General Description

The USRD Type F50 Transducer was designed for use primarily as an underwater sound receiver in the frequency range 1 Hz to 70 kHz; however, it can be used as a sound source in the frequency range 10 to 70 kHz. The active sensor element consists of lead zirconate-titanate cylinders mounted coaxially and mechanically isolated from each other in an oil-filled, butyl boot. Normally, these transducers are supplied with a 23-m 2-conductor shielded cable. Figure 71 is a photograph of the transducer.

Fig. 71. USRD Type F50 Transducer.

Specifications

Frequency range:	1 Hz to 70 kHz
Free-field voltage sensitivity (nominal):	-205 dB re 1 V/μPa at end of 23-m cable, below 10 kHz
Transmitting voltage response:	117.5 dB re 1 μPa/V at 20 kHz
Maximum driving voltage:	200 V rms (300 V pulse, 30% duty cycle)
Nominal capacitance:	0.015 μF at end of 23-m cable
DC resistance:	greater than 1000 MΩ
Maximum hydrostatic pressure:	6.9 MPa (690-m depth)
Operating temperature range:	0 to 35°C
Weight with 23-m cable:	4.3 kg
Shipping weight:	8.6 kg

Electroacoustic Characteristics

The free-field voltage sensitivity of the Type F50 Transducer is determined by comparison with standard hydrophones in free-field measurements, or by the reciprocity method. Figure 72 shows a typical free-field voltage sensitivity curve in terms of open-circuit voltage at the end of a 23-m cable. A calibration curve is provided with each transducer.

Figure 73 shows a typical transmitting voltage response curve. The transducer will produce an undistorted source level that is linear with driving voltage up to 200 V rms or 300 V pulse, 30% duty cycle, in the frequency range 10 to 70 kHz.

Measurements indicate that the open-circuit voltage sensitivity of the transducer is independent of temperature in the frequency range 1 Hz to 70 kHz at temperatures between 3 and 30°C. The sensitivity changes by approximately 1 dB at 70 kHz because of a slight shift in the resonance frequency as the temperature changes.

Measurements made at hydrostatic pressures to 6895 kPa in a closed tank under controlled pressure and temperature conditions indicate that at this pressure the sensitivity decreases approximately 0.8 dB uniformly over the frequency spectrum.

Typical impedance values for the F50 at 25°C are shown in Fig. 74.

Directivity. The F50 Transducer is omnidirectional within ±0.5 dB at frequencies below 70 kHz in the horizontal (XY) plane--that is, in the plane normal to the longitudinal axis of the transducer. The vertical directivity approximates that of a 4-cm line. Typical directivity patterns in the vertical plane are shown in Fig. 75.

Preparation for Use

Figure 76 is a dimensioned outline drawing showing the orientation of the transducer. Mount the transducer in a fixture that can be clamped around the stainless-steel mounting sleeve near the cable. Wash the entire transducer with a wetting agent or detergent to remove all air bubbles. Permit the temperature of the transducer to stabilize with that of the water before making any measurements.

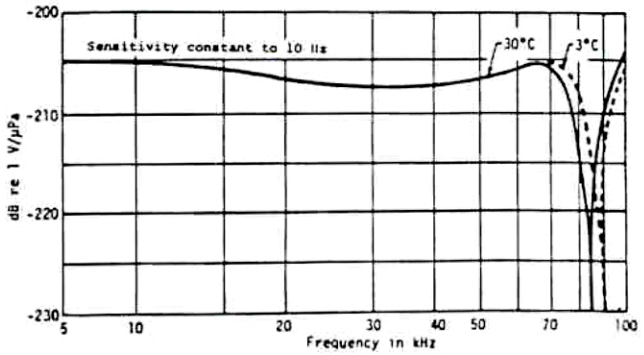


Fig. 72. Typical free-field voltage sensitivity, Type F50 Transducer, open-circuit voltage at end of 23-m coaxial cable.

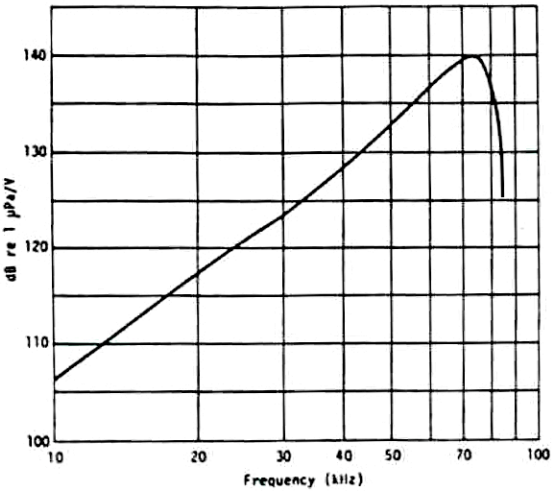
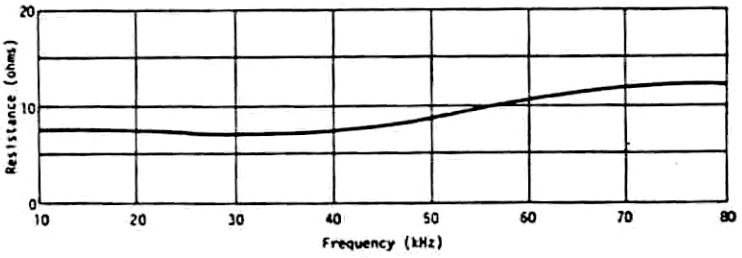
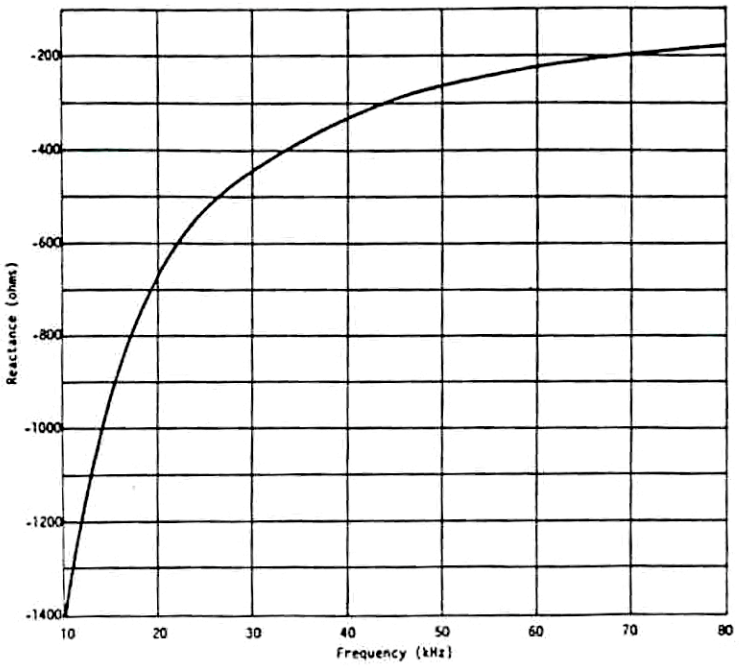


Fig. 73. (Left) Typical transmitting voltage response, Type F50 Transducer.

Fig. 74. (Right) Typical impedance at 25°C, Type F50 Transducer.





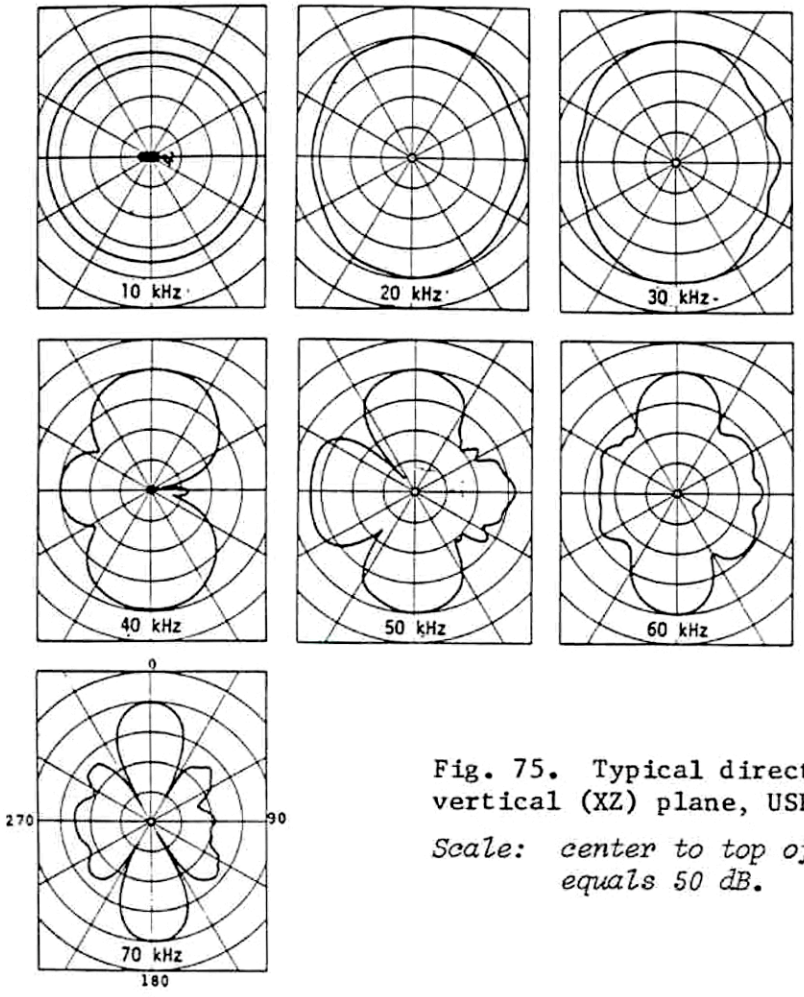


Fig. 75. Typical directivity patterns in the vertical (XZ) plane, USRD Type F50 Transducer.

Scale: center to top of grid, each pattern, equals 50 dB.

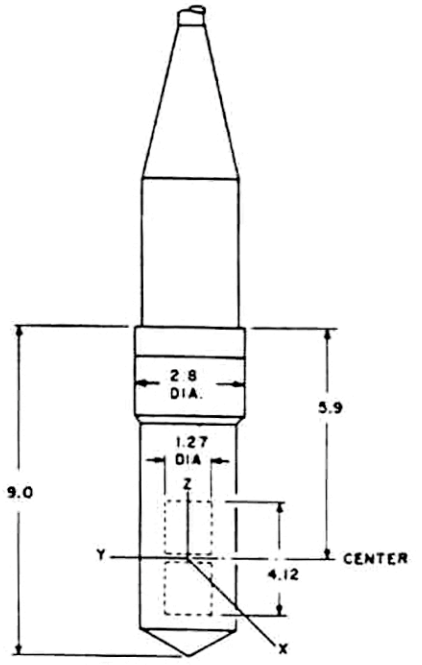


Fig. 76. (Right) Dimensions (in centimeters) and orientation of Type F50 Transducer.