

REVEL®

C U S T O M W I N E C E L L A R S

WINE CELLAR CONSTRUCTION GUIDE

This guide will take you step-by-step through the basic elements of the wine cellar design and construction process. Each individual cellar provides a unique set of circumstances however, and as a result this guide should be considered general in nature. Every cellar presents a unique set of demands, circumstances and challenges, making it impossible to provide a one-size-fits-all how-to manual. Some of the content is technical in nature and consultation with qualified professionals within the various disciplines involved is strongly recommended.

I. The Enclosure

A. Determining the Location of the Wine Cellar

Wine cellars can be either passive or active. Passive cellars maintain an environment without using mechanical systems. Examples of passive cellars are underground caverns used by European wineries for centuries that are cool, damp, and dark continuously. While it is not feasible for most of today's wine cellars to be fully passive, the location of a wine cellar can provide some of the benefits of a passive cellar, thus reducing the cost of mechanical systems and increasing their reliability. The easiest way to gain this benefit is to locate the cellar below grade, as in a basement, and insulating the space properly.

Since fully passive cellars are not generally feasible, we use modern technology to regulate the environment mechanically. Generally speaking, we construct wine cellars the way refrigerators are built, with mechanical cooling units and a very efficient "enclosure." While variations within a certain range can be acceptable, the consensus is that something on the order of a constant 55 degrees, and 70 percent humidity is optimal.

In general, look to position your wine cellar where there is:

- a) Adequate ventilation
- b) Minimal direct exposure to sunlight or to heat; and
- c) Limited vibration

B. Framing the Room

Standard 2x4 or 2x6 framing is sufficient for wine cellar walls, and standard ceiling joists are adequate for the cellar ceilings.

Please consult your local construction building codes for more information.

For concrete walls, 2x4 wood studs should be inset about one-inch from walls, to allow insulation to go behind the studs.

Your wine cellar should be constructed to exact dimensions of the wine cabinetry or racking to go inside. The more precise, the more your wine cellar will appear custom made. All necessary electrical and plumbing rough-in work should be installed prior to insulation.

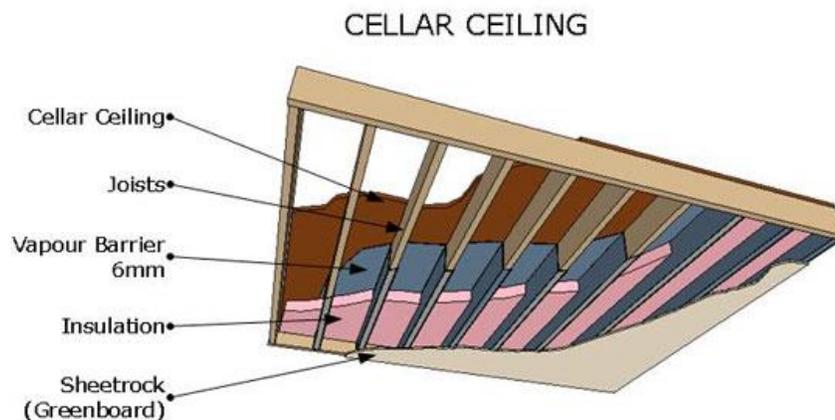
C. Vapor Barrier

A vapor barrier is critical to controlling the humidity inside your wine cellar.

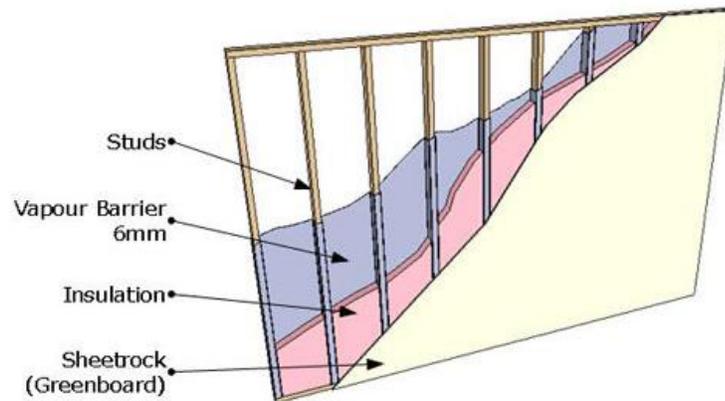
In humid climates, this prevents warm, moist air from entering the cellar, which can cause mold. In dry climates, this helps to maintain the humidity within the cellar in dry climates.

Sprayed-in, closed-cell foam insulation can serve as both insulation and moisture barrier.

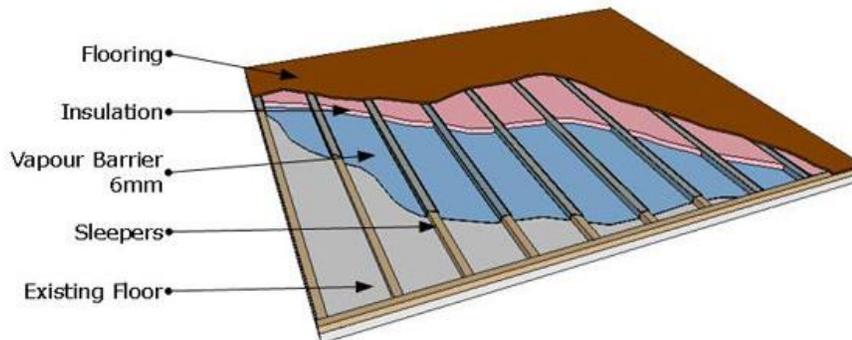
If using another type of insulation, a separate vapor barrier is needed. Apply 6mm poly to the warm side of all wine cellar walls, as well as the ceiling and floor. On interior walls this is done by wrapping the poly around the studs and applying it to the surface behind the insulation. This means continuous application between and around all studs and joists. This is the only way to ensure a complete and proper vapor barrier.



CELLAR WALL



CELLAR FLOOR



D. Insulation

Walls and ceilings must be insulated, using fiberglass, rigid foam (polystyrene), or blown-in insulation (fill to min. 4" depth for R-28).

In general, thicker insulation translates to better cooling. We recommend a minimum rating of R-22 for interior and exterior walls, and a minimum rating of R-32 for the ceiling (or higher if the ceiling is exposed to direct sunlight or strong winds).

For concrete walls, we recommend blown-in insulation (fill to minimum 4" depth for R-28).

If you suspect that the floor of your wine cellar might directly affect the temperature of the space, floor insulation should also be considered. Installing 2" x 2" wood sleepers with rigid insulation of R-7.5 placed

between them should be sufficient. In really cold situations you can build the floor with 2" x 4" studs on edge and fill with sprayed-in-place 2lb polyurethane.

E. Walls and Ceiling

If you plan on a standard drywall solution for walls and ceilings, moisture-resistant drywall also known as "purple board" or a product such as DensArmor (a paperless drywall product) is highly recommended. In the past, greenboard had been the standard, but it has been found to be less effective at inhibiting mold than is mold resistant drywall. Since paper can serve as a food source for mold and mildew, it is now recommended that wine cellar spaces avoid the use of drywall board that is paper-faced.

Mold-resistant drywall is composed in one of 3 ways:

Uniform: Some brands, such as USG's Fiberock Aqua-Tough, have a uniform composition of materials; in other words, no facing materials of any sort.

Mat-Faced: Other brands, such as Georgia-Pacific's DensArmor, have a gypsum core and fiberglass mat facings on both sides of the board.

Paper-Faced: Georgia-Pacific's ToughRock and Certainteed's M2Tech® Moisture & Mold Resistant Gypsum Board still have 100% recycled paper facing. The only difference is that the paper is treated to resist the growth of mold.

Use a water based, exterior grade paint to prime and paint the walls. Walls should be finished all the way to the floor as baseboards will not be needed as they will be hidden behind your wine racking.

Other hard surface finishes are acceptable as well, such as stone, tile, etc. If your particular selection is questionable, seek advice from a knowledgeable source. Primary consideration is that the material is mold and mildew resistant and remains stable in a damp, cool environment.

F. SOLID GLASS WALLS, ENTRY SYSTEMS AND ENCLOSURES

Collectors are increasingly opting to incorporate glass into their cellar designs to allow dramatic views into their cellars from the outside. This creates challenges in terms of energy efficiency and infiltration of damaging ultra violet light penetration. Recent advances in glass technology have made it possible to address these challenges, at least in part.

Tempered, double-paned insulated glass with Low-E coatings produce reasonably good R values and serve as effective vapor barriers. They can also effectively filter damaging UV rays. The proportion of glass in the cellar envelope will need to be factored into the heat loss calculation when selecting the cooling system. This type of glass must be contained in a framing system that will become part of the visual effect of the cellar.

Collectors sometimes prefer solid glass alternatives to avoid the framing systems required by the double-paned glazing. When selecting the solid glass approach, it is important to know that thermal performance may be diminished, both in terms of temperature and humidity control. It is also recommended that the solid glass be a minimum of one half inch thick. Given the close tolerances necessary to fit the glass together without a frame, a highly skilled and specialized glass fabricator is a must to achieve the desired

end result. Again, this will need to be factored into the cooling system planning. We strongly urge you to consult with a qualified glass professional to assist in the design of the enclosure.

G. Flooring

Most common treatments are tile, slate, marble, and concrete or other “hard surfaces”, but vinyl, cork and gravel are also acceptable. Hardwood floors can be acceptable, but considerable care should be taken. Typical hardwood floor finishes can create indoor air quality problems. Unfinished wood stains easily, and within the humid environment, swelling and buckling can occur.

We advise that you NEVER use carpet of any kind in a wine cellar. Carpet will mold and mildew in the cool, damp conditions of a wine cellar.

As with the case of wall coverings, flooring is normally chosen to match the overall décor and theme of the cellar/home. Finally, the flooring should be applied to a level surface.

H. Wood Framed Doors

A wine cellar should be a sealed environment, and in this respect, the cellar door is often the weakest link. When a wine cellar isn't sealed, it is difficult to control the temperature and the humidity, which often leads to cooling units running continually (not a good thing!) and burning out prematurely.

We recommend an exterior grade door with weather-stripping on all four sides. We also recommend the use of a sweep or threshold to form a tight seal. You should hear a vacuum 'whoosh' when you close and open the cellar door.

Final note on enclosure: if possible, the enclosure will be completed before the design of the racking, cabinetry, and other finishes and systems are finalized. In this way, the design of these important elements can be based upon exact final finished interior dimensions.

II. Cooling System

A. System Types

The requirements of your wine cellar's cooling unit will depend on several factors, including cellar size, your ambient climate, your intended use, construction plans, etc. There are a wide range of cooling systems, each with its own set of pros and cons. Essentially they fall into one of three types:

- ***Self-contained***, which are placed into one of the cellar walls, and blow cold air into the cellar and exhaust warm air out of the cellar and into the adjacent space. These systems are generally the most economical, but also have important disadvantages. They take up valuable space inside the cellar, they generally have more limited capacity, and they are the noisiest option.
- ***Split Systems*** allow the condensing unit to be located remotely outside the cellar (either inside or outside of the building) and are connected to an evaporator inside the cellar by a line set

consisting of a liquid line and a suction line. These systems also require a drain line from the condenser unit and must be installed by a licensed plumber. Split systems can be quieter, longer lasting, more efficient and have greater cooling capacity than self-contained systems.

- **Fully Ducted Systems** operate in a manner similar to a home HVAC system, using a remotely located evaporator/condenser unit, and connecting to the cellar via ductwork for supply and return air. These systems offer the significant advantage of having no mechanical equipment inside the cellar, which saves space inside the cellar and are essentially silent within the cellar.

We recommend you contact a professional to ensure you get the cooling unit right for your cellar.

B. Placement of Cooling Unit

This will vary depending on the specific cooling unit chosen. Follow instructions that come with the unit.

C. Venting

Ventilation is critical when building a wine cellar. The room adjoining the cellar (which shares the same wall that the cooling unit is installed in) is called the exhaust room, and it requires proper ventilation.

Any given cooling unit can only maintain a maximum of a certain temperature difference between the wine cellar and the exhaust room (typically around 30 degrees, but some systems claim up to 70 degrees). So, for example, if the temperature of a wine cellar is set at 55F and the maximum differential from the manufacturer is 30 degrees, the exhaust room cannot go lower than 25F or higher than 85F. While this is fine for most installations, some will require alternative solutions.

This is how a wine cellar maintains a consistent temperature. A cooling unit blows cool air down at a 45 degree angle into the cellar, which pushes warm air to the ceiling. That warm air is then brought into the unit and passed into the exhaust space.

As the unit cools the cellar, it generates at least as much heat on the exhaust side. If the heat in the exhaust room is not properly dissipated (i.e., if the room is not properly ventilated), the exhaust room will continue to heat up, and will likely surpass the 85F threshold. The result is that the cellar temperature will also rise.

Exhausting directly to the outdoors can alleviate many ventilation issues.

Improper ventilation of the exhaust room is the most common mistake made in wine cellar construction. If the exhaust room is allowed to get too hot, the cellar temperature rises and overall system integrity is compromised.

III. Other Systems

A. Electrical

It is a good idea to use a surge protector or power conditioner to protect your cooling unit. Make sure you run adequate electrical to accommodate the cooling unit, the main lights of the cellar, and also any accent lighting.

B. Lighting

Lighting in a wine cellar comprises an important part of the overall cellar décor. A wide range of low voltage or LED lights are available for your cellar, some of which can be installed within the cabinetry at the factory. The goal should be minimal heat output and 0% UV rays. It may also be a good idea to install timers or motion detectors, to avoid lights being left on, which could heat up the cellar over a long period of time.

C. Security

There are a wide range of security measures that can be incorporated into your cellar, from CCTV recording systems, to environmental monitoring systems that provide warnings in the event of equipment failures, power outages, or other environmental problems. Emergency power back-up systems and wine cellar inventory management systems are also available. There is a direct relationship between the value of the collection and the value of the investment that is appropriate. Additionally, some insurance companies are willing to provide premium discounts when good security is incorporated into the design.

Final note on systems: if possible, the cellar systems will be installed and operational before racking or cabinetry is installed and the collection is brought in. We want to make sure the systems are operating properly before any wine is brought into the cellar. If the systems are not operating properly, the trouble shooting process will work better if the cellar is empty.

IV. Racking, Cabinetry, Balance of Cellar

We typically start with a floorplan of the proposed racking or cabinetry design, and work backwards from there in terms of the rest of the cellar. This is appropriate, since this is the “heart” of the cellar, and this will provide guidance for the multitude of decisions that will come later. Alternatives vary dramatically based on style, cost, functionality, materials and quality.

Care should be taken to ensure that the choice you make not only fits your budget, but also functions well for the intended use of the cellar, and accommodates your collection properly. Mass market racking companies tend to oversimplify the process, and also use inferior materials and marginally qualified installers. Also consider your collecting plans in terms of storage for full cases, large format bottles and half bottles. Consideration of how you will actually use the cellar is important to your ultimate satisfaction with the project.

If using wood racks, mahogany or other hardwoods are strongly advised as opposed to soft woods such as Redwood, which will show wear and tear very quickly. A general rule of thumb would be that the racking/cabinetry will comprise about 70 percent of the cost of the cellar, and the balance of the cellar will

absorb the remaining 30 percent. Of course, this may vary dramatically depending on finish quality, system choices, etc.

A final note on the balance of the cellar: We have often found that collectors desire entertainment and dining space within the cellar. We generally issue a word of caution here. Tasting rooms and entertainment space work best adjacent to but not inside of a wine cellar. We have had too many clients come back and express regret after setting up their cellars with these “amenities”. Cold, damp environments do not lend themselves to warm, social activities. It works much better to design a tasting room or entertainment area adjacent to the cellar, and if the view of the cellar is integral to the overall design, the spaces can be divided by a floor-to-ceiling glass wall and integrated door system that provides a similar effect with much greater customer satisfaction!