



Designation: E 1065 – 99

Standard Guide for Evaluating Characteristics of Ultrasonic Search Units¹

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1. Scope

1.1 This guide covers measurement procedures for evaluating certain characteristics of ultrasonic search units (also known as “transducers”) that are used with ultrasonic examination instrumentation. This guide describes means for obtaining performance data that may be used to define the acoustic and electric responses of ultrasonic search units.

1.2 The procedures are designed to measure search units as individual components (separate from the ultrasonic test instrument) using commercial search unit characterization systems or using laboratory instruments such as signal generators, pulsers, amplifiers, oscilloscopes, and waveform analyzers.

1.3 The procedures are applicable to manufacturing acceptance and incoming inspection of new search units or to periodic performance evaluation of search units throughout their service life.

1.4 The procedures in Annex A1-Annex A6 are generally applicable to ultrasonic search units operating within the 0.4 to 10 MHz range. Annex A7 is applicable to higher frequency immersion search unit evaluation. Annex A8 describes a guide for measuring sound beam profiles in metals from contact straight-beam search units. Additional Annexes, such as sound beam profiling for angle-beam search units in metal and alternate means for search unit characterization, will be added when developed.

1.5 The values stated in inch-pound units are to be regarded as standard.

1.6 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 ASTM Standards:

E 1316 Terminology for Nondestructive Examinations²

2.2 Other Document:

¹ This guide is under the jurisdiction of ASTM Committee E-7 on Nondestructive Testing and is the direct responsibility of Subcommittee E07.06 on Ultrasonic Method.

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² *Annual Book of ASTM Standards*, Vol 03.03.

Standard Methods for Testing Single Element Pulse-Echo Ultrasonic Transducers³

3. Terminology

3.1 *Definitions*—For definitions of terms used in this guide, see Terminology E 1316.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *aperture*—the dimension(s) of the active area of the piezoelectric element of the search unit as established by experimentation.

3.2.2 *bandwidth (BW)*—that portion of the frequency response that falls within given limits. In this text, the limits used are the -6 dB level, as measured from the peak of the frequency response. The equation used for BW is:

$$BW = (f_u - f_l)/f_c \times 100 \quad (1)$$

where:

f_u = upper frequency,

f_l = lower frequency, and

f_c = center frequency.

Bandwidth is expressed as a percentage.

3.2.3 *center frequency (f_c)*—the frequency value calculated to be at the center of the bandwidth limits.

3.2.4 *depth of field (F_D)*—as measured on the on-axis profile of a focused search unit, that portion of the sound beam that falls within given limits.

3.2.5 *focal length (F_L)*—for focused search units, the distance from the lens to the focal point.

3.2.6 *focal point (F_p)*—for focused search units, the point along the acoustic axis of the beam in water at which the peak (maximum) pulse-echo amplitude response is recorded from a ball target reflector.

3.2.7 *frequency response*—the pulse-echo response of the search unit measured as a function of frequency. (This term also referred to as frequency spectrum.)

3.2.8 *nominal frequency (f_{nom})*—the frequency stated on the label supplied by the manufacturer.

3.2.9 *on-axis profile*—a sequence of measurements made along the acoustic axis of the beam of the search unit.

3.2.10 *peak frequency (f_p)*—the frequency value at the maximum amplitude of the frequency response.

³ Available from the American Institute of Ultrasonics in Medicine, 14750 Sweitzer Lane, Suite 100, Laurel, MD 20707-5906.