

ASA S12 Committee on Noise
Working Group (WG) 47 – Underwater Noise Measurement of Ships

Grades Matrix

Revision 7 – Dated August 8, 2007

GRADE	A	B	C
GRADE NAME	Precision Method	Engineering Method	Survey Method
Example Use/Application (note 1)	Contract requirements Conformance R&D	Contract Requirements Conformance Periodic Assessment R&D	Mission Requirements Periodic Assessment Quick Look R&D
Example User	Navy NOAA Quiet R/V's	UNOLS R/V Commercial Vessels Navy/NOAA	UNOLS R/V's Commercial Vessels
Grade Driving Factor	Accuracy	Accuracy/Cost	Cost (Note 2)
Measurement Reporting Units	SPL - dB re 1 μ Pa		
Reference Distance	1 meter		
Distance Adjustment Method	Spherical Spreading		
Measurement Accuracy	± 2 dB	± 3 dB	± 4 dB
Measurement Repeatability	± 1 dB	± 2 dB	± 3 dB
Frequency Response, Primary	10 to 50,000 Hz	10 to 25,000 Hz	100 to 10,000 Hz
Frequency Analysis, Primary	1/3 octave band	1/3 octave band	1/3 octave band
Frequency Resolution , Primary	23%	23%	23%
Frequency Response, Secondary	10 to 50,000 Hz	10 to 25,000 Hz	100 to 10,000 Hz
Frequency Analysis, Secondary	Narrowband	Narrowband	Narrowband
Frequency Resolution, Secondary	1 Hz (note 4)	As Needed	As Needed
System Sensitivity	10 dB below Sea State 0 (Knudsen)		
Minimum Number of Hydrophones	Three	Three	One
Hydrophone Geometry/Position	Vertical/Beam Aspect	Vertical/Beam Aspect	Beam
Hydrophone Depth(s) (note 5)	15°, 30°, 45° angle	15°, 30°, 45° angle	30° Angle
Minimum Water Depth	5x Ship Length	2x Ship Length	1x Ship Length
Distance Ranging Accuracy	5%	5%	10%
Measurement Distance (CPA)	1x Ship Length		
Deployment Requirements	No limitations. May use bottom mounted hydrophones.	Small craft, such as crew boat. No divers shall be required.	Small "launch" such as RHIB. No divers required.
Weather/Sea Conditions	\leq Sea State 2; (See Note 3)		
Auxiliary Measurements	Engine (shaft) speed, Wind Speed & Direction, Sound Velocity Profiles	Engine (shaft) speed, Wind Speed & Direction	Engine (shaft) speed, Wind Speed & Direction
Other Factors	Mitigation of for cable strum and sea surface affects.	Mitigation for cable strum and sea surface affects.	None
Calibration	Hydrophones field calibrated and Insert Voltage (i.e. full system calibration)	Hydrophones field calibrated	Hydrophones field calibrated

Notes On Next Page

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NOTES:

1. Conformance tests are those that are conducted after contractual requirement tests and would then be performed repeated with frequency greater than a year (3-5 years).
2. Committee believes that most important factor related to cost is the water depth at which measurements can be taken.
3. Higher sea states and/or precipitation should be allowed as long as the user can show they are complying with signal-to-noise requirements. This will have to be details put into writing in the standard itself. For the novice user, they should/could follow the sea state weather limitations, but more advanced user could test in foul weather conditions assuming they meeting S/N requirements.
4. Resolution subject to instrumentation, reporting limitations and costs thereof.
5. Hydrophone depths are to be angle down from the centerline of the ship at the distance of one ship length.