

FACILITIES AND EQUIPMENT

by
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Small quantities of wine can be made in the kitchen or on a bench in the garage, and little special equipment is needed. A larger work space and access to some basic winemaking equipment are necessary when a barrel of wine is made each year. When several barrels of wine are produced each season, specialized winemaking equipment, a large work space and storage space for both bulk wine containers and bottled wine will be needed. Home winemakers often produce wine in five, fifteen, thirty, fifty-five or sixty gallon quantities because containers having these specific capacities are readily available.

Oxygen in the air can spoil table wines so producing high quality wine in small containers is difficult due to oxidation problems. A one-gallon container is suitable for bulk storing wine for only a few months. Five-gallon "water bottles" are readily available, and they are popular with home winemakers. But, water bottles are marginal bulk wine containers because of their small size. A 15-gallon stainless steel beer keg is less susceptible to oxidation so it is a better bulk wine storage container. A thousand gallon tank seldom has oxidation problems.

FACILITIES

Winemaking requires several types of work space, and each type has different requirements. A crush area is needed to receive and process the grapes. Cellar space is needed where the wines are fermented, aged and bottled. In addition, some general storage space is needed to store winemaking equipment and supplies. A separate area set aside for each specific function is the ideal arrangement. However, most winemakers have limited space for winemaking, so compromises are often necessary.

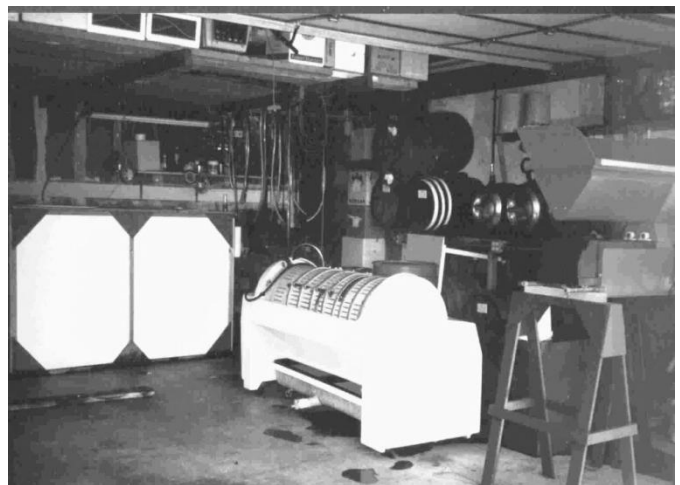
Crush Area

Many home winemakers use their garages as temporary crush areas each season. The crusher is placed near the front of the garage. The grapes are unloaded in the driveway and dumped directly into the crusher. All winemaking equipment must be washed before it is used and then wash again after it is used. Cleaning a small crusher or press will generate large amounts of wastewater so water disposal can be a problem. A hose with an adjustable spray nozzle permanently installed at or near the crush pad is a great convenience. Provide a hook or other arrangement so the hose can be hung in a convenient place. Ants can become a terrible problem, so the entire crush area should be carefully washed as soon as the crush operations are finished.

Cellar Space

Wines are fermented, clarified, stabilized, aged and bottled in the "cellar." Cellar activities generate residue so some way of disposing of liquid waste material is needed. A centrally located floor drain equipped with a removable grate is a great convenience.

Aging wine is mostly a passive operation, and little more space than is necessary to hold the storage containers is needed. Five-gallon water bottles are about 10 inches in diameter and 20 inches high. Fifteen-gallon stainless steel beer kegs are roughly 15 inches in diameter and 23 inches high. Standard oak barrels are about 24 inches in diameter and 36 inches long. Double stacking or even triple stacking barrels is possible, but most home winemakers find stacked barrels difficult to handle and clean.



Bottling wine requires a moderate amount of cellar space. A typical bottling setup for an advanced home winemaker might consist of a small transfer pump, a filter, a bottle-filler, a corker, a labeling rack and a label

pasting machine. A large table or bench is needed to hold the empty bottles, the filler and the filled bottles. In addition, a second table or a small bench is needed to hold the label pasting machine and the rack used to hold the bottles while the labels are applied.

EQUIPMENT

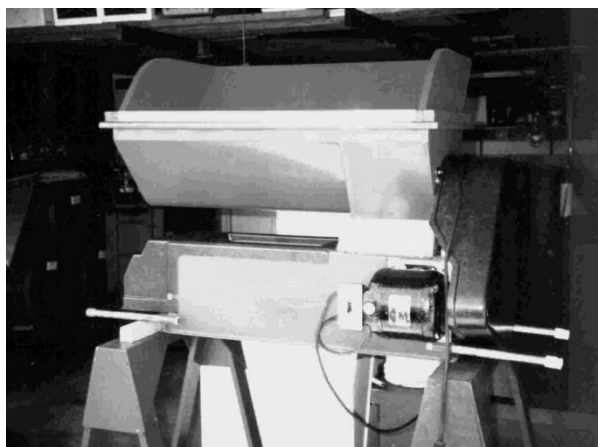
Small wineries and home winemakers often make their wines using a minimum amount of equipment. Basic crush equipment consists of a crusher and a wine press. Basic cellar equipment consists of wine storage containers, transfer equipment, bottling equipment and test equipment.

Crusher

For the average home winemaker, a hand crank crusher is probably the most practical method of crushing small quantities of grapes. Operation of these little machines is very simple. The crusher is placed on top of a suitable container. The hopper is filled with fruit, and the crank is turned. Clusters of grapes pass between rollers and the crushed fruit and stems drop into the container.

Stems can be easily removed by hand using the following technique. Put a clean, plastic milk crate on top of a suitable container. Place a few pounds of crushed fruit in the bottom of the milk crate and make a scrubbing motion with the hand. The crushed fruit will drop through the crate into the container. Then discard the stems from the crate and repeat the process.

A motor driven crusher/stemmer will crush and separate the grapes from the stems in one fast, simple operation. The grapes are dumped in the fruit hopper, and the machine does the rest. Power crushers have capacities ranging from about 1 ton to more than 50 tons of grapes per hour and the smallest machine will keep one person busy filling the hopper. Unfortunately, small power crushers cost several hundred dollars, but these machines can save a tremendous amount of time and labor.



Press

Most home winemakers use a small vertical basket press similar to that shown in the Figure. Smaller presses use a screw mechanism to generate the pressure. Large, commercial basket presses often use a hydraulic cylinder to generate the pressure. Some homemade presses use a hydraulic automobile jack to squeeze the grapes. Most compound screw presses can generate high pressures. High press pressures extract the juice with a minimum amount of labor, but high pressures can extract excessive amounts of phenolic materials and produce harsh, bitter wines. So, small screw presses must be used with care.

The major disadvantage of any vertical press is the large amount of labor required. The press must be completely disassembled and the basket removed before the pomace cake can be crumbled. Then, after the cake has been broken up, the basket must be reassembled and refilled to start a new press cycle. Several press cycles are usually required to produce dry pomace. So, using a vertical basket press properly requires a lot of hard work.

During the 1950's, many California wineries replaced their big vertical hydraulic presses with horizontal presses. Horizontal presses offer a major advantage because the pomace cake can be crumbled automatically by releasing the pressure and rotating the horizontal basket. Horizontal presses



are simple and easy to operate, and they save wineries a tremendous amount of labor. Modern horizontal presses use an inflatable rubber bladder. After the press is loaded, the bladder is inflated and the grapes are gently squeezed against the basket to extract the juice. Modern wine presses are nearly self-operating, and they only require attention when the press is being loaded or unloaded.

Pumps

Home winemakers use a variety of small pumps to move juice and wine. A typical rubber impeller pump can deliver five gallons per minute and has a maximum pressure head of 30 pounds per square inch. Many of these little rubber impeller pumps are self priming, inexpensive and can provide good performance if they are used carefully. But, they should not be run dry for extended periods, and their shaft seals have a limited service life. **A leaky pump with a worn shaft seal will quickly oxidize the wine, so shaft seals on small pumps must be replaced often.**

Small, magnetically coupled, centrifugal pumps are suitable for any small winery. A magnetically coupled centrifugal pump does not have a shaft seal. The impeller is coupled to the drive motor by means of two powerful permanent magnets. These little magnetically coupled pumps have advantages and disadvantages. They are more expensive than direct-coupled pumps. They are not self-priming, and sometimes getting these pumps started is difficult. On the other hand, magnetically coupled pumps have long, trouble free lives, and they do not have shaft seals that can leak air and oxidize the wine.

Filters

Home winemakers use two types of wine filters. Pad type filter assemblies consist of a stack of ridged plastic or stainless steel frames held together by a powerful clamping mechanism. A filter pad separates each frame. The wine flows into half the frames, through the filter pads and then out of the other frames. Pad type filter assemblies are made of stainless steel and molded plastic. The clamping mechanisms are large. The materials are expensive and the frames are difficult to manufacture. Consequently, pad type filter assemblies are expensive. But, filter pads become more economical when large quantities of wine are filtered, so commercial wineries use pad type filters.

Cartridge type filters consist of filter materials made in the shape of a hollow cylinder. The cylindrical filter cartridge is housed in a plastic or stainless steel container. Wine flows into the housing and through the filter cartridge from the outside to the inside. After passing through the filter material, the wine flows out of the housing. Both depth type filter cartridges and membrane type filter cartridges are available. Cartridge type filter housings made of plastic are used extensively for domestic water filtration. These plastic housings are made in large quantities, and they are inexpensive. Wine filter systems can be built from inexpensive plastic housings, so home winemakers often use cartridge type filters.

Bottle Filler

Reducing wine oxidation is always desirable, so wine bottles should be filled from the bottom with a minimum amount of splashing and bubbling. Simple wand-type bottle fillers consist of a 14-inch length of rigid plastic tubing fitted with a small plastic valve at the bottom end. The filler is attached to the end of a piece of plastic siphon tubing. When the wand is inserted into the empty bottle, the valve presses against the bottom of the bottle and the wine starts to flow. Wine flow automatically stops when the operator raises the tube. Wand type fillers minimize wine oxidation but they fill bottles slowly.

Two, three and four spout, gravity bottle fillers are more suitable for home winemakers producing 50 or more gallons of wine each year. These fillers have a small tank to hold the wine and two or more siphon tubes to transfer the wine into the bottles. A simple float-valve



mechanism keeps the tank full of wine. Operating a small multi-spout, gravity type filler is simple. An empty wine bottle is placed on a spout, and then the machine fills the bottle to a preset level and automatically stops. Many gravity type bottle fillers will fill two bottles per spout per minute. So when a bottle filler has four or more spouts, one person is kept busy just removing the full bottles and replacing them with empty bottles.

Corker

Small, manual corking machines are made in a variety of styles, and prices range from a couple of dollars to several hundred dollars. An effective corking machine must be able to do two functions, and these two functions must be done separately. First, the cork must be compressed, and then the cork must be driven into the bottle. A good manual corker can drive dry corks into the bottles without excessive effort. The better machines are solidly built and have a useful life greater than 100,000 corks. Well-designed "floor" corkers sell for about \$100. Many small, inexpensive, hand held corking machines are practically worthless.

WINE STORAGE CONTAINERS

The traditional material used to make wine containers is white oak. However, in California, redwood was extensively used for constructing wine containers from the mid eighteen hundreds until after prohibition. Concrete storage tanks were widely used in wineries until about fifty years ago (a large bank of concrete tanks can still be seen at the old Galleano Winery in Mira Loma). In recent years, stainless steel has become the material of choice for wine tanks, and several manufacturers are now producing smaller size tanks from high-density polyethylene.

Open Fermentors

Small commercial wineries and most home winemakers use open containers when fermenting red wine. Large amounts of carbon dioxide gas are generated during fermentation, and the wine becomes saturated with carbon dioxide. The constant evolution of gas prevents air from entering the wine, so oxidation is not a problem. Small producers seldom use open fermentors larger than a few hundred gallons because it is difficult to punch down the cap in a large vat by hand. Polyethylene and stainless steel are the most suitable construction materials for small red fermentors. Small commercial wineries often use half-ton, fruit bins holding about 175 gallons, as temporary, red fermentors. A good open fermentor can be made from a 55-gallon polyethylene drum by cutting out the top with a saber saw. Thirty-gallon, food grade polyethylene containers with tight fitting lids are available at most home winemaking shops. Large amounts of homemade red wine is fermented in 32-gallon plastic trash cans each year.

Closed Containers

Most white and blush wines are fermented in closed containers. Large volumes of carbon dioxide gas are produced during fermentation, so winemakers seal closed tanks with fermentation locks until all signs of fermentation have stopped. Fermentation locks come in several sizes and styles. Most small fermentation locks contain a liquid trap of some sort. The liquid in the trap lets the carbon dioxide gas escape while preventing air from entering the tank.

Five-gallon water bottles are readily available, and water bottles are the containers most often used by beginning home winemakers. They have both advantages and disadvantages. Glass is a smooth vitreous material, and it can be cleaned easily. Glass is transparent, so fermentation progress is easy to monitor visually. But, glass containers are heavy, and some winemakers find it difficult to move a full 5-gallon carboy. Glass is both slick and fragile and handling heavy glass bottles with wet hands can be quite dangerous. Even so, a few water bottles are handy for storing leftovers.

Polyethylene has become a recognized "food grade" material. Polyethylene drums are widely used for storing and shipping liquid food products, and wine can be safely stored for extended periods in heavy walled, containers made of dense polyethylene. Several firms are now producing polyethylene tanks in a variety of sizes and shapes specifically for use as wine storage containers. Used poly drums are available in 20, 30, 40 and 55 gallon sizes, and they make excellent wine storage containers. Wine storage containers made of polyethylene have both advantages and disadvantages. They are lightweight, so polyethylene drums can be handled and stored easily. Best of all, they are inexpensive. New poly drums sell for about \$1.00 per gallon, and good used drums are often

available for a few dollars each. But, polyethylene has a porous microstructure. It is a difficult material to clean completely and used polyethylene drums can retain odors for extremely long times. Off odors can contaminate wine, so secondhand drums must be selected with care.

Most winemakers agree that stainless steel is the best material for fabricating closed wine storage tanks. A polished, food grade surface made of stainless steel is easy to clean and sterilize. Properly designed stainless tanks are inert, and they are completely tight. Unfortunately, stainless steel is an expensive material. Large wine tanks cost two or three dollars per gallon of capacity and small tanks cost several dollars a gallon. But, stainless steel tanks give many years of trouble free service. Home winemakers often use surplus stainless beer kegs for wine storage containers. The deposit for a 15-gallon beer keg is \$12 to \$15. That is about a dollar per gallon of storage capacity and finding a less expensive wine container is difficult.



Barrels

Oak barrels have been used for storing wine for hundreds of years. Standard wine barrels hold 225 liters (59 gals). When wine is stored in oak barrels for an extended time, the oak wood imparts a spicy, vanillin flavor to the wine. But, after a barrel is four or five years old, it no longer produces the desirable flavors so wineries replace their barrels from time to time. A few wineries replace all of their barrels each year, but most wineries replace 20 to 30 percent of their barrels each year. In 2007, new French barrels cost about \$700 each, so barrel replacement is a considerable expense when a winery uses barrels in their wine-aging program.

Besides their high cost, oak barrels have several other disadvantages. Barrels are heavy, difficult to handle and hard to clean. An empty barrel weighs almost 100 pounds, and a barrel full of wine weighs about 600 pounds. With a little practice, empty barrels can be moved by hand without much difficulty, but moving full barrels more than a short distance by hand is seldom feasible.

Oak chips can be added to wine to impart desirable oak flavors, and many home winemakers use oak chips to flavor their wines rather than barrels. Some winemakers put the oak chips in a nylon mesh bag and then suspend the bag in the wine. Other winemakers just add the chips directly to the wine. After a few days, the loose chips sink to the bottom of the container, and then the chips are treated just like lees. Estimating the quantity of chips to be added is difficult for the inexperienced winemaker. The amount needed depends on the specific wine and on the winemaker's personal preference. About twelve ounces of chips for 50 gallons of red wine is a reasonable place to start. But, considerably fewer chips are appropriate for many white wines. All wines should be tasted every few days after oak chips are added. Then when the oak flavor is just a little bit too strong, the wine can be racked off the oak chips.

Barrels full of wine require little extra attention, but used, empty barrels are difficult to maintain. When a barrel is first filled, almost four gallons of wine soaks into the wood. When a used barrel is left empty for a few days, the wine in the wood starts turning into vinegar. Sterilizing oak barrels is practically impossible, so when barrels become infected with vinegar bacteria, they must be discarded. Commercial winemakers avoid this problem by not emptying their barrels until new wine is available. Home winemakers should avoid very small oak barrels. Small oak barrels or casks are difficult to build, so they are very expensive per gallon of capacity. They are prone to leakage, and small wood cooperage is more difficult to maintain properly. Wine stored in small oak containers becomes over-oaked very quickly. Oak casks of five or ten-gallon capacity are often recommended by home winemaking shops, but these tiny barrels are little more than expensive toys.