

# 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



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'

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.

The second, thinner layer of foam is there simply to insulate the barrier from the bulkhead, preventing the transmission of vibrations to the hull.

Different overall thicknesses of material are available, usually between 15mm and 50mm. Acoustically, thicker is better, but it's often difficult to find room to fit it into the engine compartment of the average modern cruising yacht. For installations with very little air-gap between the engine and side panels you'd be better using a thinner foam, but one with a lead barrier to compensate.

Two primary standards of soundproofing material are available, one being noticeably more expensive than the other.

For coded craft in the EU you must use insulation that is both non-absorbent and meets the latest ISO 9094 Class 0 fire-retardant requirements of the RCD. To my mind this is the minimum standard you really should try to attain. For commercial purposes and Lloyd's-rated installations there is a more stringent specification that must be adhered to, where only Class A-rated fireproof materials can be used. These materials are often based on rock mineral wool.

**How did the products perform? See p86**



Without decent noise insulation you may miss something vital during a radio call

PHOTOS: BOB AYLOTT

## How we tested them



We mounted the engine onto a pallet and then led the fuel, exhaust, cooling water and electrics out through the bottom

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 led 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 =



*We took sound readings around the box at increasing distances*

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.



# Products tested

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



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

## EC Smith BOAK £66.74/m<sup>2</sup>



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/m<sup>2</sup> minimum standard.

There is no self-adhesive option on this version, but ECS does offer the choice on some other types, for a little extra money.

Despite 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.



The 5kg/m<sup>2</sup> polymer barrier is almost as effective as solid lead

**CONTACT** EC Smith & Sons Ltd  
**TEL** 01582 729721  
**WEB** [www.ecs-marine-equipment.co.uk](http://www.ecs-marine-equipment.co.uk)



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

## Halyard RSP £77.78/m<sup>2</sup>



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.



Although similar to others, this material performed slightly better all round

**CONTACT** Halyard (M & I) Ltd  
**TEL** 01722 710922  
**WEB** [www.halyard.eu.com](http://www.halyard.eu.com)



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

## Noisekiller Lead £62.50/m<sup>2</sup>



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.

Noisekiller also supplies 32mm-thick, foil-faced sheets with a 2mm-thick PVC barrier and two layers of Class 0 rated fireproof open-cell foam.



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

**CONTACT** Noisekiller  
**TEL** 0161 652 7080  
**WEB** [www.noisekiller.co.uk](http://www.noisekiller.co.uk)

Shown  
actual  
size –  
23mm



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

**Quietlife** £46.23/m<sup>2</sup>



**73dB**  
1m from  
front

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!



The tear-resistant facing was tougher than on other materials

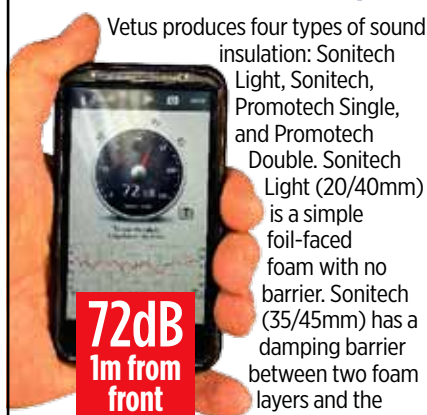
**CONTACT** ASAP Supplies  
**TEL** 01502 716993  
**WEB** www.asap-supplies.com

Shown  
actual  
size –  
35mm



A thinner barrier than the other polymer types, and therefore not as quiet

**Vetus Sonitech** £81.58/m<sup>2</sup>



**72dB**  
1m from  
front

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.



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

**CONTACT** Vetus Ltd  
**TEL** 02380 454507  
**WEB** www.vetus.com



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.

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.



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

For verdict & results, see p88



# The results

dB readings taken at the following distances from the engine box

Make	Brand	Above 0m	Above 1m	Front 0m	Front 1m	Front 2m	Front 3m	Rear 0m	Rear 1m	Rear 2m
ECS	BOAK	73	65	73	68	64	62	75	72	70
Halyard	RSP	73	67	75	70	65	63	73	71	70
Noisekiller	Lead	78	68	79	72	69	66	74	73	71
Quietlife	SlimSlab	77	70	76	73	69	67	77	75	73
Vetus	Sonitech	75	68	74	72	70	69	73	72	70
Box without insulation fitted		84	78	85	79	76	71	84	78	75

## Conclusion

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/m<sup>2</sup> polymer barrier, as this stops the bulk of the noise penetrating into the cabin and cockpit.

## Product specifications

Make	Brand	Foam	Barrier	Sheet sizes	Sheet price	Finish	Fireproof	Adhesive
ECS	BOAK	30mm	5.0kg/m <sup>2</sup> Polymer	1.0m x 0.6m	£40.05	Foil	Class 0	Glue
Halyard	RSP	32mm	5.0kg/m <sup>2</sup> Polymer	1.0m x 0.6m	£46.67	Foil	ISO9094	Self-adhesive
Noisekiller	Lead	15mm	Lead	1.0/2.0m x 1.2m	£75/£140	Foil	Class 0	Self-adhesive
Quietlife	SlimSlab	23mm	5.0kg/m <sup>2</sup> Polymer	1.0m x 0.6m	£27.75	Foil	BS476	Glue
Vetus	Sonitech	35mm	3.6kg/m <sup>2</sup> Polymer	1.0m x 0.6m	£48.95	Cloth	BS4735	Self-adhesive

## Can it be done cheaper?



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

*Sound-absorbing foam will dampen high frequency noise but not low level 'thumping'*

on high frequency noise, but the typical 'thumping' lower frequencies emitted by a marine diesel will pass right through.

Of course, if you lined the compartment with lead first, then glued the foam on top, it would be much better. But then the noise hitting the lead barrier would simply be transmitted to the hull as vibration, which is why professional acoustic material has a layer of foam behind the barrier, for insulation.

The second consideration

is durability. Cheaper foams without a sealed face will absorb fluids, such as oil, fuel and water, which will quickly make them rot, with the added danger of pieces falling onto the engine and exhaust.

The final consideration is fire resistance. Although most foams are rated as 'furniture grade' fireproof, they tend to be poor in this respect.

A properly fire-rated material will 'cocoon' the inferno, giving you time to extinguish it.

## YACHTING MONTHLY

## Recommended Products

### Noisekiller Lead £62.50/m<sup>2</sup>

*If there isn't much space between your engine and its box, a lead barrier is the best solution*



### Halyard RSP £77.78/m<sup>2</sup>

*Although it has a polymer barrier, this one proved very effective at deadening the boom*

### EC Smith BOAK £66.74/m<sup>2</sup>

*Another polymer barrier, also an excellent performer. Slightly thinner, lighter and cheaper*

