



VLF/LF ANTENNA

VLF/LF LOOP ANTENNA SYSTEM



ocean systems division

The ability of very low and low frequency transmissions to penetrate seawater allows a fully submerged submarine to copy a broadcast. For that reason, VLF/LF communication has been used as prime submarine broadcast for many decades.

The most common antenna type used for receiving VLF/LF transmissions is the crossed-loop antenna. Although more advanced VLF/LF receiving antennas, such as Buoyant Wires, are available today, virtually all submarines in service are equipped with a crossed loop antenna.

The Spears Communications Group of Sippican, Inc. has long been the leader in the field of loop antenna systems, having designed and manufactured many of the loop antennas in service today. We offer a standard, high quality submarine loop antenna system that is in service on many submarines. We also offer the capability of providing custom loop antennas to fit the specific performance and/or installation mounting requirements of our customers.

All of the VLF/LF loop antenna systems provided by Sippican are comprised of five units, configured as shown in the diagram on the back. Unit 1, the VLF/LF Antenna/Preamplifier, is designed to mount atop or within the fin of the submarine. It can be provided with or without a fiberglass fairing.

The VLF/LF Antenna/Preamplifier is comprised of a ferrite loaded, crossed loop antenna and a matched set of VLF/LF low noise preamplifiers. One loop is oriented in the fore-aft (F/A) direction of the ship and the other in the Athwartship (ATH) direction. The VLF/LF signals receive patterns on the loop antennas in the form of orthogonal figure-eights. These signals are preamplified by matched low

noise amplifiers which are housed in an electronics cavity located at the center of the antenna. The crossed loop antenna is in the shape of a picture frame and it surrounds the electronics cavity. The crossed loop antenna is fully encapsulated for environmental protection while the preamplifiers are accessible through an access port at the top of the watertight electronics cavity.

The balanced output of each matched loop preamplifier is provided at a single, watertight connector located at the bottom of the Antenna/Preamplifier Unit.

Unit 2, the Outboard Transmission Line, is a shielded, waterblocked cable that carries the R.F. signals from the outboard Antenna/Preamplifier to the



inboard Amplifier/Combiner.

Unit 3, the Hull Penetrator, provides the electrical connection through the submarine pressure hull. This penetrator is of the M24231 type and is sub-safe certified. A stuffing tube can be used in lieu of a penetrator if the customer so desires.

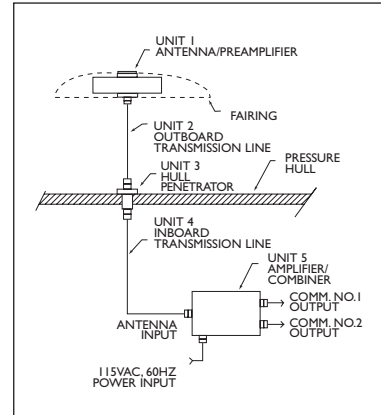
Unit 4, the Inboard Transmission Line, is the same cable type that is used for the outboard Transmission Line. Watertight connectors are not used inboard.

Unit 5, the Amplifier/Combiner, is located in the submarine Radio Room and provides the interface between

the unique Antenna/Preamplifier and standard shipboard receivers. It contains low noise amplifiers, an omni-azimuthal pattern generator, output drivers and the required power supplies for both inboard and outboard use.

The preamplified VLF/LF signals from the Antenna/Preamplifier arrive at the Amplifier/Combiner input as orthogonal figure-eights. These signals are amplified and then combined in an omni pattern generator to produce the omni-azimuthal signal. Separate output drivers provide this omni signal to two, balanced, 50 ohm output jacks

which can be cabled to any standard VLF/LF communication receiver.



PERFORMANCE CHARACTERISTICS

Outputs (two (2) provided)	Balanced, 50 Ohm, Omni-Azimuthal Pattern
Frequency Band	10-160kHz (usable through 600 kHz)
Omni-Azimuthal Response	Better than 1.5dB from 10-160kHz through 360° of Azimuth
System Effective Height	1 meter nominal, open circuit
Sensitivity	Better than 0.26 $\mu\text{V}/\text{m}/\text{Hz}^{1/2}$ - 10-20kHz Better than 0.14 $\mu\text{V}/\text{m}/\text{Hz}^{1/2}$ - 20-160kHz
Output Impedance	50 ohms nominal
Maximum Output	0.1 VRMS open circuit for less than 1% Total Harmonic Distortion

ANTENNA CHARACTERISTICS

Loops	Ferrite loaded, crossed loops, oriented fore-aft and athwartships (displaced by 90° from each other)
Preamplifier	Two Identical (F/A and ATH) located integral to the antenna
Antenna Nulls	Greater than 40db

AMPLIFIER/COMBINER CHARACTERISTICS

Input Power	115VAC, 50/60Hz, 10 watts nominal
-------------	-----------------------------------



Antenna/Preamplifier without fairing



Antenna/Preamplifier with fairing

Sippican, Inc.

Spears Communications Group
 7 Barnabas Road, Marion, MA 02738
 TEL (508) 748-1160
 FAX (508) 748-9569
 EMAIL spears@sippican.com
 WEB www.sippican.com

Sippican is an ISO-9001 Certified Company

