

Guide
To
**INSULATING
YOUR RV**

COMFORTABLE

VAN LIVING

in
HOT SUMMERS
and
COOL WINTERS

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INSULATING YOUR RV ACOUSTIC & THERMAL INSULATION PASSIVE COOLING

INTRODUCTION

Insulating an RV is a controversial subject among RV owners. With such a great variety of products and even more opinions about the ones to use, it's unavoidable that individual choices will lead to multiple solutions, customized to local climates and personal convictions. But in the end, if it works for you, then it works great!

Cooling the RV starts with minimizing heat gain by using lighter colored vehicles to reflect as much heat as possible. Parking in the shade will reduce direct solar radiation and insulation limits any radiated and conducted heat gains.

To me, insulating an RV or Cargo Van involves more than just applying a layer of fiberglass insulation; attention should be given to both sound & temperature insulation. Several of the new European style vans are already equipped with some sound-deadening materials and combining them with temperature regulating insulation that has good sound vibration limiting properties is the ultimate goal. Additional temperature control by itself can be achieved with regular insulation and passive cooling techniques, standard in many home designs, can to some degree be applied too.



ACOUSTIC INSULATION

Let's first concentrate on noise reduction for our upcoming van conversion. Cargo vans are notoriously noisy with their exposed walls and ceiling. Contrary to the design of passenger cars, their payload areas are not equipped with interior finishes, specifically designed to add comfort and to reduce exterior noise penetration from reaching its passengers.



Some of the new European cargo vans are already equipped with some basic 'noise reduction padding', but adding some insulation at specific locations around the van may improve the acoustic qualities of the van considerably. Despite the implied need, acoustic insulation for RV's may be overrated, as these vehicles tend to be stationary and not driven on a daily

basis. The high price AND weight of some of these products may deter many from using these materials, without having a major impact on their outdoor experience.

Personally, I would prefer to use the soundproofing qualities of some thermal insulation products, to achieve some level of noise reduction. Fiberglass batting, polyurethane spray foam and Blue Jeans insulation are well-known to serve as a barrier to airborne sounds. In contrast, Styrofoam boards have little effect. This will make for easier installation and a major reduction in weight.

Dynamat is perhaps the best known of these products, is butyl based and quite expensive at approx. \$4.00/sf. Cheapskates substitute it with products like Peel & Seal or Snow and Ice Shield. These roofing materials are asphalt based, but at \$1.50 much less expensive.



Just 25% coverage will limit the redistribution of sound through vibration, but not necessarily the transmission of noise. Butyl and rubberized asphalt are chemical compounds and their use in a confined space may have environmental consequences. These are heavy materials and will easily add 100 lbs to the overall weight of the vehicle.

ACOUSTIC MATERIALS							
	Dynamat	Fatmat	Thinsulate	Snow and Ice Shield	Peel & Seal	Fiberglass	Blue Jeans
Price/sf	\$4.00	\$4.00	\$3.00	\$1.50	\$1.50	\$0.30	\$1.10
Fire Resistant			yes			yes	yes
Contains Chemical Irritants	no	no		yes	yes	no	no
Waterproof	yes	yes		yes	yes	no	no
Noise Reduction	no	no	yes	no	no	yes	yes
Sound Vibration Reduction	yes	yes	no	yes	yes	no	no
Weight	heavy	heavy	light	heavy	heavy	light	light

PASSIVE COOLING

Insulating is only one approach to avoid heat gain/loss. Passive cooling techniques were developed for the home, yet also apply to recreational vehicles.

Cooling is enhanced through natural breezes or by fans that move the air; improved evaporation exposes the skin to dryer air as long as the humidity is not too high. Rising warm air flows out out the vehicle through the roof-mounted vent and that pulls in cooler air from lower ventilation openings.



To boost air movement, exit locations in the form of roof vents can be found in most RV's, yet low placed entryways are virtually non-existent. Windows and doors take their place, but doors are often closed and windows are located fairly high in the walls of the van. A better solution may be to

introduce a floor vent at the opposing end of the vehicle and away from the roof vent. Relatively cooler air from the permanently shaded area below the vehicle would be able to enter the vehicle here, move through the interior to the other end of the van, to exit at the roof vent location, either naturally or mechanically.

There are some limitations to introducing a new opening in the floor of your cargo van. Not only do I feel uncomfortable to cut a sizable hole in the vehicle's body, but it also may expose the interior to exhaust gases, vermin, dust and road debris. Yet increased circulation and relatively cooler air may offset any negative issues.



A new trend in Class B RV's is the installation of a permanent screen door inside the sliding side door. At your campsite, the somewhat awkward side door could

be left open, while preserving your privacy. A major improvement in ventilation, and a great way to keep those nasty bugs out.

More Conventional Passive Cooling Techniques:

Shady Campsites

A shady spot will avoid the harsh summer sun rays to hit your van and keep you consistently cooler during the day. As more and more RV owners install solar panels in their rig, this option becomes less relevant on their boondocking trips.



Waterfront

Oceanside locations, lake or river settings have continual breezes and natural cooling in place.

Window Tints



Dark window tints cut interior temperatures significantly without obstructing views. If permanently installed window tints are not an option for you, removable tints are available that can be applied to any window thru static electricity, removed and reapplied again and again.

Exterior Screening

Residential outdoor shade fabric can be used in addition or in place of an awning and provide a cool and protected place to sit, while preventing the sun rays from reaching your van.

Interior Shades

Heavy-duty, blackout window shades keep the heat and noise out and offer, sometimes much needed privacy. A similar floor-to-ceiling curtain between the front cabin and the living area of the van, will repel the heat generated by the large front windows. In winter, they reduce the area to be heated at night, while opening up during the day allows for a quick warm-up.

Roof Vent

Crucial for proper ventilation, these vents also allow heat to enter the van. A double-insulated dome will mediate heat gain/loss and a vent cover enhance it's use measurably.

RV Fridge

Preventing the sun from hitting the back of your refrigerator, will reduce operating cycles and keep your drinks cooler with lower energy use.



Somewhat Less Passive Cooling

Fans

Continuously circulating air or directing it at your body with fans, will help you feel cooler.

Refrigerator

An evaporator fan in the form of a small computer fan uses little energy, but improves the circulation behind the fridge immensely.

THERMAL INSULATION

This discussion here is not about the solution to the great insulation debate among RV'rs, but my personal view of the many topics involved when insulating an RV. The decisions I take are based on my preferences, my budget, my location(s) and how I'm going to use the van, thus your selection will definitely be different.

I'll focus primarily on boondocking, where temperatures are mostly unregulated; if you're spending most of your time on campgrounds, you may opt for more or less insulation materials.

A highly contested subject is the use of vapor barriers in an RV. I regard the outside metal skin of the van as the main vapor barrier, others would like to add a separate layer. The skin of the van will always sweat and some airflow is needed, for this condensation and the existing moisture inside the van, to escape, otherwise it will lead to moisture, mold and rust problems. An extra vapor barrier doesn't make sense.

At best insulation will keep temperatures regulated for a few hours, but eventually the heat will get in the van and the insulation won't let it out. Ventilation does the same in hot weather. Winter mornings will be cold, because the same insulation is keeping the warmer outside air out longer. You have to balance its benefits and its drawbacks.

Windows may look like a liability, but in winter they can act like solar heaters, while giving ventilation in summer. In hot climates, some insulation with a good roof exhaust will keep the interior cooler day and night, but at some point it is going to get hot inside even with lots of insulation.

Staying cool starts with a light colored van, that will reflect more of the sun's rays. And rather more, than less windows to help regulate the inside temperatures during different seasons. Wear more clothes and use more blankets to offset colder winter temperatures.

With a medium roof Ford Transit, where height is critical, I'm inclined to minimize insulation, especially on the ceiling. I'm not willing to lose much interior space to insulation.

Many issues can be defined by identifying the major insulation areas around the RV:

Floor

The floor is the least important and matters much less when it comes down to insulation needs. My previous cargo van had a ½ inch layer of foam board with ½ inch plywood on top and I wouldn't hesitate to do that again. This rigid panel probably works better as noise reduction material than as insulation.



Walls

For a well-insulated van we have to protect it against conductive, convective and radiated heat transfer.

Polyiso panels often have a reflective barrier on one side. For that to work properly, we'll use a 1 inch air gap.



Install horizontal furring strips along the walls with a full inch Polyiso in between, with the reflective barrier facing the skin of the van. The additional 1 inch air space between the foam and the outside skin prevents heat transfer through conduction. The small air gap also limits the possibility of convection and the reflective barrier eliminates most of the radiated heat. You can add another 2

inch layer of blue jeans insulation, to give you even more protection against the elements.

For me, by applying only a single panel of Polyiso directly to the skin of the van, I maximize the interior space, while minimizing the negative properties of insulation (longer cooling off periods at night and colder mornings). At the same time, increased ventilation keeps me cooler during the day and more windows bring in more heat in winter. In the end your choice will vary greatly, dependent on use, location and your conviction!

Ceiling

The roof gets to withstand the full force of the sun and would benefit most from an increased amount of insulating materials. Polyiso, complemented by an extra layer of blue jeans insulation could increase the R-Value to R-14.

In my van of choice, the medium roof Ford Transit, height is critical; the combined layers of insulation will have to stay within the thickness of the ceiling ribs, to maintain interior standing height.



Roof Vent



The roof vent plays a pivotal role in ventilation, yet at the same time is a major source of heat loss. It is exposed to the sun for most of the day, especially when the van is equipped with solar panels.

Two kinds of insulation will help mediate this.

- Use an insulated domed lid.
- Add a shade or cover to prevent heat gain/loss when not in use.

Windows

With reduced insulation, the windows play an important role in heating the interior in winter, while keeping the van cool by means of ventilation. An extra layer of light blocking, heavy double-sided curtains minimizes heat loss/gain in summer, while opening the windows up in winter, will allow for the morning sun to enter and quickly reheat the cool interior.

Cabin Area

The windows in the front cabin could be treated with Reflectix. A better solution is blocking off the driver's area with an insulated heavy curtain, separating the cabin from the payload area. The curtain would allow continued use of the swiveled passenger chair, while adding more privacy, stealth and insulation. It also reduces winter heating to a smaller interior area.



Refrigerator



While not part of the insulation process to keep us comfortable, the fridge needs the same insulation and ventilation to work properly. An extra 2 inch layer of Polyiso can cut the energy use of a 12V Danfoss refrigerator in half and one or more built-in computer fans will improve ventilation greatly.

Insulation Materials

In addition to the items I described above, there are many more materials that can be used to insulate a van. Each has to be evaluated on its properties to decide its suitability for the location and climate where the RV is to be deployed. A good example is fiberglass use in the wet North-West is prone to absorb moisture and will lead quickly to mold and rust. To the contrary, my old Dodge van used it many years without problems, but was stationed in Florida and used mainly in the southern parts of the US.

Fiberglass

Pros

- Price at \$0.30/sf.
- Suited for dry climates.
- Non-flammable.

Cons

- R-3.5 at 1 inch thickness.
- Doesn't insulate when wet.
- Not mildew resistant.
- Rodents love it.
- It settles and sags with movement.
- Unhealthy breathable fibers.



Reflectix

Pros

- To prevent thermal heat gain.

Cons

- No good RV applications.
- NOT insulation, simply a thermal barrier.
- Fragile material, not for long time use.
- Less effective for heat retention.



- Bulky and difficult to store.
- R-Value of 1.

This material is not intended for use in RV windows. The heat radiated from it will continue to build and could break the glass or ruin window tint or rubber seals.

Polyiso (Polyisocyanurate)

Pros

- R-7 at 1 inch thickness (much less at below 10°).
- Usually has a reflective barrier on one side.
- Price at \$0.65/sf.
- Non-flammable.



Polystyrene/Styrofoam

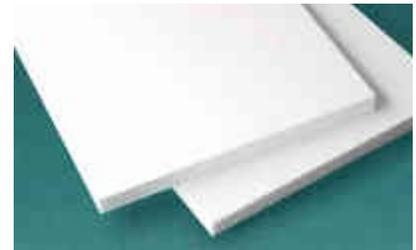
Squeaks while installing, but quiet once in place.

Pros

- Price at \$0.50/sf.

Cons

- R-4.3 at 1 inch thickness.
- Flammable.
- May damage wiring.



Spray Polyurethane Foam

Pros

- Price at \$2.50/sf.
- R-6 at 1 inch thickness.
- Good air barrier.
- Water vapor barrier.
- Reduces noise.
- Non-flammable.
- Closed cell foam.



Blue Jeans Insulation

Pros

- Also acts as a noise barrier.
- Fire resistant.
- Fungi resistance.
- Reduces airborne sound transmission.
- Contains no chemical irritants.

Cons

- Price at \$0.60/sf.
- R-3.5 at 1 inch thickness.
- It doesn't expand well to fill the cavities.
- It can hold moisture.



CONCLUSION

No matter what kind of insulation you use in your project, the materials have to suit your needs and the climate you're in. The wide choice of materials offers many opportunities to choose your level of insulation, its properties, like fire resistance or Eco-friendliness and its application methods.



At the top of my list are Polyiso (Polyisocyanurate) (affordable, high R-value, ease of use) and Blue Jeans Insulation (acoustic properties, safe product). At the bottom is Reflectix, often over-hyped and with few useful properties.

Moderately insulate your vehicle, but don't over-insulate as your van will retain more heat for a longer period on those hot summer evenings and keep your van cooler on cold winter mornings!

I'm not an expert in insulation techniques and these are just my personal views on a complicated issue.

Van Williams is the editor of the Cargo Van Conversion website.

ONLINE PROJECTS

For all online projects, go to:

► cargovanconversion.com/woodworking

Follow the progress of a hands-on cargo van conversion project online at:

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Thank You For Your Attention!

I thank you for reading this guide from start to finish.

Thanks again, and I'll see you on-line....

Van Williams

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P.S.

I'd appreciate it if you shared this guide with anyone you think could benefit from it. You can send them to cargovanconversion.com

Or just forward this PDF directly through to them via email. Thanks again!

Disclaimer (And Reality Check!)

The above information is for entertainment purposes only. I'm not an expert in any of these subjects, so please, verify any installations with the appropriate specialists.

I have 30 years of experience in the outdoors and a wealth of practical knowledge about campers and RV's, but every situation is different and in need of its own solution.

I hope the included information will help you get started, because there is no gain without trying.

*Set a realistic goal and **Go!***