

NOISE & VIBRATION DESIGN GUIDANCE
ACOUSTIC INSULATION
(Prepared by Noise Control Engineering, Billerica, MA)

Introduction

The purpose of this document is to provide design guidance for use of acoustic insulation and acoustic absorption in accommodation and machinery spaces. Guidance of installation of the material and composition of the material itself are provided.

General Requirements, Compartments

For accommodation compartments, the minimum overhead absorptive insulation shall consist of a at least 2 inches thick absorptive material, which may be covered by a perforated sheathing or vapor barrier or soft finish surface. The Noise Reduction Coefficient (NRC)¹ shall be 0.75 or greater.

General Requirements, Machinery Spaces

For machinery spaces, the minimum overhead absorptive insulation shall consist of a at least 2 inches thick absorptive material, 0.002 inch maximum vapor barrier, which may be covered by a perforated sheathing. The Noise Reduction Coefficient (NRC) shall be 0.75 or greater. (Almost all material vendors can supply their product's NRC rating.)

For machinery spaces adjacent to noise sensitive compartments, the deckhead or bulkheads boundaries shall be fitted with acoustic treatments incorporating high transmission loss (HTL) materials. Required fire treatments shall be in addition to these treatments. The insulation shall be located on the engine room sides. The HTL material is described in the "Material Requirements" section below.

All boundaries common to noise sensitive spaces shall be treated with at least a two-inch thick, 3 pound density absorptive material.

Material Requirements

Acoustic insulation covers two similar materials with different uses. Absorption material consists of fiberglass or mineral wool. To provide absorption the material must be exposed within the compartment of interest. For instance, fiberglass insulation placed between a structural bulkhead and a joiner bulkhead is not considered acoustic insulation (though it will help increase the airborne transmission loss, not the absorption). All acoustic material should have a NRC of 0.75 or greater. Thermal or fire insulation, if left as the finish surface², can also qualify as acoustic insulation treatments.

Acoustic insulation such as high transmission loss (HTL) material is comprised of either higher density mineral wool or a composite a limp mass layer (usually sheet lead of at least 1 lb/ft²) sandwiched midway between two absorptive materials, minimum two inches thick.

¹ The NRC value defines the amount of acoustic absorption.

² Covered by either a vapor barrier and/or perforated sheathing.

NOISE & VIBRATION DESIGN GUIDANCE
ACOUSTIC INSULATION
(Prepared by Noise Control Engineering, Billerica, MA)

If the absorption material is to be covered by a sheathing, the sheathing must be perforated. Perforated lining usually have 0.125 inch holes on staggered center with a minimum open area of 30%. The sheathing must be painted prior to installation and the builder should cover and protect perforated linings during construction to assure that the perforations are not plugged by paint and debris. If the absorption needs to be covered with an un-perforated sheathing as a vapor barrier, the material should be 0.001 inch thick.

Ceilings panels, if used, shall have sufficient suspension attachments to preclude any sagging, vibration or buckling. All continuous ceiling systems shall have modules with perforations of 1.8 mm holes on 3.5 mm centers. All units shall have an inlay of 25 mm or greater fiberglass or mineral wool.

General Requirements, Privacy

If privacy is a concern each stateroom and cabin should be sound insulated for privacy along all boundary bulkheads. An acceptable design standard for privacy is an airborne Sound Transmission Class (STC) of 25 dB. Joiner vendors should be made aware of this requirement as soon as possible. Divisional bulkhead should be continuous from deck to deckhead. If deck to deckhead bulkheads do not exist, curtain plates or limp mass layers should be used between the top of the joiner and the deckhead.

To provide adequate privacy, the construction needs to present a uniform transmission loss from deck to deckhead and side to side. To ensure privacy in critical areas, penetrations of the bulkhead should be minimized. If penetrations are required, they should be grouped and sealed light tight.