# IALA GUIDELINE

# G1090
# THE USE OF AUDIBLE SIGNALS

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# CONTENTS


**1. INTRODUCTION ..... 4**

**2. AUDIBLE SIGNALS AND THEIR USE ..... 4**

2.1. Audible signals as a hazard warning ..... 4

2.2. Audible signals to augment floating aids to navigation ..... 4

2.3. Considerations ..... 4

2.4. Range of an audible signal ..... 5

2.4.1. Nominal range ..... 5

2.4.2. Usual range ..... 6

2.5. Fog detectors ..... 6

2.6. Remote activated audible signal systems ..... 6

**3. DEFINITIONS ..... 7**


## List of Tables


*Table 1 Nominal range ..... 5*

*Table 2 Usual range ..... 6*

# 1. INTRODUCTION

This Guideline is intended to provide clarification for the use of audible signals to warn mariners of navigational hazards and for use as an augmentation to floating Marine Aids to Navigation (AtoN).

# 2. AUDIBLE SIGNALS AND THEIR USE

## 2.1. AUDIBLE SIGNALS AS A HAZARD WARNING

Although audible signals, also referred to as sound signals, are still used as AtoN, it has been IALA policy since 1985 that these devices should only be used as a hazard warning. These hazards refer to certain man-made structures such as offshore structures, renewable energy infrastructure, bridges, breakwaters, and isolated AtoN. The competent authority shall determine whether a hazard requires an audible signal and the level of reduced visibility per year that justifies its installation (e.g., 10 days of visibility under one nautical mile per year).

Where provided, audible signals for navigational hazards should have a usual range of at least two nautical miles. In addition, competent authorities may require a backup audible signal of a reduced range (these do not necessarily need to be separate units); 0.5 nautical mile usual range is considered adequate for these backup audible signals.

## 2.2. AUDIBLE SIGNALS TO AUGMENT FLOATING AIDS TO NAVIGATION

Audible signals may also be used to augment buoys, both lighted and unlighted, to enhance their effectiveness to the mariner in reduced visibility. Audible signals on buoys are most often powered by the motion of the sea and include bells, gongs, and whistles. Buoys may also be fitted with electronic horns. Audible signals on buoys should be used to warn mariners of a particular hazard, such as proximity to shoals, rocks or other hazards; or to alert the mariner to a change in navigational requirements, such as the entrance to a restricted channel.

Where electronic audible signals are used to augment buoys, they should have a usual range of 0.25 to 0.5 nautical miles.

## 2.3. CONSIDERATIONS

There are a number of considerations to be taken into account with regards to audible signals and their use:

- Sound propagates in the atmosphere in a variable manner, making the perception of direction and distance to the emitter difficult. It may be very difficult to estimate the location of danger.
- A linear increase in the perception of a sound corresponds to an exponential power increase in the sound source.
- Background noise level on board vessels may prevent recognition of an audible signal.
- Occasionally, sound propagation is such that a signal may be almost inaudible close to the source, but of the expected level further away from the source.
- The identification of the audible signal characteristics may not be reliable as a result of fluctuations in propagation causing interruption of reception.
- An audible signal may be considered a nuisance by the local community.

- In some situations, there is the need to combine two or more sound sources or to install a baffle device to avoid the propagation of sound in a certain direction. In both cases, care must be taken to avoid the sound of one source being cancelled by the sound of the other or by the reflected sound.

## 2.4. RANGE OF AN AUDIBLE SIGNAL

Audible AtoN signal range is calculated as nominal and usual and is expressed in nautical miles. Specific ranges cited in this Guideline refer to the usual range calculation. The following paragraphs provide general definitions for nominal and usual ranges of audible signals; more detailed information and guidance is contained in IALA Recommendation *R0109 The Calculation of the Range of a Sound Signal.*

### 2.4.1. NOMINAL RANGE

The distance at which, in fog, a lookout positioned on the wing of the bridge has a probability of 90% of hearing the signal when subjected to noise as defined by IALA as being equal to or in excess of that found in 84% of large merchant vessels, the propagation between the sound signal emitter and the listener occurring during relatively calm weather and with no intervening obstacles (see table 1).

*Table 1 Nominal range*

| Sound Pressure Level (decibels) | | | | |
|---|---|---|---|---|
| Pn(NM) / f(Hz) | 0.5 | 1 | 1.5 | 2.0 |
| 25 | 162 | 172 | 176 | 178 |
| 50 | 149 | 161 | 165 | 168 |
| 100 | 138 | 150 | 154 | 157 |
| 200 | 130 | 142 | 147 | 150 |
| 400 | 122 | 135 | 140 | 144 |
| 800 | 115 | 130 | 137 | 142 |
| 1000 | 113 | 129 | 137 | 144 |
| 1250 | 112 | 129 | 138 | 146 |
| 1600 | 110 | 130 | 140 | 150 |
| 2000 | 109 | 132 | 145 | 156 |
| 2500 | 108 | 136 | 151 | 166 |
| 3150 | 107 | 141 | 160 | 179 |
| 4000 | 109 | 150 | 177 | 199 |

Pn – Nominal Range in sea miles

f – Frequency of the sound in Hz

Nr – Sound Pressure Level, in decibels, of the sound emitted by the AUDIBLE SIGNAL at the reference distance of 1 metre in the direction concerned.

### 2.4.2. USUAL RANGE

The distance at which, in foggy weather, a lookout positioned on the wing of the bridge has a probability of 50% of hearing the signal when subjected to noise as defined by IALA as being equal to or in excess of that found in 50% of large merchant vessels, the propagation between the sound signal emitter and the listener occurring during relatively calm weather and with no intervening obstacles (see table 2).

*Table 2 Usual range*

| Sound Pressure Level (decibels) | | | | |
|---|---|---|---|---|
| Pu(NM) / f(Hz) | 0.5 | 1 | 1.5 | 2.0 |
| 25 | 155 | 162 | 165 | 168 |
| 50 | 144 | 150 | 154 | 157 |
| 100 | 132 | 139 | 143 | 146 |
| 200 | 125 | 132 | 136 | 140 |
| 400 | 117 | 125 | 130 | 135 |
| 800 | 112 | 121 | 128 | 134 |
| 1000 | 110 | 121 | 128 | 135 |
| 1250 | 109 | 121 | 129 | 137 |
| 1600 | 109 | 122 | 132 | 141 |
| 2000 | 108 | 123 | 136 | 148 |
| 2500 | 109 | 127 | 142 | 157 |
| 3150 | 110 | 132 | 152 | 170 |
| 4000 | 112 | 142 | 168 | 193 |

Pu – Usual Range in sea miles

f – Frequency of the sound in Hz

Nr – Sound Pressure Level, in decibels, of the sound emitted by the AUDIBLE SIGNAL at the reference distance of 1 metre in the direction concerned.

## 2.5. FOG DETECTORS

Automatic fog detectors that emit an infrared beam, measure the reflection from the water particles in the air and activate the audible signal at certain visibility thresholds. Reliable remote visibility meters, developed for use at remote meteorological stations, are used as fog detectors. These may be activated by heavy rain or snow, as well as fog. Fog detectors may not be entirely reliable and are expensive to procure, operate, and maintain.

## 2.6. REMOTE ACTIVATED AUDIBLE SIGNAL SYSTEMS

Remote activated audible signals systems can be activated by a competent authority or a mariner via a predetermined radio frequency. These systems may increase reliability and decrease costs of AtoN audible signals.

# 3. DEFINITIONS

The definitions of terms used in this Guideline can be found in the *International Dictionary of Marine Aids to Navigation* (IALA Dictionary) and were checked as correct at the time of going to print. Where conflict arises, the IALA Dictionary should be considered as the authoritative source of definitions used in IALA documents.