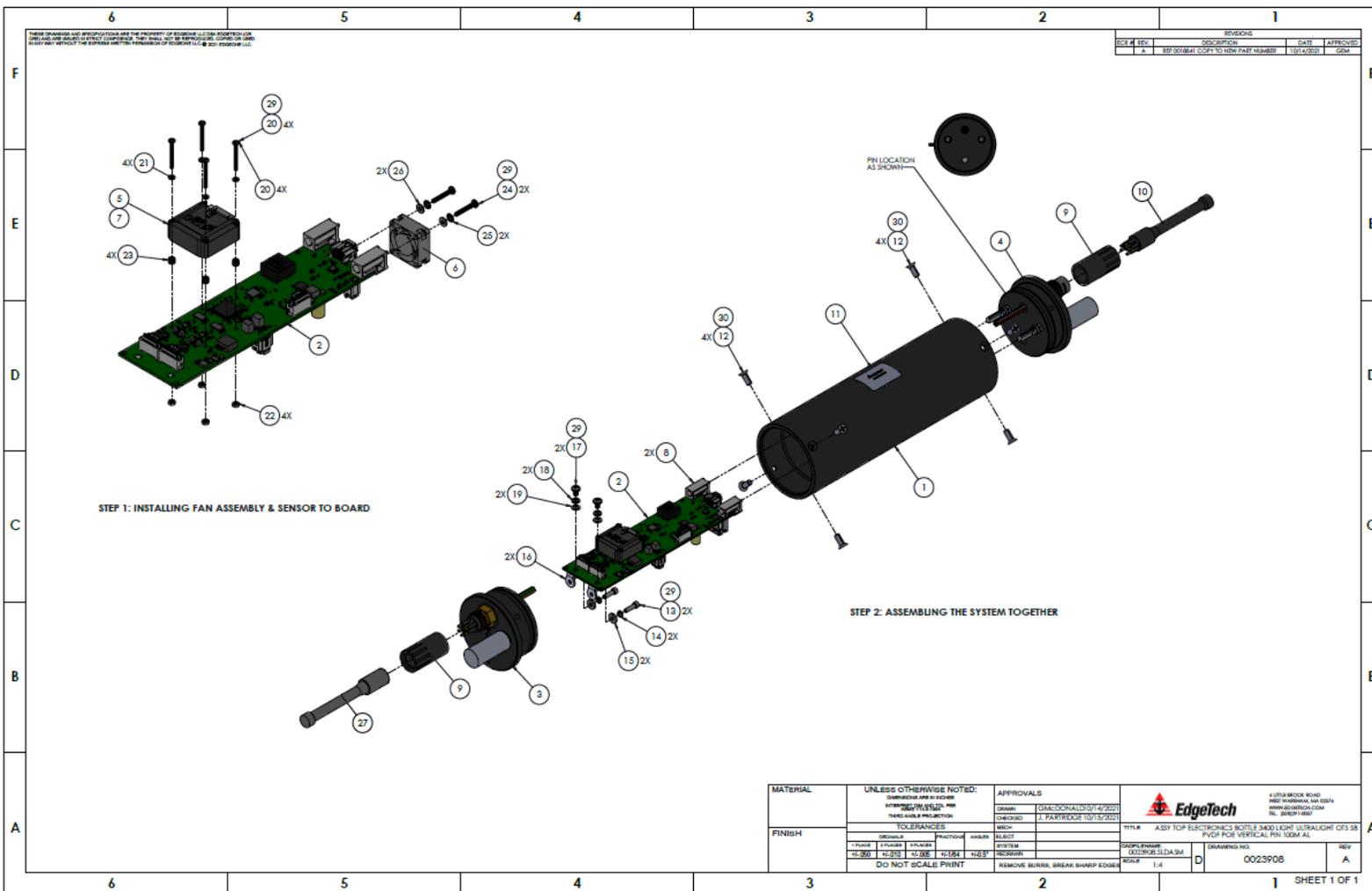
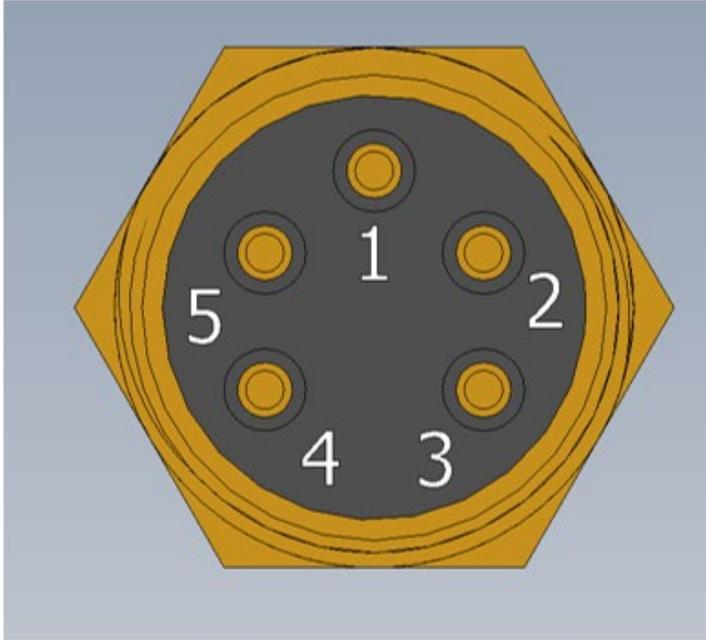
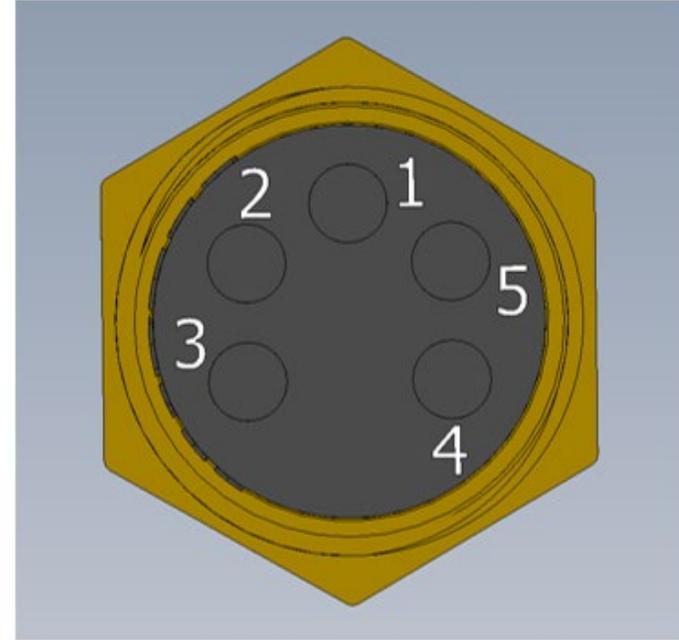


Figure 3-30: 3400 Light and Ultra-Light Sub-Bottom Profiler Electronics Bottle Endcaps



MCBH5M
 PIN 1 Shield
 PIN 2 PVDF-
 PIN 3 PVDF +
 PIN 4 RPVDF-
 PIN 5 RPVDF+



MCBH5F
 PIN 1 Shield
 PIN 2 POE RX_N
 PIN 3 POE RX_P
 PIN 4 POE TX_N
 PIN 5 POE TX_P

Figure 3-31: 3400 OTS Light and Ultra-Light Electronics Bottle Pinouts

3.5.3 3400 OTS and Ultra-Light Vehicle Cable and Connector Diagram

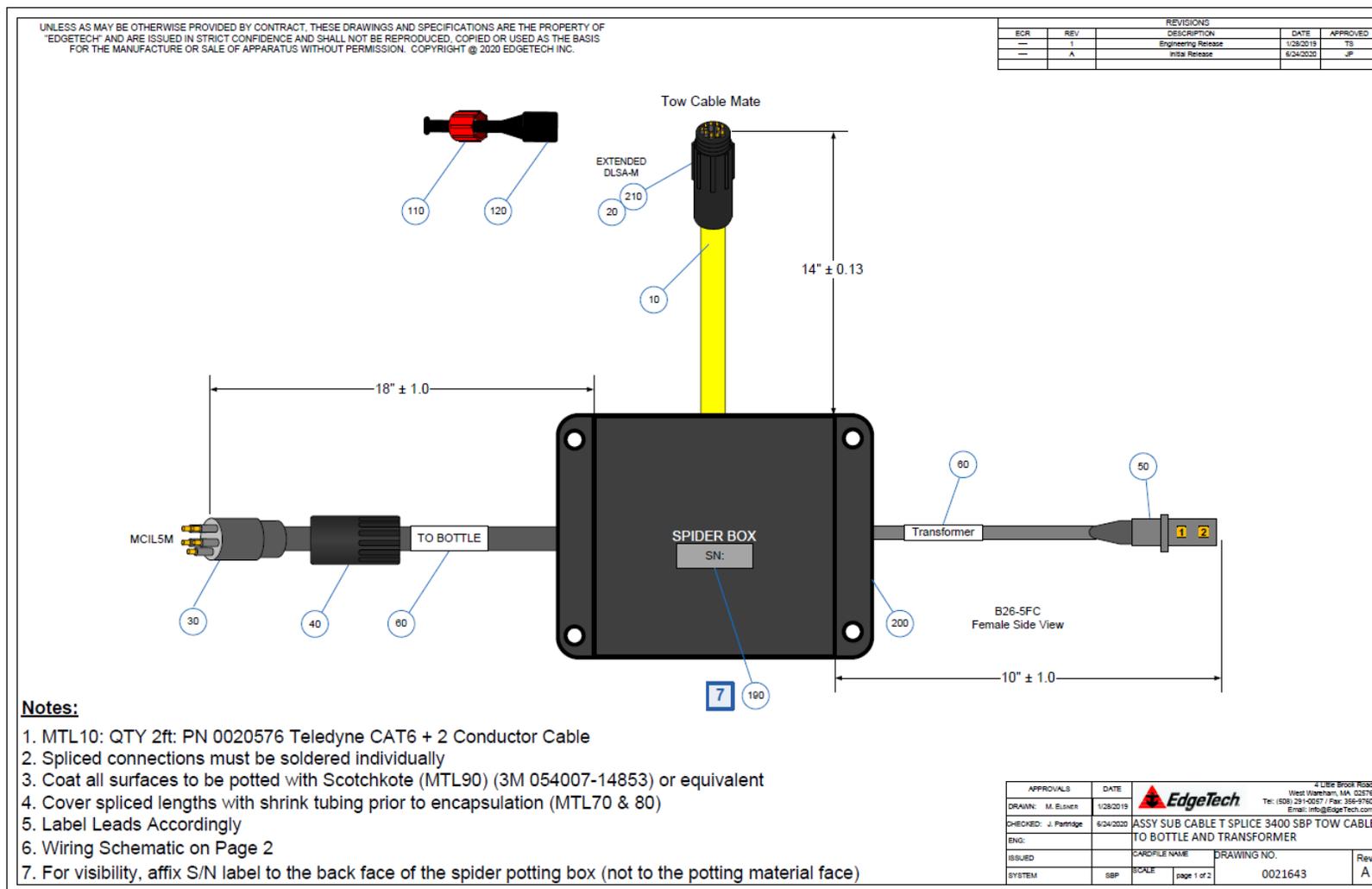


Figure 3-32: Sub Cable T Splice 3400 OTS Light and Ultra-Light Tow Cable to Bottle, Transformer, and Tow Cable

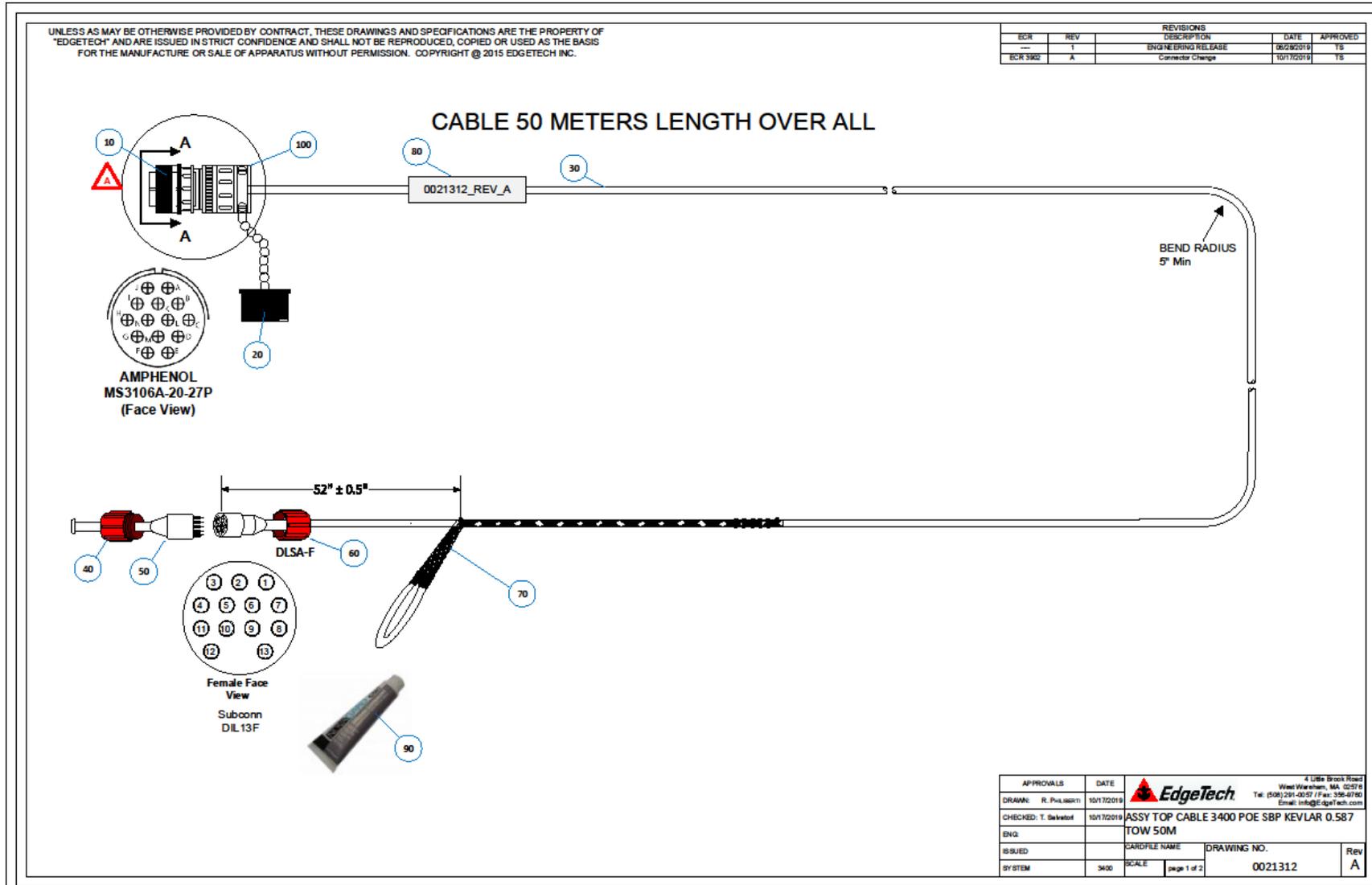


Figure 3-33: 3400 OTS Light and Ultra-Light 50 Meter Tow Cable Page 1

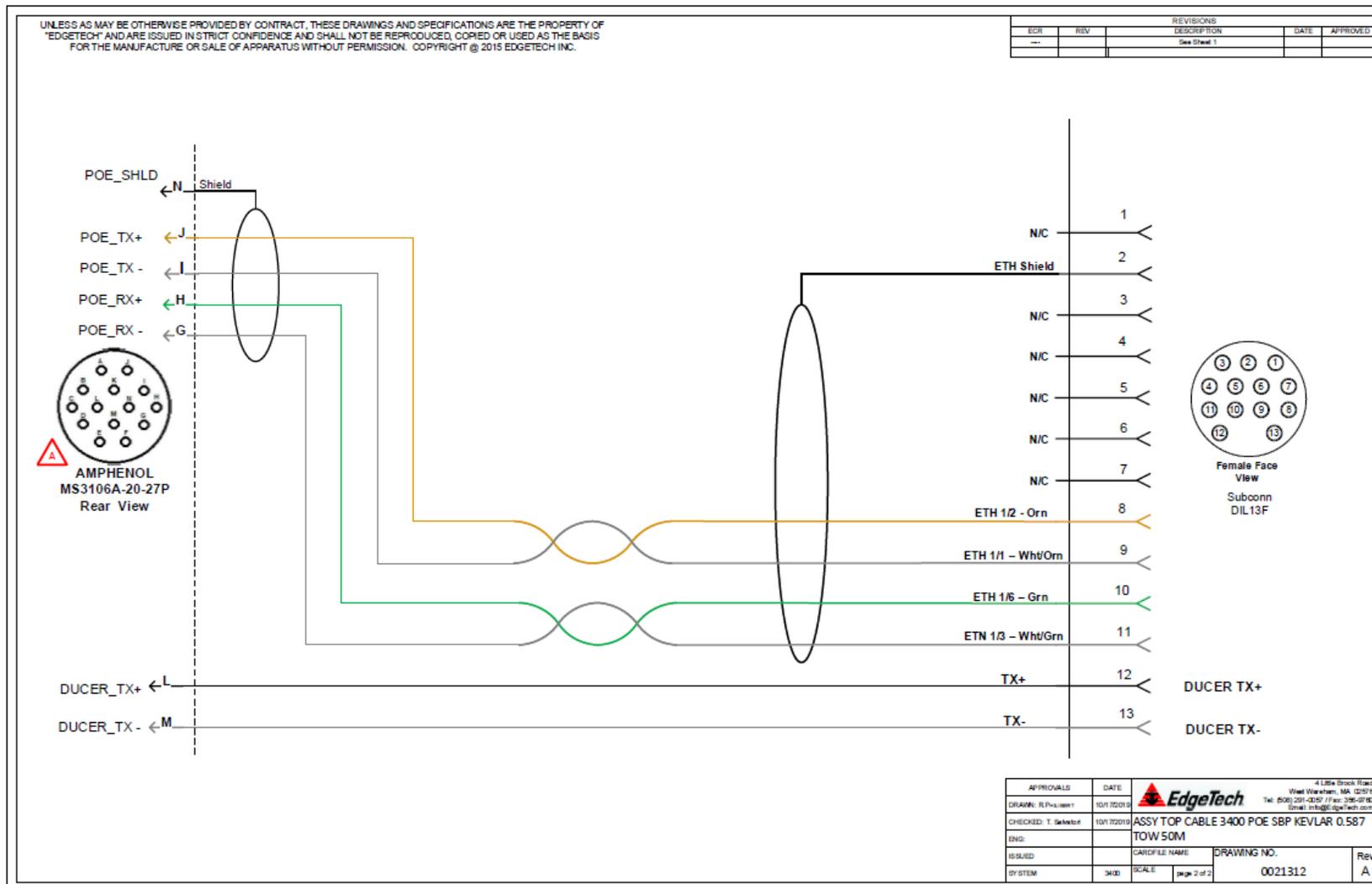
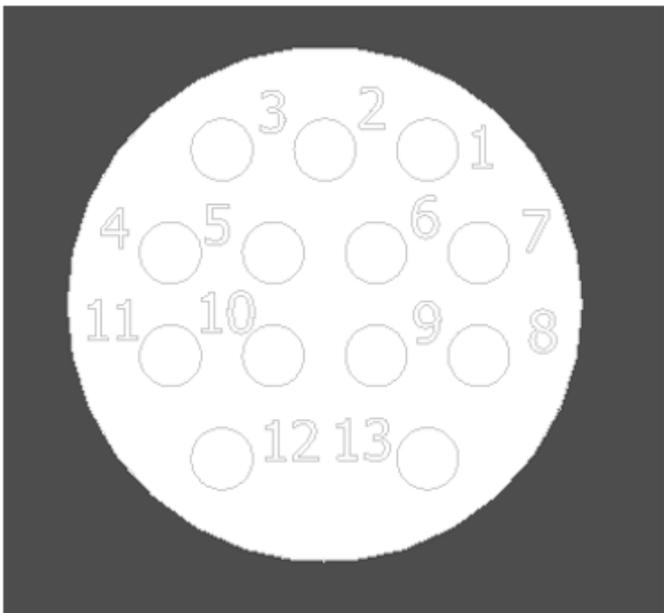
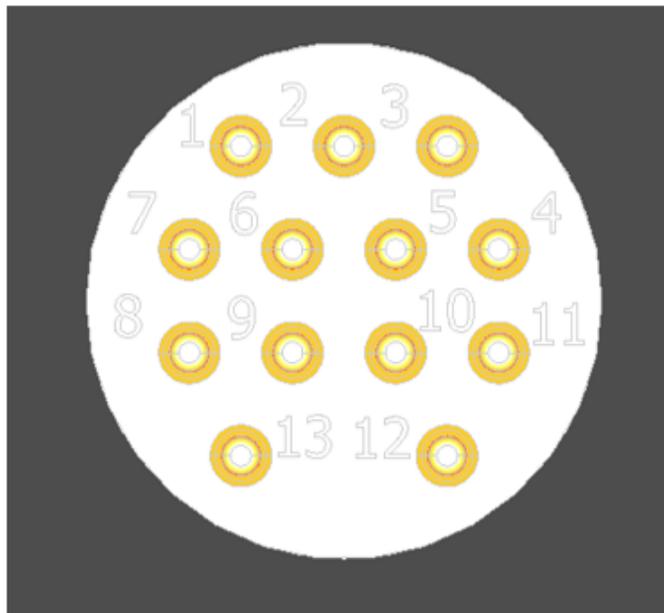


Figure 3-34: 3400 OTS Light and Ultra-Light 50-Meter Tow Cable Page 2



TOW CABLE WET END DIL13F
 PIN 8 POE_TX+
 PIN 9 POE_TX-
 PIN 10 POE_RX+
 PIN 11 POE_RX-
 PIN 12 Transducer TX+
 PIN 13 Transducer TX-



TOW FISH WET END DIL13M
 PIN 8 POE_TX+
 PIN 9 POE_TX-
 PIN 10 POE_RX+
 PIN 11 POE_RX-
 PIN 12 Transducer TX+
 PIN 13 Transducer TX-

Figure 3-35: 3400 OTS Light and Ultra-Light Cable and Vehicle Pin Diagram

4.0 SETUP AND ACTIVATION

Setup and test of the EdgeTech 3400 Sub-Bottom Profiling System involve:

1. Unpacking, inspecting, and connecting the system components
2. Connecting a navigation system and external sonar systems, if required
3. Activating the system
4. Verifying operation using Discover Sub-Bottom

This section provides instructions on how to perform these tasks and provides information on how to deploy and tow the 3400 Towfish.

4.1 Standard 3400 Towfish Setup and Activation

4.1.1 Unpacking and Inspection

The 3400 Towfish, Portable Topside, and Tow Cable are shipped in separate, reusable, heavy-duty transport cases. Essential cables and documentation are also included.

Before unpacking the system components, inspect the shipping containers for any damage. Report any damage to the carrier and EdgeTech. If the shipping containers appear free of damage, carefully unpack the components, and inspect them for damage. Review the packing list and verify all the listed items are included.

Again, if any damage is found, report it to the carrier and EdgeTech. If any items are missing, immediately contact EdgeTech. Do not install or operate any equipment that appears to be damaged.

Although the items shipped may vary, depending on the customer requirements, the 3400 Sub-Bottom Profiling System typically includes the following:

- 3400 Tow Vehicle
- 3400 Portable Topside
- Optional Laptop
- AC power cords (1)
- Ethernet cable
- System Recovery Drive
- Electronic Manuals

After unpacking the system components, safely store the shipping containers for later use, including any packing materials. When transporting or storing the system, all items should be packed in their original shipping containers in the same way they were originally shipped. Always store the system in a dry environment when not in use.

4.1.2 Power Requirements

The 3400 power requirements are 120–220 VAC and 50/60 Hz, and the input voltage is auto-sensing.

4.1.2.1 Use of an Uninterruptable Power Supply

The power source should be continuously free of high amplitude, high-frequency transients, as this type of interference could cause degraded performance or damage to the equipment. An Uninterruptable Power Supply (UPS) with power surge protection is recommended for powering the equipment.

Whether or not a UPS is used, the power source should never be the same as that being used to power electric motors, such as pumps and winches, on the survey vessel.

4.1.2.2 Changing to a Non-US Power Plug

An AC power cord is provided for connecting the 3400 Portable Topside to a standard U.S. 3-pronged outlet. For non-U.S. power outlets, you can modify this cord by cutting off the 3-pronged plug and attaching the appropriate plug.

AC POWER CORD WIRE COLOR	FUNCTION
Black	AC line
White	AC neutral
Green	Earth ground

Table 4-1: AC Power Cord Wiring

4.1.3 Navigation Interface

The 3400 Sub-Bottom Profiling System accepts all standard National Marine Electronics Association (NEMA) 0183 message sentence formats from a connected Global Positioning System (GPS) or Integrated Navigation System. The devices are connected to the system by plugging them into the COM A or COM B serial ports located on the rear panel of the 3400 Topside. Optionally they could be connected to the serial port of the computer as well. Configuration instructions are found in the [DISCOVER 3400 SOFTWARE MANUAL](#).



Figure 4-1: 3400 Topside Serial Port Navigation Connection

4.1.4 3400 Portable Topside Placement

Ideally, the Portable Topside will always be in a dry, sheltered area that is protected from weather and water spray. However, the unit's rugged design allows it to be exposed to light precipitation when the case is sealed.

CAUTION! Never operate or open the unit where it can become wet from sea spray or precipitation. Injury or death from electric shock can occur as well as damage to the equipment.

The unit should also be placed in an area where the temperature is consistently between 0°C and 40°C (32°F and 104°F). Avoid areas of direct sunlight, especially in tropical environments, as heat buildup could occur, and viewing the laptop display and status indicators could be difficult. The location should also enable direct communications with the deck crew that is handling the Tow Vehicle.

4.1.5 Connecting 3400 Sub-Bottom Profiler System Components

WARNING! NEVER attempt to tow or lift the 3400 tow vehicle with the eye bolts at the nose or tail. These are to be used for auxiliary safety lines.

WARNING! Do not connect the tow cable to the 3400 Portable Topside before connecting it to the tow vehicle; otherwise, injury or death can occur if the tow cable's exposed connector is energized. Always connect the tow cable to the tow vehicle first.

4.1.6 Connecting and Attaching the Tow Cable to the Tow Vehicle

To connect and attach the tow cable to the tow vehicle:

1. Verify that the tow cable is not connected to the portable topside.
2. Coil the tow cable in a figure-eight configuration.
3. Verify that the tow cable and tow vehicle connectors are free of corrosion or dirt. If dirty, clean them with an alcohol wipe.
4. Apply a thin film of silicone grease to the pins of the tow vehicle tow cable connector.

5. Mate the connectors by pressing them firmly together. Do not wiggle the connectors.
6. Mate the connector locking sleeves.
7. Connect the cable grip's eyelet to the shackle on the tow bridle and secure them with seizing wire or a tie wrap.
8. Secure the tow cable to the tow bridle using tie wraps. Electrical tape can also be used.
9. Secure the cable pigtail to tow bridle, ensuring proper strain relief and that the connector does not strum or move in the water current.

4.1.7 3400 Portable Topside Connection and Activation

The following procedure describes how to connect the 3400 Portable Topside system. A **3400 SYSTEM CONNECTION DIAGRAM** is provided in the **TOWFISH TECHNICAL DESCRIPTION** section of this manual to assist.

4.1.7.1 Connecting 3400 System Components

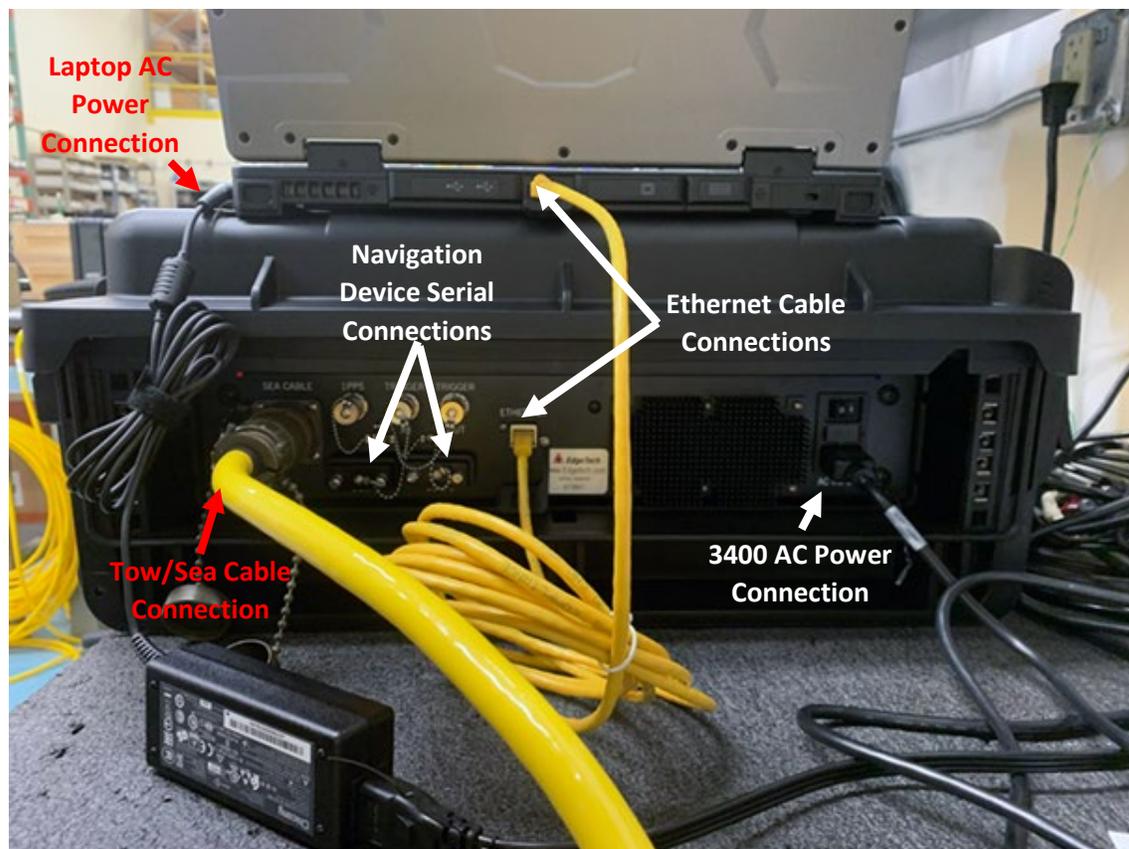


Figure 4-2: 3400 System Connections

1. Check to ensure the power entry module is in the off position and the front panel switch is in the off position before connecting the supplied AC Power Cable (switch position = DOWN).
2. Connect the 3400 Topside to a source of AC power using the AC power cable. (Check system power specifications).
3. Connect the 3400 Topside via the Tow cable connection to the Tow Vehicle using the supplied tow cable.
4. Connect the Navigation device to the COM A or COM B serial port on the 3400 Topside.
5. Connect the Laptop to the 3400 Topside using a 100BaseT direct Ethernet cable.

The Ethernet cable may be extended up to 100 feet using a Category 5 Ethernet patch cable and Ethernet connector. A crossover or direct cable may be used.

4.1.7.2 Connecting 3400 Systems Components and Optional Amplifier.

The 3400 with amplifier option connection setup is different than the standard 3400 setup configuration. An **AMPLIFIER CONNECTION DIAGRAM** is provided in the **3400 AMPLIFIER OPTION TECHNICAL DESCRIPTION** section of this manual to assist with the instructions below. To connect:

1. Check to make sure the power entry module is in the Off position, and the front panel switch is in the off position before connecting the supplied AC Power Cable (switch position = DOWN).
2. Connect the 3400 Topside to a source of AC power using the AC power cable. (Check system power specifications).
3. Connect the 3400 Topside Tow cable connection to the J1 3400 I\O Connector on the amplifier with the amplifier interface cable
4. Connect the J2 Sea Cable Connector on the Amplifier to the Towfish using the supplied tow cable.
5. Connect the Navigation device to the COM A or COM B serial port on the 3400 Topside.
6. Connect the Laptop to the 3400 Topside using a 100BaseT direct Ethernet cable.

The Ethernet cable may be extended up to 100 feet using a Category 5 Ethernet patch cable and Ethernet connector. A crossover or direct cable may be used.

4.1.7.3 Making an Ethernet Connection

The 3400 Topside processor is assigned a static (fixed) IP Address of **192.9.0.101** at Port **1700**. This is preconfigured and should not need to be modified unless there is a specific reason.

EdgeTech assigns static (fixed) TCP/IP addresses for all Ethernet devices in a 3400 Topside and reserves all TCP/IP addresses in ranges 192.9.0.nnn.

EdgeTech advises that any Laptop (or Desktop) intended to connect to the 3400 Topside must, therefore, use a TCP/IP address 192.9.0.xxx where xxx is in the range of 64 to 100. EdgeTech Factory defaults for EdgeTech Laptop is 192.9.0.99 for the Ethernet LAN.

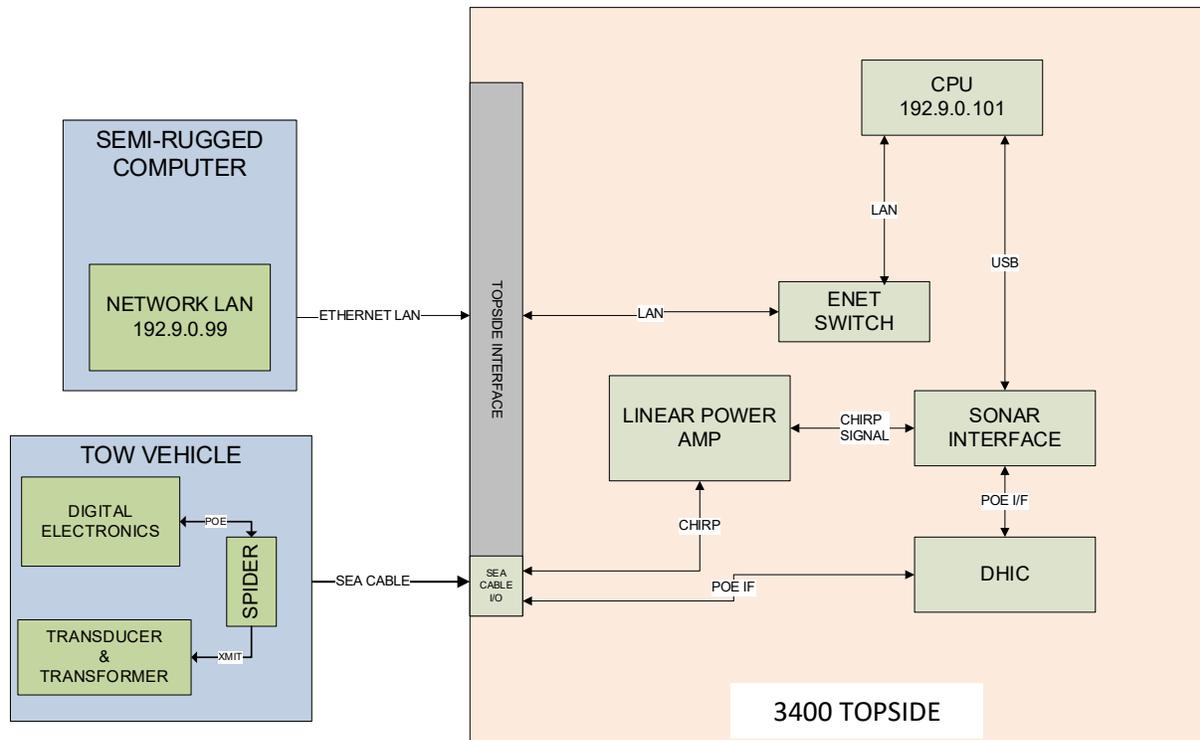


Figure 4-3: 3400 Network Configuration Diagram

ETHERNET LAN CONNECTION:

The Ethernet LAN connection is made using an ethernet cable. The cable uses a standard RJ-45 Ethernet plug for direct connection to the RJ-45 LAN jack on a Laptop. The 3400 Topside auto-senses straight and crossover Ethernet cables. The following steps should be taken on the Laptop to use the Ethernet LAN connection:

1. Insert the Ethernet cable between the RJ-45 LAN jack of the Topside and Laptop.
2. Enable the Ethernet LAN: Locate the Ethernet LAN on Windows Desktop or the System Tray, then click and Enable it.

If the Ethernet LAN does not indicate "Connected" status in the Local Area Network Properties Box, check all hardware connections, LAN IP address (see Section 7), that the Ethernet LAN is enabled and that the 3400 Topside is powered on.

4.1.7.4 Activating the System

To activate the 3400 Portable Sub-Bottom Profiling System after making all necessary connections:

1. Operate the ON/OFF switch to the ON position (switch position = UP).
2. Observe the front panel LEDs.



Figure 4-4: 3400 Topside Front Panel-LED Indicator Lights

The Power-on sequence for the LEDs should appear as follows once the power is turned on.

1. The green Power Button LED should illuminate.
2. All LEDs will momentarily illuminate after power is applied for about 20-25 seconds.
3. All LEDs will turn off except the green Link LED, which will turn off a few seconds after.
4. The green Link LED and blue TX Light will flash on the first CHIRP Signal. The blue TX LED will then turn off.
5. The red power LED will illuminate, the green Link LED will Flash, the blue TX LED will turn off, and the tri-color Data LED will initially be amber and then transition to green if data integrity is good.

After startup, LEDs on the topside processor should display the following under normal circumstances:

LED	LIGHT INDICATION
Power Indicator Light	A red power indicator LED. When illuminated, AC power is applied to the topside and towfish.
Power Button Light	A green power indicator LED. When illuminated, AC power is applied to the topside.
Link Indicator Light	A green link indicator LED. Flashes, while the 3400 Topside is establishing a reliable communications link with the side-scan sonar. Illuminates continuously when a reliable communications link with the sonar is established.
Tx Indicator Light	The blue LED lights up during startup to show system initialization, then shuts off. Once the system begins pinging, the LED blinks continuously.
Data Indicator Light	A Tri-Color Data indicator LED. The LED is green when the data is good. If the signal degrades, it will turn to yellow and then red, showing data loss.

Table 4-2: 3400 LED Indicator Light Type, Color and Status

4.1.8 Performing Sub Bottom Pre-Deployment Checks

Pre-deployment checks should be performed *before* the tow vehicle is deployed and *after* the system is activated. Pre-Deployment checks involve:

1. Listening for the transmitted pulses from the transducers on the tow vehicle

2. Tapping the with a hand or, gently, with a screwdriver handle near the PVDF panel while observing the Sub-Bottom Displays in the Discover Application Window, ensuring it plays back and navigation is present. The Discover 3400 Application Windows is shown in the figure below, and the results of a tap test are displayed in **FIGURE 4-9**.

NOTE: See the **DISCOVER 3400 SOFTWARE MANUAL** for detailed software information.

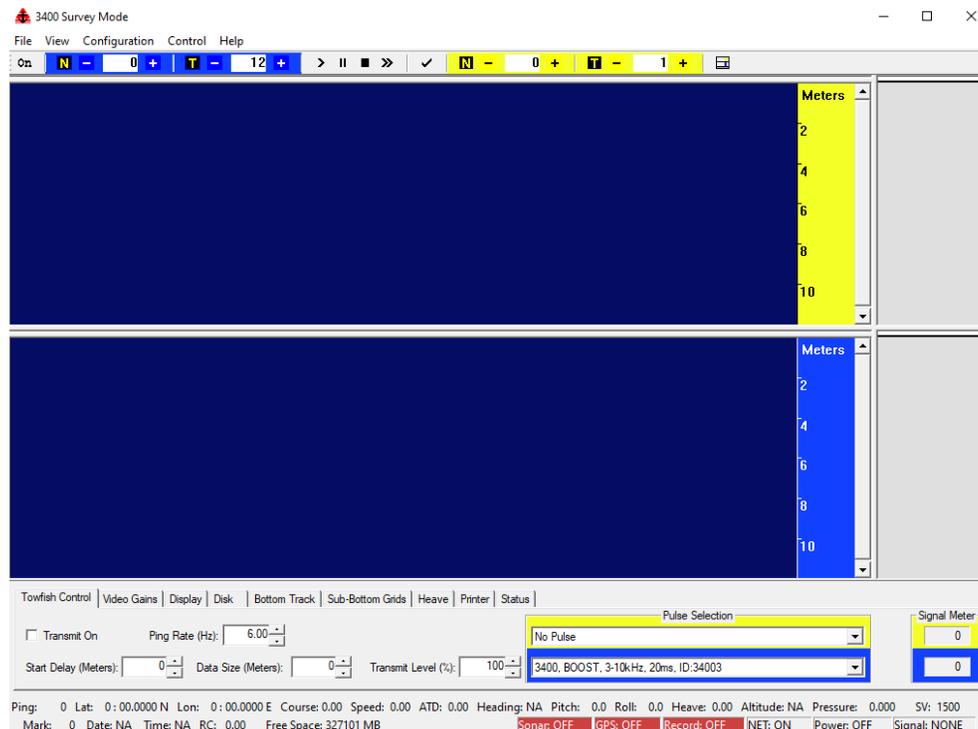


Figure 4-5: Discover 3400 Application Window

To perform the pre-deployment checks:

1. Follow the instructions in the **ACTIVATING THE SYSTEM** section of this manual.
2. Run a Tap Test – Navigate to the Towfish Control Tab, shown in **FIGURE 4-6**.

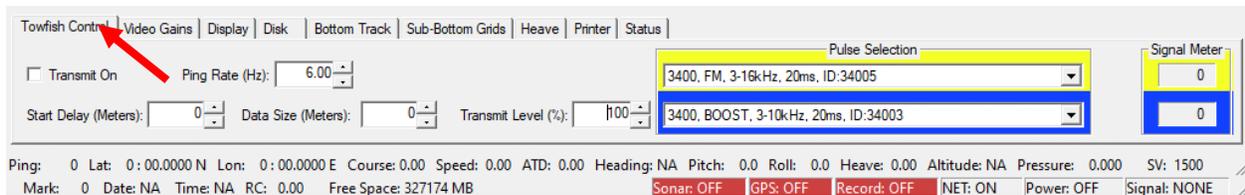


Figure 4-6: The Towfish Control Tab

- In the Sub-Bottom Control Tab, select a Transmit Pulse using the “Pulse” dropdown. Set “Transmit Level (%)” to “100”. Select the “Transmit On” checkbox. Verify that you can hear the system transmitting. The transducers should begin transmitting (at 100%) and receive data should begin scrolling on the Waterfall Display in Discover Sub-Bottom, from right to left.

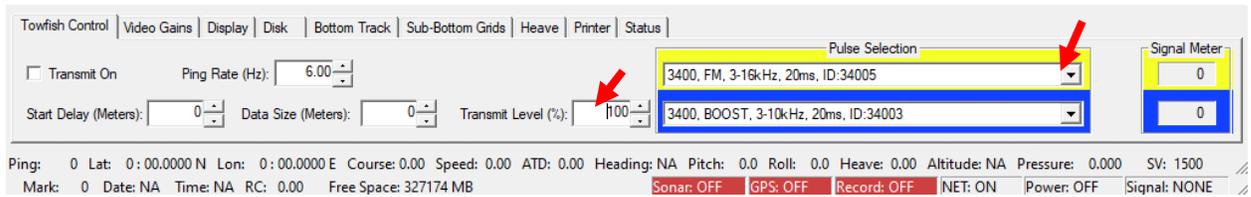


Figure 4-7: Towfish Control Tab-Pulse and Transmit Level Called Out

- In the Towfish Control Tab, select a Transmit Pulse using the “Pulse” dropdown. Set “Transmit Level (%)” to “0”. The transducers should begin transmitting (at 0%) and receive data should begin scrolling on the Waterfall Display in Discover Sub-Bottom, from right to left.
- In the Discover Window Shortcut Toolbar, set Gain to either 0 or -3 dB, and then click the Normalize Gain (N) Button.



Figure 4-8: Discover Shortcut Toolbar- Range Text Field and Normalize Gain Button Called Out

- Tap the tow vehicle's underside near the PVDF receiver with a screwdriver handle while observing the Sub-Bottom Waterfall Display in Discover. Streaks or noise spikes should be visible in the Sub-Bottom Display, as shown in **FIGURE 4-9**. This verifies the receive channel is operating.

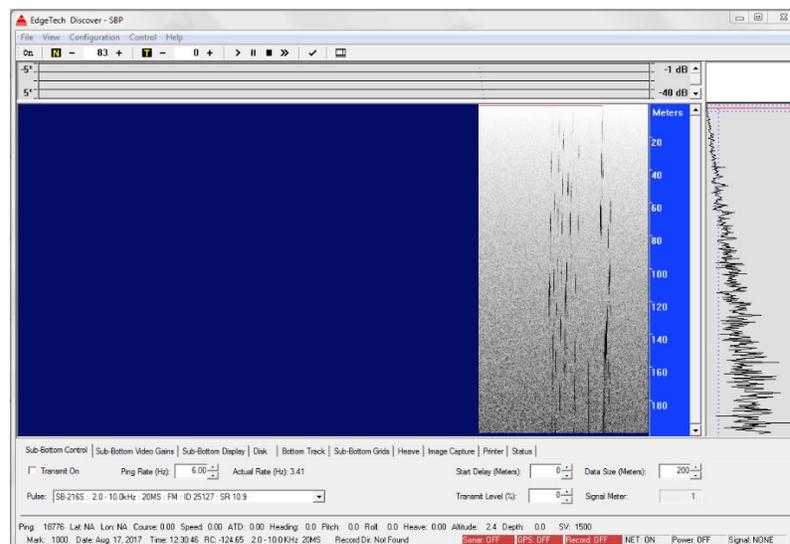


Figure 4-9: Tap Test Results

7. Test that the vehicle's compass is working correctly by moving the towfish and checking that the pitch and roll are reported correctly in the Main Status Line Display in Discover.
 - Verify that the starboard roll is correct by rotating the fish's tow arm towards its starboard direction around 20 degrees. The Roll value should be positive in this direction. (max is +180 degrees).
 - Verify that the port roll is correct by rotating the fish's tow arm towards its port direction around 20 degrees. The Roll value should be negative in this direction. (max is -180 degrees).
 - Verify that the pitch is working correctly by lifting the nose of the fish. The pitch value should read positive and reach a max of +90 degrees.
 - Verify that the pitch is working correctly by lifting the tail of the fish. The pitch value should read negative and reach a max of -90 degrees.

4.1.9 3400 Tow Vehicle Deployment

The 3400 Tow Vehicle can be towed using the tow cable purchased with the vehicle. The towfish end of the cable should be secured to the bridle shackle with the cable grip, and the tow cable is then run down along a towfish bridle arm to the connector, where both ends are mated. Cable ties should be used to secure the cable to the bridle arm giving the tow cable enough slack between the shackle and connector to prevent the endpoints from being pulled loose. Load-bearing cables can be used by attaching them to the bridle shackle.

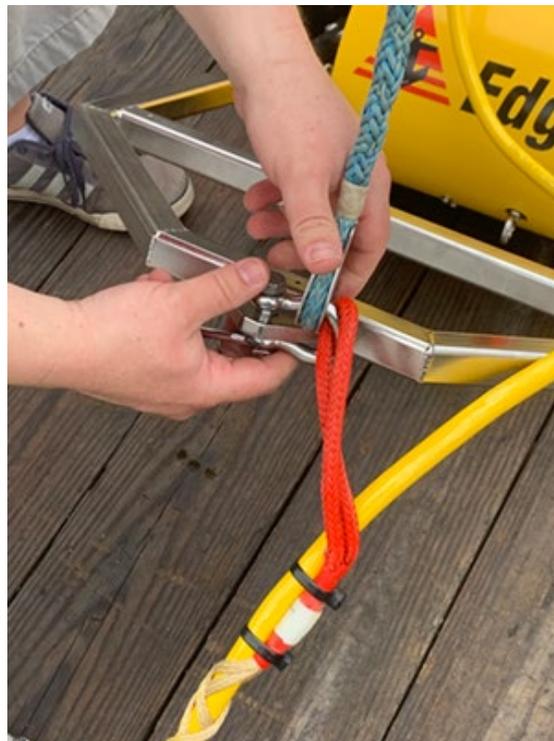


Figure 4-10: 3400 Tow Cable Grip Bridle Shackle Attachment



Figure 4-11: Towfish Deployment

CAUTION! Do not tow the tow vehicle too close to the survey vessel. Towing in this manner can cause the tow vehicle to be pulled in against the ship's hull due to the low pressure of the propeller wash and the effect of the water flowing by the hull. Also, sonar reflections from the hull may be evident in the records.

The tow vehicle may be towed at speeds of up to 8 knots. However, to optimize performance and minimize flow noise, it is recommended that the tow vehicle be towed at speeds of less than 5 knots. Lead ballast in the tow vehicle's nose provides towing stability by placing the tow point as far forward as possible and making the tow point well above the tow vehicle's center of gravity. The tow point is factory adjusted to position four so that the tow vehicle is level when it is towed in the water at approximately 3.5 knots. This factory setting is position 4, or the fourth position down out of five for the elevator's trailing edge. Adjust the tow point to position 5 or the lowest trailing edge position for higher tow speeds.

CAUTION! The tow vehicle **should not** be towed with the nose angled up or down, as this can degrade Sub-Bottom Imagery. Before towing the Tow Vehicle, verify that it is as level as possible when towing the Tow Vehicle at 3 to 5 knots.

4.1.9.1 Obtaining the Best Sonar Imagery When Towing

To generate good sonar imagery, the vehicle's pitch, which is how much in degrees the nose is angled up or down, must be less than one-half of the -6-dB beamwidth of the acoustic pulse its highest frequency—and less at lower frequencies. As a rule of thumb, for a 0.5-meter long hydrophone array, the -6-dB beamwidth at 10 kHz is 20 degrees. For example, if you are transmitting a 2 to 15 kHz FM pulse using a Tow Vehicle with a 0.5-meter long receiving array, such as in the 3400 Tow Vehicle, you must keep the Tow Vehicle from pitching more than about 7 degrees in either direction, or

$$\frac{\frac{1}{2} \times 20 \text{ degrees} \times 10 \text{ kHz}}{15 \text{ kHz}} = 6.6 \text{ degrees}$$

Equation 1

The same criteria applies to vehicle roll, which is how much in degrees it is listing to port or starboard. Sensors can be installed on the Tow Vehicle to measure its pitch and roll under various towing conditions.

4.1.9.2 Conducting Sediment Classification Surveys When Towing

To conduct sediment classification surveys, the reflection coefficient should be measured with better than 10% accuracy. The seafloor reflection's normal component must arrive within the angle corresponding to one-half of the -1dB beamwidth of the vehicle's acoustic axis at the center frequency of the pulse, the frequency where most of the acoustic energy is concentrated, and where the reflection coefficient is measured. As a rule of thumb, for a 0.5-meter long hydrophone array, the -1dB beamwidth at 10 kHz is 4 degrees.

Example:

If the seafloor is expected to have slopes of up to 5 degrees during the survey, and a vehicle with a 0.5-meter hydrophone array and a 2 to 10 kHz FM pulse is selected, the -1 dB beamwidth should be at least 10 degrees at 6 kHz. For this pulse and receiving array, the -1 dB beamwidth at 6 kHz is about 7 degrees, or

$$\frac{4 \text{ degrees} \times 10 \text{ kHz}}{6 \text{ kHz}} = 6.6 \text{ degrees}$$

Equation 2

Therefore, only reflection coefficient measurements made when the seafloor slope is within 3.5 degrees of horizontal will be accurate within 10% (1 dB).

The tow vehicle's attitude with respect to the horizontal plane must meet the -1 dB criteria described above for sediment classification surveys. Rough sea conditions tend to move the car up and down vertically, causing oscillations in the images. Discover Sub-Bottom has a swell filter that will help reduce the heave effect on the record. Refer to the [DISCOVER 3400 SUB-BOTTOM MANUAL](#) for details.

For sediment classification, the towfish pulses must be calibrated by the end-user. This calibration procedure is also described in the software manual.

4.1.9.3 AHRS Usage

The vehicle's Attitude Heading Reference System (AHRS) provides the operator with pitch and roll data to help make deployment decisions while conducting surveys. The AHRS does not provide a heading.

4.1.9.4 Towfish Layback Charts

The following towfish layback charts are provided to assist in towing. Please consider the following points if they are used:

- Model refinements have been made. Therefore, all charts in the previous manual (0021270_Rev_B) have been updated to reflect the changes.
- The standard 3400 towfish currently supports depths no greater than 100 meters.
- The results listed in these tables are calculated using the Woods Hole WHOI cable program with best-estimated parameters for vehicle weight, drag, lift, and buoyancy, as well as cable weight and stiffness. EdgeTech disclaims any liability for consequential damage resulting from using the data in the tables.
- The values contained in these charts are subject to change and have been assigned an error of +/- 10%. Keep this in mind, especially if within 10% of the endpoint of any parameter.

TOWED 3400 WITH LEAD WEIGHT PACK INSTALLED AND 25 METERS OF CABLE (PN# 0020874) PAID OUT

Speed (kts)	Speed (m/s)	Cable Paid Out (m)	Max Cable Tension (N)	Depth (m)	Distance Behind Ship (m)	Down Angle from Horiz. (deg)
2.00	1.03	25	129	19	16	50
2.50	1.29	25	129	15	19	38
3.00	1.54	25	132	13	21	32
3.50	1.80	25	138	11	22	27
4.00	2.06	25	147	9	23	21
4.50	2.31	25	159	8	23	19
5.00	2.57	25	176	7	24	16

Table 4-3: 3400 25-Meter with Lead Pack Installed Layback Chart

**TOWED 3400 WITH LEAD WEIGHT PACK INSTALLED AND 40 METERS OF CABLE (PN# 0020874)
PAID OUT**

Speed (kts)	Speed (m/s)	Cable Paid Out (m)	Max Cable Tension (N)	Depth (m)	Distance Behind Ship (m)	Down Angle from Horiz. (deg)
2.00	1.03	40	133	25	29	41
2.50	1.29	40	133	20	33	31
3.00	1.54	40	136	13	35	20
3.50	1.80	40	143	13	37	19
4.00	2.06	40	152	11	38	16
4.50	2.31	40	166	10	38	15
5.00	2.57	40	183	9	39	13

Table 4-4 3400 40-Meter with Lead Pack Installed Layback Chart

**TOWED 3400 WITH LEAD WEIGHT PACK INSTALLED AND 50 METERS OF CABLE (PN# 0020874)
PAID OUT**

Speed (kts)	Speed (m/s)	Cable Paid Out (m)	Max Cable Tension (N)	Depth (m)	Distance Behind Ship (m)	Down Angle from Horiz. (deg)
2.00	1.03	50	135	29	38	37
2.50	1.29	50	136	23	43	28
3.00	1.54	50	139	18	45	22
3.50	1.80	50	146	15	47	18
4.00	2.06	50	156	13	48	15
4.50	2.31	50	171	11	48	13
5.00	2.57	50	189	10	49	12

Table 4-5: 3400 50-Meter with Lead Pack Installed Layback Chart

4.1.10 U-Hinge Tow Bridle

If you purchased this option, the U-Hinge Tow Bridle comes preinstalled. Should you need to remove or change the bridle's position for any reason, instructions for removing it are written below.

NOTE: Should you intend to switch from the tow bridle option to the pole mounting option, you must remove the lead weights from the nose, the elevator from the rear, and remove the bridle from the 3400 Towfish. Safety lines must secure the vehicle to the vessel as well. If you switch from the pole mount option to the tow bridle option, the weights and elevator need to be added.

4.1.10.1 U-Hinge Tow Bridle Adjustment

The U-Hinge Bridle angle can be adjusted for stowage or any other reason by folding the bridle against the vehicle. This is done by pulling the bridle base forward and then folding the upper bridle against the vehicle. If the elbow bolts are tight and the upper bridle is challenging to move, the elbow bolt hardware can be loosened using a 3/4 wrench and adjustable wrench to allow movement.



Figure 4-12: Loosening Bridle Elbow



Figure 4-13: Bridle Stowed Against Vehicle

4.1.10.2 U-Hinge Tow Bridle Removal Instructions:

The U-Hinge Tow Bridle can be removed either at the flanges at the bridle's base or higher up the bridle at the elbows.

Removing the bridle at the flanges at the base of the bridle.

REQUIRED TOOLS

- 3/8" Ratchet
 - 3/8" Square Drive Socket Extension (12")

REQUIRED TOOLS

- 3/8" Square Drive Socket with 5/16" Hex Bit Ball End
- Adjustable Crescent Wrench or 9/16" Wrench
- Needle Nose Pliers

Instructions:

1. Remove the [2] split rings from the center bolts on both port and starboard sides of the towfish. The bolts and split rings can be accessed through the handhold holes on the forward port and forward starboard side panels of the towfish or propping the fish up onto skids and reaching underneath the vehicle.



Figure 4-14: Nut and Bolt Location Looking Through Handhold Hole.

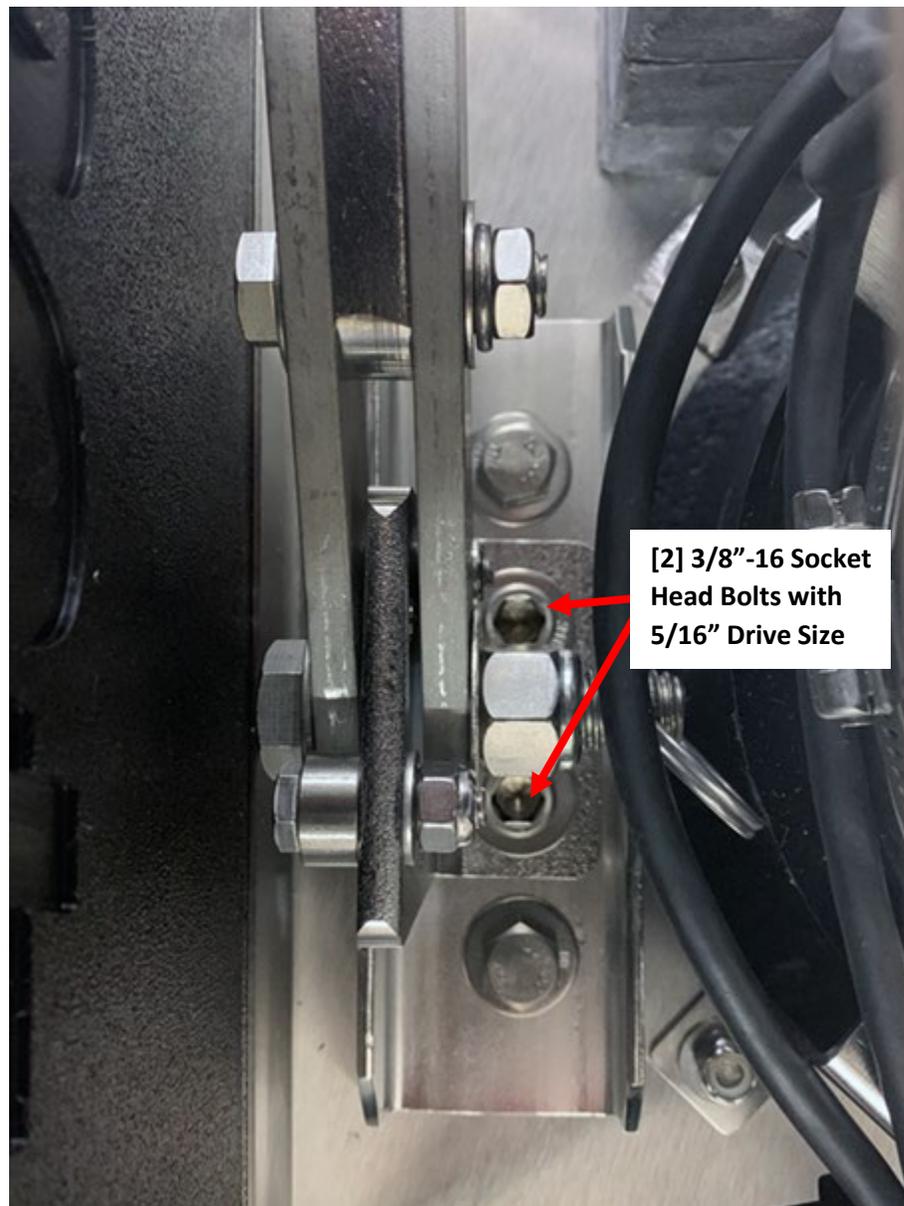


Figure 4-15: Bridle Arm Bolt Locations- 2 Bolts Port and Starboard Sides



Figure 4-16: Bridle Removal Tool Orientation

2. Through the top of the towfish, remove [2] 1/2" inch bolts both port and starboard side mountings using 3/8" drive socket wrench with 12" extension and 5/16" Ball End socket. Hold the nuts securing the bolts, and access the towfish with a wrench through the forward side panel handhold holes.
3. Lift the bridle from towfish and store.

Removing bridle from the bridle elbows.

REQUIRED TOOLS

- 3/4" Wrench
- Adjustable Crescent Wrench
- Pliers

Instructions:

1. Remove split rings from left and right 1/2-inch bolts at bridle elbows with pliers.



Figure 4-17: Bridle Removal: Split Ring Removal

2. Remove left and right 1/2 inch bolt, 1/2 inch nut, and washers using 3/4" wrenches or adjustable crescent wrenches. This will separate the bridle from the towfish at the elbows.

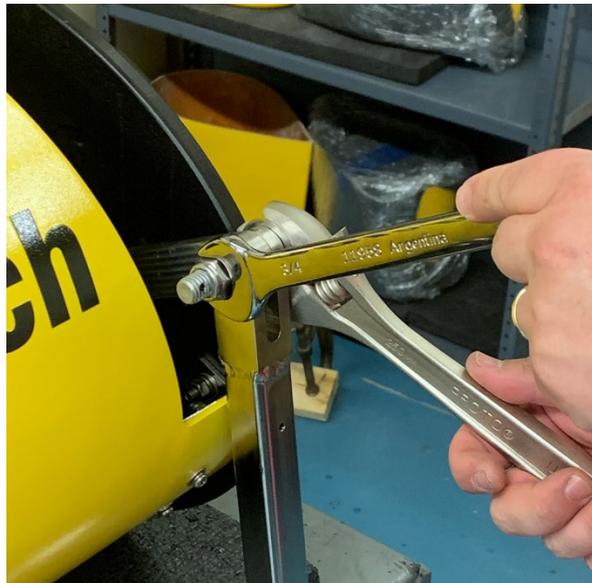


Figure 4-18: Bridle Removal-Elbow Hardware Removal

3. Lift bridle away and store.

4.1.11 Pole Mounting the 3400 Tow Vehicle



Figure 4-19: 3400 Towfish with Pole Mount Installed, Tow Arms, Weights, and Elevator Removed

If you purchased this option with the standard 3400 Towfish, the Pole Mount Flange comes preinstalled. If you buy the pole mounting kit later or have previously configured the 3400 towfish for towing, you will need to remove the tow bridle, remove the weights in the forward section of the vehicle, remove the rear elevator, and install the pole mounting flange. Your manufactured pole should have a flange that matches the bolt pattern and dimensions of the EdgeTech flange.

4.1.12 Removing the Tow Bridle

The bridle should be uninstalled. The preceding **U-HINGE TOW BRIDLE REMOVAL INSTRUCTIONS** section of this manual includes complete instructions to accomplish this task.

4.1.13 Removing Weights

The weights are located in the lower nose of the towfish. They can be accessed and removed by removing the forward panel or through the forward port and starboard bridle ports.

Instructions:

REQUIRED TOOLS

- 7/16" Combination Wrench
- Adjustable Crescent Wrench
- Stubby #2 Phillips Screwdriver

1. The front panel is removed by unthreading the [12] screws using the Stubby #2 Phillips Screwdriver and unthreading the front eyebolt using a 7/16" wrench.

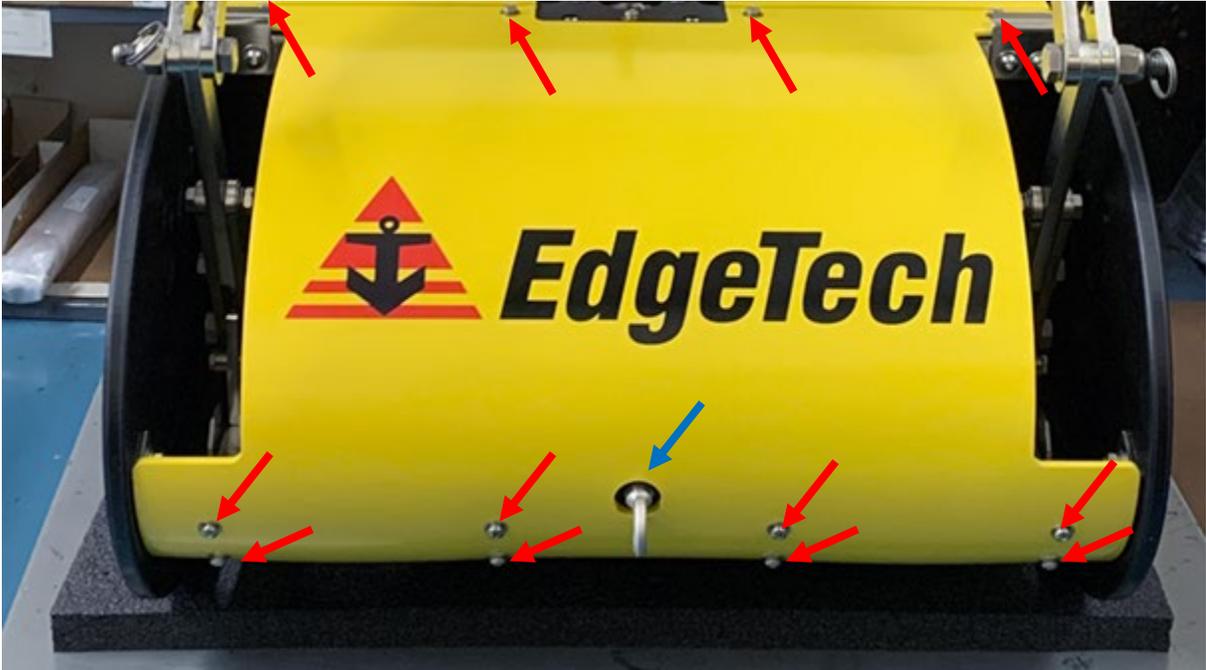


Figure 4-20: 3400 Pole Mount Instruction-Front Panel Removal With (12) Screws and Eye Bolt Called Out

2. Loosen and remove [4] hex nuts and [4] washers using the 7/16" Combination Wrench or Adjustable Crescent Wrench.



Figure 4-21: 3400 Pole Mount Instruction - Weight Removal Top Bolt Assembly Location

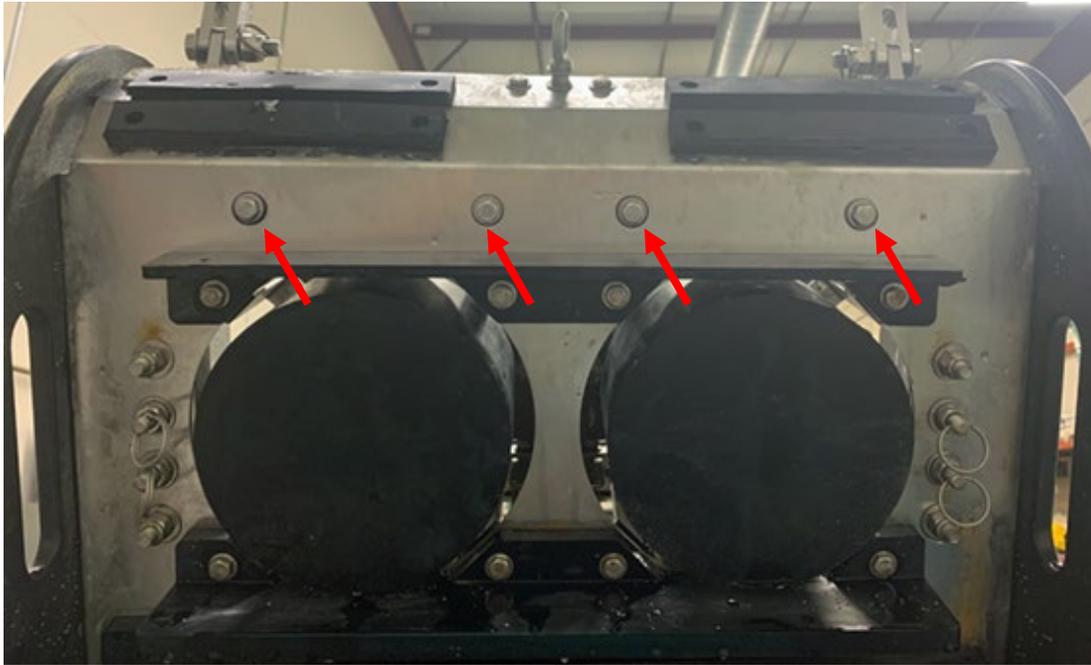


Figure 4-22: 3400 Pole Mount Instruction - Weight Removal-Location of Bolt Heads on Bottom of Vehicle

3. Lift the weight block(s) from bolts and remove them from the vehicle.

Instructions for Reinstalling or Adding Weights

1. Install additional or a replacement weight block by aligning the weight's four bolt holes with the towfish's four bolts and setting the weights into position.
2. Thread the [4] washers and [4] hex nuts onto the [4] bolts. Tighten using a 7/16" Combination Wrench or Adjustable Crescent Wrench. Reinstall the front cover, screws, and eyebolt.

4.1.14 Removing the Rear Elevator

The rear elevator is attached to the vehicle by [2] hex screws and [2] washers on the vehicle's aft-port and aft-starboard tail fins. These must be unthreaded and removed to detach the elevator.

REQUIRED TOOLS

- 5/32" Allen Wrench
- 7/16" Wrench



Figure 4-23: 3400 Pole Mount Instruction - Elevator Hex Screw Positions

Instructions:

1. Remove the [4] 1/4"-20 Flat Head Hex-head screws with a 5/32" Allen wrench on both side panels and a 7/16" wrench.
2. Remove and save the [4] Shoulder washers from the elevator.

4.1.15 Pole Mount Installation Instructions

Should you need to install or remove the Pole Mount for any reason, instructions are written below.

CAUTION: If pole mounting, you must use safety lines to secure the system when deployed. There are eye bolts on the nose and tail of the vehicle that, along with taut lines, should be used for this purpose. See the **UTILIZING THE FORWARD AND AFT EYE BOLTS** section of this manual for details

NOTE: When tightening the bolts on the Pole Mount Flange Installation, always be sure to tighten the bolt on one side slightly, followed by the other, alternating sides until tightened. NEVER fully tighten the bolts on one side only. This will cause the Pole Mount Flange to warp to one side. Once you tighten a screw, tighten down the mated screw on the opposite side.

REQUIRED TOOLS

- 1/4" Allen Wrench or T-handle
- 1/2" Breaker Bar
- 1-5/16" Size x 1.75 Inch Length x 1/2" Square Drive Socket for Breaker Bar
- Adjustable Crescent Wrench or 3/4" Wrench
- Tube of TS-70 Molybdenum Disulfide Lubrication
- 2047 Loctite Adhesive- Loctite requires 24 hours of curing before towing to provide the best bond between materials.

REQUIRED HARDWARE

- [2] 1/4" Clevis Pins with split rings
- [6] 1/2" Wedge Lock Washers
- [6] 1/2"-13 Hex Bolts
- [4] 3/4"-10 Hex Nuts
- [4] 3/4" Split Lock Washer
- [4] 3/4" Flat Washer
- [4] 3/4"-10 Hex Head Screw
- [1] 7/8" Wedge Lock Washer
- [1] 7/8"-9 Bolt
- [1] Cable Tie (heavy-duty)

Pole Mount Flange Mounting Instructions:

1. You will need to buy or manufacture a pole flange that matches the hole pattern dimensions of the towfish mounting flange. A **3400 POLE MOUNT PLATE DRAWING** with the necessary dimensions is found in the **MECHANICAL DRAWINGS** section of this manual.
2. Remove the [6] 1/2"-13 set screws in the vehicle's sidewalls using a 1/4" Allen key or T-handle. The set screws may be secured with 2047 Loctite, in which case a significant amount of hand torque may be required.



Figure 4-24: Port and Starboard Set Screw Removal

3. Take the pole mount assembly and place it on the top of the vehicle, careful to let the cable connector's locking sleeve pass through the appropriate hole.

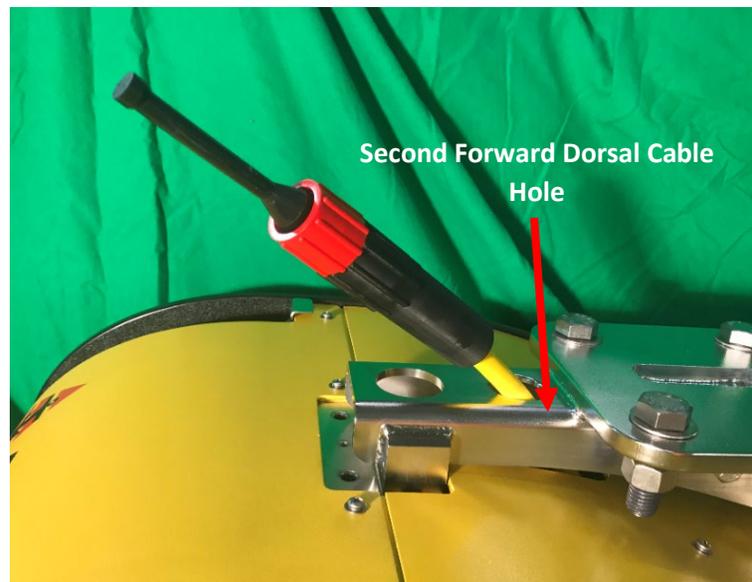


Figure 4-25: Forward Dorsal Pole Mount Cable Hole Position

4. Apply a generous amount of Molybdenum Disulfide to the threads of the [1] 7/8"-9 3.0" length (~76 mm length) bolt. Confirm the proper wedge lock (aka Nordlock) 7/8" locking washer pair is on the bolt. Install the bolt into the dorsal hole forward of the hole the cable connector was passed through. Just get the first few threads started.



Figure 4-26: Forward Dorsal Bolt Locking Washer and Molybdenum Disulfide Coating

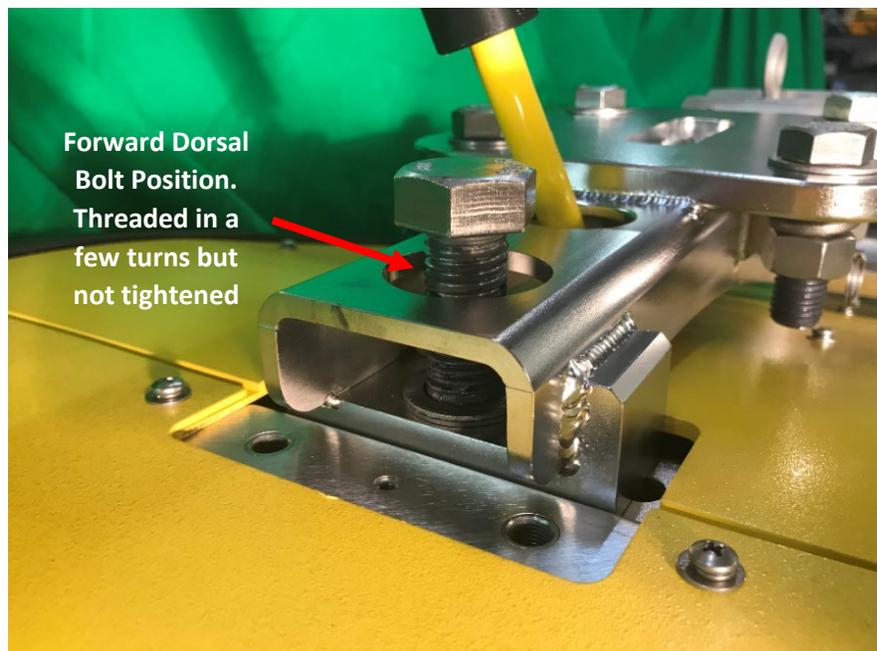


Figure 4-27: Forward Dorsal Pole Mount Bolt Position

5. Apply a generous amount of Molybdenum Disulfide to the threads of the [6] 1/2"-13 2.0" length (~51 mm length) bolts if they are not already lubricated from previous steps. Next, insert one of the 6 1/2" ID (~13 mm ID) wedge lock washer pairs onto each bolt. Thread them into the sidewall tee-nuts. Again, just get the threads started and note any interferences or tightness. Move/shift the pole mount as needed.



Figure 4-28: Port and Starboard Pole Mount Bolt Positions

6. Tighten all seven bolts systematically, several threads at a time. Use the breaker bar and 1-5/16" socket for the [1] 7/8"-9 bolt and the 3/4" wrench for the [6] 1/2"-13 bolts. Be careful to feel for the possibility of galling. If a bolt starts resisting torque, back it off. In the end, all seven bolts should be tightened to a torque beyond hand-tool tight. Nordlock recommends approximately 100 N*m for the 1/2"-13 bolts and approximately 600 N*m for the 7/8"-9 bolt, but be careful not to overapply torque.

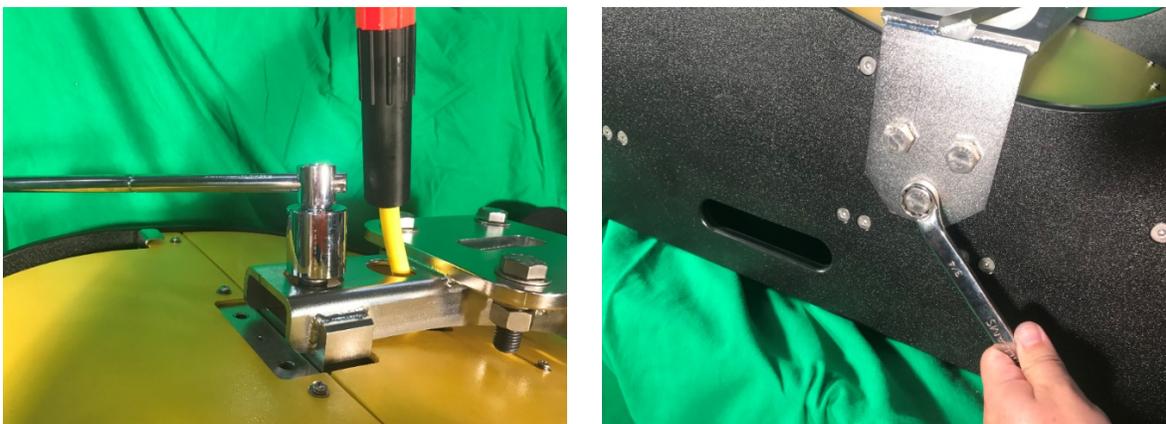


Figure 4-29: Pole Mount Bolt Tightening

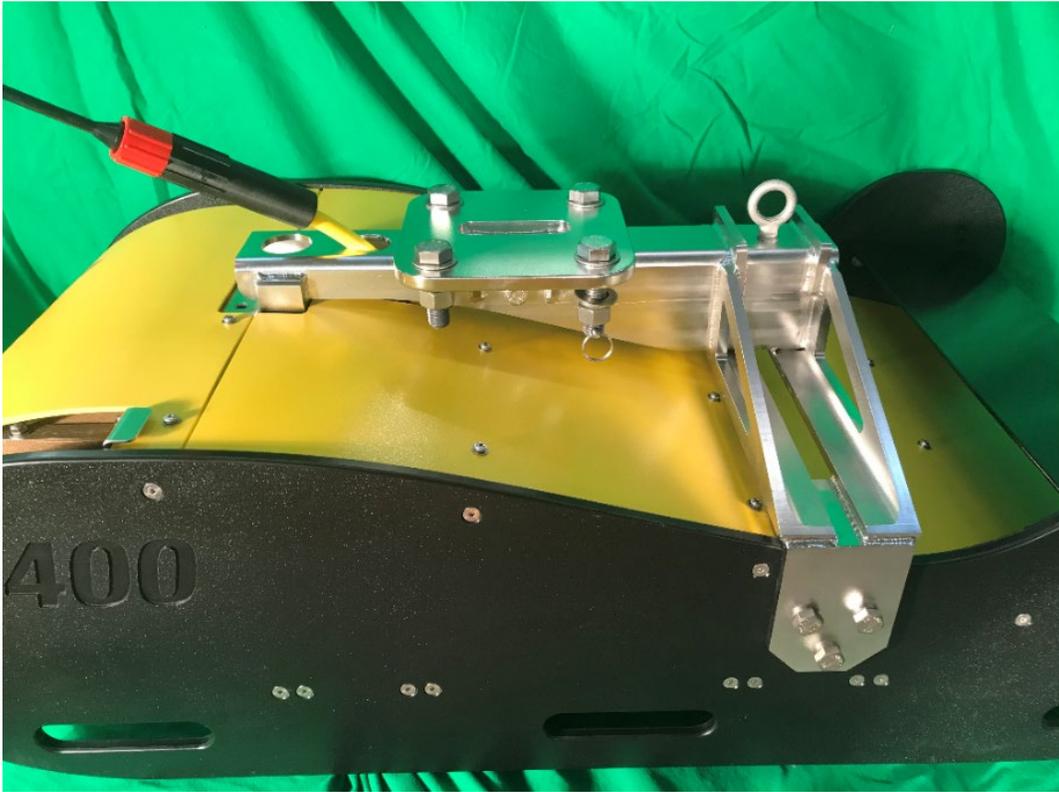


Figure 4-30: 3400 Sideview with Pole Mount Installed

7. Insert the [4] 3/4" Bolts down through the [4] 4/4 flat washers, the holes of your pole flange, the upper plate flange holes of EdgeTech's mount, the [4] flat washers, the [4] lock washers, and [4] a 3/4" Hex nuts. Thread and tighten using a 3/4" wrench and the adjustable wrench to assist. Next, insert [2] 1/4" Clevis pins into the [2] 3/4" Bolts and attach [2] split rings.

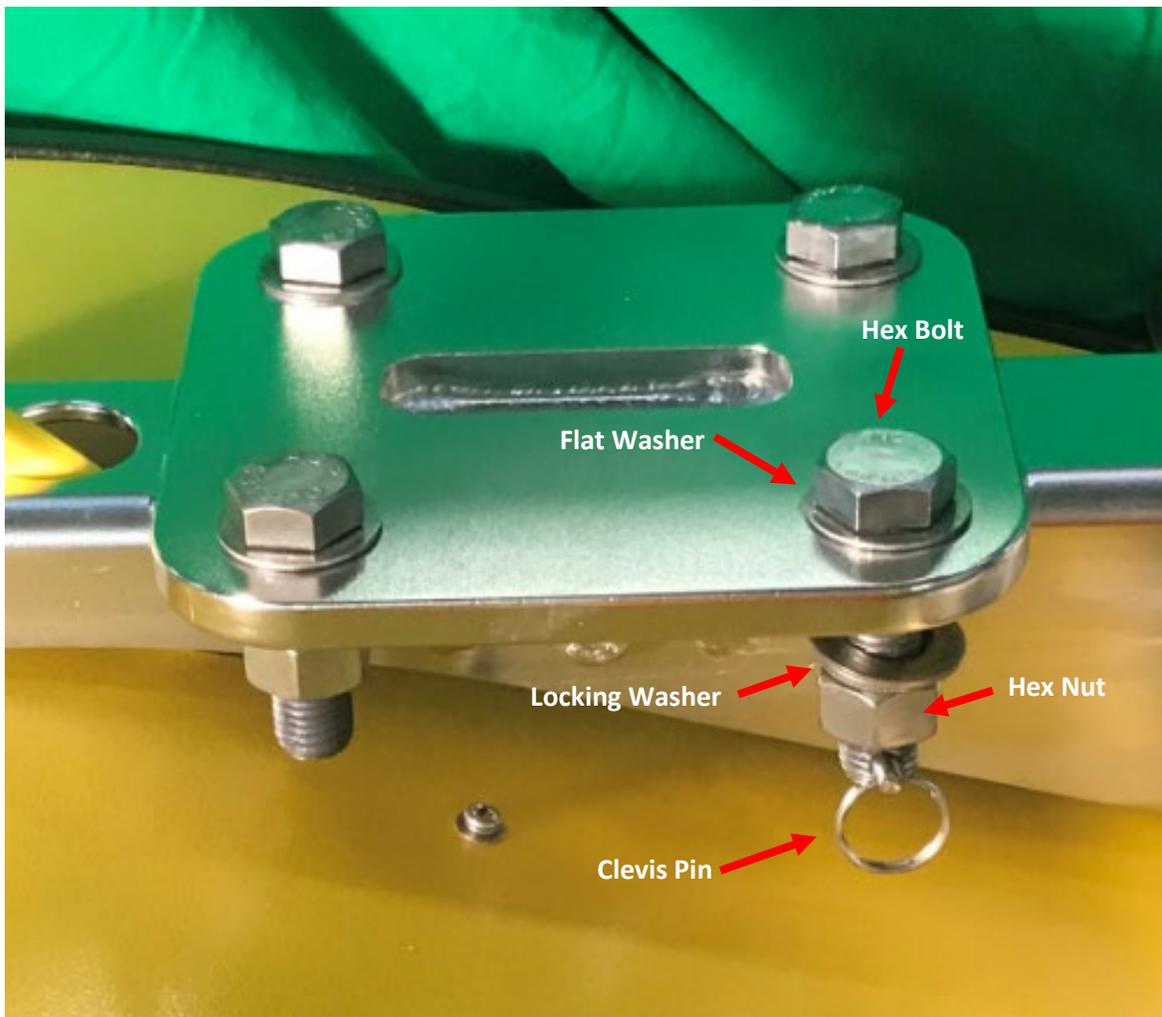


Figure 4-31: Towfish Mounting Flange to Pole Mount Flange Bolt Assembly



Figure 4-32: Pole Mounted 3400 System

Removing the Pole Mount Flange:

1. To remove the pole mount flange, reverse the installation instructions above.

NOTE: If reverting back to the Tow Bridle option, the weights and elevator must be reinstalled on the vehicle along with the tow bridle. It is also recommended but not critical to install the [6] ½"-13 set screws into the side tee-nuts using a 1/4" Allen key or T-handle. Next, apply some 2047 Loctite on the threads to ensure the set screws remain in place during towing. Loctite 2047 takes 24 hours to cure fully. Towing before the 24-hour cure period could lead to the set screws twisting out of the tee-nuts.

4.1.16 Utilizing the Forward and Aft Eye Bolts

The 3400 Towfish includes two auxiliary eye bolts located on the vehicle's central bow and central stern portions. These provide additional stabilization when attached to the towing vessel with tensioned safety lines. If pole-mounting the system, you must use these eye bolts along with taut safety lines to secure the vehicle.

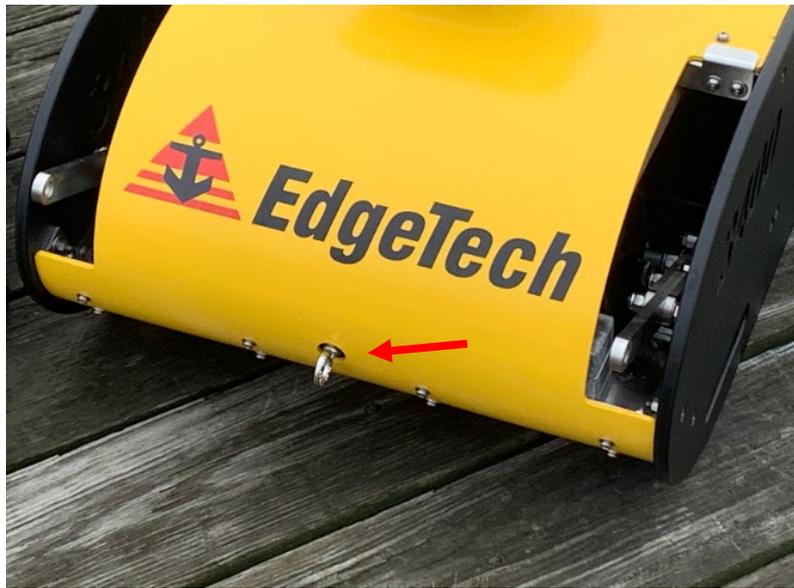


Figure 4-33: Forward Eye Bolt



Figure 4-34: Aft Eye Bolt

4.2 3400 OTS Low-Frequency Sub-Bottom Profiler Setup and Activation

4.2.1 3400 OTS LF Sub-Bottom Profiler Unpacking and Inspection

The 3400 OTS LF Vehicle, Portable Topside, and Tow Cable are shipped in separate, reusable, heavy-duty transport cases. Essential cables and documentation are also included.

Before unpacking the system components, inspect the shipping containers for any damage. Report any damage to the carrier and EdgeTech. If the shipping containers appear free of damage, carefully unpack the components, and inspect them for damage. Review the packing list and verify all the listed items are included.

Again, if any damage is found, report it to the carrier and EdgeTech. If any items are missing, immediately contact EdgeTech. Do not install or operate any equipment that appears to be damaged.

Although the items shipped may vary, depending on the customer requirements, the 3400 Sub-Bottom Profiling System typically includes the following:

- 3400 OTS LF Sub-Bottom Profiler Vehicle
- 3400 Portable Topside
- Optional Laptop
- AC power cords (1)
- Ethernet cable
- System Recovery Drive
- Electronic Manuals

After unpacking the system components, safely store the shipping containers for later use, including any packing materials. When transporting or storing the system, all items should be packed in their original shipping containers in the same way they were originally shipped. Always store the system in a dry environment when not in use.

4.2.2 Installing Rubber U-Shaped Safety Trim

EdgeTech suggests installing the provided rubber U-shaped trim along the 3400 OTS vehicle body's edges to prevent injury to personnel working with the vehicle.

WARNING! The 3400 OTS vehicle edges can be sharp and cause lacerations to exposed skin if rubbed against with pressure. Please wear gloves and install rubber safety lining to prevent injury.

Tools:

TOOLS REQUIRED	HARDWARE REQUIRED
Scissors, Superglue (401 Loctite)	Rubber U-Shaped Trim

Instructions:

1. Uncoil and install the rubber trim by lining up both sides of it on each side of the vehicle edge and pressing down to wrap it around the edge as the trim is uncoiled.

2. Cut the trim at sharp angles or endpoints using scissors. Repeat the process in Step 1 to continue the process as necessary.



Figure 4-35: 3400 OTS LF Rubber Trim Installation

4.2.3 Power Requirements

The 3400 power requirements are 120–220 VAC and 50/60 Hz, and the input voltage is auto-sensing.

4.2.3.1 Use of an Uninterruptable Power Supply

The power source should be continuously free of high amplitude, high-frequency transients, as this type of interference could cause degraded performance or damage to the equipment. An Uninterruptable Power Supply (UPS) with power surge protection is recommended for powering the equipment.

Whether or not a UPS is used, the power source should never be the same as that being used to power electric motors, such as pumps and winches, on the survey vessel.

4.2.3.2 Changing to a Non-US Power Plug

An AC power cord is provided for connecting the 3400 Portable Topside to a standard U.S. 3-pronged outlet. For non-U.S. power outlets, you can modify this cord by cutting off the 3-pronged plug and attaching the appropriate plug.

AC POWER CORD WIRE COLOR	FUNCTION
Black	AC line
White	AC neutral
Green	Earth ground

Table 4-6: AC Power Cord Wiring

4.2.4 Navigation Interface

The 3400 Sub-Bottom Profiling System accepts all standard National Marine Electronics Association (NEMA) 0183 message sentence formats from a connected Global Positioning System (GPS) or Integrated Navigation System. The devices are connected to the system by plugging them into the COM A or COM B serial ports located on the rear panel of the 3400 Topside. Optionally they could be connected to the serial port of the computer as well. Configuration instructions are found in the [DISCOVER 3400 SOFTWARE MANUAL](#).



Figure 4-36: 3400 Topside Serial Port Navigation Connection

4.2.5 3400 Portable Topside Placement

Ideally, the Portable Topside will always be in a dry, sheltered area that is protected from weather and water spray. However, the unit's rugged design allows it to be exposed to light precipitation when the case is sealed.

CAUTION! Never operate or open the unit where it can become wet from sea spray or precipitation. Injury or death from electric shock can occur as well as damage to the equipment.

The unit should also be placed in an area where the temperature is consistently between 0°C and 40°C (32°F and 104°F). Avoid areas of direct sunlight, especially in tropical environments, as heat buildup could occur, and viewing the laptop display and status indicators could be difficult. The location should also enable direct communications with the deck crew that is handling the tow vehicle.

4.2.6 Connecting 3400 OTS LF Sub-Bottom Profiler System Components

4.2.6.1 Instructions on Running Tow Cable to Connector

Users must run the tow cable through the OTS Mount and cable clip and mate it to the vehicle's tow cable connector.

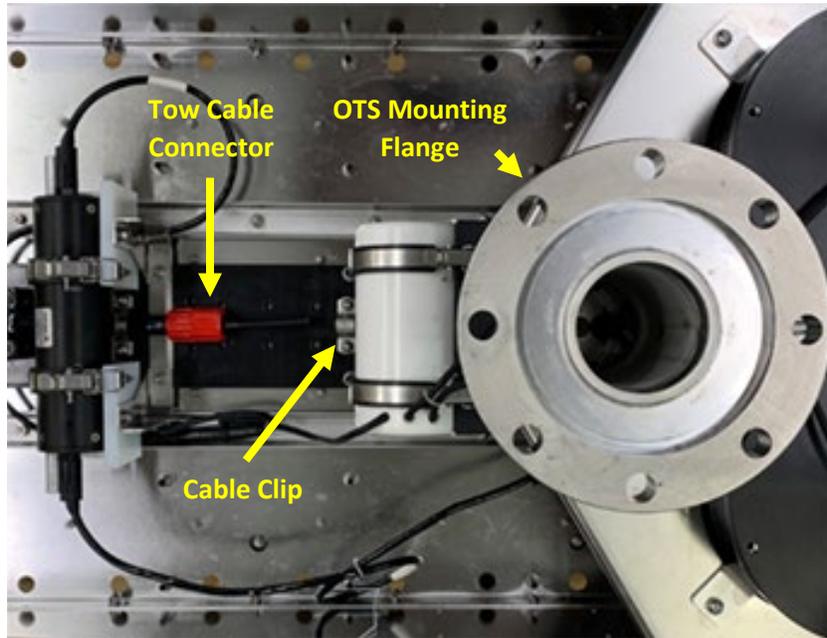


Figure 4-37: OTS LF Mounting Flange, Cable Clip, and Sea Cable Connector

TOOLS REQUIRED

5/32" Allen Wrench

HARDWARE REQUIRED

[2] 1/4"-20 Pan Head Bolts with 5/32" Drive Size

1. Run the tow cable down through the large central hole in the OTS mounting flange to the hole at the bottom toward the two-cable connector.



Figure 4-38: OTS LF Mounting Flange

- Unclip the cable clip at the bottom by unthreading the [2] 5/32" hex bolts securing it to the vehicle. Next, Unthread the dummy plug installed over the vehicle's tow cable connector.

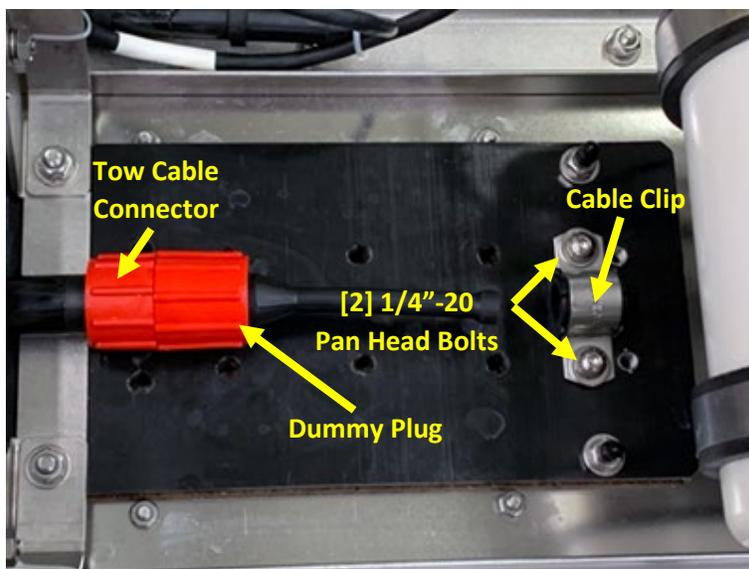


Figure 4-39: OTS LF Sea Cable Connector and Clip

- Mate the two cable connectors and secure the cable to the vehicle by installing the cable clip over the tow cable and securing it to the vehicle but threading the [2] 1/4\"-20 pan head bolts using the 5/32" Allen wrench.

4.2.6.2 Instructions on Securing OTS LF Mount to Vessels Mounting Hardware

The 3400 OTS is connected to a vessel's mounting hardware by using Edgetech provided mounting hardware to secure it to the vessel's mounting hardware.

TOOLS REQUIRED	HARDWARE REQUIRED
3/4" Wrench Adjustable Wrench	[8] 3/4"-10 Bolts, [16] 3/4" Flat Washers, [8] 3/4"-10 Hex Nuts

Instructions:

- 1) The provided OTS Mounting Flange provides 8-bolt holes to connect to a vessel's side mounting hardware. If an adapter needs to be manufactured, size and bolt hole specifications are provided in the **OTS MOUNTING FLANGE DRAWING** found in the **MECHANICAL DRAWINGS SECTION** of this manual.
- 2) Secure the OTS Mounting Flange to the vessel's mounting flange by threading up to [8] 3/4"-10 bolts through [8] flat washers, flanges, [8] 3/4 flat washers, and [8] 3/4"-10 hex nuts using 3/4" Wrench and Adjustable Wrench.



Figure 4-40: OTS LF Mounting Flange with Bolts Installed Figure 4-41: OTS LF Flange Bolt Assembly

4.2.7 3400 OTS LF Sub-Bottom Portable Topside Connection and Activation

The 3400 OTS uses the same portable topside as the standard 3400 system. Connection and system activation is explained in the **3400 PORTABLE TOPSIDE CONNECTION AND ACTIVATION** section and subsections of this manual. A **3400 SYSTEM CONNECTION DIAGRAM** is provided in the **TOWFISH TECHNICAL DESCRIPTION** section of this manual to assist. If using an amplifier, refer to **AMPLIFIER CONNECTION DIAGRAM**.

4.2.8 Performing Sub-Bottom Pre-Deployment Checks

The suggested sub-bottom pre-deployment checks are the same as with a standard 3400 system. They are explained in the [PERFORMING SUB BOTTOM PRE-DEPLOYMENT CHECKS](#) section of this manual.

4.2.9 3400 OTS LF Sub-Bottom Profiler Vehicle Deployment

The 3400 OTS is designed to be securely mounted to a customer's pole mounting over a vessel's side. It is not designed to be towed.

4.2.9.1 Obtaining the Best Sonar Imagery

To generate good sonar imagery, the vehicle's pitch, which is how much in degrees the nose is angled up or down, must be less than one-half of the -6-dB beamwidth of the acoustic pulse its highest frequency—and less at lower frequencies. As a rule of thumb, for a 0.5-meter long hydrophone array, the -6-dB beamwidth at 10 kHz is 20 degrees. For example, if you are transmitting a 2 to 15 kHz FM pulse using a Tow Vehicle with a 0.5-meter long receiving array, such as in the 3400 Tow Vehicle, you must keep the Tow Vehicle from pitching more than about 7 degrees in either direction, or

$$\frac{\frac{1}{2} \times 20 \text{ degrees} \times 10 \text{ kHz}}{15 \text{ kHz}} = 6.6 \text{ degrees}$$

Equation 3

The same criteria applies to vehicle roll, which is how much in degrees it is listing to port or starboard. Sensors can be installed on the Tow Vehicle to measure its pitch and roll under various towing conditions.

4.2.9.2 Conducting Sediment Classification Surveys When Towing

To conduct sediment classification surveys, the reflection coefficient should be measured with better than 10% accuracy. The seafloor reflection's normal component must arrive within the angle corresponding to one-half of the -1dB beamwidth of the vehicle's acoustic axis at the center frequency of the pulse, the frequency where most of the acoustic energy is concentrated, and where the reflection coefficient is measured. As a rule of thumb, for a 0.5-meter long hydrophone array, the -1dB beamwidth at 10 kHz is 4 degrees.

Example

If the seafloor is expected to have slopes of up to 5 degrees during the survey, and a vehicle with a 0.5-meter hydrophone array and a 2 to 10 kHz FM pulse is selected, the -1 dB beamwidth should be at least 10 degrees at 6 kHz. For this pulse and receiving array, the -1 dB beamwidth at 6 kHz is about 7 degrees, or

$$\frac{4 \text{ degrees} \times 10 \text{ kHz}}{6 \text{ kHz}} = 6.6 \text{ degrees}$$

Equation 4

Therefore, only reflection coefficient measurements made when the seafloor slope is within 3.5 degrees of horizontal will be accurate within 10% (1 dB).

The tow vehicle's attitude with respect to the horizontal plane must meet the -1 dB criteria described above for sediment classification surveys. Rough sea conditions tend to move the car up and down vertically, causing oscillations in the images. Discover Sub-Bottom has a swell filter that will help reduce the heave effect on the record. Refer to the [DISCOVER 3400 SUB-BOTTOM SOFTWARE MANUAL](#) for details.

For sediment classification, the tow fish pulses must be calibrated by the end-user. This calibration procedure is also described in the software manual.

4.2.9.3 AHRS Usage

The vehicle's Attitude Heading Reference System (AHRS) provides the operator with pitch and roll data to help make deployment decisions while conducting surveys. The AHRS does not provide a heading.

4.3 3400 OTS Light and Ultra-Light Sub-Bottom Profiler Setup and Activation

4.3.1 3400 OTS Light and Ultra-Light Sub-Bottom Profiler Unpacking and Inspection

The 3400 OTS Light and Ultra-Light Vehicles, portable topside, and tow cable are shipped in separate, reusable, heavy-duty transport cases. Essential cables and documentation are also included.

Before unpacking the system components, inspect the shipping containers for any damage. Report any damage to the carrier and EdgeTech. If the shipping containers appear free of damage, carefully unpack the components, and inspect them for damage. Review the packing list and verify all the listed items are included.

Again, if any damage is found, report it to the carrier and EdgeTech. If any items are missing, immediately contact EdgeTech. Do not install or operate any equipment that appears to be damaged.

Although the items shipped may vary, depending on the customer requirements, the 3400 Sub-Bottom Profiling System typically includes the following:

- 3400 Light or Ultra-Light OTS Vehicle
- 3400 Portable Topside

- Optional Laptop
- AC power cords (1)
- Ethernet cable
- System Recovery Drive
- Electronic Manuals

After unpacking the system components, safely store the shipping containers for later use, including any packing materials. When transporting or storing the system, all items should be packed in their original shipping containers in the same way they were originally shipped. Always store the system in a dry environment when not in use.

4.3.2 Power Requirements

The 3400 power requirements are 120–220 VAC and 50/60 Hz, and the input voltage is auto-sensing.

4.3.2.1 Use of an Uninterruptable Power Supply

The power source should be continuously free of high amplitude, high-frequency transients, as this type of interference could cause degraded performance or damage to the equipment. An Uninterruptable Power Supply (UPS) with power surge protection is recommended for powering the equipment.

Whether or not a UPS is used, the power source should never be the same as that being used to power electric motors, such as pumps and winches, on the survey vessel.

4.3.2.2 Changing to a Non-US Power Plug

An AC power cord is provided for connecting the 3400 Portable Topside to a standard U.S. 3-pronged outlet. For non-U.S. power outlets, you can modify this cord by cutting off the 3-pronged plug and attaching the appropriate plug.

AC POWER CORD WIRE COLOR	FUNCTION
Black	AC line
White	AC neutral
Green	Earth ground

Table 4-7: AC Power Cord Wiring

4.3.3 Navigation Interface

The 3400 Sub-Bottom Profiling System accepts all standard National Marine Electronics Association (NEMA) 0183 message sentence formats from a connected Global Positioning System (GPS) or Integrated Navigation System. The devices are connected to the system by plugging them into the COM A or COM B

serial ports located on the rear panel of the 3400 Topside. Optionally they could be connected to the serial port of the computer as well. Configuration instructions are found in the [DISCOVER 3400 SOFTWARE MANUAL](#).



Figure 4-42: 3400 Topside Serial Port Navigation Connection

4.3.4 3400 Portable Topside Placement

Ideally, the Portable Topside will always be in a dry, sheltered area that is protected from weather and water spray. However, the unit's rugged design allows it to be exposed to light precipitation when the case is sealed.

CAUTION! Never operate or open the unit where it can become wet from sea spray or precipitation. Injury or death from electric shock can occur as well as damage to the equipment.

The unit should also be placed in an area where the temperature is consistently between 0°C and 40°C (32°F and 104°F). Avoid areas of direct sunlight, especially in tropical environments, as heat buildup could occur, and viewing the laptop display and status indicators could be difficult. The location should also enable direct communications with the deck crew that is handling the tow vehicle.

4.3.5 3400 Light and Ultra-Light Pole-Mounting Instructions

The 3400 OTS Light and Ultra-Light vehicles are designed to be mounted on a customer's Schedule-80 2-inch pipe pole using [2] 1/2" Bolt assemblies. Customer Pole hole spacing and dimensions are found in [ERROR! REFERENCE SOURCE NOT FOUND.](#) of this manual.

TOOLS REQUIRED	HARDWARE REQUIRED
<ul style="list-style-type: none"> • 3/4" Wrench • Adjustable Wrench • Needle Nose Pliers 	<ul style="list-style-type: none"> • [1] Customer Schedule-80 2-inch pipe pole • [2] 1/2"-13 Hex Head Bolts • [2] 1/2"-13 Hex Nuts • [2] 1/2" Split-Lock Washers • [4] 1/2" Flat Washers • [2] 1-1/16" 15/16" Split Rings • [1] 5 oz Tube 70% Molybdenum Disulfide

Instructions:

1. Lift and slide your manufactured Schedule-80 2-inch pipe pole onto the vehicle's Schedule-160 1-1/2-inch pipe mounting on the top of the 3400 vehicle while properly orienting it by matching the [2] bolt holes in each piece.
2. Coat the 1/2" -13 bolts and screws with molybdenum disulfide before threading.
3. Thread both screw hardware assemblies through each hole to secure the pipes together. Each hardware assembly should be assembled by threading the [1] 1/2" bolt through [1] 1/2" washer, both pole and pipe mount holes, [1] 3400 nylon lifting strap*, [1] 1/2" washer, [1] 1/2" split lock washer, and [1] 1/2" hex nut. Tighten with a 3/4" crescent wrench and an adjustable wrench.

NOTE: The nylon lifting strap is optional. It can be looped around either bolt assembly and pulled up through the center of the hole, making it accessible for use.

4. Install the [2] 1/16" split rings to each bolt assembly using needle-nose pliers.

NOTE: Additional fairings and/or bracing may be required depending on the operating conditions (pole length, speed, and sea state). Contact EdgeTech [CUSTOMER SERVICE](#) for suggestions.



Figure 4-43: 3400 OTS Light and Ultra-Light Pole Mounting with Strap Installed.

4.3.6 3400 Light and Ultra-Light Pole-Mounting Using the Optional 3400 OTS Light and Ultra-Light Flat Plate Pole Mounting Adaptor Flange

EdgeTech offers an optional Flat Plate Pole Mount Adaptor Flange designed to be mated with the 3400 vehicle's Schedule-160 (pipe) pole mounting and a customer's matching flange to provide further stability to 3400 vehicles. A matching flange can be manufactured using the dimensions provided in **FIGURE 2-10: 3400 OTS LIGHT AND ULTRA-LIGHT FLAT PLATE POLE MOUNT ADAPTOR FLANGE**. This Adaptor Flange can be purchased pre-installed with the vehicle or separately in a **3400 OTS LIGHT AND ULTRA-LIGHT POLE-MOUNT ADAPTOR PLATE KIT**.

The Adaptor Flange is secured to the vehicle by aligning, installing, and securing the plate using the [2] 1/2" bolt assemblies. The vehicle with and an installed adaptor flange is installed on a customer manufactured pole-mount flange using adaptor plate face's [4] 3/4" bolt assemblies.



Figure 4-44: 3400 Light and Ultra-Light Flat Plate Pole-Mount Adaptor Flange

4.3.6.1 3400 Light and Ultra-Light Flat Plate Pole Mount Adaptor Flange Installation

TOOLS REQUIRED	HARDWARE REQUIRED
<ul style="list-style-type: none">• 3/4" Wrench• Adjustable Wrench• Needle Nose Pliers	<ul style="list-style-type: none">• [1] 3400 OTS Light/Ultra-light Adaptor• [1] Customer Schedule-80 2-inch pipe pole• [2] 1/2"-13 Hex Head Bolts• [2] 1/2"-13 Hex Nuts• [2] 1/2" Split-Lock Washers• [4] 1/2" Flat Washers• [2] 1-1/16" 15/16" Split Rings• [1] 5 oz Tube 70% Molybdenum Disulfide

NOTE: The 1/2 inch hardware needed to install the flange onto the vehicle is included with the 3400 OTS Light and Ultra-Light Vehicles.

Instructions:

1. Lift and slide the adaptor flange onto the pipe mounting on the top of the 3400 vehicle while correctly orienting it by matching the [2] bolt holes on the adaptor plate mounting pipe and [2] bolt holes in the vehicle pipe mounting.



Figure 4-45: 3400 Light and Ultra-Light Adaptor Flange Installation - Adaptor Installation and Alignment

2. Each hardware assembly should be assembled by threading the [1]1/2 bolt through, [1] 1/2" washer, both adaptor, and vehicle mounting pipe holes, [1] 3400 nylon lifting strap, [1] 1/2" washer, [1] 1/2" split lock washer, and [1] 1/2" hex nut. Coat the bolts with molybdenum disulfide before threading.

NOTE: The nylon lifting strap is optional. It can be looped around either bolt assembly and pulled up through the center of the hole, making it accessible for use.



Figure 4-46: 3400 Light and Ultra-Light Adaptor Flange Installation - Threading 1/2" Bolt Assembly

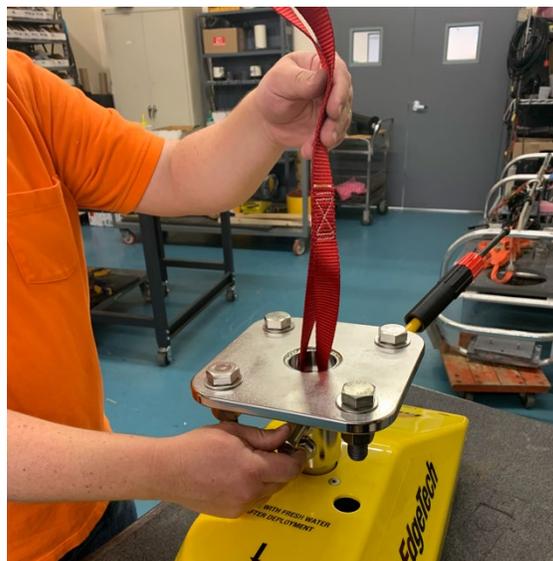


Figure 4-47: 3400 Light and Ultra-Light Adaptor Flange Installation - Lifting Strap Installation



Figure 4-48: 3400 Light and Ultra-Light Adaptor Flange Installation - Bolt Hardware Configuration

3. Tighten both 1/2" both assemblies using a 3/4" wrench and adjustable wrench.
4. Install the [2] 1-1/16" split rings to each bolt assembly using needle-nose pliers.



Figure 4-49: 3400 Light and Ultra-Light Adaptor Flange Installation - Tightening Hardware Assembly



Figure 4-50: 3400 Light and Ultra-Light Adaptor Flange Installation - Split Ring Installation



Figure 4-51: 3400 Light and Ultra-Light Adaptor Flange Installation - Pole-Mount Adaptor Flange Mounted

4.3.6.2 3400 OTS Light and Ultra-Light with Flat Plate Pole Mounting Adaptor Flange Mounting

TOOLS REQUIRED

- 1 1/8" Crescent Wrench
- Adjustable Wrench
- Needle Nose Pliers

HARDWARE REQUIRED

- [4] 3/4-10" Hex Nuts
- [4] .75 Split Lock Washers
- [2] 3/4-10 2.5" Screws
- [8] 3/4" Washers
- [2] 3/4 -10 3" Bolts
- [2] 1-1/16" 15/16" Split Rings
- [2] 1/4" Clevis Pins
- [1] 5 oz Tube 70% Molybdenum Disulfide

Instructions:

A matching pole mount flange is needed to mate with the 3400 OTS Adaptor Flange. A matching flange can be manufactured using the dimensions provided in [ERROR! REFERENCE SOURCE NOT FOUND.](#) and **FIGURE 2-10: 3400 OTS LIGHT AND ULTRA-LIGHT FLAT PLATE POLE MOUNT ADAPTOR FLANGE.**

1. Tuck the 3400 nylon lifting strap into the pipe mount hole, so it does not interfere with the flanges' fitting.
2. Coat the 3/4" bolts and screws with molybdenum disulfide before threading.
3. The starboard forward and aft port assemblies should be assembled by threading the [1] 3/4-10 3" bolt through, [1] 3/4" washer, both [2] flange plates, [1] 3/4" washer, [1] 3/4" split lock washer, and [1] 3/4" hex nut. Next, tighten using the 1 1/8" Crescent Wrench and Adjustable Wrench. A [1] 1/4" clevis pin is then pushed through the bolt end and secured with a split ring using the needle-nose pliers.



Figure 4-52: 3400 Light and Ultra-Light Adaptor Flange Plate Bolt Assembly Locations



Figure 4-53: 3400 Light and Ultra-Light Adaptor Flange Plate Bolt Assembly - Bolt Tightening



Figure 4-54: 3400 Light and Ultra-Light Adaptor Flange Plate Bolt Assembly - Clevis Pin and Ring Installation

4. The starboard aft and forward port assemblies should be assembled by threading the [1] 3/4-10 2.5" screw through, [1] 3/4" washer, both [2] flange plates, [1] 3/4" washer, [1] 3/4" split lock washer, and [1] 3/4" hex nut. Tighten using a 1 1/8" Crescent Wrench and Adjustable Wrench. Coat the bolt with molybdenum disulfide before threading.



Figure 4-55: 3400 Light and Ultra-Light Adaptor Flange Plate Screw Assembly Locations

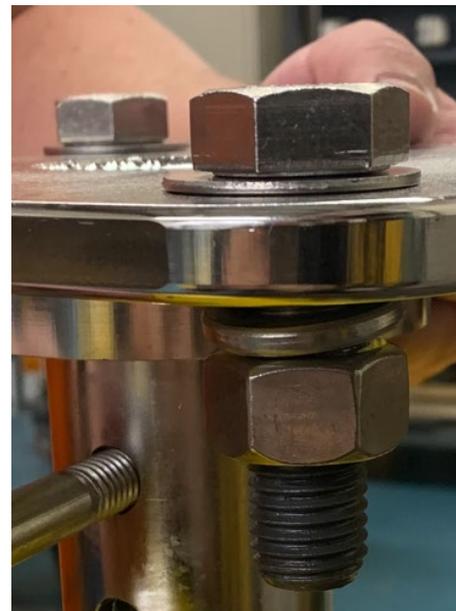


Figure 4-56: 3400 Light and Ultra-Light Adaptor Flange Plate Screw Assembly Locations

4.3.7 Connecting 3400 OTS Light and Ultra-Light Sub-Bottom System Components

WARNING! Do not connect the tow cable to the 3400 Portable Topside before connecting it to the tow vehicle; otherwise, injury or death can occur if the tow cable's exposed connector is energized. Always connect the tow cable to the tow vehicle first.

4.3.8 Connecting and Attaching the Tow Cable to the Vehicle

To connect and attach the tow cable to the tow vehicle:

1. Verify that the tow cable is not connected to the portable topside.
2. Coil the tow cable in a figure-eight configuration.
3. Verify that the tow cable and vehicle connectors are free of corrosion or dirt. If dirty, clean them with an alcohol wipe.
4. Apply a thin film of silicone grease to the pins of the vehicle tow cable connector.
5. Mate the connectors by pressing them firmly together. Do not wiggle the connectors.
6. Mate the connector locking sleeves.
7. Secure the tow cable to the pole mounting using tie wraps. Electrical tape can also be used.

4.3.9 3400 OTS Light and Ultra-Light Portable Topside Connection and Activation

The 3400 OTS Light and Ultra-Light uses the same portable topside as the standard 3400 system. Connection and system activation is explained in the [3400 PORTABLE TOPSIDE CONNECTION AND ACTIVATION](#) section and subsections of this manual. A [3400 OTS LIGHT AND ULTRA-LIGHT SYSTEM CONNECTION DIAGRAM](#) is provided in this manual's [TOWFISH TECHNICAL DESCRIPTION](#) section.

4.3.10 Performing Sub-Bottom Pre-Deployment Checks

The suggested sub-bottom pre-deployment checks are the same as with a standard 3400 system. They are explained in the [PERFORMING SUB BOTTOM PRE-DEPLOYMENT CHECKS](#) section of this manual.

4.3.11 3400 OTS Light and Ultra-Light Vehicle Deployment

The 3400 OTS Light and Ultra-Light vehicles are designed to be securely mounted to a customer's pole mounting over a vessel's side. They are not designed to be towed.

4.3.11.1 Obtaining the Best Sonar Imagery

To generate good sonar imagery, the vehicle's pitch, which is how much in degrees the nose is angled up or down, must be less than one-half of the -6-dB beamwidth of the acoustic pulse its highest frequency—and less at lower frequencies. As a rule of thumb, for a 0.5-meter long hydrophone array, the -6-dB beamwidth at 10 kHz is 20 degrees. For example, if you are transmitting a 2 to 15 kHz FM pulse using a Tow Vehicle with a 0.5-meter long receiving array, such as in the 3400 Tow Vehicle, you must keep the Tow Vehicle from pitching more than about 7 degrees in either direction, or

$$\frac{\frac{1}{2} \times 20 \text{ degrees} \times 10 \text{ kHz}}{15 \text{ kHz}} = 6.6 \text{ degrees}$$

Equation 5

The same criteria applies to vehicle roll, which is how much in degrees it is listing to port or starboard. Sensors can be installed on the Tow Vehicle to measure its pitch and roll under various towing conditions.

4.3.11.2 Conducting Sediment Classification Surveys When Towing

To conduct sediment classification surveys, the reflection coefficient should be measured with better than 10% accuracy. The seafloor reflection's normal component must arrive within the angle corresponding to one-half of the -1dB beamwidth of the vehicle's acoustic axis at the center frequency of the pulse, the frequency where most of the acoustic energy is concentrated, and where the reflection coefficient is measured. As a rule of thumb, for a 0.5-meter long hydrophone array, the -1dB beamwidth at 10 kHz is 4 degrees.

Example

If the seafloor is expected to have slopes of up to 5 degrees during the survey, and a vehicle with a 0.5-meter hydrophone array and a 2 to 10 kHz FM pulse is selected, the -1 dB beamwidth should be at least 10 degrees at 6 kHz. For this pulse and receiving array, the -1 dB beamwidth at 6 kHz is about 7 degrees, or

$$\frac{4 \text{ degrees} \times 10 \text{ kHz}}{6 \text{ kHz}} = 6.6 \text{ degrees}$$

Equation 6

Therefore, only reflection coefficient measurements made when the seafloor slope is within 3.5 degrees of horizontal will be accurate within 10% (1 dB).

The tow vehicle's attitude with respect to the horizontal plane must meet the -1 dB criteria described above for sediment classification surveys. Rough sea conditions tend to move the car up and down

vertically, causing oscillations in the images. Discover Sub-Bottom has a swell filter that will help reduce the heave effect on the record. Refer to the [DISCOVER 3400 SUB-BOTTOM SOFTWARE MANUAL](#) for details.

For sediment classification, the tow fish pulses must be calibrated by the end-user. This calibration procedure is also described in the software manual.

4.3.11.3 AHRS Usage

The vehicle's Attitude Heading Reference System (AHRS) provides the operator with pitch and roll data to help make deployment decisions while conducting surveys. The AHRS does not provide a heading.

5.0 MAINTENANCE

The 3400 Sub-Bottom Profiling System is ruggedly designed and built, therefore requiring little maintenance. To ensure long-lasting and reliable service, however, some periodic maintenance is recommended. This section provides some maintenance recommendations and includes instructions on disassembling and reassembling a Tow Vehicle should it be required to replace internal components.

5.1 Portable Topside

The 3400 Portable Topside requires no maintenance.

5.2 Cleaning 3400 Vehicles and Tow Cable After Use

After retrieving the 3400 vehicle from the water, use a hose to wash it down, along with the tow cable, with clean, fresh water. Thoroughly spray the transducers and the hydrophone arrays from underneath the tow vehicle and remove any buildup of debris that may have been trapped inside. Inspect the inside of the tow vehicle, especially the transducers, the hydrophone arrays, and the cables, for any damage and loose connectors. Also, inspect the tow cable and the connectors on each end.

After washing down the tow vehicle, clean the transducers and hydrophone arrays using a mild, non-abrasive detergent and water. Do not use any abrasive detergents or ammonia-based cleaners. After cleaning, thoroughly spray the transducers and hydrophones again with fresh water.

5.2.1 Cleaning the 3400 LF OTS Vehicle Mounting Flange After Use

Special attention should be paid to rinsing the OTS LF mounting flange after use, as its recessed structure can trap corrosive saltwater.



Figure 5-1: OTS LF Mounting Flange Recessed Structure

5.3 Inspecting and Cleaning the Underwater Connectors

Regularly inspect the contacts on each underwater connector's pins on the tow vehicle's connector and the tow cable connector for corrosion or oxidation. To remove any oxidation, rub the contacts lightly with an 800-grit emery cloth cut into strips equal to or less than the width of a contact. A pencil eraser can also be used for this purpose. The female sockets can be cleaned using a cotton swab and rubbing alcohol. A .22 caliber bore brush with only nylon bristles can be used to remove light oxidation.

To extend the life and increase the connectors' reliability, apply a thin film of silicone dielectric grease, such as Novagard G624 general purpose silicone grease or an equivalent, to the entire surface of each male pin. A small amount of grease should also be applied to the opening of each female socket.

NOTE: Remember to always install dummy connectors on the tow cable's connector and the vehicle's tow cable connector.

5.4 Storage

When not in use, all the 3400 Sub-Bottom Profiling System components should be packed in their original shipping containers, in the same way they were originally shipped and stored in a dry area.

5.5 Altering the 3400 Sub-Bottom Profiler Towfish Configuration

The procedures below describe how to alter the configuration of the 3400 Tow Vehicle. There is little to no reason to disassemble the tow vehicle. Should you need to disassemble the tow vehicle for any reason, contact **EDGE TECH CUSTOMER SERVICE** before any attempts to disassemble the vehicle.

CAUTION! Disassembling a Tow Vehicle may void its warranty. If in doubt, contact **EDGE TECH CUSTOMER SERVICE** for more information.

REQUIRED TOOLS

- 5/32 Allen wrench
- Socket wrench,
- 7/16 Socket wrench
- 1/2-inch Socket wrench
- 10-32 Phillips head

5.5.1 Adjusting or Removing the Rear Elevator

The rear elevator is secured to the vehicle by [2] hex screws with washers on both aft fins. The elevator's angle can be adjusted by moving the rear hex screws to one of six possible positions. The trailing edge matches the direction of the nose.



Figure 5-2: Elevator Hex Screw Positions

Adding or Removing the Rear Elevator:

1. Remove the [4] 1/4"-20 Flat Head Hex-head screws with a 5/32 Allen wrench on both side panels and a 7/16" wrench.
2. Remove and save the [4] Shoulder washers from the elevator.

Reverse this procedure to mount the elevator to the vehicle.

To change the position of the elevators:

1. Remove the [2] 1/4"-20 Flat Head Hex-head screws with a 5/32 Allen wrench on both side panels and a 7/16" wrench.
2. Move the elevator to the desired position.

- If the vehicle is pitching nose down and you want to level it out, go to a trailing edge higher position.
 - If the vehicle is pitching nose up and you want to level it out, go to a trailing edge in a lower position.
 - Typically the lower three elevator positions are the most suitable for keeping the towfish level at higher tow speeds
3. Reinsert the shoulder washers when reinstalling the 1/4"-20 Flat Head Hex-head screws.

5.5.2 Removing the Sonar Processor Bottle

The bottle can be removed from the tow vehicle for storage or cleaning. However, care should be taken when removing the bottle and reinstalling it.

Do not scratch the bottle, as this can cause corrosion.

1. Remove the screws from the top cover of the tow vehicle with the Phillips #2 screwdriver.
2. Remove the cover completely.
3. Remove the [2] Cotter pins in the [2] latches holding the Bottle in Place.

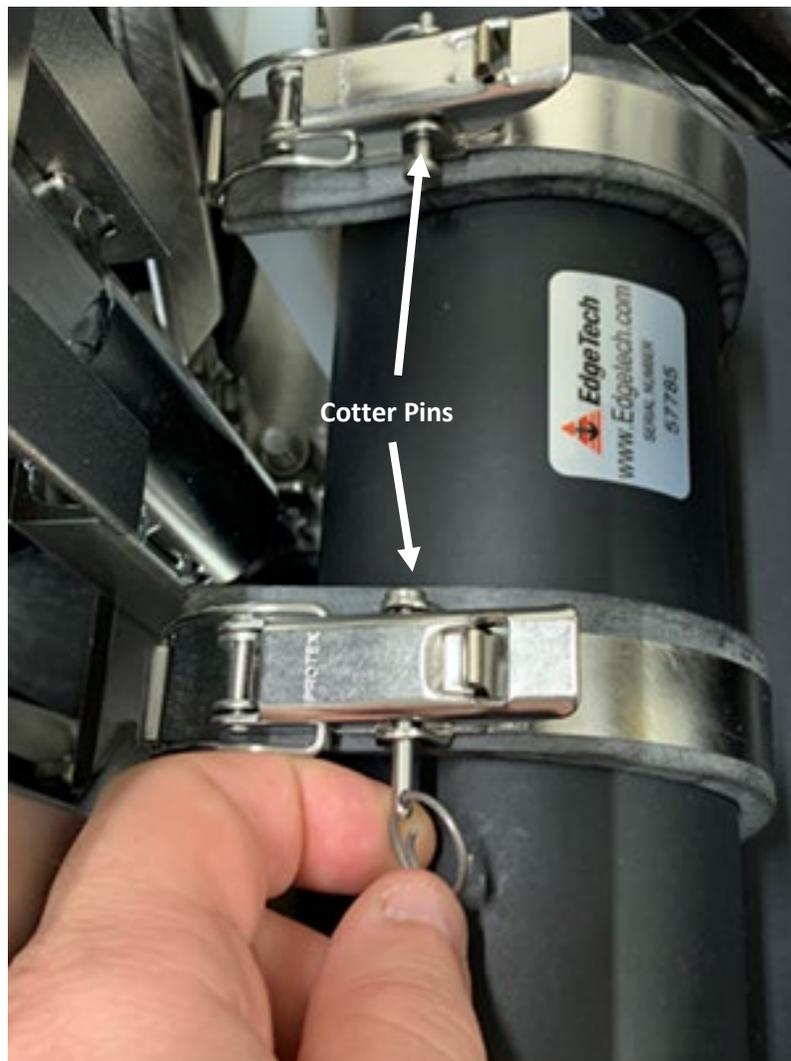


Figure 5-3: Electronics Bottle Cotter Pin Removal

4. Pull back the center clip and lift each latch. Disconnect the clip from the strike

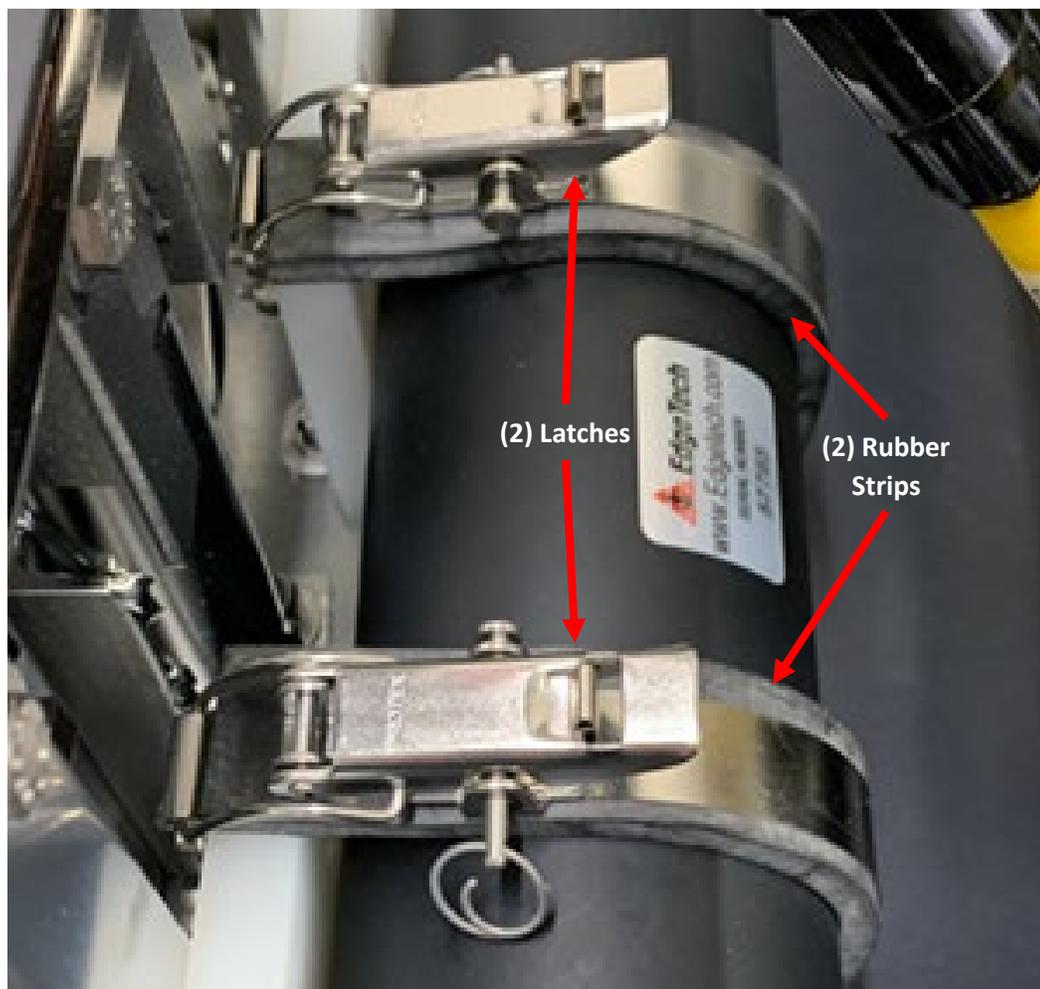


Figure 5-4: Electronic Bottle Latch and Rubber Strip Locations

5. Rubber strips protect the bottle from the latches. Be sure these rubber strips stay inside the vehicle while the bottle is removed. When reinstalling the bottle, replace the rubber between the latch straps and the bottle.
6. Pull the bottle aft (away from the mounting plate) to disengage the bottle pin from its mount.
7. Lift the bottle up and out of the tow vehicle.

To reinsert the bottle, perform these same steps in reverse order.

5.6 3400 OTS Light and Ultra-Light Bottle or Transducer Replacement

There is little to no reason to disassemble the 3400 OTS Light or Ultra-Light vehicle unless removing or installing an EdgeTech transducer or sonar processor bottle. Should you need to disassemble the vehicle for any reason, contact **EDGE TECH CUSTOMER SERVICE** before attempting to dismantle the vehicle for the latest instructions and avoid voiding the product's warranty.

CAUTION! Disassembling a Tow Vehicle may void its warranty. If in doubt, contact **EDGE TECH CUSTOMER SERVICE** for more information.

5.6.1 Removing the Outer Shell of the 3400 OTS Light and Ultra-Light Vehicle

3400 OTS Light and Ultra-Light vehicles can be opened by unthreading the [2] 1/2" bolt pole mount screws, removing the optional pole mount adaptor plate if attached, and unthreading the [13] 1/4"-20 screws securing the upper shell to the vehicle body, and then carefully lifting the upper shell off the vehicle. This exposes the electronics bottle, transducer, and cabling for service.

TOOLS REQUIRED	HARDWARE REQUIRED
<ul style="list-style-type: none"> • 5/32 Hex Tool • 3/4" Wrench • Adjustable Wrench • Needle Nose Pliers 	<ul style="list-style-type: none"> • 3400 Light or Ultra-Light Vehicle • [13] 1/4"-20 Hex Screws

Instructions:

1. Unthread the [2] 1/2" bolt assemblies in the pole mounting pipe, and if the optional flat plate pole mount adaptor plate is mounted, it will need to be removed as well.



Figure 5-5: 3400 OTS Light and Ultra-Light Mounting 1/2" Bolt Locations

2. Unthread the [13] 1/4"-20 hex screws that attach the shell to the vehicle using a 5/32" hex. There are [3] screws on top, [2] screws forward, [2] screws aft, and [6] screws on the port and starboard sides of the vehicle.

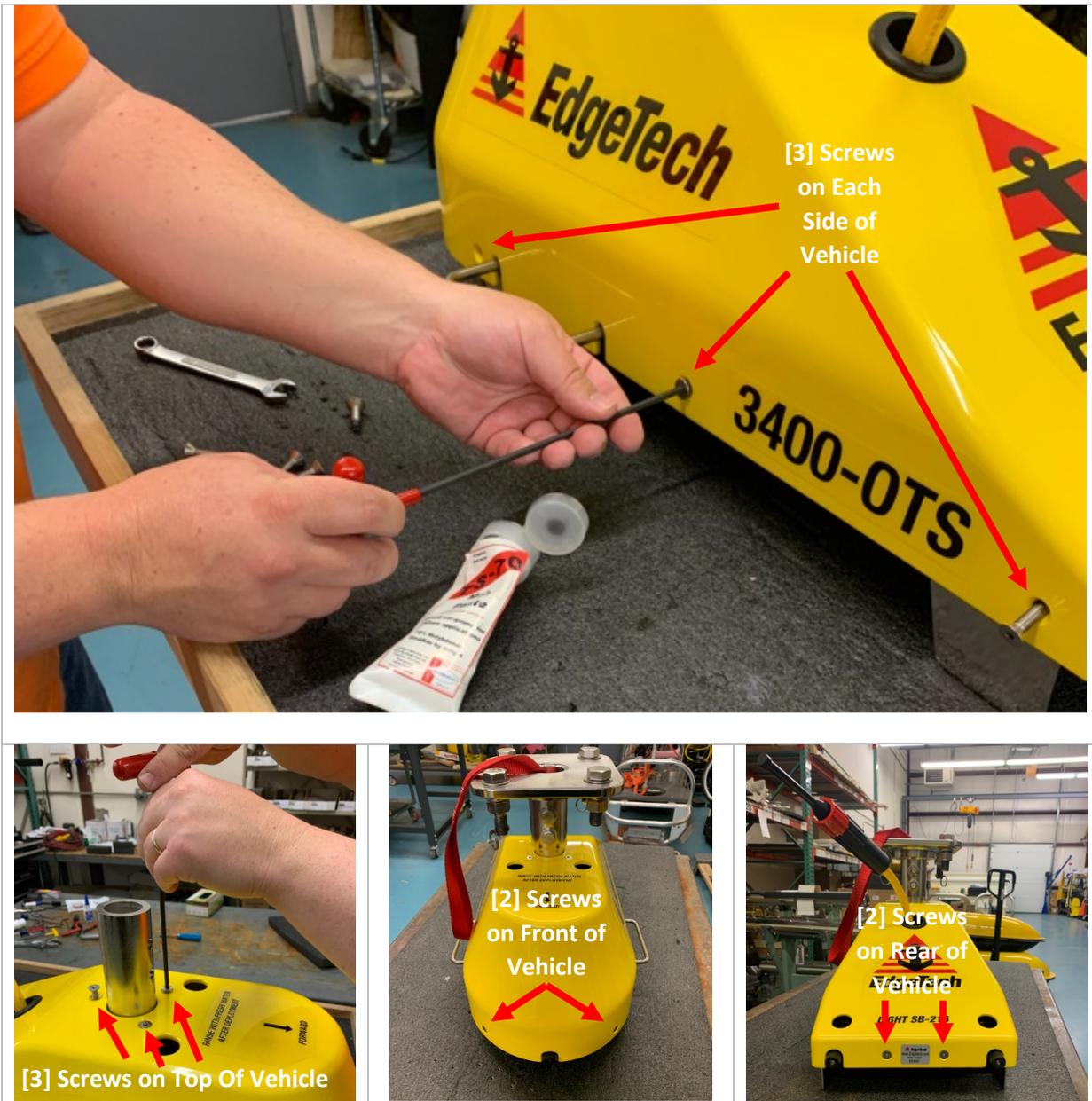


Figure 5-6: 3400 OTS Light and Ultra-Light Vehicle Shell Removal - Unthread [13] Mounting Screws

3. Lift the upper outer shell from the vehicle. If it is snug, it can be wobbled off. Take care to guide the vehicle cable through the hole.



Figure 5-7: 3400 OTS Light and Ultra-Light Shell Removal

5.6.2 3400 OTS Light and Ultra-Light Transducer Removal and Installation

Removing the sonar transducer involves unplugging the transducer cable from the electronic bottle, removing the cable ties securing the cabling to the vehicle, unthreading and removing the worm clamp securing the transducer to the vehicle, pulling the transducer mount back, and lifting the transducer and cable from the vehicle. Installing is a reversal of the removal process.

TOOLS REQUIRED	HARDWARE REQUIRED
<ul style="list-style-type: none"> Flathead Screwdriver or Hex Nut Driver Cutting Plier 	<ul style="list-style-type: none"> 3400 Transducer ½" Band Width 3-5/8" to 6-1/2" Drive Worm Clamp [3] Cable Ties

Transducer Removal Instructions:

1. Remove the outer shell as instructed in the **OPENING THE 3400 OTS LIGHT AND ULTRA-LIGHT VEHICLE** section of this manual.
2. The transducer cabling is secured to the vehicle using heavy cable ties. Cut each using a cutting plier.
3. The transducer is secured to the vehicle with a drive worm clamp and two mounting brackets. Unthread the worm clamp screw using a flathead screwdriver or hex nut driver. The transducer and cabling can then be lifted from the vehicle by pulling back on the mounting brackets and lifting the transducer from the vehicle.



Figure 5-8: 3400 OTS Light and Ultra-Light Transducer Installation - Cable Ties

Transducer Installation Instructions:

1. Mount the transducer by pulling back on the transducer mounting brackets and sliding the transducer into place.
2. Secure the transducer into place ½" Band Width 3-5/8" to 6-1/2" Drive Worm Clamp. Thread screw in with flathead or hex screwdriver.
3. Secure cabling to the inner vehicle frame using heavy cable ties. Wiring should be managed with enough slack not to be unplugged.
4. Install the outer shell as instructed in **THE INSTALLING THE OUTER SHELL OF THE 3400 OTS LIGHT AND ULTRA-LIGHT VEHICLE** section of this manual.



Figure 5-9: 3400 OTS Light and Ultra-Light Transducer Installation - Worm Clamp and Mounting Bracket Locations

5.6.3 3400 OTS Light and Ultra-Light Electronics Bottle Removal and Installation

The 3400 OTS Light and Ultra-Light electronics bottle is removed by unplugging both cables from the electronics bottle and unthreading the [2] 1/4" bolt assemblies securing the bottle to a mounting block. Installing the sonar bottle is a reversal of the removal process.

TOOLS REQUIRED

- 7/16" Wrench

HARDWARE REQUIRED

- 3400 Sonar Bottle
- 3400 Mounting Block
- [2] 1/4"-20 Bolts
- [2] 1/4" "Split Lock Washer
- [2] 1/4" Flat Washer
- [1] 5 oz Tube 70% Molybdenum Disulfide

Electronics Bottle Removal Instructions:

1. Remove the outer shell as instructed in the [OPENING THE 3400 OTS LIGHT AND ULTRA-LIGHT VEHICLE](#) section of this manual
2. Carefully unplug the [2] cables connected to the electronics bottle.



Figure 5-10: 3400 OTS Light and Ultra-Light Electronics Bottle-Cable Disconnection Figure 1



Figure 5-11: 3400 OTS Light and Ultra-Light Electronics Bottle-Cable Disconnection 2

3. Unthread the 1/4" bolt assemblies attaching the electronics bottle to the mounting block and mounting block to 3400 OTS Frame using a 7/16" wrench. Retain all hardware for later installation.



Figure 5-12: 3400 OTS Light and Ultra-Light Electronics Bottle - Mounting Block to Electronics Bottle Mounting Bolt Unthreading



Figure 5-13: 3400 OTS Light and Ultra-Light Electronics Bottle - Mounting Block to Electronics Bottle Bolt Unthreading

4. Carefully lift and slide the electronics bottle from the vehicle's electronic bottle mountings.

Electronics Bottle Installation Instructions:

1. Lift and slide the electronics bottle into the vehicle's electronics bottle mountings.



Figure 5-14: 3400 OTS Light and Ultra-Light Vehicle Bottle Mountings

2. Place the mounting block in place, orienting it to match the bolt holes in the vehicle mounting and mounting block.
3. Secure the block on the bottle by threading [1] 1/4"-20 bolt, [1] 1/4" split lock washer, and [1] 1/4" flat washer using the 7/16" wrench. Reapply Molybdenum Disulfide to bolt before threading.



Figure 5-15: 3400 OTS Light and Ultra-Light Bottle Mounting Block

4. Secure both block and bottle to the vehicle by threading the [1] 1/4"-20 bolt, [1] 1/4" split lock washer, and [1] 1/4" flat washer using the 7/16" wrench. Reapply Molybdenum Disulfide to bolt before threading.



Figure 5-16: 3400 OTS Light and Ultra-Light Mounting Block Bolts

5. Reconnected both [2] cables as shown in **FIGURE 5-10** and **FIGURE 5-11**.

6. Install the outer shell as instructed in **THE INSTALLING THE OUTER SHELL OF THE 3400 OTS LIGHT AND ULTRA-LIGHT VEHICLE** section of this manual.

5.6.4 Installing the Outer Shell of the 3400 OTS Light and Ultra-Light Vehicle

3400 OTS Light and Ultra-Light shell is installed by properly aligning and positioning the shell back on the vehicle, threading the [13] screws securing the upper shell to the vehicle body, and threading the [2] 1/2" bolt pole mount bolt assemblies.

TOOLS REQUIRED	HARDWARE REQUIRED
<ul style="list-style-type: none"> • 5/32 Hex Tool • 3/4" Wrench • Adjustable Wrench • Needle Nose Pliers 	<ul style="list-style-type: none"> • 3400 Light or Ultra-Light Vehicle • [13] 1/4"-20 Hex Screws • [1] 5 oz Tube 70% Molybdenum Disulfide

Instructions:

1. Place the shell back onto the vehicle. Notches in the shell line up with the vehicle handles and bumpers, ensuring proper orientation.

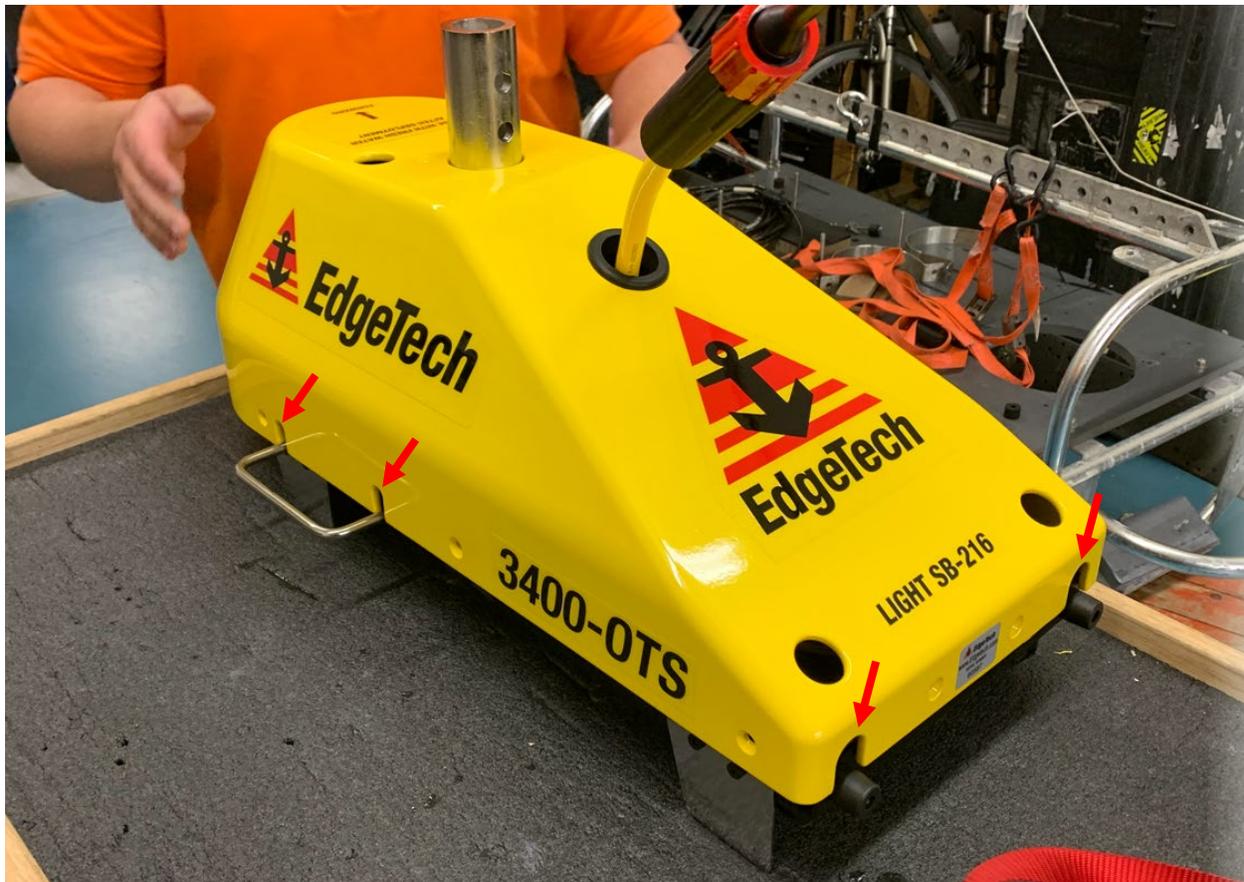


Figure 5-17: 3400 OTS Light and Ultra-Light Shell Orientation and Notches

2. Coat the 1/4"-20 Hex screw threading with Molybdenum Disulfide.
3. Thread the [13] 1/4"-20 hex screws securing the shell to the vehicle using a 5/32" hex. There are [3] screws on top, [2] screws forward, [2] screws aft, and [6] screws on the port and starboard sides of the vehicle. See **FIGURE 5-6** for screw hole locations.
4. Thread the [2] 1/2" bolt assemblies in the pole mounting pipe as depicted in **FIGURE 5-5**. Detailed instructions can be found in the **3400 LIGHT AND ULTRA-LIGHT POLE-MOUNTING INSTRUCTIONS** and **3400 OTS LIGHT AND ULTRA-LIGHT WITH ADAPTOR FLANGE POLE MOUNTING INSTRUCTIONS** sections of this manual.

6.0 TROUBLESHOOTING

The 3400 Towfish is a complex computer-controlled system that requires engineering expertise and the proper test equipment to service. Please contact **CUSTOMER SERVICE** for updated instructions, drawings, documentation, tools, and guidance for any service or troubleshooting. This ensures success and is necessary to maintain the product's warranty.

The 3400 Towfish is a software-controlled computer system that includes both digital and analog connections between components. Many digital connections share and are dependent on the same data and address lines, so one component's failure may cause others to fail. Therefore, to successfully troubleshoot an issue, it is best to understand the data flow and methodically test to isolate the problem.

Should some operational or performance problems occur with the 3400 Sub-Bottom Profiling System, it may be possible to correct them using the troubleshooting guide below.

This troubleshooting guide identifies some symptoms that could occur and presents one or more possible causes and the recommended corrective action for each. When using the troubleshooting guide, perform the corrective action for any given symptom in the order of possible causes, which generally corresponds to the degree of troubleshooting difficulty, from the simple to the more complex.

Before proceeding with any corrective action(s), verify the following:

- The topside is plugged into an appropriate power source
- The 3400 Portable Topside is switched on

NOTE: Be sure to verify that all the cables in the topside and the Tow Vehicle are correctly mated and are not loose or damaged. Most causes of operational or performance problems are a result of a poor connection.

6.1 Computer System Restoration

The following section outlines the procedures for backing up and restoring the system drive. EdgeTech currently uses Macrium Reflect as system restoration software.

CAUTION! All data will be lost upon restoring the system to factory settings. Be sure to backup all data before performing the procedure below.

NOTE: A mouse may be needed to operate the Macrium Reflect UI.

1. Before Powering on the topside, insert the USB3 flash drive into a blue USB3 port.
2. Power on the topside and press the **F**** key. **F**** will be different depending on what you are booting.
 - a. If the Topside is a rack mount, Press **F11**.
 - b. If the Topside is a laptop, Press **F10**.
3. Under the **Boot Manager**. Use the up/down arrows to select the flash drive **Corsair Voyager 3.0**.
4. Wait for **Macrium Reflect** to boot, and then select the **Existing Backup** tabs.
5. Under the **Image** tab, select **Edit**

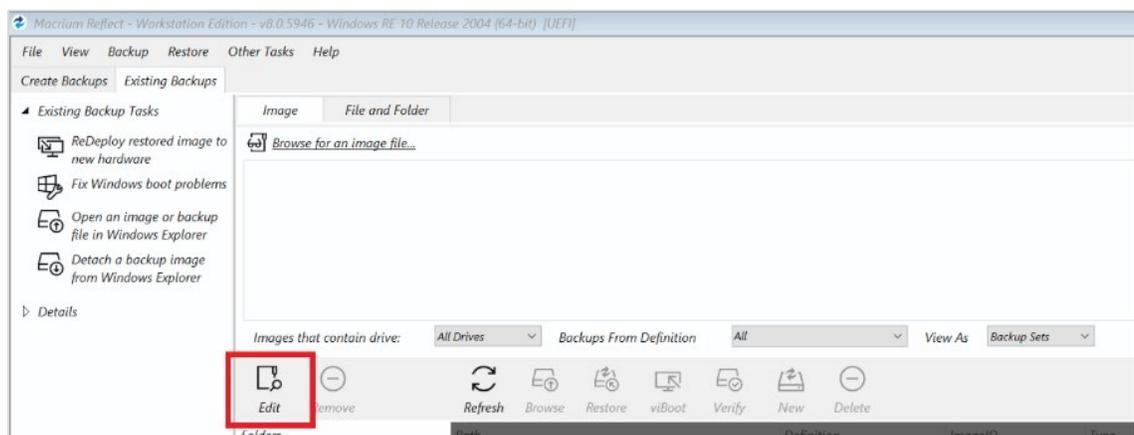


Figure 6-1: Restoration Edit Image Selection

6. **Browse** for the backup folder located on the **0020475_Rev_”** drive. The folder should have the following format **XXXX_SNSSSSS**. Once the folder has been selected, click **OK** and then **OK**.

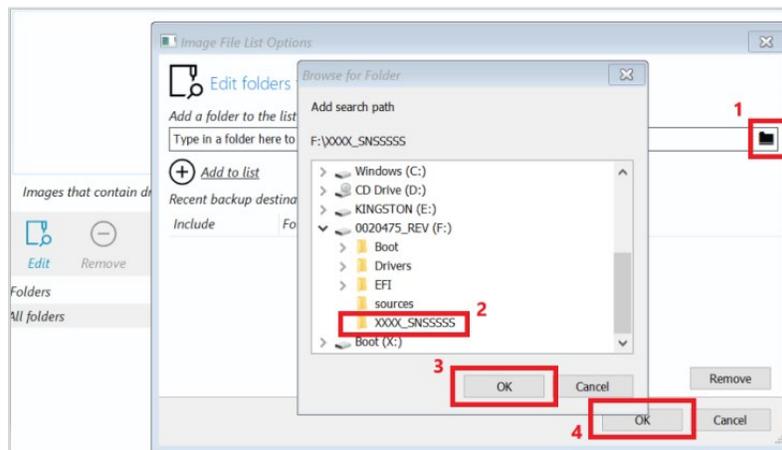


Figure 6-2: Restoration- Add Search Path Confirmation Buttons

7. You should now see that the restore file has been populated in the window. Next, click on **Restore**.

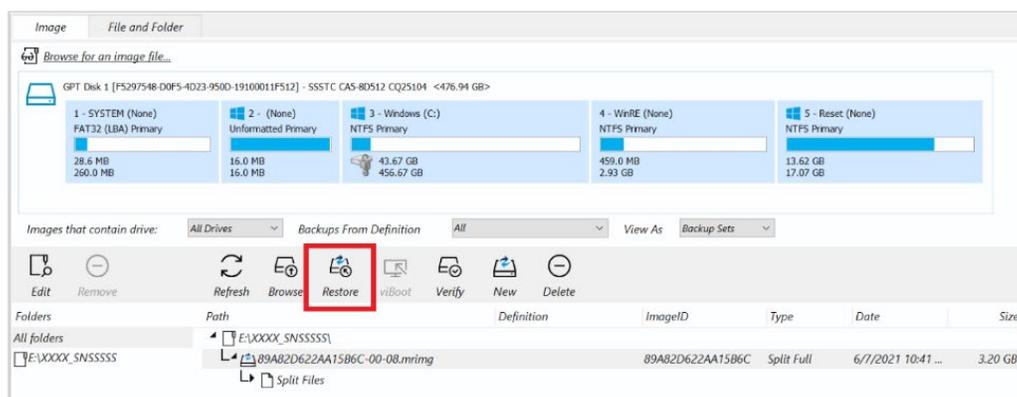


Figure 6-3: Restoration Restore Button

8. On the next window, Select **Next**, followed by **Finish**.

9. A window will open, warning you that everything will be overwritten. Click on the **Check Box** to approve and then click **Continue** on this window.

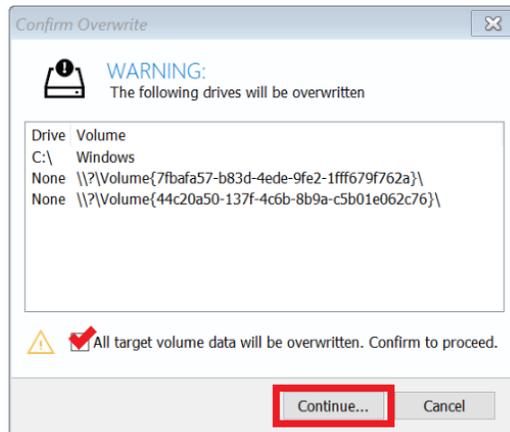


Figure 6-4: Restoration-Confirm Overwrite Continue Button

10. The restoring process should take 2-4 minutes to complete. Once it is finished, click the red button on the bottom left of the screen  and select **Shutdown** and then **Okay**.
11. Remove the USB3 flash drive and turn the power to the topside back on to verify the image has been restored successfully.

6.2 AHRS Calibration (Heading-Not Used in 3400)

CAUTION! Heading from AHRS is not used by 3400 systems.

The Attitude Heading Reference System (AHRS) is calibrated and configured at the EdgeTech manufacturing facility and should not require additional calibration.

7.0 KITS

0021538		ASSY SUB KIT 3400 SBP TOWFISH KIT	
Mtl	Part	Description	Qty
10	0021309	ASSY SUB TO BRIDLE 3400 REMOVABLE	1
20	0021311	ASSY SUB LEAD BALLAST REMOVABLE	1
30	0021312	ASSY TOP CABLE 3400 POE SBP KEVLAR 0.587 TOW 50M	1

Table 7-1: 3400 Towfish Kit

0021575		ASSY TOP KIT SPARES 3400 TOPSIDE RACKMOUNT	
Mtl	Part	Description	Qty
10	0003796	CONN BULKHEAD WETMATE CIRCULAR 08 POS MALE 7/16-20 MCBH8M 0.50 INCH STEM SS	1
20	0014454	POWER SUPPLY CHASSIS CONVERTER AC-DC 90-264V INPUT 48V OUTPUT 365W W/ U-CHASSIS	1
30	0020272	FUSE DRAWER 2 5X20MM 2POLE EXTRA SAFE SNAP IN FOR KM POWER ENTRY MODULE	1
40	0014581	CIRCUIT PROTECT FUSE AXIAL 12.5A 250V FAST ROHS	4
50	0006128	PCB ASSY TOP POWER AMP ANALOG SUB BOTTOM 3100P	1
60	0021675	PCB ASSY TOP TOPSIDE SUB BOTTOM INTERFACE W/ POE	1
70	0013614	PCB ASSY TOP INPUT PSU 2205 AUV 36-60V ISOLATED FROM CHASSIS AT 44V	1
80	0020557	MEMORY FLASH 3400 SB 216 DW	1
90	0012536	ASSY SUB 2205 STORAGE CAPACITOR 06 SIM 4920UF 63VDC	1
100	0012699	ASSY SUB 2205 STORAGE CAPACITOR 12 SIM 9840UF 63VDC	1
110	0021578	PCB ASSY TOP SONAR INTERFACE MODULE SIM 2205 GENERIC WITH TRIG OUT	1
120	0020556	PCB ASSY TOP SONAR ACQUISITION INTERFACE BOARD USB AND DUAL LVDS INTERFACE SAIBU 3400 POE	1

Table 7-2: 3400 Topside Spares Kit

0021539		ASSY SUB KIT 3400 SBP POLE MOUNT KIT	
Mtl	Part	Description	Qty
10	0021310	ASSY SUB POLE MOUNT 3400 REMOVABLE	1
20	0021547	ASSY TOP CABLE 3400 POE SBP KEVLAR 0.587 DECK CABLE 10M	1

Table 7-3: 3400 SBP Pole Mount Kit

0022004 ASSY TOP KIT ACCESSORY 3400			
Mtl	Part	Description	Qty
10	0003246	BAG TOOL 4200 CANVAS	1
20	0022665	LUBRICANT ANTI-SEIZE THREAD COMPOUND 70% MOLYBDENUM DISULFIDE 5OZ TUBE	1
30	0010685	LUBRICANT O-RING SUPER	1
40	0022157	TOOL T-HANDLE ALLEN KEY 3400 5/32 INCH SIZE BALL-END	1
50	0022158	TOOL SCREWDRIVER 3400 ULTRA-GRIP STUBBY NUMBER 2 PHILLIPS	1
60	0022159	TOOL PLIERS 3400 SLIP-JOINT FLAT AND CURVED JAWS CUSHION GRIP 6.50 INCH	1
70	0022165	TOOL WRENCH COMBINATION 3400 7/16 INCH SIZE DEEP-OFFSET POLISHED CHROME STEEL	1
80	0021955	TOOL SOCKET EXTENSION 3400 TOW BRIDLE 12 INCH LENGTH 3/8 INCH SQUARE DRIVE CHROME	1
90	0022363	TOOL SOCKET BIT 3400 TOW BRIDGE 5/16 INCH BALL-END HEX EXTENDED REACH 6.25 INCH LENGTH 3/8 INCH SQUARE DRIVE CHROME	1
100	0022160	TOOL WRENCH COMBINATION 3400 9/16 INCH SIZE DEEP-OFFSET POLISHED CHROME STEEL	1
110	0022161	TOOL WRENCH COMBINATION 3400 3/4 INCH SIZE DEEP-OFFSET POLISHED CHROME STEEL	1
120	0022162	TOOL WRENCH ADJUSTABLE 3400 1-5/16 INCH MAXIMUM JAW CAPACITY 10 INCH OVERALL LENGTH	1
130	0022163	TOOL WRENCH COMBINATION 3400 1-1/8 INCH SIZE POLISHED CHROME STEEL	1
140	0022164	TOOL WRENCH RATCHET 3400 3/8 INCH DRIVE 8.00 INCH LENGTH QUICK RELEASE	1
150	0022005	ASSY TOP SPARES	1
160	0023645	TOOL T-HANDLE ALLEN KEY 3400 1/4 INCH SIZE 6.0 INCH LENGTH	1

Table 7-4: 3400 Accessory Kit

0021642 ASSY TOP SPARES 3400 TOW FISH OTS			
Mtl	Part	Description	Qty
10	0022009	PCB ASSY TOP POE 4 CHANNEL 3400 PROGTEST	1
20	0021312	ASSY TOP CABLE 3400 POE SBP KEVLAR 0.587 TOW 50M	1
30	0020712	ASSY SUB KT 2 X 216 TRANSFORMER NETWORK	1
40	0021643	ASSY TOP SPIDER 3400 SBP TOW CABLE TO BOTTLE AND TRANSFORMER	1
50	0021548	CONN INLINE CIRCULAR 23 POS MALE 20-16 AWG PT06A SERIES	1
60	0021549	CONN CAP DUST 16 CIRCULAR NON-ROHS METAL W/CHAIN	1

Table 7-5: 3400 OTS-LF Vehicle Spares Kit

0023668 ASSY TOP KIT SPARES 3400 OTS 1 X 216 / 424			
Mtl	Part	Description	Qty
10	0005290	HARDWARE NUT STD HEX 1/2-13 316 SS	1
20	0007165	HARDWARE WASHER STD FLAT 0.25 INCH 316 SS	4
30	0007216	HARDWARE WASHER STD SPLIT LOCK 0.5 INCH 316 SS	1
40	0007219	HARDWARE WASHER STD SPLIT LOCK 1/4-20 316 SS	2
50	0007421	HARDWARE WASHER STD FLAT 0.50 INCH ID 1.063 INCH OD 316 SS	2
60	0007434	HARDWARE RING STD SPLIT 1-1/16 INCH OD 15/16 INCH ID 316 SS	2
70	0015232	HARDWARE NUT STD HEX 1/4-20 7/16 INCH WIDTH 7/32 INCH THICK 316 SS	2
80	0016720	HARDWARE WASHER STD SHOULDER 0.25 0.030 INCH BARREL HARD FIBER	2
90	0022178	HARDWARE SCREW STD MACHINE CAP SOCKET FLAT HD 82 HEX 1/4-20 1.00 INCH 316 SS	2
100	0022418	HARDWARE CLEVIS PIN 0.25 INCH DIAMETER 0.875 USABLE LENGTH INCH 316 SS	1
110	0024148	HARDWARE BUMPER PUSH-IN COMPRESSIBLE STEM 0.25 INCH ID 17/64 INCH STEM LENGTH SBR RUBBER BLACK	2
120	0024149	HARDWARE BUMPER PUSH-IN COMPRESSIBLE STEM 0.375 INCH ID 29/32 INCH STEM LENGTH SBRRUBBER BLACK	2
130	0024305	HARDWARE BUMPER UNTHREADED 0.78 INCH HEIGHT 0.80 INCH OD 0.17 INCH MOUNTING HOLE DIAMETER TAPERED RUBBER	1

Table 7-6: 3400 OTS Light and Ultra-Light Spares Kit

0024206 ASSY TOP ADAPTOR 3400 OTS LIGHT POLE TO FLAT PLATE			
Mtl	Part	Description	Qty
10	0024039	WELDMENT ADAPTOR 3400 OTS LIGHT POLE MOUNT STAINLESS STEEL	1
20	0015889	HARDWARE NUT STD HEX 3/4-10 316 SS	4
30	0015890	HARDWARE WASHER STD SPLIT LOCK 0.75 316 SS	4
40	0021349	HARDWARE SCREW STD MACHINE HEX HD 3/4-10 2.50 INCH 316 SS FULL THREAD	2
50	0021345	HARDWARE WASHER 316 SS FOR 3/4" SCREW SIZE, 0.812" ID, 1.5" OD	8
60	0022355	HARDWARE BOLT STD MACHINE CAP HEX HD 3/4-10 3 INCH MODIFIED 316 SS	2
70	0022418	HARDWARE CLEVIS PIN 0.25 INCH DIAMETER 0.875 USABLE LENGTH INCH 316 SS	2
80	0007434	HARDWARE RING STD SPLIT 1-1/16 INCH OD 15/16 INCH ID 316 SS	2
90	0022665	LUBRICANT ANTI-SEIZE THREAD COMPOUND 70% MOLYBDENUM DISULFIDE 5OZ TUBE	1

Table 7-7: 3400 OTS Light and Ultra-Light Pole-Mount Adaptor Plate Kit