

Weatherized Refrigerator Design Manual

Worcester Polytechnic Institute IQP D23

A guide to creating an outdoor refrigerator enclosure

Compiled by: Ian MacInerney, Valerie Childers, Michael Weideman, Zackary DiCelico

Table of Contents

Table of Contents	2
Executive Summary	4
Best things to prioritize	4
Things to avoid	4
Things to consider	5
Methods for Weatherization	6
Insulation	6
What does it do?	6
Things to consider	6
Insulation Options	9
Example wall sections	11
Comparison table	12
Sources	12
Siding	13
What does it do?	13
Things to consider	13
Siding Options	14
Comparison Table	16
Sources	16
Fridges	17
Best Practices to Keep Fridges Running Well	17
Fridge Options	17
Comparison table	19
Sources	19
Seals	20
Why you may want to seal around a fridge	20
Considerations	20
Options	22
Comparison table	23
Sources	23
Vents	24
What are they for?	24
Considerations	24
Options	25
Comparison Table	26
Sources	26
Foundations	26
Why an enclosure needs a foundation.	26
Considerations	27
Options	27
Comparison Table	28
Sources	28

Roofing	29
What does a roof need to do?	29
Considerations	29
Options	30
Comparison table	32
Sources	32
Author's Note	33
Retrofit for Existing Enclosures	34
Diagram	34
Cost estimate	34
New Enclosure for a Reasonable Budget	35
Diagram	35
Cost estimate	35
High-End Enclosure for Larger Budgets	36
Diagram	36
Cost estimate	36
References	37

Executive Summary

Best things to prioritize (High to low)

Insulation:

- **Closed cell foam** is the most effective but is expensive and requires professional installation.
- **Fiberglass Batts** are cheap and easy to install but not as effective and absorb moisture.
- **Foam boards** are cost-effective with easy installation. These boards are outside the studs and don't retain moistures or settle over time, making them highly compatible with other insulation solutions.
- Any insulation will do best if covered on both sides, preferably by plywood.

Sealing

- **Foam board** to cover gaps around the fridge due to its cheap and easy installation.
- **Garage seals** cover smaller gaps under the fridge. While this may make it harder to move the refrigerator, the extra seal provides more weatherizing overall.

Ventilation

- **Adjustable louver vents** are passive, cost-effective, and easy to install on any wall providing flexibility to the enclosures.

Roofing

- **Galvalume steel** is a weather-resistant and reflective corrugated sheet lasting up to 50 years per roof.
- **Cedar shingles** are an excellent choice for blending form and function, having a natural wood pattern, and being easily paintable.

Siding

- **Fiber cement** siding is costly however is damage-resistant, requires little maintenance, and is long-lasting.
- **Wood siding** is cheaper, ubiquitous, and less durable, needing more maintenance overall.

Foundation

- **Pier and beam** are durable, sturdy, and raised to prevent water from pooling. These are costly and need professional installation.
- **Paver bricks** were significantly cheaper while sacrificing some durability and accessibility.

Things to avoid

- When designing an enclosure, the insulation, seals, and vents should all be considered together. Changing one could impact the overall cooling of the fridge and weather resistance.
- One vapor barrier or no vapor barrier (a vapor barrier helps prevent moisture from getting into the rest of the enclosure, generally a plastic sheet) two vapor barriers can lead to moisture getting trapped between the two sheets and causing mold growth.

Things to consider

- Gasket seal maintenance is critical. All fridges contain a gasket around their doors, forming a seal when the door is closed, keeping the cold air in. A guide for maintenance is linked below: <https://repair.geappliances.com/resources/faq/how-do-i-tell-if-a-refrigerator-door-seal-is-bad>
- High emissivity paint is incredibly reflective against UV and can get rid of warming caused by the sun and even cool its surroundings in some situations.
- Ventilation is critical in an insulated enclosure. Without any ventilation the condenser at the back of the fridge won't have anywhere to dump the excess heat from the fridge and heat up the enclosure.

Methods for Weatherization

The following are several methods that can be employed to protect a fridge and its enclosure from weather and extreme temperatures. The list is not exhaustive, but the methods listed are some of the more common solutions. For each method diagrams will be provided.

Insulation

Insulation provides a barrier between the air inside and outside the enclosure, restricting heat transfer in a system and ensuring the internal temperatures are less dependent on the external air temperatures. By maintaining a more consistent internal temperature, refrigerators can keep food safe for long periods and will require less maintenance year-round.

Things to consider	
There is a lot to think about when choosing a type of insulation, like how it is installed, how well it works, and how durable it is in the long run. Here are a few important things to keep in mind when making a plan for an enclosure.	
Where to Insulate	
Insulation is only necessary for the fridge section of the enclosure. For the insulation to do best, it is a good idea to only insulate the external walls around the fridge, the wall between the fridge and the rest of the enclosure, and the floor and roof for the fridge section of the enclosure.	
Effectiveness	
Different kinds of insulation provide different levels of protection against extreme weather. An R-value is a measure of how insulative a material is, or how well a material resists heat passing through it. A higher R-value means the insulation is more effective. Every insulation type has an R-value which is dependent on the properties of the material, as well as how thick it is.	
Professional Installation	
Some kinds of insulation are readily available and relatively simple to install without a professional, which can significantly cut down on prices. Other kinds of insulation require either expensive equipment or a professional to install them. Often, for smaller jobs such as a fridge enclosure, a professional will charge a “job minimum,” which helps them to cover the expenses of the time it takes to get to the enclosure and set up. Job minimums will significantly increase the cost of insulating an enclosure.	
Superinsulation	

Not all insulation is installed in the same location in the wall. While most insulations sit between the studs in the wall, some types are designed to be placed on the face of the wall. A material that is installed outside the studs could be used in addition to another kind of insulation. This technique is called superinsulation, and can significantly improve the effectiveness of insulation.

Hybrid Insulation

Hybrid insulation uses more than one type of insulation in order to get some of the benefits of both. A popular example of this is combining fiberglass with a thin layer of closed-cell spray foam, which is a less expensive way of getting the sealing qualities of closed-cell foam. Another method that can be employed is to install foam panels on the outside of the wall, essentially adding a second layer of insulation.

Water Resistance

Some kinds of insulation are known to absorb moisture. This often becomes a problem, as they can begin to lose their insulative properties or even begin to grow mold and degrade. If you have insulation that is known to absorb moisture, you may have to invest more in waterproofing the siding of your enclosure to help protect the insulation from rain and snow. However, a word of warning: you do not want to seal both sides of your insulation because if you do it will be unable to dry out over time.

Settling

Some kinds of insulation have been known to settle over time, slowly sinking in the wall and losing some effectiveness. If this becomes too severe, the insulation may lose effectiveness and wi.

Sheathing

Insulation needs to be protected from the elements, and it is also best to shield people from most types of insulation. Builders typically use 7/16" plywood sheathing on the external face of the wall to hold in and protect the material (there is also a material called zip plywood that is treated with a green coating that acts like a home wrap). A vapor barrier or home wrap is also used on the outside to protect the frame from moisture (More on this in siding!). Additionally, a thin material such as MDO or cement backer board should be used to protect both the insulation and the people interacting with the structure.

Sources -Here are a few sources for interior and exterior sheathing

Cement backer board:

<https://www.homedepot.com/p/James-Hardie-HardieBacker-0-25-in-x-3-ft-x-5-ft-Cement-Backerboard-220022/100183556>

Zip plywood:

<https://www.homedepot.com/p/Huber-7-16-In-4-Ft-x-8-Ft-Zip-OSB-Wall-Sheathing-777198/202089190>

Plywood:

<https://www.homedepot.com/p/OSB-7-16-in-Sheathing-Panel-Application-as-4-ft-x-8-ft-386081/202106230>

Stud sizing and wall thickness

Most walls are made out of 2x4 boards spaced 16" apart (known as studs), as that is the minimum standard for construction. The insulation lives between these studs, so if thicker boards such as 2x6 are used, more insulation can be put in the enclosure. The issue with this is that it makes the walls thicker, reducing internal space for the same footprint.

Insulation Options

Blow-in Cellulose

A fluffy material that can be used to fill the spaces inside completed walls. It is treated to protect from pests, but needs to be professionally installed and can lose effectiveness over time as it absorbs water and settles in the walls.



[Image credit](#)

Source - This is often installed professionally, so a local insulation provider may be the best source. However, home improvement retailers will rent out the tools required. Here's a source for the cellulose itself.

<https://www.homedepot.com/p/Greenfiber-25-lbs-Cellulose-Blown-In-Insulation-or-Spray-Applied-Insulation-INSSANC/311574454>

Fiberglass batts

A fluffy material that is often backed with paper. It is usually placed in between studs before being closed in with plywood. It is inexpensive and relatively easy to install (with proper safety equipment like a good mask and gloves), but will also absorb water and settle over time.



[Image credit](#)

Source - Readily available at home improvement stores

<https://www.homedepot.com/p/Owens-Corning-R-13-Kraft-Faced-Fiberglass-Insulation-Continuous-Roll-15-in-x-32-ft-RF10/202585857>

Rockwool

A fibrous material that is placed between the studs and closed in with plywood. It is very similar to fiberglass but has a higher R-value and is somewhat less prone to settling over time. It still does settle, and it also absorbs moisture.



[Image credit](#)

Source - Readily available at home improvement retailers

<https://www.homedepot.com/p/ROCKWOOL-R-15-Comfortbatt-3-1-2-in-x-15-in-x-47-in-Fire-Resistant-Stone-Wool-Insulation-Batt-59-7-sq-ft-RXCB351525/202090820>

Spray foam

An expanding foam is sprayed into the walls. It is a phenomenal insulator but comes at the cost of being expensive and requiring a professional to install it.



[Image credit](#)

Closed cell - The best in the business, closed cell foam is waterproof and sealed against air, and the best insulator that is readily available. It is also the most expensive.

Open cell - A more porous material, it's great for filling small gaps and is cheaper than closed cell, but it is not water resistant, and it doesn't create a seal.

Source - This is one that is likely not a great idea to DIY. You're going to want a professional to install this stuff.

Foam board

Foam panels are made of closed-cell foam but are sold in premade panels instead of being sprayed in. This comes with a number of advantages, namely the ability to install them outside of the studs and their resistance to moisture. If installed outside of the studs, it is a good idea to do 2 layers if possible and to have the seams of the boards offset from each other to prevent airflow.



[Image credit](#)

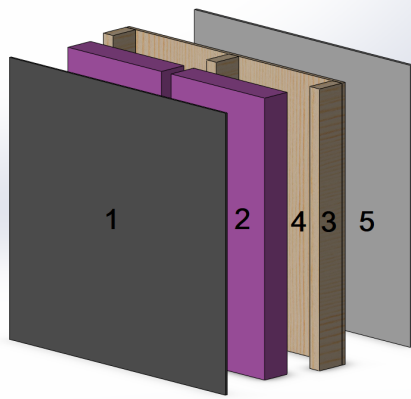
Source - Readily available at home improvement retailers

<https://www.homedepot.com/p/Owens-Corning-FOAMULAR-NGX-F-250-2-in-x-4-ft-x-8-ft-SSE-R-10-XPS-Rigid-Foam-Board-Insulation-52DDNGX/315197962>

Example wall sections

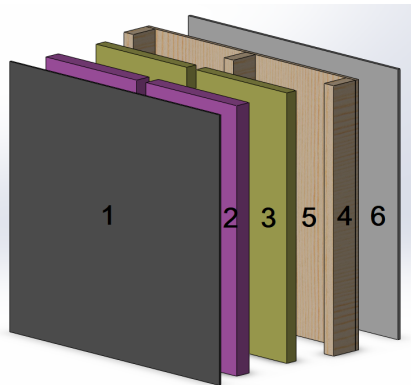
Here are a few diagrams of how walls can be constructed with different insulation layouts. These patterns would be repeated throughout the wall.

Typical Insulation



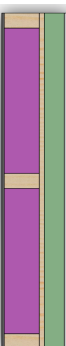
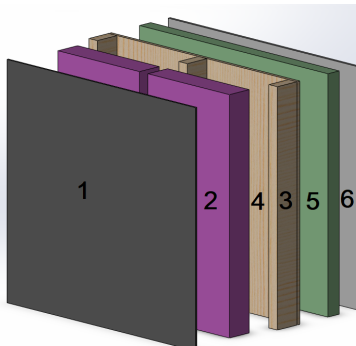
1. Interior sheathing
2. Insulation
3. Studs
4. Exterior sheathing
5. Siding/vapor barrier

Hybrid closed cell/fiberglass insulation



1. Interior sheathing
2. Fiberglass
3. Spray foam
4. Studs
5. Exterior sheathing
6. Siding/vapor barrier

Superinsulation



1. Interior sheathing
2. Insulation
3. Studs
4. Exterior sheathing
5. Foam panels with taped joints
6. Siding/vapor barrier


Comparison table

Insulation	R-value per inch (Min and Max)		Price per sq. Foot (min and max)		Estimated minimum	Easy installation	Retains shape	Water resistant	Outside of studs
Blow-In Cellulose	3.1	3.8	\$1	\$2.80	\$800.00	No	No	No	No
Fiberglass Batts	2.9	3.8	\$0.80	\$2.60	\$600.00	Yes	No	No	No
Closed Cell Spray Foam	6	7	\$2.50	\$5.80	\$1,500.00	No	Yes	Yes	No
Open Cell Spray Foam	3.6	3.9	\$0.88	\$3.00	\$1,500.00	No	Yes	No	No
Foam Board	4.5	5	\$1.20	\$1.50	\$600.00	Yes	Yes	Yes	Yes
RockWool	3.3	4.3	\$1.10	\$3.10	\$600.00	Yes	Yes	No	No

Siding

Siding's primary job is to protect the walls of the enclosure, but it is also the most important aesthetic component of the entire structure. The goal is to choose an aesthetically pleasing, weather-resistant, and durable enclosure, and balancing these factors while accounting for constraints and location can be challenging.

Things to consider	
Aesthetics	
Looking nice is a critical aspect of any fridge enclosure. A good-looking enclosure will help to make a space more pleasant and will strengthen the connection between the community and the fridges. As such, siding choice and color may be entirely dependent on complimenting the surrounding area.	
Expected Lifespan	
Depending on the material, siding can last any number of years. The lifespan of siding is often decades. This may be longer than an enclosure is expected to hold up for, but the lifespan can still be an indicator of the durability of any particular siding.	
Damage resistance	
Some siding varieties, namely wood, can be damaged somewhat easily. When damaged, they will begin to absorb water, furthering the damage, as well as their susceptibility to pests. These siding types need to be repaired relatively quickly or they will be ruined.	
Reflectivity	
How reflective a material is can have a notable effect on how it performs in the summer. Lighter colored siding will reflect more light, causing them to absorb less of it as heat. This can help keep enclosures exposed to direct sunlight cooler in the summer. There also exist paints that are high emissivity, meaning they can emit extra energy, causing additional cooling effects.	
Source - You can get normal paint at any home improvement retailer. Here is a source for high emissivity paint https://cpicoatings.com/products/stop-heat?variant=39713370439728&currency=USD&utm_medium=product_sync&utm_source=google&utm_content=sag_organic&utm_campaign=sag_organic&gad=1&gclid=CjwKCAjwxr2iBhBJEiwAdXECww5AVPfNSRG_iosZRwM_WgV-oIYkZeBkjN8lzKv-kqoogWKgaYSv7BoCFHEQAvD_BwE	

Homewrap and vapor barrier		 <p data-bbox="1198 407 1386 443">Image credit,</p>
<p data-bbox="107 191 1029 394">Unfortunately, no siding is perfectly waterproof. Moisture can trickle through small gaps in the siding, and over time can damage the wood frame of the enclosure. To stop this, you can use a home wrap or vapor barrier to help repel any water that gets through the siding.</p>		

Home wrap - A normal home wrap will be resistant to water but will allow water vapor to seep through, this can help to dry out an enclosure if it gets wet, but can also expose insulation to moisture that it can absorb

Vapor barrier - A vapor barrier repels water as well as water vapor. This is good for walls that have absorbent insulation in them. The challenge comes when moisture does get in, in which case it will have to dry towards the inside, meaning there needs to be a way for vapor to get out of the enclosure. Warning: putting two vapor barriers in a wall is a recipe for disaster, as water will eventually seep in, and then be unable to escape, rotting the wall.

Source - Readily available at home improvement retailers


Non-vapor barrier home wrap

<https://www.homedepot.com/p/TYVEK-3-ft-x-165-ft-HomeWrap-Housewrap-D15540828/308793245>

Vapor barrier

<https://www.homedepot.com/p/HDX-10-ft-x-25-ft-Clear-6-mil-Plastic-Sheeting-RSHD610-25C/204711657>

Siding Options

Vinyl siding	 <p data-bbox="1198 1755 1386 1791">Image credit</p>
<p data-bbox="107 1541 1029 1745">Vinyl siding comes in dozens of different colors and styles. It can be made to look like just about any material while also being weather resistant. It requires little to no maintenance but can be limited in color and style selection. Unfortunately, it can degrade in sunlight, which will make it brittle and prone to cracking</p>	

Source - Readily available at home improvement retailers

<https://www.homedepot.com/p/Ply-Gem-Transformations-Double-4-in-x-150-in-White-Lap-Vinyl-Siding-PC4004H/301837334>

Wood Siding

Wood siding is a common choice for fridge enclosures. It is readily available and can be painted in a near-infinite range of colors. However, it also requires high maintenance, needing to be repainted and repaired if damaged. It also has the advantage of coming in a wide variety of options, from beautiful cedar board siding to inexpensive T1-11 (a premade wood siding panel).



[Image credit](#)

Sources - There are several options for wood siding, here are a few

T1-11:

<https://www.homedepot.com/p/Plytanium-Plywood-Siding-Panel-T1-11-8-IN-OC-Nominal-19-32-in-x-4-ft-x-8-ft-Actual-0-563-in-x-48-in-x-96-in-113699/100000016>

Cedar shingles:

<https://www.homedepot.com/p/5-in-x-16-in-Eastern-White-Cedar-Kiln-Dried-Wall-Grade-Architectural-Shingles-63903747/324354723>

Fiber Cement Siding

Fiber cement is a more expensive option for siding, but it comes with many of the same advantages as vinyl. It's durable, damage resistant, and requires no maintenance. The main draw, however, is that it's tougher and lasts longer than vinyl siding, and can be painted to be any color.



[Image credit](#)

Source - Readily available at home improvement retailers

<https://www.homedepot.com/p/James-Hardie-HardiePlank-HZ5-5-16-in-x-8-25-in-x-144-in-Fiber-Cement-Primed-Cedarmill-Lap-Siding-6000265/202035444>

Metal Siding

Metal siding is made from the same material as metal roofing. Its main advantage is that it is reflective, making it an excellent choice for enclosures that get a lot of sunlight. It is also waterproof and durable, making it excellent for protecting the wall underneath. The downside of metal siding is that it is not very attractive, and can dent and stain over time, eventually becoming unpleasant.



[Image credit](#)

Source - Readily available at home improvement retailers

<https://www.homedepot.com/p/8-ft-SM-Rib-Galvalume-Steel-29-Gauge-Roof-Siding-Panel-987601/314709085>

Comparison Table

Siding	Price per square foot (Min and Max)		Expected lifespan (yrs)	Requires maintenance	Damage and pest resistance
Vinyl	\$2.00	\$13.00	30	No	Yes
Wood	\$6.90	\$13.90	30	Yes	No
Fiber cement	\$4.70	\$8.50	50	No	Yes
Metal	\$4.50	\$21.00	50	No	Yes

Fridges

Best Practices to Keep Fridges Running Well

There is a lot to think about when choosing a type of insulation, like how it is installed, how well it works, and how durable it is in the long run. Here are a few important things to keep in mind when making a plan for an enclosure.

Gasket Maintenance

All fridges contain a gasket around their doors, which forms a seal when the door is closed that keeps the cold air in. These gaskets are made of rubber and will wear and harden over time, especially when exposed to the elements and frequent door openings. When they wear down, they will begin to leak air. To keep the gaskets functioning, there are several things that can be done.

1. Keep them clean - Mold and dirt will cause them to seal poorly
2. Oil them if they begin to get stiff - this can be done by coating them in a very thin layer of Vaseline
3. Check that the gasket is properly attached - Gaskets are not glued in and can be accidentally pulled out of place. Luckily they can be pushed back into place just as easily.
4. Replace damaged gaskets - If a gasket is damaged (cracked or split), you can order a replacement from the manufacturer. Here is an excellent guide on replacement/detecting damage <https://repair.geappliances.com/resources/faq/how-do-i-tell-if-a-refrigerator-door-seal-is-bad>

Leveling

Fridge doors close automatically using gravity. This means that if the fridge is not level, the door may not close properly. The best way to solve this is to make sure that the floor under the fridge is level, but this may not always be possible. Most fridges have adjustable legs that will allow you to level the fridge.

Fridge Options

Garage-certified fridges

These fridges are the most cost-effective option. They are specially designed to deal with the fluctuating temperatures of a garage, which can go a long way to help keep safe internal temperatures. They are also readily available and can be bought at most home improvement stores.

Source - Readily available at home improvement retailers
<https://www.homedepot.com/p/GE-19-2-cu-ft-Top-Freezer-Refrigerator-in-White-GTS19KGNRWW/312429505>



[Image credit](#)

Stainless garage-certified fridges

These have the same design as a regular garage-certified fridge, but they are made of stainless steel. The steel makes the fridges more expensive, but it is more resistant to weather conditions. It is also reflective, which makes the fridge more resistant to direct sunlight.

Source - Readily available at home improvement retailers
<https://www.homedepot.com/p/GE-19-2-Cu-Ft-Top-Freezer-Refrigerator-in-Fingerprint-Resistant-Stainless-Steel-GTS19KYNRFS/319881478>



[Image credit](#)

Glass-door fridges

These fridges are designed for restaurants and stores that want to display their products. The glass door allows users to see what's in the fridge without opening it, which can significantly reduce the frequency of door openings. This will drastically increase the effectiveness of the fridge, as it will not be leaking cold air as often. That said, glass doors can be broken, which can be a serious issue on the street, and they do not have freezers.

Source - Readily available at home improvement retailers
<https://www.lowes.com/pd/Premium-Levella-6-5-cu-ft-Commercial-Upright-Display-Refrigerator-Glass-Door-Beverage-Cooler-in-Silver/5013802245?user=shopping>



[Image credit](#)

Commercial fridges

These fridges are designed for restaurant use, and as such are larger and heavier duty than domestic fridges. They require more power, and make more noise, but are sturdier than domestic refrigerators.

Source - There are a lot of places to get these fridges. Here is one of them
<https://www.kitchenall.com/coldline-u-12r-25-solid-door-commercial-reach-in-refrigerator-11-cu-ft.html?source=googleshopping&locale=en-US>



[Image credit](#)

Comparison table

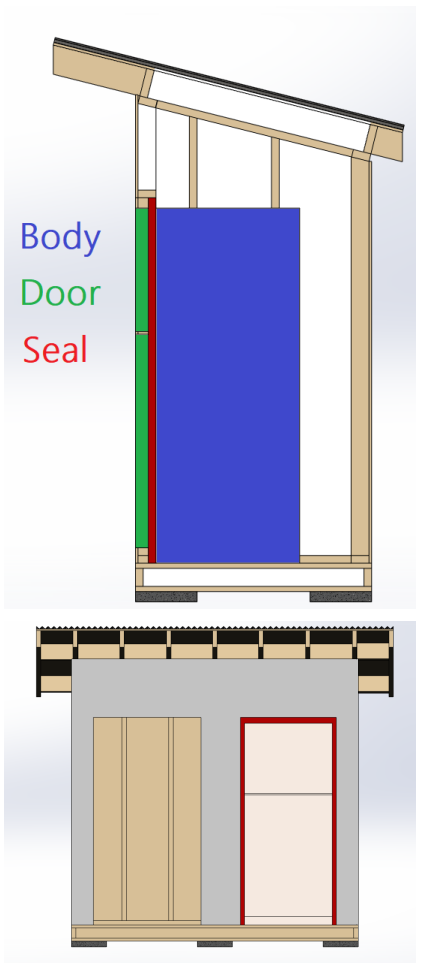
Fridges	Cost	Readily available	Freezer	Window
Garage Ready	\$700	Yes	Yes	No
Stainless Garage Ready	\$900.00	Yes	Yes	No
Glass Door Fridge	\$1,000	Yes	No	Yes
Commercial Fridge	\$1,350	No	No	No

Seals

A wide open fridge enclosure allows wind and debris to get in, which will both negate the effectiveness of the insulation, as well as cause garbage to build up around the fridge. Sealing around the fridge will significantly help this. The seal should be placed around the main body of the fridge, just behind the door, allowing the door to be opened while keeping the enclosure sealed. While this method is less effective than enclosing the entire fridge, it gives moderate protection while retaining full accessibility for users.

Considerations

Sealing the gaps around a fridge is a tricky balance between closing the enclosure and keeping the fridge available. A potential balance between these is to seal around the body of the fridge and leave the door exposed. The rest of this section operates under the assumption that this method is used. The diagrams on the right show the positioning of the seals. The seals attach to the body immediately behind where the door starts.



Attachment method

How a seal is attached can affect its long-term viability. Seals either are adhered in place or screwed on the enclosure. Screws add to installation difficulty, while adhesives may fall off over time and need replacement.

Gap Size

Depending on the construction of the enclosure, the gap between the fridge and the sides may vary. Different seals are going to work better for different gap sizes. Larger gaps will likely need something more durable, as they will likely be more exposed, while small gaps may require something that fits better.

Pest Resistance

Seals keep more than airflow out of an enclosure. Pests may find the protective environment to be an excellent home or at least a meal. The seals around the fridge can help to keep them out, so long as they are strong enough.

Long-term durability

Different seal designs will deteriorate in different ways. Depending on the seal design, they may need to be replaced more often to continue doing their job.

Accessibility

The backs of the fridges still need to be accessed in case of a breakdown. As such, a fridge needs to be able to be removed without damage in order to fix or replace it.

Vents

If an enclosure is completely sealed, some problems can arise. First, if moisture gets in, it won't be able to get out. Second, the fridge still needs airflow to function properly, or it may overheat the enclosure in the summer.

Sealing larger gaps

For abnormally large gaps, it may be necessary to modify the frame, or to install a piece of rigid foam board insulation to fill the space

Options

Foam Weather Stripping

An excellent solution for tight spaces, this foam comes with an adhesive side that can be placed on the edges of gaps around the fridge. They are easy to install, and seal the gap effectively, but will likely make removing the fridge more difficult

Source - Readily available at home improvement retailers
<https://www.homedepot.com/p/M-D-Building-Products-1-1-2-in-Black-Platinum-Expandable-Foam-Weatherseal-for-Uneven-Gaps-03115/314012150>

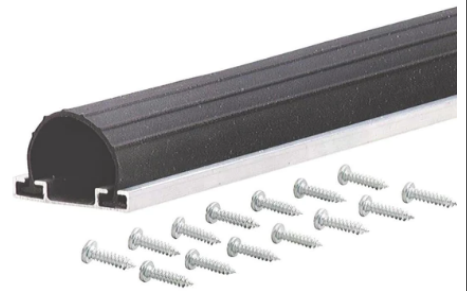


[Image credit](#)

Garage Door Seals

These seals are designed to go on the bottom of garage doors. They can be bolted in place, and are highly durable. They will likely make the fridges somewhat more difficult to remove, but provide a good seal and can prevent pests.

Source - Readily available at home improvement retailers
<https://www.homedepot.com/p/Xcluder-X2-Rodent-Proof-Garage-Door-Seal-Kit-8ft-x-1-75in-x-1-75in-Individual-Pest-Control-Retainer-162971/313936107>

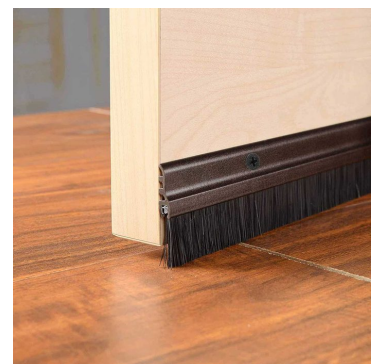


[Image credit](#)

Door Sweeps

These seals are made of stiff bristles or rubber flaps. They would likely be the best option for fridge accessibility. They will not provide the best air seal, but they will reduce airflow. They are also somewhat resistant to pests.

Source - Readily available at home improvement retailers
<https://www.homedepot.com/p/Frost-King-36-in-x-25-in-Heavy-Duty-Aluminum-and-Brush-Door-Sweep-Weatherstrip-SB36/202525375>



[Image credit](#)

Comparison table

Seals	Cost estimate	Mounting method	Gap size (inches)	Pest Resistant	Long term durability	Easy to remove fridge
Garage door seal	\$200	Screws	2	Yes	Yes	Yes
Adhesive foam tape	\$30	Adhesive	1.5	No	No	No
Brushed Door Sweeps	\$50	Screws	1.75	No	Yes	Yes

Vents

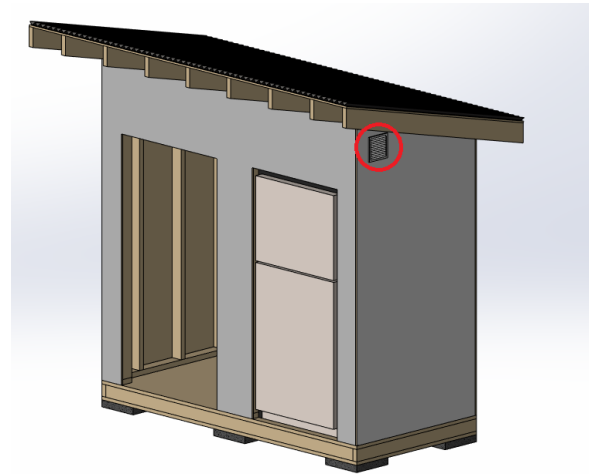
If an enclosure is sealed and moisture gets in, it will have nowhere to go. Having ventilation allows the moist air to escape, preventing mold and bacteria buildup. It can also help with the heat in the summer by allowing hotter air to leave the enclosure. Additionally, when a fridge cools its internals, all of the heat that it is removing needs to go somewhere. If it is all trapped in the enclosure the fridge will be at serious risk of overheating.

Considerations	
Sizing	
<p>The sizing of a vent is largely dependent on the amount of airflow that is desired. Most fridge enclosures are relatively small, so less ventilation is needed. It is important to not over ventilate the structure, as that will defeat the purpose of sealing and insulating the enclosure. Due to the small size of the enclosure, smaller vents will likely be sufficient.</p>	
Water/Pest resistance	
<p>Adding vents to an enclosure provides another avenue for water and pests to get in. There are many ways this can be counteracted. Vents can be placed under overhangs or be shielded from water, and screens can be added to keep insects and other pests out.</p>	
Powered Airflow	
<p>Vents can be considered either passive or active. Passive vents have no mechanism for creating airflow, they only permit air to pass through them. As a result, they are usually cheaper and simpler solutions to implement. Active vents contain a mechanism to push air, which significantly increases the throughput of air. Active solutions are very effective for ventilation but can be expensive and delicate, as well as running the risk of moving too much air, which would negate the insulation.</p>	
Placement	
<p>The placement of vents is important to their function. Ideally, a vent should be placed high up in the enclosure, preferably under the overhang of the roof to keep water out. Placing the vent high up also allows for the hotter air to escape, which will also contain most of the moisture.</p> <p>Modern fridges have an internal fan that pulls air in from vents in the back, and pushes it out the vents at the bottom front of the fridge (there is a handy diagram included). Older fridges have large coils on the back that passively release heat.</p> <p>For a modern fridge, it may be a good idea to put a vent near the air intake on the back. In a normal house, modern fridges need approximately 1 to 2 inches of space behind them. This is likely a good practice to follow if there is only a vent at the top, but if there is a vent directly next to the air intake of the fridge this may not be entirely necessary. For an older model, 3 to 4 inches is needed, and more than that may be necessary due to the reduced airflow of an enclosure.</p>	

Air intakes on the back of a modern fridge



Vent placement to remove moisture



Options

Louvered Wall Vent

Louvered wall vents are on the smaller side of vents. They are passive vents, which mount onto a hole cut in the wall. The louvers are designed to keep water out without blocking airflow. They are inexpensive and can be mounted on almost any wall. They are often screened to prevent pests from getting in, and if not a screen can be added to them.



[Image credit](#)

Source - Readily available at home improvement retailers

<https://www.homedepot.com/p/Master-Flow-6-in-x-6-in-Galvanized-26-Gauge-Louver-with-Screen-26L6X6GS/205430389>

Turbine vent (whirligig)

A turbine vent is a clever way to make an active vent without requiring power. It uses wind power to force air out. It mounts onto the roof of the enclosure. It is expensive and can be off putting, but if active ventilation is needed it can be an effective solution. They are also often adjustable, so they can be closed or opened depending on the season.



[Image credit](#)

Source - Readily available at home improvement retailers

<https://www.homedepot.com/p/LOMANCO-12-in-Galvanized-Steel-Internally-Braced-Whirlybird-Wind-Turbine-GT12/100572638>

Soffit Vents

Soffit vents go on the underside of the roof overhang. They are the lowest-profile vent on this list and are relatively inexpensive and durable. The main disadvantage they possess is that for them to work there must be a path for air to take through the ceiling beams. This will require a path to be made through the insulation and will result in reduced airflow.



[Image credit](#)

Source - Readily available at home improvement retailers

<https://www.homedepot.com/p/Master-Flow-3-in-Resin-Circular-Mini-Wall-Louver-Soffit-Vent-in-White-4-Pack-RLSC3/100038053>

Comparison Table

Vents	Cost estimate	Size	Water-resistant	Pest-resistant	Durability	Forces airflow
Louvered vent	\$20	Small	Yes	Yes	High	No
Turbine Vent	\$60	Large	Yes	Yes	Medium	Yes
Soffit vents	\$20	Medium	Yes	Yes	Medium	No

Foundations

A good foundation has several benefits for an enclosure. Most importantly they provide a base for the structure, keeping it level and stable. Furthermore they keep the frame off of the ground, preventing moisture from absorbing into the building.

Considerations

Location

Where an enclosure is built determines what it is going to need for a foundation. If the area is already paved, an enclosure can likely get away with being put up on blocks just to protect it from water damage. If it is being built on an unpaved area, a more substantial foundation is likely needed to keep the structure safe from moisture as well as level.

Stability

Fridge enclosures tend to be rather tall with a narrow base, making them liable to tip if conditions are right. As such, a foundation may be extra necessary to ensure a fridge doesn't fall over or shift.

Accessibility

Lifting a structure off of the ground, while excellent for protecting it from moisture, can become an issue for some users. For the best accessibility, it is good to raise the structure off the ground as little as possible (just an inch or two).

Freeze/thaw line

In colder climates, the ground will often freeze in the winter. This can cause excess stress on a concrete foundation, which will eventually cause it to get damaged. A way to prevent this is to have your foundation go down below the line where the ground freezes, but this can get expensive and difficult for some types of foundations. It is important to note, however, that a foundation of a smaller size is less susceptible to these issues

Options

Pier and Beam

A pier and beam foundation is a way to build an enclosure in an unpaved area. It is made of a series of concrete piers, which are poured into the ground. Wood beams are placed between the piers to make a solid base that is raised off the ground to protect the wood from rotting. This solution is relatively simple and is an excellent way of working around particularly uneven terrain. It is also a good way to reach below the freeze/thaw line. The biggest downside is that it is more expensive, and it will likely raise the fridge higher off the ground than other solutions.



[Image credit](#)

Slab

A slab foundation is another way to build an enclosure on an unpaved area. Concrete is poured directly into the ground in the shape of the floor, and the structure is built on top of it. Unfortunately, slabs require relatively flat ground to work best and may run into freeze-thaw issues.



[Image credit](#)

Bricks

Bricks are an easy way to put a structure up on blocks if you have a paved surface. They are cheap and readily available, but they rely on the underlying surface to be level and are small, which may cause uneven distribution of weight.



[Image credit](#)

Pavers

Putting an enclosure up on pavers has the same advantages as bricks, but pavers are larger, thus distributing loads more evenly. They are also large enough to be a potential solution for non-paved surfaces, but a concrete foundation will be far more stable.



[Image credit](#)

Comparison Table

Foundation	Materials	Labor	Total cost	Stability	Good on unpaved surfaces
Pier and beam	\$800.00	\$1,000	\$1,800	Excellent	Yes
Slab	\$180.00	\$500	\$680	Excellent	Yes
Bricks	\$10.00	\$0.00	\$10.00	Questionable	No
Pavers	\$30.00	\$0.00	\$30.00	Good	Sometimes

Roofing

What does a roof need to do?

The roof of a fridge enclosure is important for several reasons. First and foremost, it protects the enclosure from snow and rain making it run off someplace else. Second, it protects the enclosure from the sun. Lastly, it provides a barrier against heat transfer between the inside and outside of the enclosure.

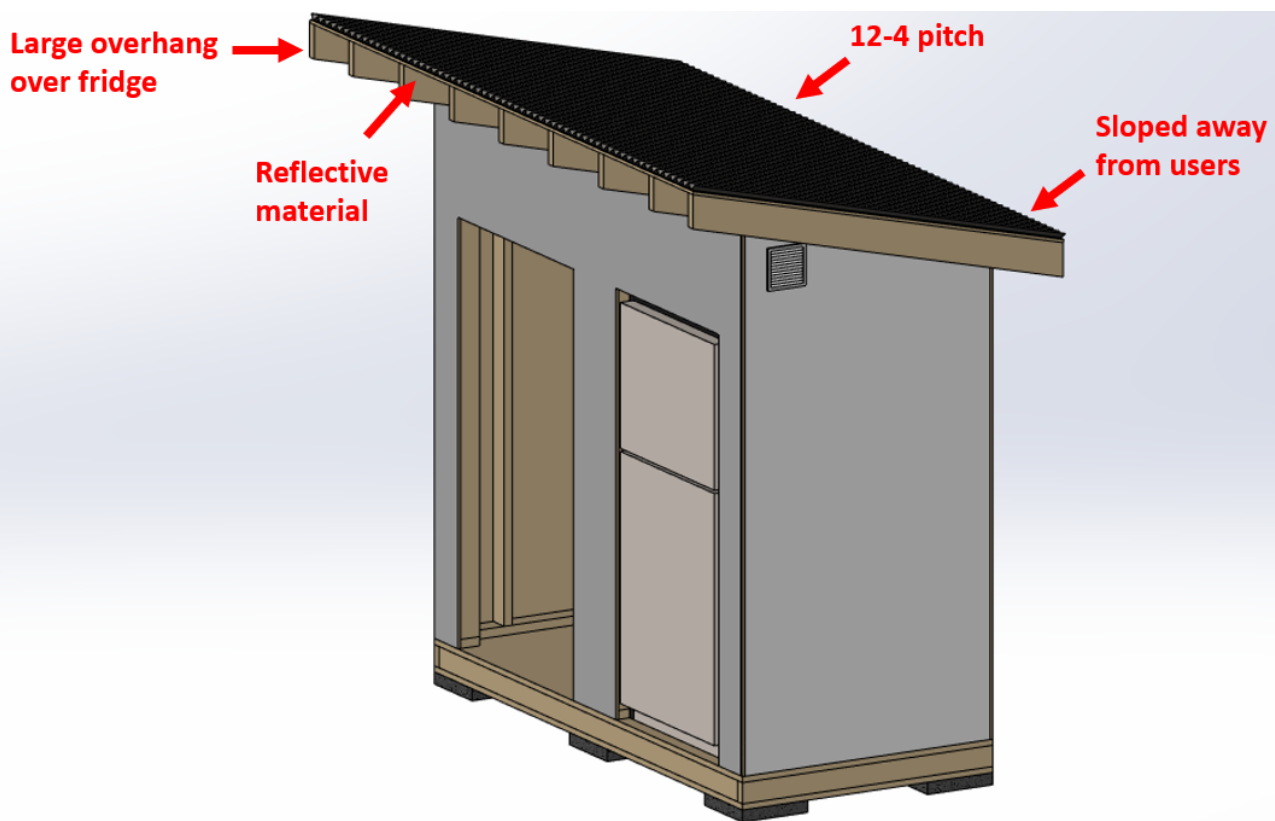
Considerations	
Overhang	
<p>Since the front of the fridge is exposed to the elements, it is important to try and keep it protected. A large overhang (1'-2') over the fridge will help to shade the fridge in the summer, as well as keep water off of users. For the other sides, a smaller overhang (at least 6") is all that is needed, as its main role is to keep the rain off the siding.</p>	
Reflectivity and Insulation	
<p>A lot of heat in the summer comes from direct sunlight. As such, a reflective or lightly colored roof material will go a long way in keeping the structure cool. Additionally, it is important to insulate the roof of the enclosure to keep any heat that does get transferred to the roof out of the enclosure.</p>	
Lifespan	
<p>The durability of roofing is particularly important, as it is responsible for keeping most of the rain and snow out. A roof that is beginning to leak can cause serious damage to an enclosure if not repaired quickly. A more durable roof provides extra peace of mind as to the safety of the enclosure.</p>	
Slope Direction	

The slope of the roof depends heavily on the fridge's surroundings. The most important thing is to keep runoff from falling on users, but the runoff must also be kept away from any nearby buildings, as it can damage them over time. The optimal slope direction has its high side where people access the fridge. If there is a building behind it's best to either have the high side on one of the side walls or to leave a space between the enclosure and the building. Single-slope roofs are usually better, as they take less complexity to build.

Slope Pitch

Pitch defines how steep the slope of the roof is. Steeper slopes are better for shedding rain and snow, but they make the enclosure taller and reduce the effectiveness of the overhang. The recommended pitch for the roof is at least 4-12 (for every 12 inches sideways, the roof rises 4 inches up). This is the standard slope for most houses.

Drawing of an optimal roof



Options

Galvanized Steel

This option has been a mainstay of roofing for decades. It is made of steel with a zinc coating that prevents rust and corrosion. Being steel, it's on the tougher side, but it will corrode over time as the coating fails. This is why it is being switched out over time for Galvalume.



[Image credit](#)

Source - Readily available at home improvement retailers

<https://www.homedepot.com/p/8-ft-Corrugated-Galvanized-Steel-31-Gauge-Roof-Panel-13513/2092961>

Aluminum

The main advantage of aluminum is its corrosion resistance. It is excellent at resisting corrosion, even when exposed to a lot of salt. The downside is that it is more expensive, and is a softer material and thus prone to denting.



[Image credit](#)

Source - Not as common as the steel varieties, if you decide on aluminum you will want to look at local providers

Galvalume Steel

Galvalume is similar to galvanized steel, but its coating includes aluminum. This gives it some extra corrosion resistance, while not sacrificing the strength of the steel inside. It is likely a better option than galvanized steel, and as a result, is more readily available



[Image credit](#)

Source - Readily available at home improvement retailers

<https://www.homedepot.com/p/10-ft-SM-Rib-Galvalume-Steel-29-Gauge-Roof-Siding-Panel-987602/314709088>

Asphalt Shingles

Asphalt shingles are the cheapest option on the market. They are easy to find and easy to put up. Unfortunately, they do suffer from a number of drawbacks. The main issue is that they don't last very long. Roofs usually need to be re-shingled every 20 years. They are also not reflective and are a dark color that absorbs even more heat.



[Image credit](#)

Source - Readily available at home improvement retailers

<https://www.homedepot.com/p/GAF-Royal-Sovereign-Charcoal-Algae-Resistant-3-Tab-Roofing-Shingles-33-33-sq-ft-per-Bundle-26-Pieces-0201180/100040028>

Cedar Shingles

Cedar shingles are the nicest-looking option. They have the same lifespan as asphalt shingles but are slightly more reflective due to their light color. They come in at roughly the same price as metal roofing but look much nicer. The other major disadvantage of cedar shingles is that they are labor intensive to install.



[Image credit](#)

Source - Readily available at home improvement retailers

<https://www.homedepot.com/p/2-in-to-12-in-W-x-18-in-Wood-Cedar-Shingle-Sliding-234159/307421043>

Comparison table

Roof	Cost per square foot	(Min and Max)	Reflective?	Lifespan
Galvanized Steel	4.5	17	Yes	50
Aluminum	6.5	21	Yes	50
Galvalume Steel	4	9	Yes	50
Asphalt Shingles	1.75	5.5	No	20
Cedar Shingles	4.1	7.5	No	20

Sources

- <https://www.decra.com/blog/homeowners-guide-which-type-of-metal-roofing-is-best-for-your-home>
- <https://www.westernstatesmetalroofing.com/blog/metal-roof-types>
- <https://sheffieldmetals.com/learning-center/galvalume-vs-galvanized-metal/>

Author's Note

Hello all,

I hope that I did a decent job conveying everything that we found in the process of making this document. I just wanted to give a little more info about this document and some of its limitations.

First, I want to stress that this is certainly not the be-all-end-all of enclosure design. There are lots of good sources out there made by more experienced folks than me, especially for shed construction. Some of them are listed in the sources, but there will always be more that I will have missed.

Second, the sources provided for materials may not be the most cost-effective. The main focus was on the major home-improvement stores (especially home depot) due to how common they are, but better deals may be available at local providers.

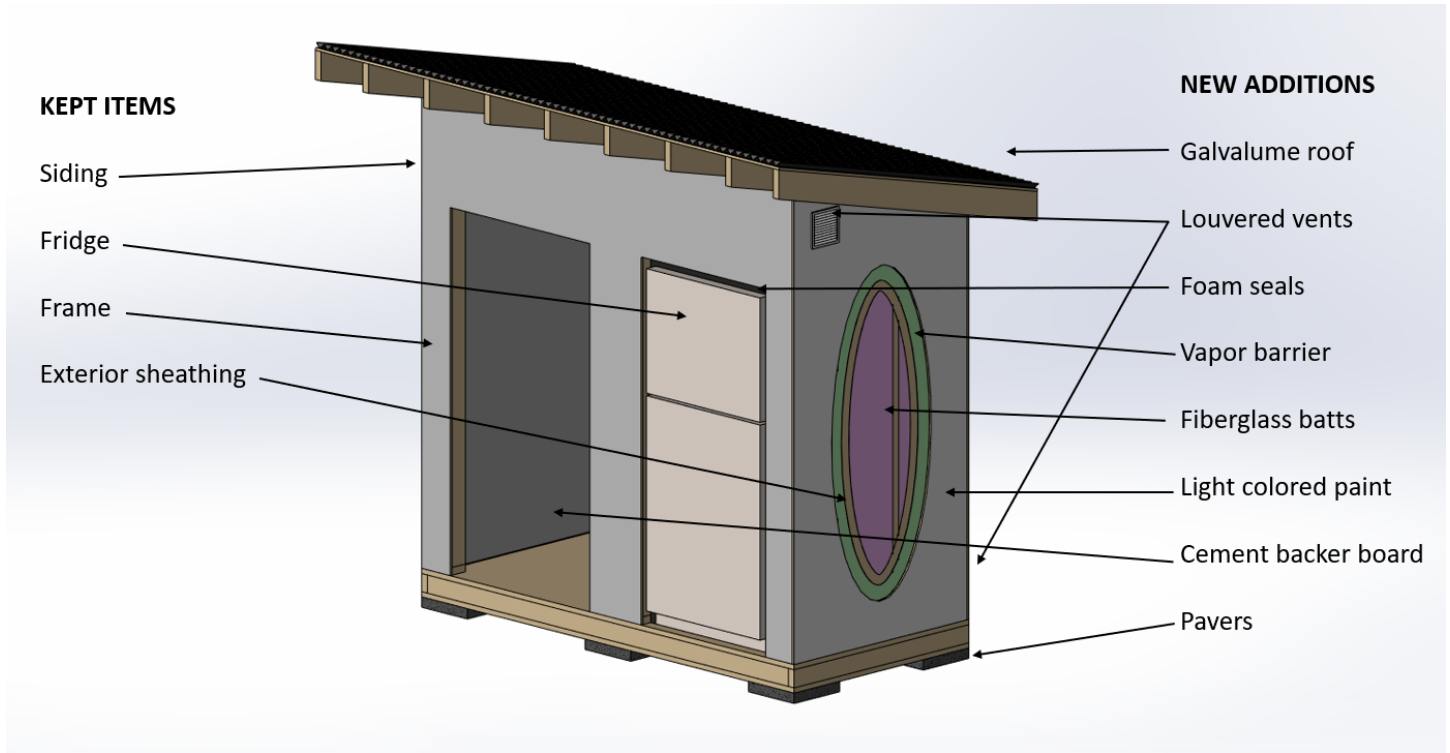
As a final note, I wanted to give everyone one of my favorite resources that I found while working on this. <https://www.secrets-of-shed-building.com/> they have some excellent ideas and guides on all sorts of designs and techniques.

Best,

Ian MacInerney

Retrofit for Existing Enclosures

Diagram

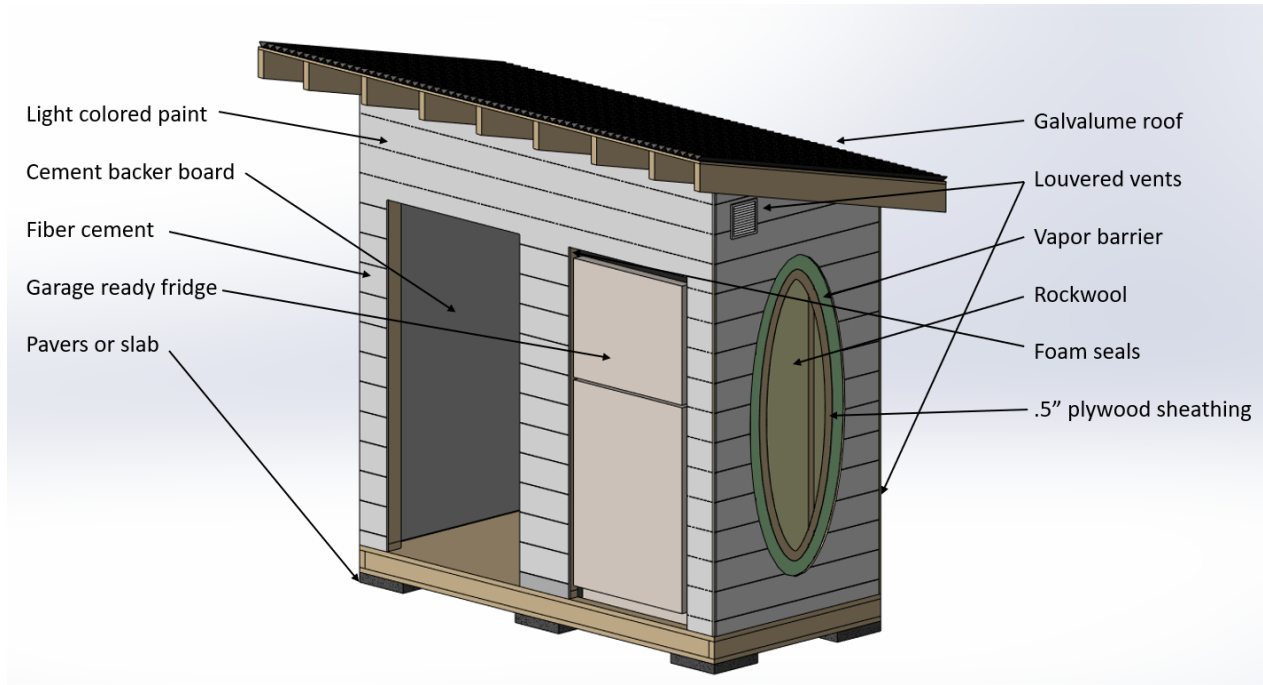


Cost estimate

Item	Material	Professional labor	Total
Fiberglass batts	\$100.00	\$500.00	\$600.00
Homewrap tape	\$15.00		\$15.00
Foam seals	\$50.00		\$50.00
Light colored paint	\$50.00		\$50.00
Louvered vents	\$40.00		\$40.00
Pavers	\$20.00		\$20.00
Galvalume roof	\$120.00		\$120.00
Vapor barrier	\$75.00		\$75.00
Cement backer board	\$120.00		\$120.00
		Total	\$1,090.00
		Cost of materials	\$590.00

New Enclosure for a Reasonable Budget

Diagram



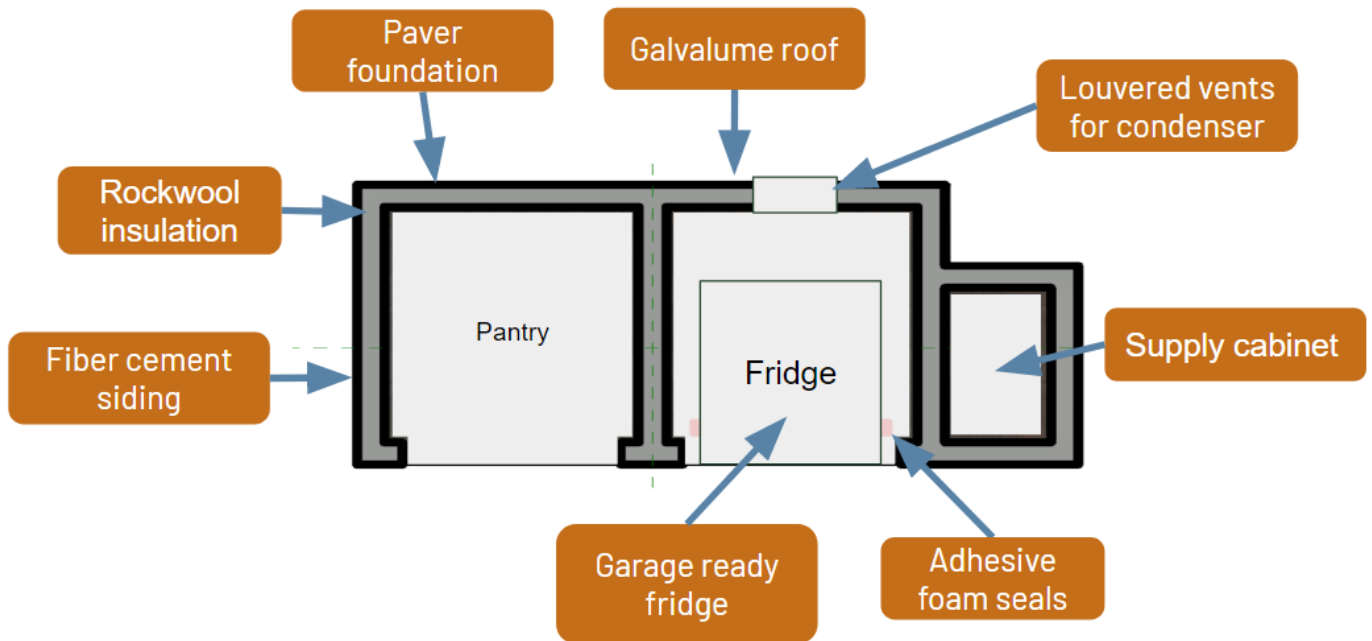
Cost estimate

Item	Material	Professional labor	Total
Rockwool	\$225.00	\$500.00	\$725.00
Slab foundation	\$200.00	\$500.00	\$700.00
Plywood sheathing	\$320.00		\$320.00
Vapor barrier	\$75.00		\$75.00
Fiber cement siding	\$250.00		\$250.00
Light color paint	\$50.00		\$50.00
Louvered vents	\$40.00		\$40.00
Galvalume roof	\$120.00		\$120.00
Garage ready fridge	\$700.00		\$700.00
Timber (2x4 frame)	\$500.00		\$500.00
Cement backer board	\$120.00		\$120.00
Foam seals	\$50.00		\$50.00
		Total	\$3,650.00
		Cost of materials	\$2,650.00

Proposed Second Iteration Floor Plan For Budget Enclosure

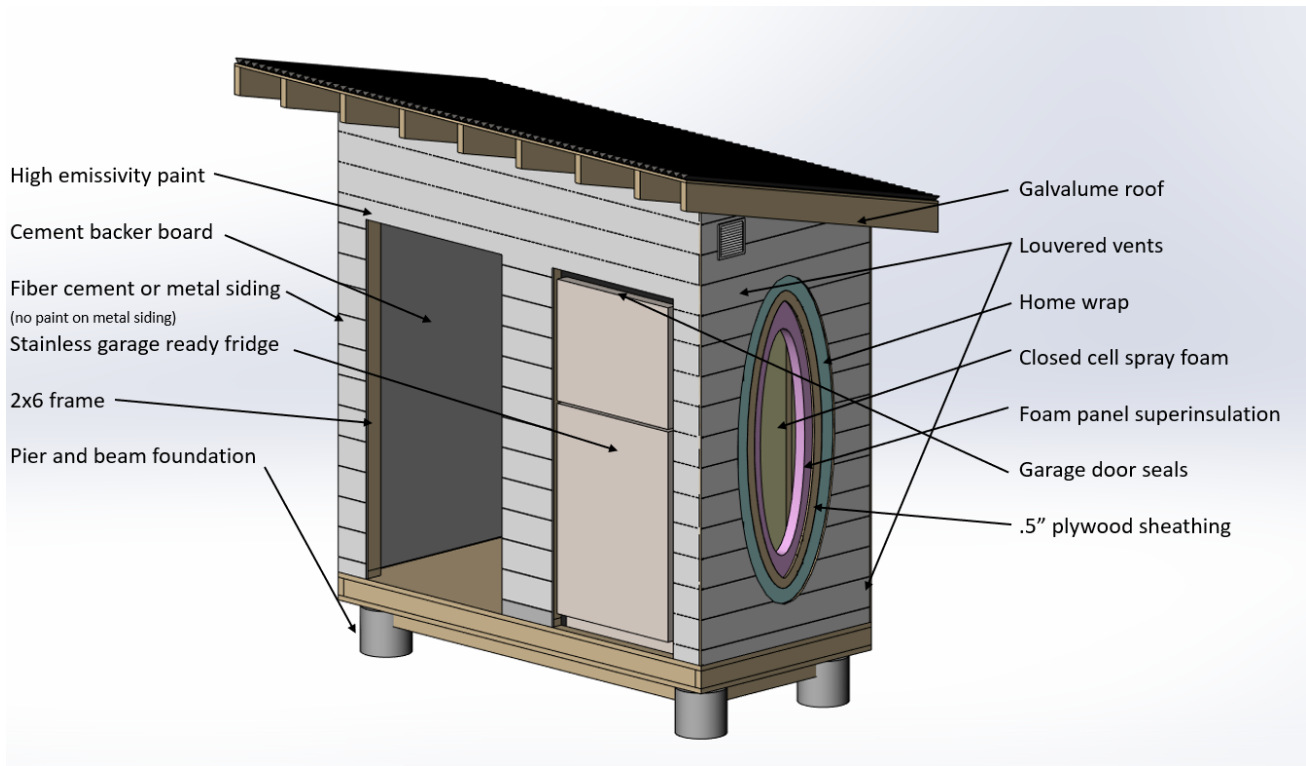
Below is the second iteration of the budget design's floor plan. Not illustrated is the inclusion of the barn-style door, similar to the one currently used on the Portland St Fridge. Our team recommends sealing the door and including a wooden stop positioned parallel to the door keeping the door from coming off the rails and preventing potential harm from the door falling on someone. Additionally, we suggest using the same construction methods shown in the above diagram.

Budget Floor Plan



High-End Enclosure for Larger Budgets

Diagram



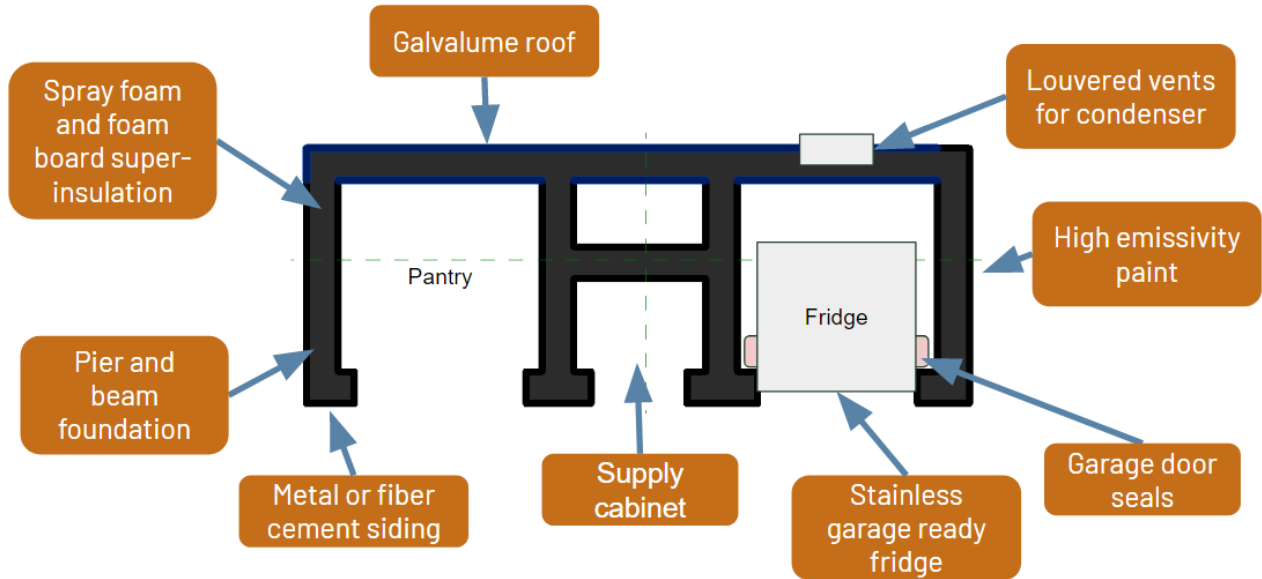
Cost estimate

Item	Material	Professional labor	Total
Closed Cell foam	\$800.00	\$700.00	\$1,500.00
2 layers foam board	500		\$500.00
Pier and beam foundation	\$200.00	\$1,000.00	\$1,200.00
Plywood sheathing	\$320.00		\$320.00
Homewrap	\$75.00		\$75.00
Fiber cement siding	\$250.00		\$250.00
High emissivity paint	\$90.00		\$90.00
Louvered vents	\$20.00		\$20.00
Galvalume roof	\$120.00		\$120.00
Stainless garage ready fridge	\$900.00		\$900.00
Cement backer board	\$120.00		\$120.00
Timber (2x6 frame)	\$700.00		\$700.00
Garage door seals	\$240.00		\$240.00
Total			\$6,035.00
Cost of materials			\$4,335.00

Proposed Second Iteration Floor Plan for High End Enclosure

Similar to the previous design, barn doors are also present in this iteration. This particular floor plan is proposed to be larger than previous designs, at 8' 5" by 4' 5". The extra room grants more space to accommodate more than one person using the enclosure at a time and can be paired with railings, ramps, and other accessibility options.

High-End Floor Plan



References

- A, F. (2022, May 2). *Open cell vs. closed cell foam: Which is best for your home*. First American Roofing.
<https://firstamericanroofing.com/open-cell-vs-closed-cell/>
- B, R. (n.d.). *Are vinyl cedar shake shingles really a better alternative?* Brava Roof Tile.
<https://www.bravarooftile.com/blog/vinyl-shakes/>
- B, R. (n.d.). *Blown fiberglass insulation or rolled - how to choose*. Attic Insulation Houston - Ultimate Radiant Barrier & Insulation Houston, TX.
<https://www.ultimateradiantbarrier.com/blown-fiberglass-insulation-or-rolled-how-to-choose/>
- B, T. (n.d.). *5 ft x 200 ft Dupont Tyvek Homewrap*. 5 ft x 200 ft DuPont Tyvek HomeWrap at J & B Materials.
<https://jbmateriale.com/product/B-TYVEK5>
- Barker, C. (2021). *8 top exterior siding options: Pros and cons*. Caroline on Design.
<https://carolineondesign.com/8-top-exterior-siding-options-pros-and-cons/>
- Cameron, S. (2011). *How much air circulation does a normal refrigerator need?* Hunker.
<https://www.hunker.com/13409874/how-much-air-circulation-does-a-normal-refrigerator-need>
- Coldline. (n.d.). *Coldline C12r 25" solid door commercial reach-in refrigerator-11 cu. ft.* Kitchenall Restaurant Equipment.
<https://www.kitchenall.com/coldline-u-12r-25-solid-door-commercial-reach-in-refrigerator-11-cu-ft.html?source=googleshopping&locale=en-US>
- Corning, O. (2021). *Foam board insulation*. Egg Energy Systems.
<https://eggenergysystems.com/foam-board-insulation/>
- D, M. (n.d.). *M-D 18 ft. universal bottom garage door seal*. Discount Building Supply.
<https://discountbuilding.net/products/m-d-18-ft-universal-bottom-garage-door-seal>
- Department of Energy. (2022). *Types of insulation*. Energy.gov. <https://www.energy.gov/energysaver/types-insulation>
- Dinh, H. (2022, February 1). *How to ventilate your shed*. Waltons.
<https://www.waltons.co.uk/blogs/blog/how-to-ventilate-shed#:~:text=Install%20vents,-A%20small%20ventilation&text=By%20installing%20two%20vents%2C%20one,will%20provide%20good%20air%20flow>
- E, E. (2012, May 2). *How to pour a concrete shed foundation*. One Project Closer.
<https://www.oneprojectcloser.com/pouring-concrete-slab-shed-base/>
- E, K. (2014, July 13). *Insulation: Stabilized cellulose advantages*. Eco Performance Builders.
<https://ecoperformancebuilders.com/insulation-stabilized-cellulose-advantages/>
- E, R. (2023). *Cost of metal siding*. Cost of Metal Siding - Get 2023 Metal Siding Prices.
<https://www.remodelingexpense.com/costs/cost-of-metal-siding/>
- E, W. (2023, January 10). *Easy whirlybird roof turbine install*. Instructables.
<https://www.instructables.com/Easy-Whirlybird-Roof-Turbine-Install/>
- General Electric. (n.d.). *Home*. How to Tell if a Refrigerator Door Seal is Bad | FAQs | GE Appliances Factory Service.
<https://repair.geappliances.com/resources/faq/how-do-i-tell-if-a-refrigerator-door-seal-is-bad>

- Gustafson, C. (2023, March 1). *Pros and cons of the most commonly used types of residential insulation*. Family Handyman. <https://www.familyhandyman.com/list/pros-and-cons-of-the-residential-insulation/>
- H, A. (2022, June 27). *Air sealing vs. insulation: What's better for efficiency?* Attainable Home. <https://www.attainablehome.com/air-sealing-vs-insulation-whats-better/>
- H, F. (2021, May 19). *Why choose mineral wool insulation?* Family Handyman. <https://www.familyhandyman.com/list/why-choose-mineral-wool-insulation/>
- H, M. (2023). *2023 fiber cement siding costs: Installation guide*. Modernize. <https://modernize.com/siding/types/fiber-cement>
- H, M. (2023). *2023 wood siding installation costs: Types of Wood Siding*. Modernize. <https://modernize.com/siding/types/wood#:~:text=Natural%20wood%20siding%20installation%20costs,approximately%20%249.75%20per%20square%20foot>
- H, O. (2022). *How much does spray foam insulation cost?* This Old House. <https://www.thisoldhouse.com/roofing/reviews/spray-foam-insulation-cost>
- Home Depot. (2023). *5 in. X 16 in. Eastern white cedar kiln dried wall grade architectural shingles 63903747*. The Home Depot. <https://www.homedepot.com/p/5-in-x-16-in-Eastern-White-Cedar-Kiln-Dried-Wall-Grade-Architectural-Shingles-63903747/324354723>
- Home Depot. (2023). *Frost king 36 in. x .25 in. heavy-duty aluminum and brush door sweep Weatherstrip SB36*. The Home Depot. <https://www.homedepot.com/p/Frost-King-36-in-x-25-in-Heavy-Duty-Aluminum-and-Brush-Door-Sweep-Weatherstrip-SB36/202525375>
- Home Depot. (2023). *GE 19.2 cu. ft. top freezer refrigerator in fingerprint resistant stainless steel GTS19KYNRFS*. The Home Depot. <https://www.homedepot.com/p/GE-19-2-Cu-Ft-Top-Freezer-Refrigerator-in-Fingerprint-Resistant-Stainless-Steel-GTS19KYNRFS/319881478#overlay>
- Home Depot. (2023). *Gibraltar Building Products 10 ft. Sm-Rib Galvalume Steel 29-gauge roof/siding panel 987602*. The Home Depot. <https://www.homedepot.com/p/10-ft-SM-Rib-Galvalume-Steel-29-Gauge-Roof-Siding-Panel-987602/314709088>
- Home Depot. (2023). *Gibraltar building products 8 ft. corrugated galvanized steel 31-gauge roof panel 13513*. The Home Depot. <https://www.homedepot.com/p/8-ft-Corrugated-Galvanized-Steel-31-Gauge-Roof-Panel-13513/202092961>
- Home Depot. (2023). *Gibraltar Building Products 8 ft. Sm-Rib Galvalume Steel 29-gauge roof/siding panel 987601*. The Home Depot. <https://www.homedepot.com/p/8-ft-SM-Rib-Galvalume-Steel-29-Gauge-Roof-Siding-Panel-987601/314709085>
- Home Depot. (2023). *Greenfiber 25 lbs. cellulose blown-in insulation or spray applied insulation INSSANC*. The Home Depot. <https://www.homedepot.com/p/Greenfiber-25-lbs-Cellulose-Blown-In-Insulation-or-Spray-Applied-Insulation-INSSANC/311574454>

- Home Depot. (2023). *HDX 10 ft. X 25 ft. clear 6 mil plastic sheeting RSHD610-25C*. The Home Depot.
<https://www.homedepot.com/p/HDX-10-ft-x-25-ft-Clear-6-mil-Plastic-Sheeting-RSHD610-25C/204711657>
- Home Depot. (2023). *Huber 7/16 in. 4 ft. x 8 ft. zip osb wall sheathing 777198*. The Home Depot.
<https://www.homedepot.com/p/Huber-7-16-In-4-Ft-x-8-Ft-Zip-OSB-Wall-Sheathing-777198/202089190>
- Home Depot. (2023). *James Hardie Hardiebacker 0.25 in. x 3 ft. X 5 ft. cement backerboard 220022*. The Home Depot.
<https://www.homedepot.com/p/James-Hardie-HardieBacker-0-25-in-x-3-ft-x-5-ft-Cement-Backerboard-220022/100183556>
- Home Depot. (2023). *James Hardie hardieplank hz5 5/16 in. X 8.25 in. X 144 in. fiber cement primed Cedarmill lap siding 6000265*. The Home Depot.
<https://www.homedepot.com/p/James-Hardie-HardiePlank-HZ5-5-16-in-x-8-25-in-x-144-in-Fiber-Cement-Primed-Cedarmill-Lap-Siding-6000265/202035444>
- Home Depot. (2023). *Lomanco 12 in. galvanized steel internally braced whirlybird wind turbine GT12*. The Home Depot.
<https://www.homedepot.com/p/LOMANCO-12-in-Galvanized-Steel-Internally-Braced-Whirlybird-Wind-Turbine-GT12/100572638>
- Home Depot. (2023). *M-D building products 1-1/2 in. black platinum expandable foam weatherseal for uneven gaps 03115*. The Home Depot.
<https://www.homedepot.com/p/M-D-Building-Products-1-1-2-in-Black-Platinum-Expandable-Foam-Weatherseal-for-Uneven-Gaps-03115/314012150>
- Home Depot. (2023). *Master flow 3 in. resin circular mini wall louver soffit vent in white (4-pack) RLSC3*. The Home Depot.
<https://www.homedepot.com/p/Master-Flow-3-in-Resin-Circular-Mini-Wall-Louver-Soffit-Vent-in-White-4-Pack-RLSC3/100038053>
- Home Depot. (2023). *Master flow 6 in. x 6 in. galvanized 26 gauge Louver with screen 26L6X6GS*. The Home Depot.
<https://www.homedepot.com/p/Master-Flow-6-in-x-6-in-Galvanized-26-Gauge-Louver-with-Screen-26L6X6GS/205430389>
- Home Depot. (2023). *OSB 7/16 in. sheathing panel, application as 4 ft. X 8 ft. 386081*. The Home Depot.
<https://www.homedepot.com/p/OSB-7-16-in-Sheathing-Panel-Application-as-4-ft-x-8-ft-386081/202106230>
- Home Depot. (2023). *Owens Corning Foamular NGX F-250 2 in. x 4 ft. X 8 ft. SSE R-10 XPS rigid foam board insulation 52DDNGX*. The Home Depot.
<https://www.homedepot.com/p/Owens-Corning-FOAMULAR-NGX-F-250-2-in-x-4-ft-x-8-ft-SSE-R-10-XPS-Rigid-Foam-Board-Insulation-52DDNGX/315197962>
- Home Depot. (2023). *Owens Corning R-13 Kraft faced fiberglass insulation continuous roll 15 in. x 32 ft. RF10*. The Home Depot.
<https://www.homedepot.com/p/Owens-Corning-R-13-Kraft-Faced-Fiberglass-Insulation-Continuous-Roll-15-in-x-32-ft-RF10/202585857>
- Home Depot. (2023). *Ply gem transformations double 4 in. x 150 in. white lap vinyl siding PC4004H*. The Home Depot.
<https://www.homedepot.com/p/Ply-Gem-Transformations-Double-4-in-x-150-in-White-Lap-Vinyl-Siding-PC4004H/301837334>
- Home Depot. (2023). *Plytanium plywood siding panel T1-11 8 in OC (nominal: 19/32 in. x 4 ft. X 8 ft. ; actual: 0.563 in. X 48 in. X 96 in.) 113699*. The Home Depot.

<https://www.homedepot.com/p/Plytanium-Plywood-Siding-Panel-T1-11-8-IN-OC-Nominal-19-32-in-x-4-ft-x-8-ft-Actual-o-563-in-x-48-in-x-96-in-113699/100000016>

Home Depot. (2023). *Rockwool R-15 COMFORTBATT 3-1/2 in. X 15 in. X 47 in. fire resistant stone wool insulation batt (59.7 sq. ft.) RXCB351525*. The Home Depot.
<https://www.homedepot.com/p/ROCKWOOL-R-15-Comfortbatt-3-1-2-in-x-15-in-x-47-in-Fire-Resistant-Stone-Wool-Insulation-Batt-59-7-sq-ft-RXCB351525/202090820>

Home Depot. (2023). *Tyvek 3 ft. X 165 ft. Homewrap Housewrap D15540828*. The Home Depot.
<https://www.homedepot.com/p/TYVEK-3-ft-x-165-ft-HomeWrap-Housewrap-D15540828/308793245>

Home Depot. (2023). *Whirlpool 20 cu. ft. top freezer refrigerator in White WRT311FZDW*. The Home Depot.
<https://www.homedepot.com/p/Whirlpool-20-cu-ft-Top-Freezer-Refrigerator-in-White-WRT311FZDW/205658420>

Home Depot. (2023). *Xcluder X2 Rodent Proof Garage Door Seal Kit - 8ft. X 1.75in. X 1.75in. individual pest control retainer 162971*. The Home Depot.
<https://www.homedepot.com/p/Xcluder-X2-Rodent-Proof-Garage-Door-Seal-Kit-8ft-x-1-75in-x-1-75in-Individual-Pest-Control-Retainer-162971/313936107>

Lowes. (2023). *Premium levella 6.5 cu. ft. commercial upright display refrigerator ...* Lowes.
<https://www.lowes.com/pd/Premium-Levella-6-5-cu-ft-Commercial-Upright-Display-Refrigerator-Glass-Door-Beverage-Cooler-in-Silver/5013802245>

M, M. (n.d.). *Corrugated metal roofing panels: Mansea Metal: MI, KY & IL*. Mansea Metal.
<https://www.manseametal.com/metal-roofing/corrugated.html>

Maxwell, R. (2023). *What to know about adding a door sweep*. Family Handyman.
<https://www.familyhandyman.com/article/all-about-adding-a-door-sweep/>

Maytag. (2021). *What is a garage ready freezer?* Maytag.
<https://www.maytag.com/blog/kitchen/what-is-a-garage-ready-freezer.html#:~:text=The%20ability%20to%20handle%20hot,F%20to%20110%C2%BF>

Nodine, S. (n.d.). *New beige vinyl siding being installed over an OSB substrate on a...* iStock.
<https://www.istockphoto.com/photo/vinyl-siding-installation-on-a-house-in-the-south-gm517925863-48941478>

Plastic wall vent with movable louvers. FAMCO. (2023, April 27).
<https://www.famcomfg.com/product/plastic-wall-vent-with-movable-louvers/>

R, E. (2020). *Corrugated metal roof or standing seam for your next replacement?* Excel Metal Roofing.
<https://excelmetalroofing.com/corrugated-metal-roof-or-standing-seam-for-your-next-replacement/>

Ravelli, M. (2021). *Our fridges*. Woo Fridge. <https://woofridge.org/locations/>

S, E. (2022). *Precompressed foam sealant and gasket tapes · Sika EMSEAL*. EMSEAL.
<https://www.emseal.com/specialty-gaskets-tapes/>

S, S. (n.d.). *How to choose the Best Shed Foundation for your shed project*. How To Choose the Best Shed foundation For Your Shed Project. <https://www.secrets-of-shed-building.com/shed-foundation.html#4>

- S, S. (n.d.). *How to choose the Best Shed Foundation for your shed project*. How To Choose the Best Shed foundation For Your Shed Project. <https://www.secrets-of-shed-building.com/shed-foundation.html#4>
- S, S. (n.d.). *Is a concrete shed base what you need?* Is a Concrete Shed Base what you need? <https://www.secrets-of-shed-building.com/concrete-shed-base.html>
- S, S. (n.d.). *Shed Pier Foundation - the advantages*. Shed Pier Foundation - The Advantages. https://www.secrets-of-shed-building.com/shed_pier_foundation.html
- Scalisi, T. (2022). *Pros and cons of metal siding*. Family Handyman. <https://www.familyhandyman.com/article/pros-and-cons-of-metal-siding/>
- Scott, S. (2021). *Metal siding: Everything you need to know*. NewHomeSource. <https://www.newhomesource.com/learn/metal-siding/>
- Sokol, E. (2018). *How much does a concrete slab for shed cost?* Plasticine House. <https://plasticinehouse.com/how-much-does-concrete-slab-for-shed-cost/>
- Sokol, E. (2020). *15 smart ideas for better shed ventilation (#10 is the best)*. Plasticine House. <https://plasticinehouse.com/shed-ventilation-ideas/>
- Sokol, E. (2021). *Pier and Beam Foundation: Design, how to build, cost, repair*. Plasticine House. <https://plasticinehouse.com/pier-and-beam-foundation/>
- Sonata, I. (2017). *Simple soffit vent installation*. Instructables. <https://www.instructables.com/Simple-Soffit-Vent-Installation/>
- Stevens, B. (n.d.). *Best wood siding options: 8 types to choose from*. Siding Authority. <https://sidingauthority.com/wood-siding/>
- V, A. (2020). *Why do so many homeowners choose asphalt shingles - Garlock-French roofing*. Garlock. <https://garlock-french.com/roofing/why-do-so-many-homeowners-choose-asphalt-shingles/>
- Wallender, L. (2022). *7 best brands of fiber-cement siding for your home*. The Spruce. <https://www.thespruce.com/best-brands-of-fiber-cement-siding-1821132>