

Soundproofing Suggestions

- A. Trawler Yachts
- B. Express Cruisers/Sportfish
- C. Sailboats
- D. Generators

A. Soundproofing on Trawler Yachts and other Aft Cabin Boats

Interior Noise

Cruising power yachts such as trawlers, sedans and aft cabin yachts, typically have inhabited accommodations during operation. Therefore, it is important to treat both airborne and structure borne noise sources appropriately to ensure acceptable levels of comfort to both operators and passengers.

Typical noise sources

Principal sources of interior noise:

- Engine room noise transmitted directly through floors and bulkheads.
- Exhaust system components radiating noise from behind the linings of the aft cabin.
- Noise transmitted by vibration at the engine and generator mounts.
- Propeller noise in the aft cabin.
- Gear noise in the aft cabin.

Secondary sources of sound in the interior spaces:

- Noise leakage through cracks and holes in the engine room perimeter.
- Vibration from the propeller shaft and struts.
- Exhaust noise at the transom.

Treatments

- Insulate engine room overhead and bulkheads with Soundown's **2" 2 lb/ft² Composite Insulation**.
- Isolate propulsion system and auxiliary equipment with **Rubber Isolation Mounts**.
- Install **"Flexible Shaft Coupling"** to control gear noise.
- Install Soundown's **"Carpet Underlayment"**
- Insulate exhaust component with Soundown's **"Soundwrap"**
- Install Soundown's **"Damping Tiles"** over propeller area on interior hull surface.
- Soundown's **"Headliner and Hull Liners"** back with 1/4" to 1" foam will contribute to interior absorption.

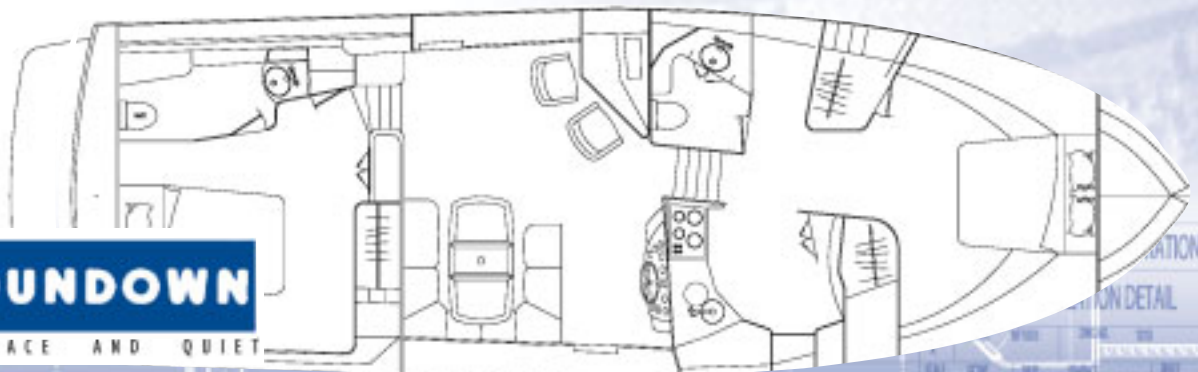
Exterior Noise

Occupants in the cockpit and flybridge areas are most often affected by noise radiating from the exhaust system, propeller, and ventilation. In the case of a poorly insulated boat, airborne machinery noise can also be a problem.

The secondary sources may limit the noise reduction achieved by the use of SOUNDOWN materials alone. Noise leakage points should be sealed while installing the SOUNDOWN insulation. Modifications for reducing the other listed secondary sources may be a considerably larger project requiring the services of a qualified naval architect or of a noise control-engineering firm, such as our associate J&A Enterprises, Inc.

Treatments

- Install Soundown's custom **"High Attenuating Waterdrop Silencers"** with optional underwater discharge.
- Install Soundown's **"QuietPro"** panels as absorptive linings for vents requiring baffles.
- Install **"Flexible Shaft Coupling"** to control gear noise.
- Install Soundown's **"Damping Tiles"** over propeller area on interior hull surface.
- Insulate engine room overhead and bulkheads with **Soundown's 2" 2 lb/ft² Composite Insulation**.



DUAL-LIFT (0.123m)

8"Ø (203.2mm) ENGINE EXHAUST PIPE

LOCATION
SECTION DETAIL

B. Soundproofing for Sportfish and Express Craft

Sportfish and open boats such as express cruisers operate with the occupants in direct contact with the outside ambient noise. The noise sources that have the greatest impact on the comfort levels in these boats are typically airborne exhaust and machinery noise and in some cases structureborne propeller or jet drive noise on the open decks. Although the exterior noise typically has the largest impact on the comfort level for these boats, interior noise underway and at anchor should not be ignored.

Exterior Noise

Primary Sources of Exterior Noise:

The current trend is to build high speed, high horsepower, and light-

weight boats. As a result, the demand for a properly designed and executed noise control plan becomes more important to achieve successful comfort levels. It is also important to note that the level of comfort is not always directly related to overall decibel levels in an open boat. The ambient water wash noise sets a lower limit to the achievable quiet for exterior spaces. These water-noise levels range from 78-87 dB(A) on high speed craft depending on hull design and actual boat speed. It is common to have pure tonal noise sources such as gear whine, or turbo whine, or exhaust rumble as an annoyance problem even when below the overall level of the wash noise. Sound quality, not just level, should be a concern in the acoustic treatment of these boats.

Interior Noise

Primary Sources of Interior Noise:

Typical noise problems in the interior spaces of these boats arise from both airborne and structureborne paths. Airborne noise in the interior spaces is typically caused by insufficient acoustic insulation of the machinery space overhead and bulkheads. It may also be caused by direct leakage through hatch perimeters and wire/hose penetrations between the interior space and the machinery space.

The structureborne noise may be introduced into the accommodations by means of stiff engine mountings, rigid stanchion or deck support from hull bottom structure and insufficient isolation of exhaust or other auxiliary components.

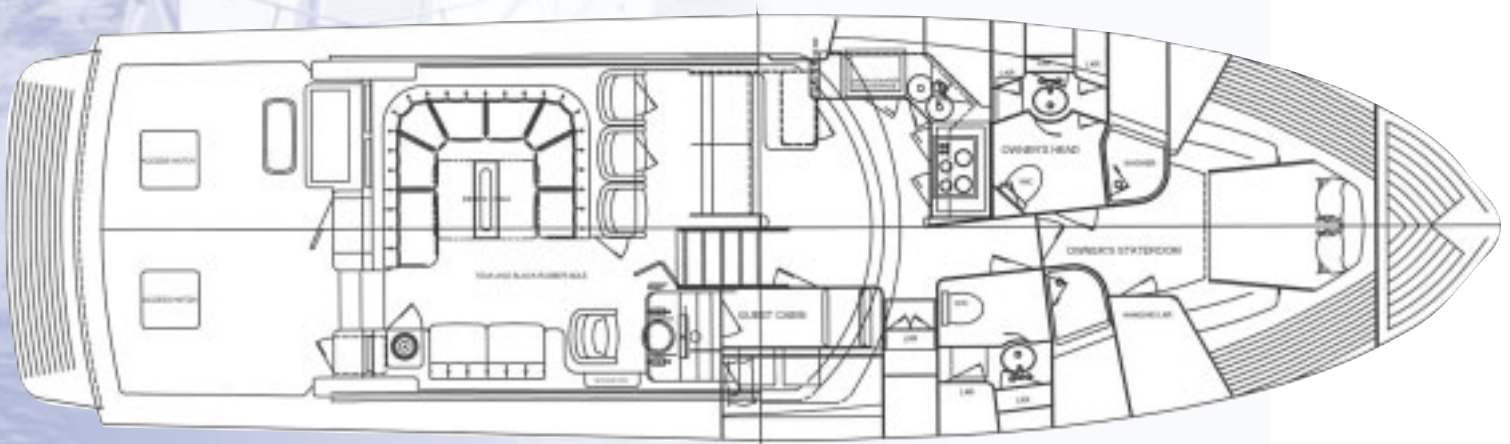
The "conditioning" of the interior spaces is also an important factor to the sound comfort levels. Hard surfaced, reverberant, interior spaces are noisier and have an adverse effect on communication than those with an absorptive treatment.

Treatments

- Install Soundown's custom "**High Attenuating Waterdrop Silencers**" with optional underwater discharge for even quieter operation.
- Insulate engine room overhead and bulkheads with Soundown's **2" 2lb/ft² Composite Insulation**.
- Install Soundown's "**QuietPro**" panels as absorptive linings for vents incorporating baffles.
- Install Soundown's "**Damping Tiles**" over propeller area on interior hull surface to reduce structure-bourn noise.
- Install "**Flexible Shaft Coupling**" to control gear noise.

Treatments

- Insulate engine room overhead and bulkheads with Soundown's **2" 2lb/ft² Composite Insulation**.
- Isolate propulsion system and auxiliary equipment with **Rubber Isolation Mounts**.
- Isolate engine room stanchion supports on Soundown's "**Ring Bushing Mounts**" and/or isolate (Float) cabin sole on "**Sylomer**" isolation support foam.
- Install Soundown's "**Carpet Underlayment in Salon**" or "**Damping Sheet**" to the underside of "hard" finish decks.



C. Soundproofing For Sailboats

In sailboats, machinery noise is usually most bothersome below deck. The space closer to the noise source and is completely surrounded by the vessel's structure. Objectionable noise on deck or in the cockpit area is mainly attributed to propulsion and generator exhaust rumble. In some cases the engine room ventilation system may deliver noise to deck level.

In a sailing vessel, there are essentially three ways to minimize noise problems:

- 1) Provide a tight and properly insulated enclosure for the machinery,
- 2) Properly isolate the machinery and exhaust from the hull and structure,
- 3) Appoint the interior of the vessel with absorptive materials.

Although there are many deck and interior designs, most aft cockpit sailboats have the engine under the companionway; with either no quarter berth, one quarter berth or two quarter berths. Assuming that the machinery is correctly mounted, the next step is to create a properly insulated engine enclosure. Panels of an enclosure should be stiff rather than wide expanses of thin unreinforced paneling. The enclosure should be airtight, so cracks and holes should be sealed. As with all engines proper ventilation needs to be present for both combustion and cooling. Air ventilation ducts are needed and may be a problem, as they carry noise as well as air vent ducts requiring proper insulation. Open spaces under the

floor should be bulkheaded to stop noise from traveling under the deck. In many situations it may be reasonable to create a partial aft bulkhead directly behind the engine and gear, thereby constructing a more complete enclosure. Electrical panels extending through the cabin should have a back plate installed, so insulation can cover this obvious leak.

Engine Under Center Cockpit

Designs with engine under center cockpit usually have the equipment in an engine room, i.e. a space with a top, two bulkheads and sides (maybe the hull side). It is very important the walls surrounding the machinery go down to the hull, so noise cannot escape underneath. Door or hatch openings must close completely and be well sealed with gasket material. The SOUNDOWN barrier composite insulation should be complete (not just on the open panels), and should butt to the corners. The insulation may be covered with perforated aluminum. This material protects the insulation and provides a high level of finish.

Engine Under Floor Or Settee

Designs with engine under floor or settee use the hull underneath and the floor above become the primary boundaries around the engine. To increase the effectiveness of the enclosure it may be wise to create a bulkhead forward and aft of the engine. If there are saddle

Treatments

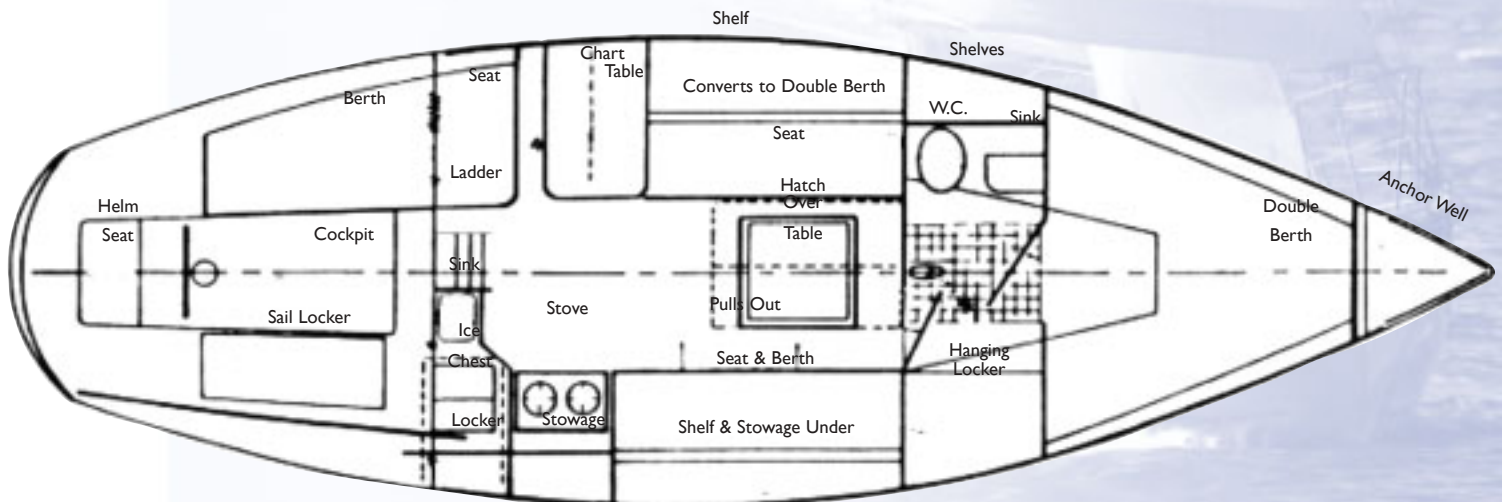
- Insulate engine room overhead and bulkheads with Soundown's **2" 2lb/ft2 Composite Insulation**.
- Isolate propulsion system and auxiliary equipment with **Rubber Isolation Mounts**.
- Install Soundown's custom **"High Attenuating Waterdrop Silencers"**
- Install Soundown's **"Damping Tiles"** over propeller area on interior hull surface to reduce structure-borne noise.
- Soundown's **"Headliner's and Hull Liners"** back with 1/4" to 1" foam will contribute to interior absorption.
- Install Soundown's **"QuietPro"** panels as absorptive linings for vents.

tanks along side, they should be used as the sidewalls. If there are no tanks, then it is advised to add side panels. Create total enclosure if possible.

The hatches over the machinery space are the main source for noise leakage. Be sure that they fit tightly and seal them with gaskets. Hatches are best dogged down on the gaskets. Carpeting installed over SOUNDOWN acoustic carpet underlayment will help to further reduce this noise.

As mentioned earlier air ventilation ducts may be a problem as they carry noise as well as air. Ventilation and combustion air noise traps or baffles should be created and lined with an absorption material such as Quietpro.

If the engine is under the settee or galley island, it should be treated as if it were in an engine box. The box surfaces are to be treated completely with the barrier composite insulation, and ideally the box should be extended from the sole level to the hull bottom.



D. Soundproofing for Generators

Generator noise can be particularly bothersome, because the machine operates during the quiet times of boat use. After the main engine is shut down, you expect quiet, and that's when the generator is most obvious and irritating. Because of this situation more stringent noise control measures may be required for the generators.

Isolation

ISOLATION - Vibration control is again very important, and double isolation systems are advised. The mounting should be as flexible as space and safety (deflection during heeling) will allow. Multiple point isolation with the SOUNDDOWN 6- series ring bushing kits is an excellent means of providing stable isolation with a low profile installation. Alternate styles of SOUNDDOWN machinery isolator mounts are also available for these applications.

Insulation

INSULATION - Commercial sound shields are available for diesel units (do not enclose gasoline units) from some generator manufacturers, but space may prohibit their use. Often, insulation on the interior of commercial units is not as good as it should be; replace it with vinyl or lead composite insulation.

If space restricts the use of a commercial sound enclosure, build one using parts of the existing structure such as the overhead, bulkhead or hullside. The balance of the panels to create the enclosure may be flexible acoustic barrier material that is suspended with grommets and velcro tabs or they may be removable plywood, metal or GRP panels that are insulated with SOUNDDOWN vinyl or lead foam composite. The rigid panels often lend themselves the provision for necessary baffled intake and exhaust ventilation passages. Penetrations in the enclosure should be gasketed and tight and the ventilation baffle boxes should be lined with an acoustic absorptive material such as the SOUNDDOWN Quietpro.

Combustion

COMBUSTION INTAKE AND EXHAUST - In many instances involving naturally aspirated generator installations a major source of objectionable noise is attributed to low frequency intake throb. A simple intake resonator-silencing device may be devised to cut this noise in the accommodation by up to 50%. Contact Sounddown for advice regarding this ENMAA Silencer

The final treatment for the "full quieting package" for generators is the super silencing of the exhaust gas discharge by means of installing a SOUNDDOWN Waterdrop Silencer in series with a conventional lifting type silencer. The Waterdrop Silencers aggressively quiet the exhaust rumble at minimal back-pressure. Waterdrop Silencers also eliminate the typical water splash noise by means of discharging the cooling water separately from the exhaust gases. The result is silent discharging at a noise level that is 50 percent lower than conventional single stage systems.



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