Engine soundproofing

Excessive engine noise can be dangerous as well as downright uncomfortable. Duncan Kent tests out a range of acoustic soundproofing materials

I know a good many yacht owners who dread firing up the donkey – and not because of high fuel costs either. No, it’s simply because they can’t stand the noise! So why do we put up with shouting at each other and turning the VHF volume up to 11, when just a little thought, time and money could make engine noise a thing of the past?

Acoustic insulation is now available from a wide selection of outlets at a reasonable price and is simple to install – provided you follow a few hard and fast rules.

**What material?**
Modern soundproofing can be made from glassfibre, Rockwool or, most commonly, open-cell polyester foam. The latter is better at absorbing frequencies generated by a low-revving diesel engine than the much denser closed-cell type. The problem, however, is that open-cell polyester foam will absorb liquids, including water and diesel, so it needs a protective face.

The two most common types of finish on the fuel-and-fire resistant materials are aluminium foil or glassfibre cloth. The foil looks neat and purposeful, but even when it is the glassfibre-backed type it is often easily damaged with tools and sharp edges. The cloth-finished material we tested, supplied by Vetus, seemed to be much tougher.

Better quality materials have two or more layers of foam, with a sound barrier between the layers. The first (thicker) foam layer absorbs much of the noise, while the sound barrier between the foam layers, ideally something with very good sound-deadening properties such as lead, stops the rest. Lead, however, is not only heavy, it’s also quite expensive, which is why it is much more common to find a thin (2-3mm) but very dense, mineral-loaded polymer layer used instead.

Most types have either a polymeric (left), or lead barrier (right)

**‘Better quality materials have two or more layers of foam, with a sound barrier between the layers’**

First of all, we made a 12mm plywood base plate and attached engine bearers to take our test engine, a 17hp, two-cylinder Volvo 2002 marine diesel, which had been removed earlier from the editor’s boat for re-conditioning.

We then built a five-sided box, also from 12mm-thick plywood, designed to fit over the engine and lock into place leaving a 50mm air gap between the engine and soundproofing material. The material was attached to five sheets of 3mm-thick hardboard to make changing from one to the next quicker and easier by simply sliding one set of panels out after testing and sliding a new set in.

All feeds to and from the engine (fuel, cooling water, battery and exhaust) were fed through holes in the base plate and three one-inch diameter air holes were added below the air intake. The exhaust was via a flexible pipe that ran outside the workshop and away from our sound recording area.

The engine was started and set to run at around 2,000rpm (no rev counter was fitted, but the throttle was fixed to the same level for all tests). Using a pre-calibrated smartphone app we then took sound readings with no box at all, then with the box over the engine, it’s important to seal all gaps and corners to stop noise leaks.
Passing messages from below to the helm can be difficult when a noisy engine is running.

The test box was designed to fit perfectly over the engine but empty of soundproofing material, and finally with five different makes, types and thicknesses of commonly available soundproofing material lining the inside of the box.

While the sound recordings we took were reasonably accurate, given the non-lab test conditions, different engines will emit louder or quieter ‘noise’ depending on capacity, stroke, injection type, rpm, load and so on. The actual noise level was not as important to us as the reduction in levels.

Sound levels are measured logarithmically in decibels, which can be a little confusing.

The best way to get a feeling of amplitude is by making a comparison with another familiar noise. For instance, 50dB = a quiet office, 60dB = normal conversation at 1m, 70dB = phone ringing or light traffic, 80dB = a busy street or alarm clock, 90dB = loud factory machinery.

So, in effect, reducing the noise level from the 78dB heard through the empty box at 1m, down to the 65dB through the best insulation tested at the same distance, is the equivalent of coming inside from a busy street and chatting to a mate quietly face to face.

We took sound readings around the box at increasing distances but empty of soundproofing material, and finally with five different makes, types and thicknesses of commonly available soundproofing material lining the inside of the box.
GROUP GEAR TEST
The UK’s most trusted sailing kit tests

Products tested
Prices include VAT, and were correct when we went to press

**Products Tested**

**EC Smith BOAK**

**Price:** £66.74/m²

ECS supplies a wide range of acoustic insulation, including foil, metal, polyurethane and PVC-covered materials. Most are Class 0 fire rated, but not all, so you must specify when ordering. It also supplies foam sheets without the barrier, which are no real use for engine noise sound deadening.

We chose the popular BOAK foam with foil facing, which can be ordered with an easy-clean PVC covering if preferred. The polymeric barrier was thinner than Halyard’s equivalent, but ECS says it is the widely-accepted 5kg/m² minimum standard.

Although the material being slightly thinner (30mm) than the more commonly found 35mm sheets, and consequently lighter, its performance was excellent – giving an impressive 13dB reduction 1m above the engine box and 11dB in front of it.

**CONTACT**

EC Smith & Sons Ltd
TEL 01582 729721
WEB www.ecs-marine-equipment.co.uk

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**Halyard RSP**

**Price:** £77.78/m²

Marine engine systems specialist, Halyard Marine, supplies several types of engine compartment soundproofing. The acoustic constituents are all similar, but the fire-retardant coatings differ. Top of the range Maritex is a tough glassfibre cloth with a sealed, metallised skin that won’t tear or absorb oil yet is fire rated to BS 476/6/7. Sealglass is similar, but meets the reduced Recreational Craft Directive’s ISO 9094 fire requirements.

We tested the more commonly installed 32mm-thick Reinforced Silver Polyester (RSP) sheets with the foil face, which, though it did prove to be tougher than others, isn’t nearly as rip-proof as the cloth-covered types. All types come in 12mm, 32mm and 45mm thicknesses and have a thicker barrier layer (3mm) than some, so its sound absorption properties were very good. Halyard claims up to 15dB reduction, which proved pretty accurate in our tests and made it the second best performer for materials thicker than 30mm.

**CONTACT**

Halyard (M & I) Ltd
TEL 01722 710922
WEB www.halyard.eu.com

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**Noisekiller Lead**

**Price:** £62.50/m²

Noisekiller supplied 15mm-thick sheets of sound-deadening lead, sandwiched inside two thin layers of Class 0 fire rated acoustic foam. Although the thinnest material on test, its lead layer acted as an effective sound barrier with the two layers of foam absorbing the airborne sounds that have been blocked, and to insulate the lead barrier from the bulkhead.

The material arrived bent double, which made it difficult to flatten neatly. Otherwise it was easy to cut with a sharp blade and its self-adhesive backing adhered well.

If this had a slightly thicker top layer of foam it would have been the best on test. However, if space is tight around your engine, this is one of the better performing materials, giving a 9dB reduction at 1m.

**CONTACT**

Noisekiller
TEL 0161 652 7080
WEB www.noisekiller.co.uk

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**Recommended**

**The ideal thickness of material for the average 20-50hp marine diesel**

**The sound-absorbent foam is 2mm thicker than the ECS material**

**The only material with a solid lead barrier, it proved to be very effective**

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**The self-adhesive back works well, but it was difficult to flatten out**

**The 5kg/m² polymer barrier is almost as effective as solid lead**

**Although similar to others, this material performed slightly better all round**
For verdict & results, see p88

**Foil, cloth and hard barrier types are best cut with a modelling knife, but it’s easier to cut foam types with a serrated blade. Thinner sheets cut well with good scissors. Self-adhesive sheets are easy to peel and attach, but must be positioned correctly first time. Suppliers advise that all joints are covered using special joining tape to avoid ‘leakage’. The self-adhesive foil tape worked excellently on the foil-covered material, but the white plastic tape from Vetus peeled off too easily.**

Soundproofed bulkheads should totally encase the engine area. Engine noise can ‘flow’ along the bilges, so bulkheads should continue down to the hull, leaving only limber holes for bilge water. Allow enough airflow for combustion. Air holes ruin insulation, but a simple baffle stops most noise escaping. Finally, all cables and pipes should pass through rubber grommets.

**Vetus Sonitech**

Vetus produces four types of sound insulation: Sonitech Light, Sonitech, Promotech Single, and Promotech Double. Sonitech Light (20/40mm) is a simple foil-faced foam with no barrier. Sonitech (35/45mm) has a damping barrier between two foam layers and the two Promotech materials have a higher fire rating (Double having two barriers with three foam layers). Thicknesses vary from 12/35/45mm to 25/45/60mm. All are liquid tight, fire resistant to BS476 Class 0 and self-adhesive. We selected 35mm cloth-covered Sonitech, rather than the foil face. It was trickier to cut, but tougher than the foil-faced types. The self-adhesive back made installation easy, but the joint tape supplied peeled off within minutes. The material is quite heavy, so we expected it to perform well. However, it was less effective than other similar products, giving a reduction of just 6dB from 2m in front of the engine box.

**Quietlife** £46.23/m²

The material supplied by ASAP Supplies was one of Quietlife’s foam-based types, but the company also makes Rockwool sheets for higher fire-resistant standards and reduced weight. Quietlife meets BS475/6, whereas its Rockwool type reaches the BS476/4 specification.

Keen to try one of the thinner types, we asked for the SlimSlab 23mm, which, despite having less overall thickness, still has a barrier and two foam layers. This material looks very similar to the Halyard Marine sheets and is Quietlife’s general-purpose acoustic insulation, commonly used for small to medium-sized vessels. It performed surprisingly well for its thickness, giving an 8dB noise reduction at 2m – the same as the lead-lined Noisekiller.

The Quietlife range goes up to 58mm in thickness and includes one with a twin barrier for maximum sound deadening, which would be the bee’s knees if you have plenty of space inside your engine compartment and a healthy budget!

**SlimSlab**

For tight engine compartments, SlimSlab has a thick barrier and a thin layer of foam

**Vetus** £81.58/m²

Cutting is best done with a sharp blade

Installation

Foil, cloth and hard barrier types are best cut with a modelling knife, but it’s easier to cut foam types with a serrated blade. Thinner sheets cut well with good scissors. Self-adhesive sheets are easy to peel and attach, but must be positioned correctly first time. Suppliers advise that all joints are covered using special joining tape to avoid ‘leakage’. The self-adhesive foil tape worked excellently on the foil-covered material, but the white plastic tape from Vetus peeled off too easily.

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1. Spray glue is easy to use but messy
2. Line up the material up carefully
3. Tape up the seams with special soundproofing tape

**CONTACT**

**Vetus Ltd**

TEL 02380 454507

WEB www.vetus.com

**CONTACT**

**ASAP Supplies**

TEL 01502 716993

WEB www.asap-supplies.com

**Quietlife** £46.23/m²

**CONTACT**

**ASAP Supplies**

TEL 01502 716993

WEB www.asap-supplies.com

**SlimSlab**

**CONTACT**

**ASAP Supplies**

TEL 01502 716993

WEB www.asap-supplies.com

**While the cloth face is very tough, it would also be prone to dirt and stains**

**For verdict & results, see p88**
Our results were never intended to be directly comparative as we didn’t test identical products. Rather, we evaluated different materials and thicknesses.

Good engine soundproofing will make a huge difference to comfort and safety, allowing crew to sleep and a navigator below decks to communicate clearly with the helm. Every 3dB increase in noise level doubles the sound a human hears, so a loss of 12-15dB will effectively make it four to five times quieter on board with the engine running.

Thickness matters – so go for the thickest material you can fit. It’s the acoustic barrier that stops the noise escaping, not the foam, which is only there to absorb the dissipated sound after it has been arrested by the barrier. The thin foam layer behind the barrier stops resonance in the barrier being transmitted to the hull.

The best performance comes from having a thicker or better barrier. There’s nothing as effective as pure lead, but the downsides are its price and its weight. A lead-loaded polymeric barrier is the next best compromise by far. A thick layer of foam might muffle higher-pitched sounds, but it won’t stop lower, thumping frequencies from turning your engine compartment into a boom-box!

I recommend that you choose the thickest material you can fit – preferably with a real lead integral barrier. If space is tight, put a thicker layer in the areas where you have more room – on the engine cover, for instance.

Those with a lesser budget should go for one of the thinner materials, preferably with a 5kg/m² polymer barrier, as this stops the bulk of the noise penetrating into the cabin and cockpit.

### Conclusion

Effective engine soundproofing requires both an acoustic barrier and sound-absorbing foam. In marine applications it has to be resistant to the hot, moist, salty and oily environment of a boat’s engine compartment, so lining it with plain or ‘egg-box’ foam is not recommended.

Plastic open-cell foams do have a dampening effect on high frequency noise, but not low level ‘thumping’ noise. Sound-absorbing foam will dampen high frequency noise but not low level ‘thumping’ noise.

### Recommended Products

**Noisekiller Lead**

- **Price:** £62.50/m²
- **Description:** If there isn’t much space between your engine and its box, a lead barrier is the best solution.

**Halyard RSP**

- **Price:** £77.78/m²
- **Description:** Although it has a polymer barrier, this one proved very effective at deadening the boom.

**EC Smith BOAK**

- **Price:** £66.74/m²
- **Description:** Another polymer barrier, also an excellent performer. Slightly thinner, lighter and cheaper.

### Can it be done cheaper?

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### Product specifications

<table>
<thead>
<tr>
<th>Make</th>
<th>Brand</th>
<th>Foam</th>
<th>Barrier</th>
<th>Sheet sizes</th>
<th>Sheet price</th>
<th>Finish</th>
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<td>30mm</td>
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