Distillery Design:
Producing Craft Spirits
at LaBelle Winery

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Submitted on March 6th, 2015

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LaBelle Winery

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A Major Qualifying Project Report
submitted to the Faculty of
Worcester Polytechnic Institute
in partial fulfillment of the requirements for the
Degree of Bachelor of Science
in the field of Chemical Engineering.

Submitted on March 6th, 2015

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Abstract

LaBelle Winery in Amherst, New Hampshire hopes to introduce a craft spirits line to their product list in the near future. Our team collaborated with the winery's owners and then communicated their wants and needs to a variety of distillation unit vendors in order to form recommendations on what company and unit would best suit LaBelle Winery's facility and vision.

Acknowledgements

Our team would like to thank the following individuals and organizations for their continuous support through the completion of our Major Qualifying Project.

- LaBelle Winery for sponsoring our project, allowing us access to their facility, and providing critical information for our report.
- Amy LaBelle and Cesar Arboleda, the co-owners of LaBelle Winery, for their time and energy in working with us to establish clear objectives and goals.
- Professor Stephen Kmiotek for his tireless efforts and invaluable guidance throughout the duration of the project.
- Worcester Polytechnic Institute and its Chemical Engineering Department for making this unique experience possible.

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Executive Summary

The objective of this project was to provide a viable distillation unit option to LaBelle Winery in New Hampshire. In order to accomplish this, we determined the owners' ideal outcome along with the resources and budget available. After speaking with the owners, we found they desired a design that would produce vodka, whiskey and brandy, fit their flexible budget of $100,000, and include distillation equipment that would be a centerpiece for the winery.

To build background knowledge, we researched and learned the local, state, and federal laws that would impact this project. We also learned more about the different types of spirits LaBelle Winery desired to produce and how batch distilleries operate through research and visits to other distilleries in New England. After compiling all of the information necessary to consult the owners of LaBelle Winery in their endeavor to purchase distillation equipment to expand their product line, we began reaching out to vendors that manufacture distillation equipment.

We contacted The Vintner's Vault, Vendome Copper and Brass Works Inc., Kothe Distilling Technologies Inc., and Daeyoo Tech with our project specifications and budget, inquiring what products they had that would match our expectations. After compiling the options each vendor provided, we created a vendor matrix to compare each design to LaBelle Winery's ideal outcome. By weighing factors such as price, level of automation, and batch size, we decided Kothe Distilling Technologies Inc.'s 600 L Twin Column Vodka Still was the ideal equipment for LaBelle Winery's new craft spirit product line. We recommended this vendor and product to the owners of LaBelle Winery for expanding their business. We also provided the owners with two alternative options from Vendome Copper and Brass Inc. and The Vintner's Vault that met most of their expectations.

To support LaBelle Winery's commitment to creating a comprehensive experience at their venue, we designed an informative poster explaining the distillation process to educate their employees and customers.

Introduction

Craft distillation of spirits has rapidly increased over the previous few years all across the country. Less than a decade ago there were about 70 distilleries in the United States. Then in 2013, over 600 distilleries were reported, and it is predicted that in a few years the market will be able to support over 1,000 independent distilleries (Distilled Spirits Council). The alcoholic beverage industry is a major contributor to the United States' economy. Distilled spirits accounted for over $120 billion in total economic activity in 2010 (Food and Beverage). With the increase of demand and economic opportunity, many business owners are looking to join the craft distillation movement.

Those already involved in the alcoholic beverage industry are much more inclined to add craft spirits to their product lists. These establishments have the opportunity to expand their current client base. Locally owned wineries see the potential in creating their own personal craft spirits and opening up a new source of revenue. However, there are many factors and obstacles that must be considered and overcome before a business can begin producing and selling spirits.

For a winery looking to enter the craft spirits industry, there is a gap between conceiving the idea and the actual production. Business owners must make several decisions before the process can begin. The type of spirits desired, the unit required to make those spirits, the materials that will be used, and the laws and regulations surrounding those spirits all must be weighed in consideration. There are companies devoted to designing and installing these distillation units. The services provided by these vendors range from selecting a standard distillation unit to developing a custom unit. Therefore, collaboration between the owner and vendor is extremely important.

The goal of this project was to provide a viable distillation unit option to LaBelle Winery in New Hampshire. In order to accomplish this, we learned the local, state, and federal laws that would impact this project. We also researched the standards for making spirits and the regulations that must be implemented. We discussed the owners' vision for the new products as well as the material they hoped to use and the capital they were prepared to invest. We contacted distillation unit vendors and conveyed to them the owners' unique needs. Finally, we discerned which distillation units would meet the requirements of the owners in both functionality and aesthetic. Based on our findings, we developed a set of possible distillation set ups for the owners of LaBelle Winery to consider as well as an informational poster to educate the winery staff and customers on the basics of distillation and the production of spirits.

Background

This section provides relevant information about the context of our project. It begins by discussing the basics of distillation and a process overview. It then moves on to explore the different types of alcohol that LaBelle Winery is interested in producing. Next, the regulations and laws associated with spirit production are explained. The section concludes with information about our sponsor, LaBelle Winery, and their vision for their future.

Distillation

Distillation is a process of separating the components of a liquid mixture by their relative volatilities through heating. Distillation has been utilized and studied for over two thousand years. Initially, distillation was used to experiment with concentrating the alcohol in wine as well as making perfumes and herbal mixtures. Today distillation is one of the most common separation methods used in the refining, chemical, pharmaceutical, and distilled spirits (alcohol) industries (Montgomery).

Process Overview

Distillation operates on the fundamental principle of differences in boiling points of the components in a liquid mixture. The mixture is heated in the distillation unit to the point where the components begin to reach their boiling points. The components with lower boiling points will begin to vaporize first and rise through the distillation unit. The vapors that form are taken off the top of the unit while the liquid is collected in the bottom. The final vapor product will have a higher concentration of the lower boiling components, while the liquid product will have a higher concentration of the higher boiling components.

The types of distillation units can be broken down into two main categories, continuous and batch. For the purposes of small scale spirits production, batch distillation is much more commonly used (Diwekar). An example batch distillation column with a pot reboiler is shown in Figure 1 below.

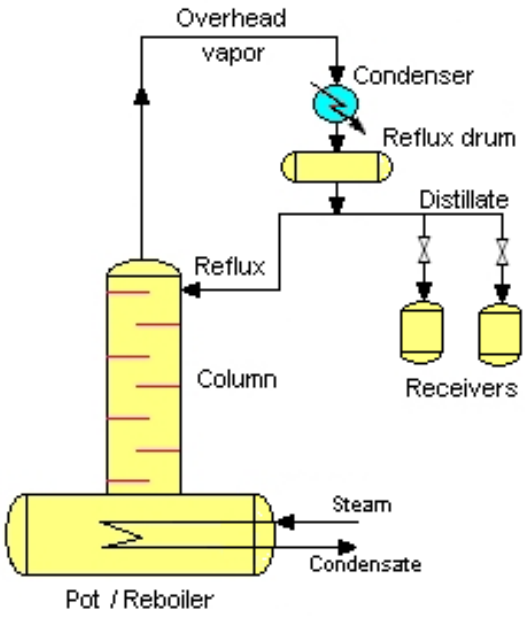


Figure 1: Batch Distillation Column with a Pot Reboiler

As the name suggests, in a batch distillation column, the feed is put into the column in batches. These batches are pumped into the pot shown in Figure 1 above. The pot in the batch column also doubles as the reboiler which heats the feed to the point of vaporization, creating the separation. The reboiler is the largest energy sink in the distillation process. Commonly, reboilers are steam heated as shown in Figure 1; however there are other heating options including electric and propane reboilers. As vapors form in the reboiler, they begin to rise through the column. The column internals are composed of either a set of trays spaced apart throughout the height of the column, or in some cases a packing material fills the column. For

the distillation of alcohol, trays are more commonly utilized as shown in Figure 1. The rising vapors pass through the porous trays as they rise through the column. On each tray or stage of the column, vapors are condensing and falling back down through the column while other liquids are vaporizing from the heat rising up through the column. At each subsequent tray from the bottom of the column, the concentration of the lower boiling point components in the mixture is increasing (Tham).

As the process heats up further, vapors begin to exit through the top, also called the overhead, of the column. The overhead vapor stream then passes through a condenser which condenses the majority of the vapor into the liquid phase. Overhead condensers typically use a cooling water utility and act as total condensers where little to no vapor is entrained in the liquid stream. Following the condenser, the overhead liquid enters a reflux drum which helps to ensure that there are no entrained vapors in the stream. Finally, the overhead liquid is split into two streams. The first stream is recycled back into the top stage of the column as the reflux. The second stream is taken off as the distillate product (Tham).

There are many factors that contribute to the cost and composition of the distillate product, but arguably the most important parameters in distillation column design are the number of stages and the ratio of the reflux flow rate to the distillate product flow rate. Increasing the number of stages will increase the distillate composition of the more volatile component; however, more trays will lead to a larger column which will require a larger capital investment. Increasing the reflux ratio will also increase the distillate composition of the more volatile component, but condensing a larger vapor overhead stream will increase utility costs. Together these factors along with column diameter, reboiler heat duty, tray spacing and type, and other

internal configuration are used to design the optimal distillation column for the project budget and specified products (Tham).

Alcohol Types

In this section we explore the various types of alcohol that can be produced from the distillation process. Different types of alcohol each require a specific set of raw materials and a specific production process. These different types of alcohols include vodka, whiskey, brandy, rum, gin, and countless others. Some of these alcohols, such as rum and whiskey, must undergo a post-production aging process that can last several years before they are finally bottled and sold on the market. Others, such as vodka and brandy, can be bottled and sold immediately following the production process. The spirits that LaBelle Winery is interested in producing include vodka, whiskey, brandy, and fortified wine.

Vodka

One of the more commonly produced and recognized spirits on the market is vodka. Vodka is an unaged pure spirit that can be distilled from various materials and is normally filtered using different types of charcoal. The types of raw materials used in the distillation process of vodka include grain, potatoes, beets, and molasses. The material used for the process can have a slight impact on the final flavor of the vodka, but the majority of the flavoring is done after the ethanol has been collected. Flavoring is added in the final stages because the vodka itself must be distilled to a purity of 95% ethanol, 190 proof, in order to be called vodka. This high purity would result in a loss of any flavors that were added to the fermentation process. Following the distillation process, the vodka is diluted by blending the ethanol product with pure demineralized water. The dilution generally brings the vodka down to about 40% alcohol by volume. The diluted product can then be fed through an activated charcoal filtering process

which is intended to remove any unpleasant flavors that may interfere with the desired taste of the product. One last important note about vodka is it does not require an aging process. Vodka can be produced, bottled, and sold in a relatively short amount of time compared to other alcohols that require years of aging such as whiskeys and rums (How…Vodka).

Whiskies

Whiskies are produced by the same general process as other spirits, but require different starting materials and also require an aging process that takes place in wooden casks. The major ingredients used for the production of whiskies are corn, rye, barley, and wheat. In the United States, corn is the most used ingredient in the production of all whiskies. The whisky aging process can take several years as the longer the whisky matures in the barrel, the more valuable it is when removed. The maturation process results in the development of mellow or mature characteristics that come from the wood and also results in the loss of harsh and unpleasant flavors from the new distillate. Aging is typically done with a whisky that is between 50% and 75% alcohol by volume, but the whisky is generally bottled at between 40% and 45% alcohol by volume (How…Whiskey).

Figure 2: Whiskey Aging in an Oak Barrel (McGinnis)

Brandy

Brandy is obtained from wine spirits and generally results in a finished product that should not exceed 50% alcohol by volume. Brandy is also another spirit that should be aged for at least 6 months to one year in oak containers. The production of brandy can be used as a way of salvaging defective wines or for utilizing excess wine products. Brandy can also be combined with regular wine products to create fortified wine. Fortified wine can also be produced by distilling wine to a higher purity that may not necessarily be classified as brandy, and then combining the higher alcohol content wine with the lower content wine. This type of product could be the easiest to begin producing at a facility that is already producing significant volumes of wine (How…Brandy).

Regulations

The Alcohol and Tobacco Tax and Trade Bureau is the federal regulating entity of distilled spirits. The Public Laws and Regulations of distilled spirits enforced by this agency can be found in Title 27 of the Code of Federal Regulations. Federal regulations require the completion, submission and approval of an application in order to initiate operations in the distilled spirits industry. The first step in this process involves determining the type of distilled spirits operation desired. These operations include Distilled Spirits Plant – Beverage, Distilled Spirits Plant – Industrial, Distilled Spirits Plant – Industrial/Beverage, or Experimental Distilled Spirits Plant. The permit required of the liquor industry applies under the "Distilled Spirits Plant - Beverage" title, which covers any business producing, bottling, or selling distilled beverages. The following step towards obtaining approval involves completing the application process for the desired distilled spirits operation. The forms necessary to complete the qualification process can be found and submitted through the TTB's automated Permits Online System. After

completing the application process, TTB will arrange the screening process in which the regional director will confirm legal eligibility and qualification for the distilled spirits operation. Following this step, the business will be authorized to proceed with their operations and liquor production. A full explanation of all federal regulations and laws pertaining to the distilled spirits industry may be found online in the Electronic Code of Federal Regulations under Title 27 (TTB Regulations).

The state of New Hampshire also regulates the production and sale of liquor within the state. According to New Hampshire Statutes, a liquor manufacturer license is required to ferment, distill, blend, age, and bottle liquor other than wine in New Hampshire. Liquor and wine vendor licenses may be issued only to a manufacturer of liquor, or to the person designated by the manufacturer as the sole supplier of its products for the state of New Hampshire. Each liquor manufacturer distilling less than 5,000 cases of liquor per year has the right to sell at retail at its facility for off-premises consumption of any of its liquor. Each retail sale is limited to one 9-liter case or less per sale. No liquor manufacturer can sell more than 12 9-liter cases of liquor to any one customer in any calendar year. A fee of $.30 for each gallon of beverage sold or transferred for retail sale or to the public shall be required for licenses issued to wholesale distributors, beverage manufacturers, and brew pubs. A liquor manufacturer may provide visitors at its facility with samples of liquor for tasting. These samples cannot exceed 1/2 ounce, and will not be provided to any persons under 21 years of age. Each liquor manufacturer must maintain records and prepare reports for the commission which indicate the sales made and must pay to the commission a monthly fee equal to 8 percent of such sales on or before the tenth day of the month following the sale. A full explanation of all state regulations and laws regarding the

manufacture and sale of liquor can be found in Title XIII Chapter 178 of the New Hampshire Statutes (New Hampshire Statutes).

LaBelle Winery

LaBelle Winery is located in Amherst, New Hampshire and is owned and operated by Amy LaBelle and her husband Cesar Arboleda. Amy started her first winery in 2005 in Walpole, New Hampshire, and doubled production each year before eventually constructing a barn behind her home in Amherst to house the growing business. In the fall of 2011, construction of a new facility in Amherst got underway and was completed in late September of 2012. The new facility opened on October 3, 2012, tripling production while also adding an Event Center, Retail Shop, and Café (LaBelle).

Figure 3: LaBelle Winery in Amherst, New Hampshire (LaBelle)

The current facility is a 20,000 square-foot building located on 11 acres of land which includes 2 acres of vineyard. The main building houses the production area, bottling line, tasting

room, bistro, and a 4,500 square foot event room. Five 23 foot-tall, stainless steel fermentation tanks rise up from the cellar to the main floor where they can be accessed by catwalk. These tanks are visible from the gallery as well as the dining area. The bottling line is located in the cellar as part of the 9,900 square-foot production/manufacturing facility. The line is capable of bottling 1,500 bottles per hour while the facility itself is capable of producing about 30,000 gallons of wine per year (LaBelle). There is a possibility of constructing another facility on the same site in the near future to account for increased production of current products as well as expansion to new product lines.

Figure 4: Five Stainless Steel Fermentation Tanks at LaBelle Winery (LaBelle)

Amy and Cesar would like expand their business to enter more markets and reach more customers around the world. One way they would like to achieve this is by producing spirits such as vodka, rum, brandy, and fortified wine. Amy would like to first sell the spirits at their current facility before eventually moving into other markets. They believe the addition of these

new products could assist with their goal of becoming a recognized brand around the world for both wine and spirits. Our goal was to help their expansion into the spirits industry by providing several options for a new batch distillation column to be installed at their current facility.

Methodology

LaBelle Winery in New Hampshire is interested in expanding its business to include not only wine but also the production of craft spirits. The goal of this project was to provide the sponsor with a variety of distillation unit options along with suggestions and recommendations on use and operation. To accomplish this goal, there were four main objectives to complete – gain background information and knowledge, understand the sponsor's wants and needs, evaluate a variety of distillation unit options, and educate the sponsor and winery staff about the distillation process.

The project began with forming a foundation of knowledge to build upon. We investigated local, state, and federal laws that would impact LaBelle Winery's installation of a distillation unit and its production and sale of spirits. This was done through internet searches through credible websites. Beyond the laws and regulations, we learned more about the craft distillation process and business. The team visited two local distilleries in New Hampshire. Sea Hagg Distillery in North Hampton, New Hampshire is a new business based on small batches of artisan spirits in a copper pot still. Visiting this business allowed us to see and learn about a smaller scale distillation unit and production process as well as understand some challenges incurred during the first years of producing spirits. We also toured Flag Hill Winery in Lee, New Hampshire. Flag Hill Winery is the largest vineyard in New Hampshire and has incorporated high quality distilled spirits into its product line. The tour allowed us to see how a winery can branch out into spirit production and be successful. We also learned about the operation of the still and the craft distillation process. Through research and tours we were able to develop a better understanding and working knowledge of the craft distillation process and business.

Figure 5: Our Team at Flag Hill Winery and Distillery in Lee, New Hampshire

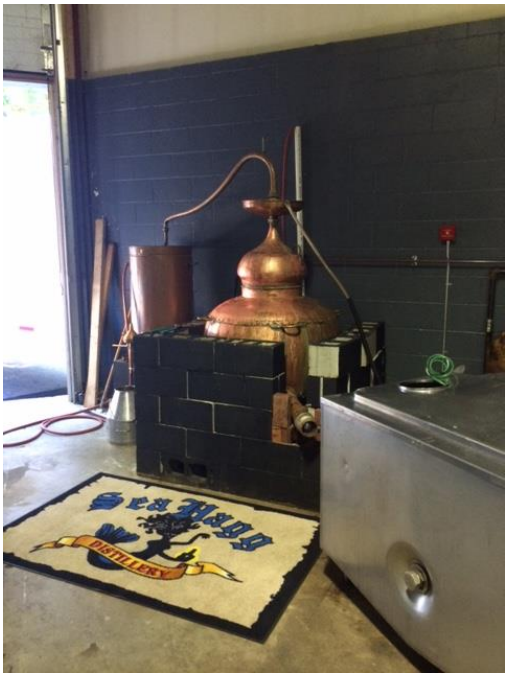


Figure 6: Sea Hagg Distillery in North Hampton, New Hampshire

The next step was meeting with our sponsors, Amy LaBelle and Cesar Arboleda from LaBelle Winery. Our meeting began with a tour of the site, including the sales area, the production area, and the vineyard. This gave our team a comprehensive feel of the location and

atmosphere. The wants and needs of the sponsors were discussed as a team. This discussion covered future plans, budget, vendor preferences, and distillation unit requirements such as appearance, capacity, and spirit capabilities. This meeting provided our team with a list of requirements to inquire about when contacting vendors. The specifics of this meeting are discussed in detail in the Results & Discussion chapter.

Figure 7: Our Team after our First Meeting with LaBelle Winery

Amy and Cesar's desires were then communicated to a variety of distillation unit vendors. Six vendors were contacted, three foreign companies and three American companies. Our team inquired what each vendor had available within LaBelle Winery's budget that also met their specific needs. The options provided by each vendor were then compiled into a matrix to compare and evaluate each bid. The main characteristics that were compared were base cost, batch size, materials of construction, and the equipment included in the package.

After assessing the distillation unit options along with the needs of the sponsor, we presented the unit options to LaBelle Winery with suggestions and recommendations. Our team provided benefits and limitations of different units and considerations for future installation. In addition to these recommendations, we created an informational poster about the distillation process to be used to educate the winery's staff so that they may be knowledgeable and provide a superior customer experience.

Results and Analysis

This section first details the results and takeaways from our initial contact with LaBelle Winery. Next, this section covers the details of the Kothe Distilling Technologies Inc. still and the reasons for our selecting this still as the primary recommendation for LaBelle Winery. Finally, this section includes the details of two additional recommendations for stills provided by Vendome Copper and Brass Works Inc. and the Vintner's Vault.

LaBelle Winery Requirements

Our team's initial meeting with LaBelle Winery exposed us to their culture and future plans and yielded several specific requirements for their ideal distillation unit. First, Amy and Cesar made clear their intentions to expand their current winery business into new ventures such as distilling craft spirits; however, they have several possible directions that they are considering pursuing in the future and they are not yet ready to commit to craft distillation as their immediate next step. This was an important message for our team because it meant that our still recommendation must assure them that craft distillation will be a worthwhile venture. During our discussion about LaBelle Winery's future direction, the possibility of buying an American made still was mentioned as a desirable option, but this was not made a formal requirement. Next, we discussed the role of the distillation unit in their current Amherst, New Hampshire facility. Amy and Cesar have made their winemaking facility a beautiful destination to host customers and wine enthusiasts as well as large events such as weddings and corporate retreats. Therefore, if they are to invest in a distillation unit, Amy and Cesar want it to be a centerpiece that will fit in with the overall aesthetic of the winery. In regards to the size limitations of the unit, they informed us that this should not be a major constraint as they are already planning future expansions, which may include a new building for the distillery. We also discussed

potential products that Amy and Cesar would want to produce with their distillation unit. They are very interested in whiskeys and aged spirits as well as vodka, brandy, and fortified wine product. Lastly, our conversation was brought to the project budget. Amy and Cesar were not specific about any budget requirements due to their inexperience in the spirits industry, so based on our team's suggestion, a $60,000 to $100,000 range was agreed upon as a reasonable target.

Kothe Distilling Technologies Inc.

Kothe Distilling Technologies Inc. is a German distillation equipment manufacturer with their United States branch based in Chicago, Illinois. After working with LaBelle Winery to determine their requirements, Kothe was contacted and given these requirements. Based on this information, and some additional information provided by our team, Kothe was able to recommend a specific distillation unit model. After receiving distillation unit quotes from multiple vendors, the Kothe model was selected as the primary recommendation for LaBelle Winery's distillation needs.

The Kothe model that fit the requirements of LaBelle Winery was the 600 L Twin Column Vodka Still. This model is constructed of stainless steel and copper and has a maximum batch capacity of 600 liters (158.5 gallons). This system may be powered by either steam or electricity. The base cost of the entire unit including the twin columns is €98,000 ($112,000 – 2/5/15). The distillation unit price includes 16 bubblecap trays, a stainless steel agitator, a full clean-in-place (CIP) system, top fill opening inspection glasses on the pot and between each bubblecap tray, an appropriate power supply for electric power or float traps for a steam setup, and analog thermometers. A variety of additional features may be provided including a 3 chamber alcohol collector (€2,000), pot and column lighting (€3,500), full electric wiring for

agitator, lights, and CIP system (€4,000), digital steam control (€2,500), botanical basket (€2,500), and additional plates (€2,000 each). Kothe also offers additional tanks, pumps, filtration sheets, and fruit processing equipment separate from the distillation unit.

Figure 8: Kothe 600 L Twin Column Vodka Still

There are many reasons for why this Kothe unit was selected as the primary recommendation for LaBelle Winery's distillation needs. First, all of the Kothe units offer full automation for an additional cost of €19,500. Although LaBelle Winery did not state full automation as a requirement for their distillation unit, automation may be very important when considering the small staff size and the additional work that the distillation business will bring to the winery. With the system fully automated, Amy and Cesar would not be burdened with constantly attending to the column to ensure a quality product. In addition to automation, this

still was desirable because the twin column system was included as a standard option. The columns are not a necessity; however, if vodka is a desired product, the columns allow for this level of separation to be achieved in a single distillation run. Without the large vodka columns, multiple distillation runs would be necessary to achieve the high alcohol concentration of a vodka product. This would create additional work for LaBelle Winery, which again could be a burden for the small staff and an inefficient use of time. Another large factor that contributed to selecting Kothe as the primary vendor was their expertise in distillation and the straight forward nature of their services and the information they provided. Based on their website and distillation unit quotes as well as our communications with Kothe before receiving their recommendation, it was clear that Kothe is a distillation expert. They specialize in distillation and offer specialized full automation services to obtain the desired products. Additionally, they offer classes and personalized workshops to learn about distillation using Kothe equipment and the craft spirit industry. The information they provided was clear and concise and left few questions as to what you were receiving with their package. These factors are all very important when LaBelle Winery is considering buying their first distillation column. They are new to the business of distillation, so working with a group of experts who offer training and are able to clearly present their information in a form that anyone could understand may make the transition into the business as seamless as possible. The only significant drawback to the Kothe distillation unit was its greater cost compared to the Vendome Copper and Brass Works Inc. and Vintner's Vault models discussed in the following sections. The packet provided by Kothe can be seen in Appendix A.

Vendome Copper and Brass Works Inc.

Vendome Copper and Brass Works Inc. is a Kentucky, USA based custom metal fabricator for industrial and commercial processing equipment. After being provided a list of LaBelle Winery's requests, Vendome suggested a distillation unit option that had both advantages as well as disadvantages.

The Vendome distillation unit model with the most potential for LaBelle Winery was their Economy Batch. This model is constructed of stainless steel and copper and is built for a 250 gallon batch. It uses a steam energy source and its base cost is $56,120. There are also a variety of additional options available through Vendome. A mirror finish may be requested for $9,100. Supplementary equipment can be purchased such as an explosion proof agitator ($6,430), additional trays ($1,380), a receiving tank ($3,060), or a fermentation vessel ($4,140). Furthermore, a vodka column can be included in the purchase of Economy Batch model for a minimum of $50,380.

Figure 9: Vendome 250 Gallon Economy Batch Still

This company and distillation unit model has both pros and cons. LaBelle Winery was in favor of purchasing a unit that was manufactured domestically in order to support its "Made in the USA" image; therefore, a Kentucky vendor is appealing. Overall, this option is less expensive than other vendors. The batch size and the inclusion of a vodka column were considered when coming to the price conclusion. This model has a significantly larger batch size, 250 gallons, compared to other units. This means that more product could be retrieved in the same number of runs. Also, there is the optional addition of a vodka column. This taller column makes the distillation process more efficient for producing higher proof alcohol. LaBelle Winery was specifically interested in adding vodka to its product line, so optimizing the unit would be a significant advantage. However, there were some drawbacks to this Vendome unit. Vendome is a

metal fabricator and distilling is neither their expertise nor priority. The company stated that it would not be able to add automation to the system. It suggested seeking an outside vendor for this job request. LaBelle Winery does not have experience or expertise with distilling spirits or operating a distillation unit; therefore, automation may be beneficial and more efficient. Moreover, the information provided after the team's inquiry was extensive and overwhelming. The models provided were laid out in fine detail but the packets contained no insight as to what the main difference between models was or in what situation a model would be most beneficial. The lack of customer centric information would be an issue for LaBelle Winery because they are new to the spirits industry and will likely require more explanation rather than a list of specifications. Overall, Vendome Copper and Brass Works Inc.'s Economy Batch model would satisfy most of LaBelle Winery's technical needs, but lacked in new customer support and service. Primary information from Vendome can be viewed in Appendix B and supplementary information can be found in Appendix D.

The Vintner's Vault

The Vintner's Vault is a winery equipment and wine making supply company located in Paso Robles, California. Though their main sector is winery equipment, Vintner's Vault sells equipment to produce other alcohols as well, including Commercial Distillation Stills. Vintner's Vault's Hagyò distillation equipment is known for its efficiency, precision, and quality. The patented Hagyò distillation equipment has an innovative design to allow greater purity in each run and the systems are produced with high quality parts to ensure excellent reliability. Not only is the product high quality and dependable, but The Vintner's Vault is committed to selling quality equipment, providing good service and consulting customers in their endeavors.

The Vintner's Vault's Hagyò Spirit 300 is a single stage distiller that operates periodically, built on the most economical distillation process to produce a high quality final product. The Hagyò Spirit 300 is an 80 gallon batch still made of stainless steel and copper that can be powered by steam, gas, wood or electricity with a base cost of $67,000. The distillation equipment offered in this base price includes a steel and copper kettle with a mash mixer, a copper cap that lends a harder reflux, a copper two disc refinery column to better infuse fruit aromas, a CIP pump for the washing system, a 150 liter tank for distillate gathering, a 150 liter insulated hot water tank for gathering the cooling water, a 1300 millimeter high end-cooler to control cooling water, and an epruvetta to measure spirit content.

Figure 10: Vintner's Vault Hagyò Spirit 300 Still

Vintner's Vault offers additional equipment and services with their Hagyò still for a supplementary price. One option includes a full automatic control system that automatically leads the distillation process on the basis of predefined parameters once the mash tank has been

filled. Another additional option offered is the mash mixing automation that enables intense mash mixing in the kettle for a more economical and swift process. The Vintner's Vault also offers the SVE (Sampling Valve Equipment) developed to make a more accurate separation of the distillate product. The Fusel Oil Filter can also be purchased with the Hagyò Spirit 300 to filter out and drain accumulated fuel-oils. Lastly, a mash preheater can be purchased as well to save the energy needed to boil mash at the beginning of each run.

The Vintner's Vault's Hagyò Spirit 300 distillation equipment meets some but not all of LaBelle Winery's necessities. The Hagyò Spirit 300 is manufactured in the USA, and therefore a good option for those concerned with supporting the domestic economy. Furthermore, of the three options we recommend, the Hagyò Spirit 300 is the least expensive. Another benefit to this alternative is the full automatic control system that is available for an additional $22,250. Purchasing this with the distillation equipment would enable easy operation and limited effort in producing high quality spirits. We would recommend full automation if purchasing the still offered by Vintner's Vault to save time for the still operator. Although the Vintner's Vault's Hagyò Spirit 300 has advantages that make it an alternative option, it is not our first recommendation. The negative aspects of this option include its lack of a distillation column and its batch size. Since there is no distillation column offered for this distillation equipment, a high number of runs would be needed to distill spirits, especially those of high proof such as vodka. Furthermore, the small batch size of only 80 gallons makes this still the smallest option and again would require more runs to produce alcohol. The quote and product information from the Vintner's Vault is located in Appendix C, with extra information provided located in Appendix E.

Conclusions and Recommendations

The purpose of this project was to provide a viable distillation unit option to LaBelle Winery in New Hampshire. A variety of distillation unit vendors were contacted in order to create a comprehensive list of options with each vendor meeting certain needs and desires expressed by the owners of LaBelle Winery.

After evaluating each vendor's bid, the team selected the three most feasible unit options. Vendome Copper and Brass Works Inc.'s unit package was manufactured domestically and was the less expensive considering it supported the largest batch size and included a vodka column; however, there was no option for system automation and the customer service and feedback was poorer than other companies which made it difficult to sort and assess information. The Vintner's Vault distillation unit was the least expensive option while being fully automated and made in the USA, but it is meant for a very small batch size and has no vodka column option, making it less efficient. Kothe Distilling Technologies Inc. is the top recommendation for LaBelle Winery because, despite being a more expensive option, this unit can be fully automated and includes a vodka column. Furthermore, Kothe Distilling Technologies Inc. is an expert in spirit distillation and offers personal training and relevant workshops.

References

CHAPTER 178: LIQUOR LICENSES AND FEES." *New Hampshire Statutes*. N.p., 2011. Web. 25 Oct. 2014. <http://www.gencourt.state.nh.us/rsa/html/nhtoc/NHTOC-XIII-178.htm>.

"Distilled Spirits Council of the United States." *Economic Contributions of the Distilled Spirits Industry*. N.p., n.d. Web. 5 Nov. 2014.

"Distilling History." *MONTGOMERY DISTILLERY RSS*. Montgomery Distillery, n.d. Web. 24 Nov. 2014. <http://www.montgomerydistillery.com/our-process/distilling/>.

Diwekar, Urmila M. "Understanding Batch Distillation Process Principles with MultiBatchDS." *Environmental Institute, Department of Engineering and Public Policy, Carnegie Mellon University* (1996): n. pag. Web.

"Food and Beverage Trend for 2014: The Rise of Craft Distilleries." *Entrepreneur*. N.p., 19 Nov. 2013. Web. 5 Nov. 2014.

"How Products Are Made." *How Brandy Is Made*. Web. 11 Nov. 2014. <http://www.madehow.com/Volume-7/Brandy.html>.

"How Products Are Made." *How Vodka Is Made*. Web. 11 Nov. 2014. <http://www.madehow.com/Volume-5/Brandy.html>.

"How Products Are Made." *How Whiskey Is Made*. Web. 11 Nov. 2014.

<http://www.madehow.com/Volume-2/Whiskey.html>.

"McGinnis Bourbon and Whiskey Barrels." *McGinnis Wood Products Bourbon and Whiskey Barrels*. McGinnis Wood Products Bourbon and Whiskey Barrels, n.d. Web. 25 Feb. 2015. <http://mcginniswoodproductsinc.com/whiskey.html>.

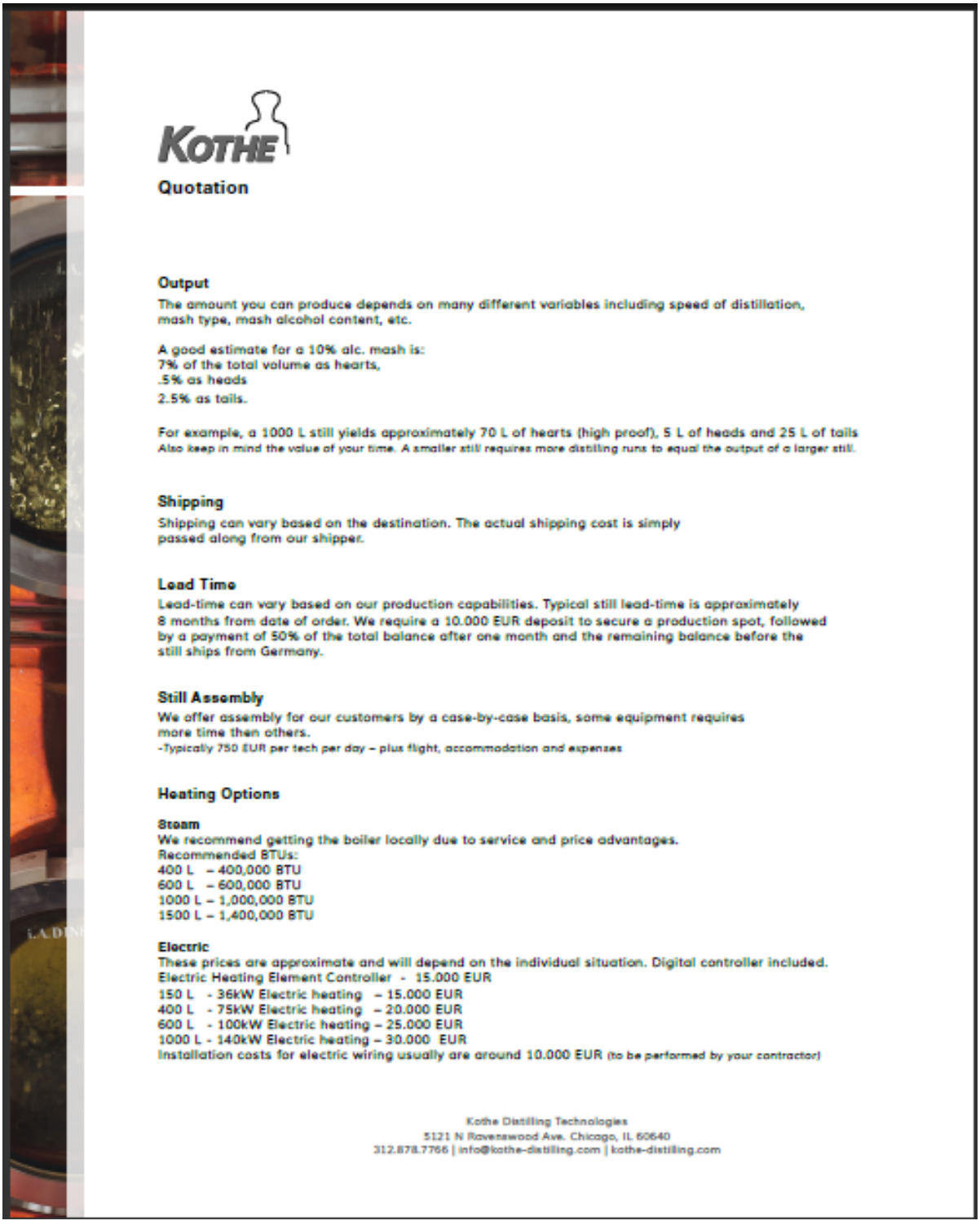
"Our History." *LaBelle Winery*. LaBelle Winery, n.d. Web. 11 Nov. 2014. <http%3A%2F%2Fwww.labellewinerynh.com%2F>.

Tham, M. T. "Introduction to Distillation." *Introduction to Distillation*. R.C. Costello and Associates Inc., n.d. Web. 1 Nov. 2014. <http://lorien.ncl.ac.uk/ming/distil/distilop.htm>.

“TTB Regulations." Alcohol and Tobacco Tax and Trade Bureau. US Department of the Treasury, 4 Sept. 2012. Web. 5 Oct. 2014. <http://www.ttb.gov/other/regulations.shtml>.

Appendices

Appendix A: Quotation from Kothe



KOTHE

Quotation

Output

The amount you can produce depends on many different variables including speed of distillation, mash type, mash alcohol content, etc.

A good estimate for a 10% alc. mash is:
7% of the total volume as hearts,
.5% as heads
2.5% as tails.

For example, a 1000 L still yields approximately 70 L of hearts (high proof), 5 L of heads and 25 L of tails
Also keep in mind the value of your time. A smaller still requires more distilling runs to equal the output of a larger still.

Shipping

Shipping can vary based on the destination. The actual shipping cost is simply passed along from our shipper.

Lead Time

Lead-time can vary based on our production capabilities. Typical still lead-time is approximately 8 months from date of order. We require a 10.000 EUR deposit to secure a production spot, followed by a payment of 50% of the total balance after one month and the remaining balance before the still ships from Germany.

Still Assembly

We offer assembly for our customers by a case-by-case basis, some equipment requires more time then others.
-Typically 750 EUR per tech per day – plus flight, accommodation and expenses

Heating Options

Steam
We recommend getting the boiler locally due to service and price advantages.
Recommended BTUs:
400 L – 400,000 BTU
600 L – 600,000 BTU
1000 L – 1,000,000 BTU
1500 L – 1,400,000 BTU

Electric
These prices are approximate and will depend on the individual situation. Digital controller included.
Electric Heating Element Controller - 15.000 EUR
150 L - 36kW Electric heating – 15.000 EUR
400 L - 75kW Electric heating – 20.000 EUR
600 L - 100kW Electric heating – 25.000 EUR
1000 L - 140kW Electric heating – 30.000 EUR
Installation costs for electric wiring usually are around 10.000 EUR (to be performed by your contractor)

Kothe Distilling Technologies
5121 N Ravenswood Ave. Chicago, IL 60640
312.878.7766 | info@kothe-distilling.com | kothe-distilling.com

KOTHE

Quotation

Still Models	Price (in Euros)
Standard Still	
- 3 plate column	
250 L	38.000
400 L	52.000
600 L	60.000
1000 L	71.000
2000 L	93.000
Exclusive Still	
- 3 plate column	
- Rum: 6 plates*	
- Gin: 8 plates*	
250 L	48.000
400 L	62.000
600 L	70.000
1000 L	81.000
2000 L	103.000
Vodka Still	
- 16 plate twin column	
600 L	98.000
1000 L	109.000
1500 L	120.000
2000 L	131.000
3000 L	153.000

Optional Features	Price (in Euros)
3 Chamber Alcohol Collector - Collection tank for heads, hearts, and tails - Sized according to still size	2.000
Lighting - Lighting of pots and column - Additional viewing windows in the back for lights - Lamps and mounting provided	3.500
Electric Wiring - Complete electrical wiring on the potstill and control panel for agitator, lights, and CIP - Includes control panel	4.000
Digital Steam Control	2.500
Botanical Basket	2.500
Additional Plates	2.000 each
Fittings	TBD

Standard features included on every still model:

Bubblecap Superaromator
(Special Distillation Column)
- 400-700 mm diameter
- Including a pre-condenser in the head of the column (dephlegmator)
- Sight Glass: 4 viewing windows of NW
- 125 mm in diameter for each bubblecap and mash return

*Additional plates can be added for 2,000 EUR each

Agitator >600L Still
- 1.5 KW, 150 RPM
- Complete stainless steel construction

Clean-in-Place System (CIP)
- Stainless steel cleaning in helmet, pot, and special distillation column (one per bubblecap)
- Spray balls in hat and column. Rotating nozzles in pot
- Max 16bar/8m3 per hour

Top Fill Opening
Inspection Glasses
- One per bubblecap and pot.

Power Supply
- 208V 3 Phase
- 230V 3 Phase
- 480V 3 Phase

Steam Setup: Float traps
- Float trap is included with pot for steam setup

Thermometers
- Analog thermometers standard, digital available

Automation
Control your still through a computer, tablet, or mobile device. Remotely access your still from anywhere that has an internet connection.
- Available on all still models.
- Complete hardware control and automation
- Ability to pre-heat the still
- Heating control during distillation
- Automated "heads," "hearts," and "tails" cutting
- Email and text message notifications
- Advanced process logging
- Additional cost of 19,500 EUR

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KOTHE

Additional Equipment

Unit	Price (in Euros)
Kothe Mash Tank	
1200 L	12.500
1500 L	13.500
2000 L	14.500
3000 L	16.500
- Steam heated and jacketed for cooling with either water or glycol.	
- Includes double paddle agitator with 2.2 kW	
- Optional (if not steam heated): Electric heating elements	4.500
Fermentation Tank	
2450 L	3.800
3300 L	4.700
5800 L	10.500
(other sizes available)	
- Stainless steel	
- Jacketed	
- Top opening	
- Analog thermometer	
- Mounting bracket for floor	
- Four feet	
- Diameter: 1430 mm Height: 2510 mm	
OIP Multistage Pump	1.600
Rotating Spray Nozzle	500
Conipac HDPE	625
- 1000 L	
Conipac Airlock	20
Stainless Steel Blending Tank	2.600
- 1100 L	
- Digital temperature probe	
- Diameter: 953 mm Height: 1820 mm	
- Three Feet	
Stainless Steel Tank	
(for finished product)	
600 L	2.000
1100 L	2.500
- Jacketed for warming of product before bottling	
- Digital temperature probe	
- Diameter: 953 mm Height: 1970 mm	
- Three Feet	
Stainless Steel Storage Can	
50 L	125
100 L	200
300 L	500

Unit	Price (in Euros)
Swinger Hammer Mill	
7.5 kW motor	5.400
12 kW motor	6.100
- Fan blower included: 3 inch connection	
Explosion Proof Alcohol Pump	2.900
- 1 1/4 inch	
- 2000 L/hour	
- 1.5 kW (wired to available power)	
Alcohol Hose	27/meter
- Up to 95% alcohol content	
Eccentric Screw Pump 8P5	3.100
- Capacity: 5000 L/10000 L water/hour	
Eccentric Screw Pump 8P6	4.200
- Capacity: 7000 L/12000 L water/hour	
- 3 kW	
Eccentric Screw Pump 8P10	6.200
- Capacity: 12000 L/25000 L water/hour	
- 4.4 kW	
- Stainless steel version available by request for all screw pumps (Heat resistant, use for spent mash)	Add 100
Eccentric Mash Hose - Red Spiral	17/meter
- Use for cold mash	
- Up to 28% alcohol content	
- Red spirals for stability	
- Max 8 bar pressure	
Eccentric Heat Resistant Spiral Hose	40/meter
- Heat resistant, for spent mash	
Impeller Pump IP3	1.350
- 0.75 kW	
- European 220V single phase (Needs small converter)	
- Capacity: 5000 L water/hour	
Impeller Pump IP10	2.000
- 1.5 kW	
- Three phase	
- Capacity: 10000 L water/hour	
Impeller Pump IP30	3.800
- 4.5 kW	
- Three phase	
- Capacity: 25000 L water/hour	
- All Impeller Pumps include a full replacement part set	
Impeller Mash Hose - Red Spiral	12/meter
- Use for cold mash	
- Up to 28% alcohol content	
- Red spirals for stability	
- Max 8 bar pressure	

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KOTHE

Additional Equipment

Unit	Price (in Euros)
Fruit Depitter - Suitable for all fruit - Removes pits and stems - 5000 lb of fruit per hour - Stainless steel construction (Note: Pears and apples need to be crushed with a fruit masher first, while plums and apricots first need to be slightly crushed with an eccentric screw pump)	12.000
Fruit Grusher - Simple - Suitable for apples and pears - Stainless steel construction - 2000 lb of fruit per hour - 2.2 kW motor - European 220V single phase (Needs small converter)	1.400
Fruit Grusher - Advanced - Suitable for apples and pears - Stainless steel construction - 10000 lb of fruit per hour - 5 kW motor - 208V, 230V, or 460V three phase	3.200
Vacuum Bottle Filler - 4 Spout - 120V - No contact of distillate with pump	3.100
Label Applicator - 120V - Front and back labels - Bottles must be round (slight taper may be acceptable)	2.000
Glycol Chiller Reliable control over fermentation and storage temperatures. 11 kW 16 kW 24 kW - Cooling water temperature from appox. -10° to +40°C - Maximal ambient temperature 32°C - Integrated heater (3.0 – 4.5 kW according to unit size) - Insulated water tank - Integrated pump - Bypass for pump protection - Environment friendly cooling gas	 12.000 17.000 22.000
Glycol System/Tank Monitor	14.000

Unit	Price (in Euros)
Filtration - 20x20 Stainless Steel - Stainless steel plate frames - 9 plates standard - Includes extension rod for lower amount of plates - Pressure gauge - No filter pump included (explosion proof alcohol pump recommended)	2.600
Filtration - 20x20 Plastic - Plastic plate frames - Smaller version - Includes filter pump - European 220V (needs small converter)	1.300
Filtration Sheet A20 - Fine filtration	1,20
Filtration Sheet A80 - Coarse filtration	1,20
Density Measurement DMA 35	2.750
Testing Glasses	4
Testing - Cleaning Solution	50
Testing - Medi-Test - Test for remaining sugar - 50 strips per package	14
Testing - pH Strip - Test for pH level - 100 strips per package	20

Kothe Distilling Technologies
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Appendix B: Quotation from Vendome Copper & Brass Works

502-587-1930
FAX 502-589-0839

VENDOME COPPER & BRASS WORKS
INCORPORATED
DISTILLERY EQUIPMENT ● STAINLESS STEEL TANKS
BREWERY EQUIPMENT ● PROCESS SYSTEMS
709 EAST FRANKLIN STREET
LOUISVILLE, KENTUCKY 40202
www.vendomecopper.com

Customer: Logan A. Roche
Address: Worcester Polytechnic Institute
Chemical Engineering Class of 2015

Email: laroche@WPI.EDU
Phone:
Cell: (207)-671-8317
Fax:

Date Sent: 11/18/2014
Price Updated: 6/26/2014
Quoted By: Kyle Grant
Phone: 502-587-1930 x147
Email: KyleG@vendomecopper.com

The systems listed on the following page are designed for low to middle proof whiskey, rum, brandy, or single distillation of GNS, for gins and vodkas. All of the systems are capable of producing 190 proof in multiple runs. A vodka column is highly recommended if vodka is the desired product and will be produced from raw materials. Any custom pot still systems that are not listed or continuous distillation systems please inquire and pricing will be provided once the design has been established.

All of the batch still systems are custom designed and fabricated upon order. All equipment is for heavy industrial use and is fabricated in Louisville, Kentucky, USA by fourth generation coppersmiths. Vendome can fabricate any size or shape to meet your needs including partial systems. Any other related stainless steel or copper equipment can also be supplied, such as, fermenters, cookers, whiskey tanks, bottling tanks, etc. Shipping can be quoted once the design, delivery date, and destination are established.

Terms are 30% down, 30% due upon receipt of major materials, remaining balance due before shipment. Prices do not include taxes, if any apply. After receipt of down payment, fabrication drawings will be supplied to customer for approval prior to start of fabrication. Pricing is subject to change once final design drawings are approved. Installation of systems by Vendome personnel is available with pricing provided upon request.

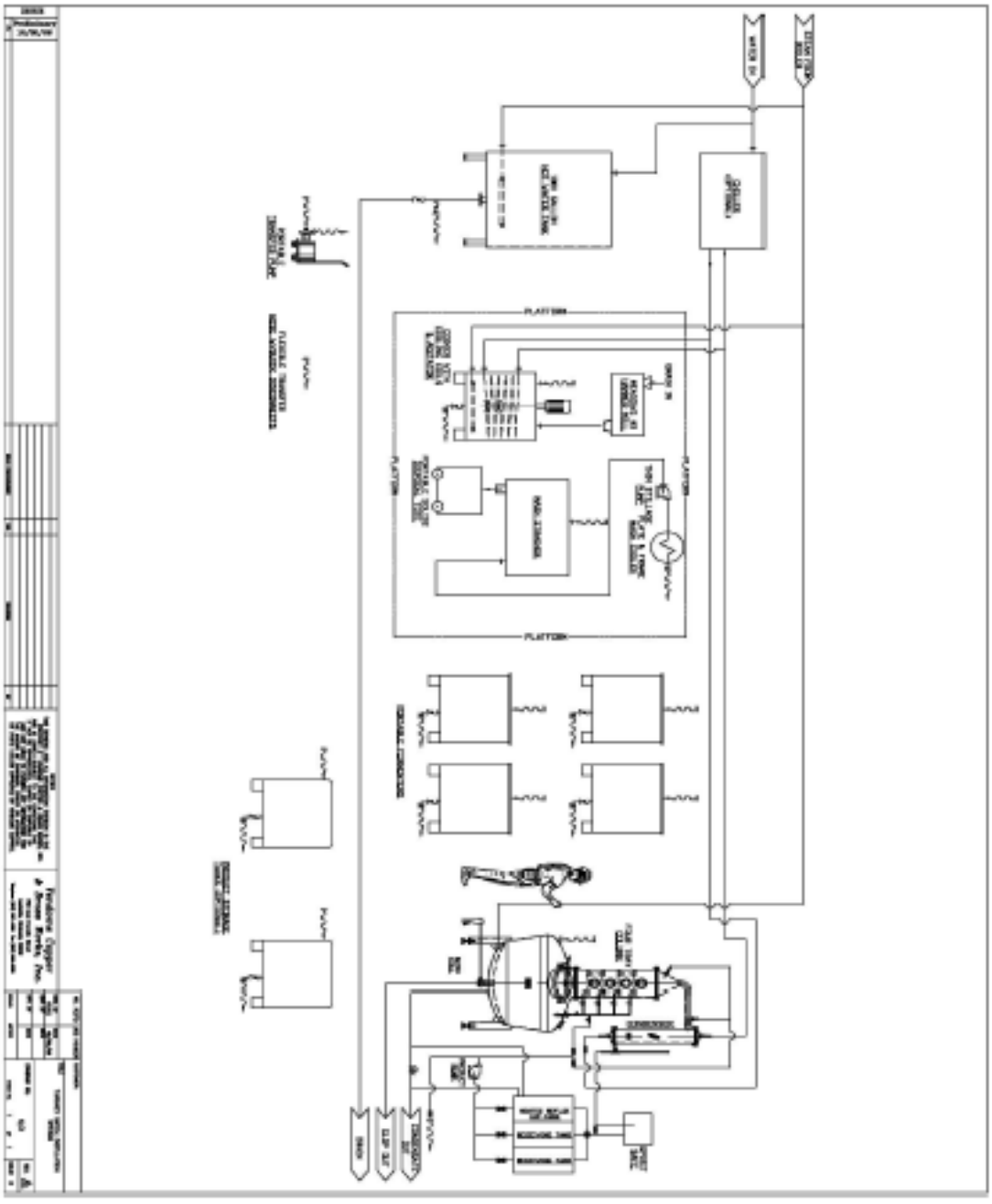
Vendome will supply serial numbers for all equipment prior to final shipping. It is the customer's responsibility to obtain all required permits and abide by all state and federal regulations.

Upon request, we can refer a consultant to help you with all of your startup and recipe development needs. We also can provide contacts if you require equipment leasing. Vendome offers a 1-year standard warranty to original purchaser that equipment is free from defects in material and workmanship only under normal use and service for one year from date of receipt of equipment.

POT STILL SYSTEM					
		Gallon Charge			
Item	Qty	15 Gallon Recipe Still	100 Gallon Stainless and Copper Still	250 Gallon Stainless and Copper Still	500 Gallon All Stainless Wash Still
Batch Still Details	1	$22,980	$38,110	$56,120	$51,680
(1) 6" Stainless and Glass Manway		x			
(1) 12" Stainless Steel Manway			x	x	
(1) 18" Stainless and Glass Manway					x
(1) Stainless Steel Dephlegmator		x	x	x	
(1) Stainless Steel Shell and Tube Condenser		x	x	x	x
(1) Copper 4 Tray Detachable Column and Gin Basket		x			
(1) Copper 4 Tray Bubble Cap Column			x	x	
(1) Stainless Helmet w/ Support Tabs for Packing					x
(4) Stainless Legs w/ Adjustable Swivel Feet			x	x	x
(1) Stainless Top Cap w/ Vapor Outlet		x	x	x	x
(1) Stainless Dished Head Steam Jacket			x	x	x
(1) Stainless Dished Top Head					x
(1) Copper Head/Cone with Flanged Connection		x	x	x	
(1) Stainless Steel Hydrometer/Parrot Cup			x	x	x
Stainless Steel Tri-Clamp Column Connections		x	x		
Stainless Steel Ring Flange Column Connections				x	x
Pot Drain w/ Valve		x	x	x	x
Tray Drains w/ Valves and Piping			x	x	
Necessary Safety devices, gauges, and nozzles		x	x	x	x
Requires a Hot Plate or Burner to Operate		x			
Requires a Boiler to Operate			x	x	x
Clamp in Options for 15 Gallon Recipe Still					
Copper Column w/ Structured Packing		$1,562			
4 Tray Bubble Cap Column w/ Small Sight Ports		$3,670			
Glass 4-Tray Column w/ Copper Internals		$4,790			
Additional Copper Trays (up to 2)		$390	$940	$1,380	n/a
Lengthens column (increases height) per tray					
For extra rectification, cleaner product, and higher proof					
Includes necessary valves and piping where applicable					
Mirror Finish On All	1	$5,050	$6,330	$9,100	$10,950
Explosion Proof Agitator	1	$3,350	$4,430	$6,430	$6,430
Agitator and Mounting Nozzle (Agitator for 15 and 100 gallon is air driven, Agitator for 250 and 500 is XP electric)					

OPTIONAL EQUIPMENT					
		Gallon Charge			
Item	Qty	15	100	250	500
Mash Cooker	1	$2,500	$21,770	$26,600	$31,060
All Stainless steel, dished heads top and bottom (except 15 gal.)					
Internal coils for cooling					
Drain with valve, top mount Agitator (no agitator on 15 gal.)					
Top manway (15 gal. Is open top)					
15 gal. Requires hot plate, others require steam boiler					
3HP Electric Pump Single or 3-Phase	1	$6,000			
Stainless steel with TEFC motor, Stainless roll a round cart, VFD, Remote					
10' intake and 20' delivery EPDM hoses with 2" camlocks couplings					
208/240 volt, on/off fwd/rev.					
Economy Fermentation Vessels					
Drain with valve and camlock connector, open top.					
Without cooling Jacket	1	$1,860	$2,870	$3,270	$3,810
With Cooling Jacket	1	$2,370	$3,640	$4,140	$4,890
Stainless Receiving Tanks	1	$1,970	$2,800	$3,060	$3,670
All Stainless steel, top manway, w/ 1-1/2" or 2" NPT Drain and Valve					
Reflux Onion		$2,090	$3,190	$4,180	$5,280
Includes necessary gaskets, flanges, and hardware					
Gin Basket		n/a	$5,450	$5,450	$6,470
Includes bypass and necessary valving and piping, all stainless steel					
Field Installation					
This can be priced after plant design and layout has been established					
Optional Totals:					
Grand Total:					

Package Boiler -Electric, propane or natural gas driven	(BTU/hr)			
We recommend you purchase boiler and have installed locally				
Minimum recommended boiler sizing for batch still only	75,000			
Minimum recommended boiler sizing for batch still and mash cooker running simultaneously	125,000			
Estimated Product Output (based on 8% ABV Charge with 5 hour run time)	**Gallon Charge**			
	30	**50**		
80 Proof	18	30		
100 Proof	14.5	24		
120 Proof	12	20		
140 Proof	10	17		
*(*multiple runs)* **190 Proof**	7.5	12.5		
	**production liters after heads and tails cuts*			



Appendix C: Quotation from The Vintner's Vault

The Vintner Vault
3230 Riverside Ave Suite 140 Paso Robles, CA 93446
Ph: (805) 226-8100 Fax: (805) 226-8188
www.TheVintnerVault.com

Worcester Polytechnic Institute

Logan A. Roche
207-671-8317
laroche@wpi.edu

HAGYÓ Spirit 300

General Description:

With the developing of our technology our purpose was, to create a complete distillation technology for the production of a high quality final product. Through this technology a distillate can be produced from the properly processed and good quality fruit mash with relative high alcohol percent that is rich in aromas. The entire technology is completely controlled.

Our further purpose in addition of providing ideal efficiency was, to keep the quality of final product on optimal level, and to preserve the primer aromas of the fruits in the distillate. To achieve this, we have combined the traditional and approved equipment with modern units supported by the newest searching results. The process controlling of this combination is accomplished through an industrial computer. This technology is completed with three patented technical solution of our company, through which the efficiency and quality of the distillation is established on new bases considering energy and technology.

Our developed technology and the accompanying equipment meet perfectly the above requirements and they can be flexibly used in all kind of distillations. Through that a top-quality final product can be produced. Our equipment is a single stage distiller, operating periodically, constructed in the latest technology and therefore is built on the most economical distillation process, integrating the newest technical solutions and providing the production possibility of an ideal final product.

Examining from the technological side, we can say the following about the one-boiler equipment:
Every plate in the refinery column is functioning, as a separate refinery boiler, where the distillate will be completely condensed, then from the surface it will evaporate. According to the quality of the final product, it can be decided, how many plates in which extent should be used, because the plates can be switched on and off, and their intensity can be continuously changed. Through that a much wider separation can be achieved, through which the required aromas can be concentrated and preserved in the distillate and parallel to that the disturbing components can be detached from the final products. The disconnecting of the plates is also possible, so that the traditional, two-boiler distillation of the equipment should be used as well.

The Vintner Vault
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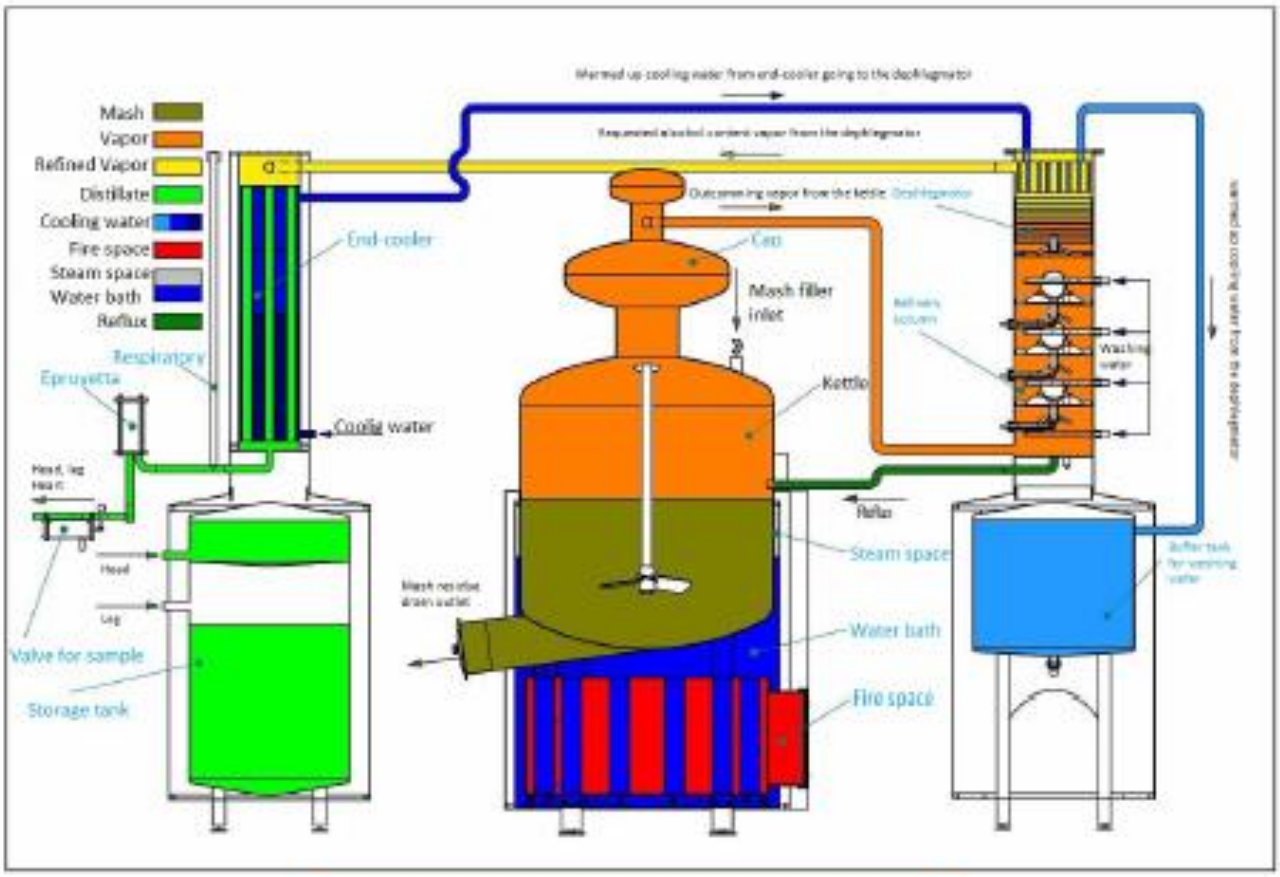
Ph: (805) 226-8100 Fax: (805) 226-8188
www.TheVintnerVault.com



The Vintner Vault
3230 Riverside Ave Suite 140 Paso Robles, CA 93446
Ph: (805) 226-8100 Fax: (805) 226-8188
www.TheVintnerVault.com

Price: HAGYÓ Spirit 300	
With Different Heating Options:	
• STEAM — SHF 300 VNM (Steam Generator Not Included)	$65,000.00
-40Kw, 60Kg/hr Required	
• GAS — SHF 300 GNM	$67,375.00
• WOOD — SHF 300 FNM	$67,000.00
• ELECTRICITY — SHF 300 ENM	$67,000.00
-36Kw, 3 x 54 Amp, 3 x 220V 3 Phase	
Options:	
• SAMPLING VALVE EQUIPMENT— SVE 300	$5,625.00
• MASH MIXING TROUGH ATOMIZATION— MMTA 300	$5,875.00
• FUSEL OIL FILTER - FOF 300	$1,250.00
• PREHEATER OF MASH— POM 300	$12,000.00
• FULL AUTOMATIC CONTROLL— FAC 300	$22,250.00
• EXTRA Column Disc Manual	$2,000.00
• EXTRA Column Disc Automatic Control	$3,500.00

Appendix D: Additional Quotations from Vendome Brass & Copper Works

Vendome Small Batch

502-587-1930
FAX 502-589-0638

VENDOME COPPER & BRASS WORKS
INCORPORATED
DISTILLERY EQUIPMENT ★ STAINLESS STEEL TANKS
BREWERY EQUIPMENT ★ PROCESS SYSTEMS
729 EAST FRANKLIN STREET
LOUISVILLE, KENTUCKY 40202
www.vendomecopper.com

Customer: Logan A. Roche
Address: Worcester Polytechnic Institute
Chemical Engineering Class of 2015

Email: laroche@WPI.EDU
Phone:
Cell: (207)-671-8317
Fax:

Date Sent: 11/18/2014
Price Updated: 6/26/2014
Quoted By: Kyle Grant
Phone: 502-587-1930 x147
Email: KyleG@vendomecopper.com

The systems listed on the following page are designed for low to middle proof whiskey, rum, brandy, or single distillation of GNS, for gins and vodkas. All of the systems are capable of producing 190 proof in multiple runs. A vodka column is highly recommended if vodka is the desired product and will be produced from raw materials. Any custom pot still systems that are not listed or continuous distillation systems please inquire and pricing will be provided once the design has been established.

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Terms are 30% down, 60% prior to shipment, remainder net 30 with established credit. Prices do not include taxes, if any apply. After receipt of down payment, fabrication drawings will be supplied to customer for approval prior to start of fabrication. Pricing is subject to change once final design drawings are approved. Installation of systems by Vendome personnel is available with pricing provided upon request.

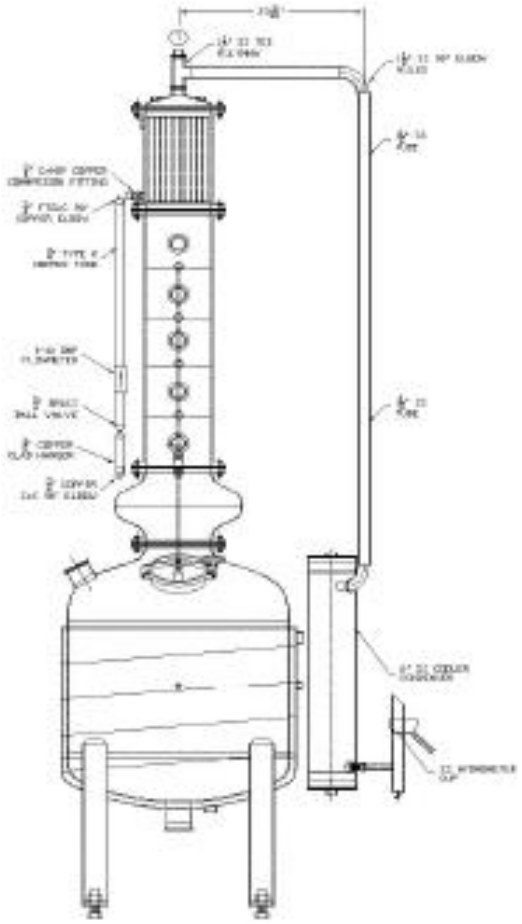
Vendome will supply serial numbers for all equipment prior to final shipping. It is the customer's responsibility to obtain all required permits and abide by all state and federal regulations.

Upon request, we can refer a consultant to help you with all of your startup and recipe development needs. We also can provide contacts if you require equipment leasing.

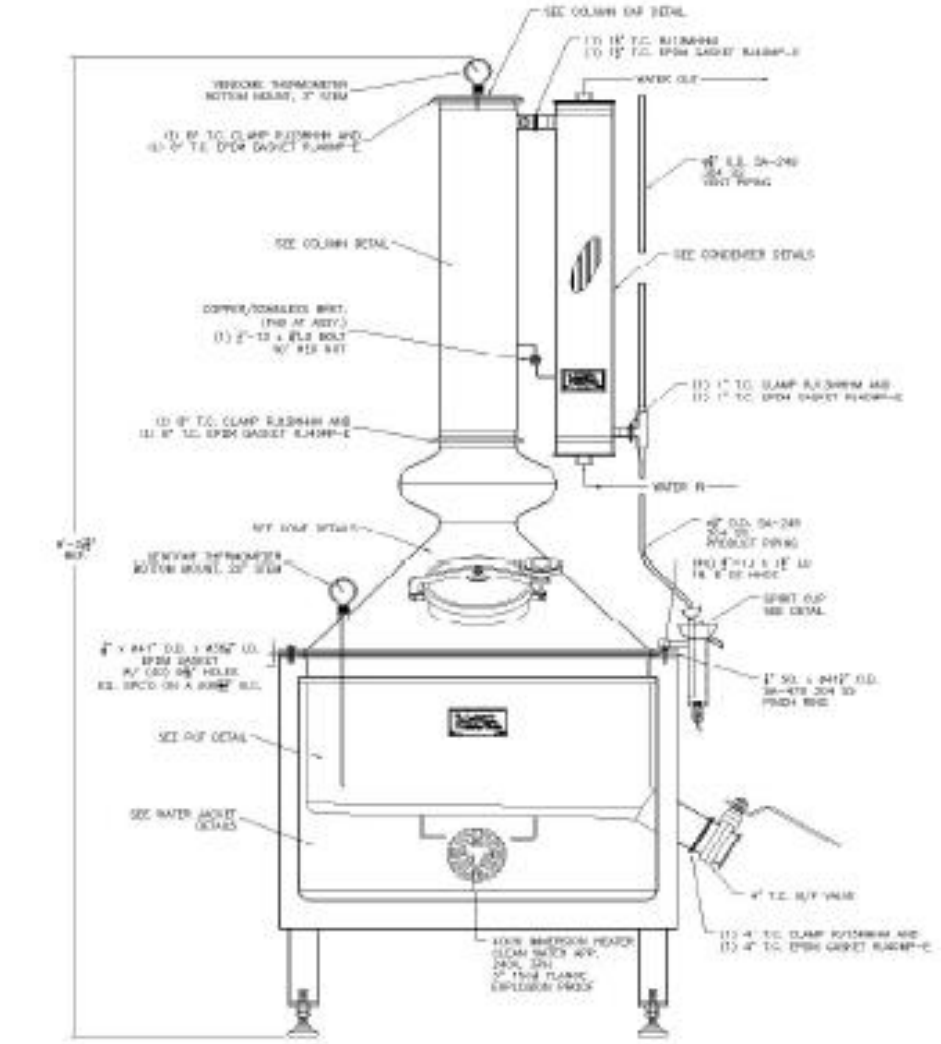
POT STILL SYSTEM					
		Gallon Charge			
Item	Qty	50 Gallon Steam or Hot Oil Jacketed	50 Gallon Electric Hot Water Bath	30 Gallon Electric Oil Jacketed	
Copper Batch Still	1	$52,590	$45,670	$44,580	
One (1) 8" stainless steel glass ornate manway. (6" on 30 gal)		x		x	
One (1) additional sightport for viewing pot contents		x			
One (1) bottom outlet with drain valve		x		x	
All couplings for heating, temperature, safety, CIP, spares		x		x	
All gauges and safety devices included		x	x	x	
Four (4) 3" pipe legs		x			
Adjustable feet					
All brass or stainless steel hardware		x			
One (1) copper lid with vapor outlet piping		x	x	x	
One (1) ss vertical condenser/product cooler with ss hardware		x			
One (1) Spirit Cup		x	x	x	
All piping for brey drains, washout, and cooling water		x			
8" dia pot mount copper column with four (4) bubble cap trays and four (4) easy open sightports		x			
8" dia pot mount copper column with easy open lid set up for trays, gin basket, dephlegmator, or structured packing. "Shown as option below"			x		
4" tube style column with stainless structured packing				x	
Copper reflux onion below column		x	x		
Insulation jacket			x	x	
Dephlegmator		x		x	
Ornate design with all machined hardware		x		x	
Economy design with cost over function. Welds left as welded.			x		
Can double as a Cooker			x		
Clamp in Options for the "New" 50 Gallon Elec HWB					
Dephlegmator for controlable reflux			$3,410		
Structured Sulzer Chemtech Packing			$3,740		
4 Bubble cap trays with dephlegmator			$4,620		
Drop in Gin Basket			$1,940		
Required but Not Included in Price					
**Requires hot oil heater or 15 psi steam boiler" Approx $7800.00		x			
**Requires 230 electric, single or three phase			x	x	
Mirror Finish On All	1	$5,020	$3,780	$3,230	
Explosion Proof Agitator	1	$5,450	$5,450	$5,450	
Explosion Proof electrical agitator with mounting port.					

OPTIONAL EQUIPMENT					
		Gallon Charge			
Item	Qty	50	50	50	50
Mash Cooker 50 gallon	1	$13,090	$13,090	$13,090	
All Stainless steel, dished heads top and bottom					
Live steam sparger for cooking, Internal coils for cooling					
3" drain with valve, top mount electrical Agitator.					
18" top manway					
Roll Around Transfer Pump	1	$5,270	$5,270	$5,270	
Moves raw materials between hot water tank, cooker, fermenters, and batch still					
Stainless steel APV 110/230v 1ph electric roll around carriage.					
10' PVC intake and 20' delivery hose with ss camlocks couplings.					
Economy air driven Air driven also availble $3350.00					
Economy Fermenter Vessels					
1-1/2" drain with valve and camlock connector, open top.					
50 gallon $1,860.00	0	$0			
100 gallon $2,960.00	0	$0			
Stainless Receiving Tanks					
50 gallon $1,970.00	0	$0			
100 gallon $3,070.00	0	$0			
Touch Screen Automated System Control Unit		Call For Pricing			
This can be priced after plant design and layout has been established					
Field Installation					
This can be priced after plant design and layout has been established					
Optional Totals:					
Grand Total:					

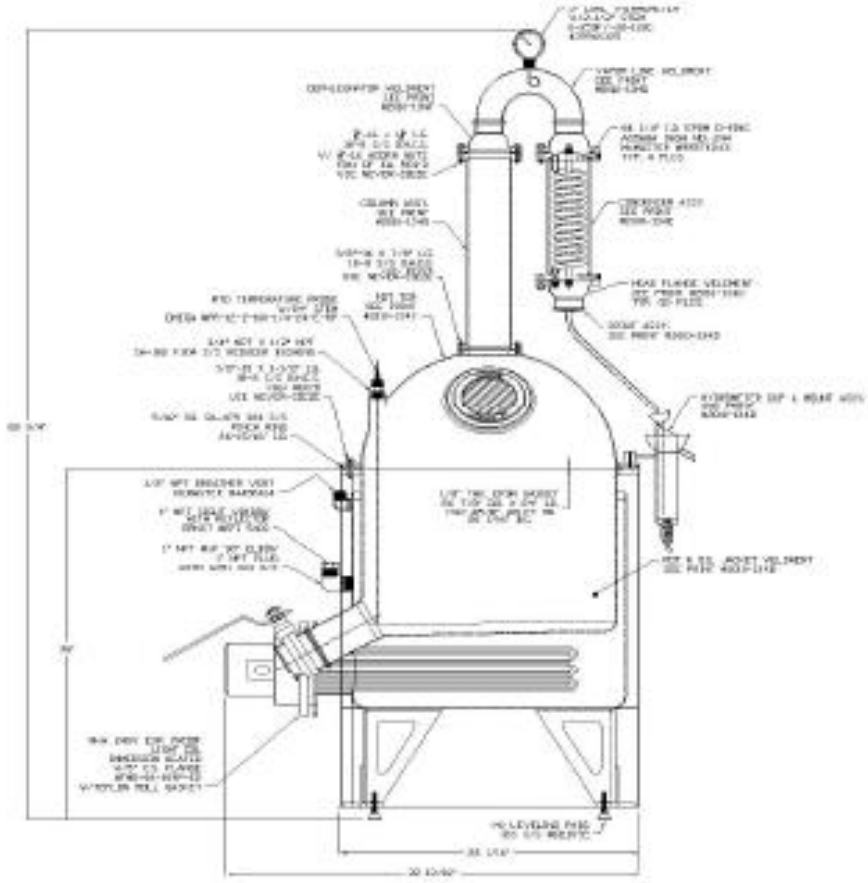
Package Boiler -Electric, propane or natural gas driven	(BTU/hr)			
We recommend you purchase boiler and have installed locally				
Minimum recommended boiler sizing for batch still only	75,000			
Minimum recommended boiler sizing for batch still and mash cooker running simultaneously	125,000			
Estimated Product Output (based on 8% ABV Charge with 5 hour run time)	Gallon Charge			
	30	50		
80 Proof	18	30		
100 Proof	14.5	24		
120 Proof	12	20		
140 Proof	10	17		
*(*multiple runs)* **190 Proof**	7.5	12.5		
	"production liters after heads and tails cuts			



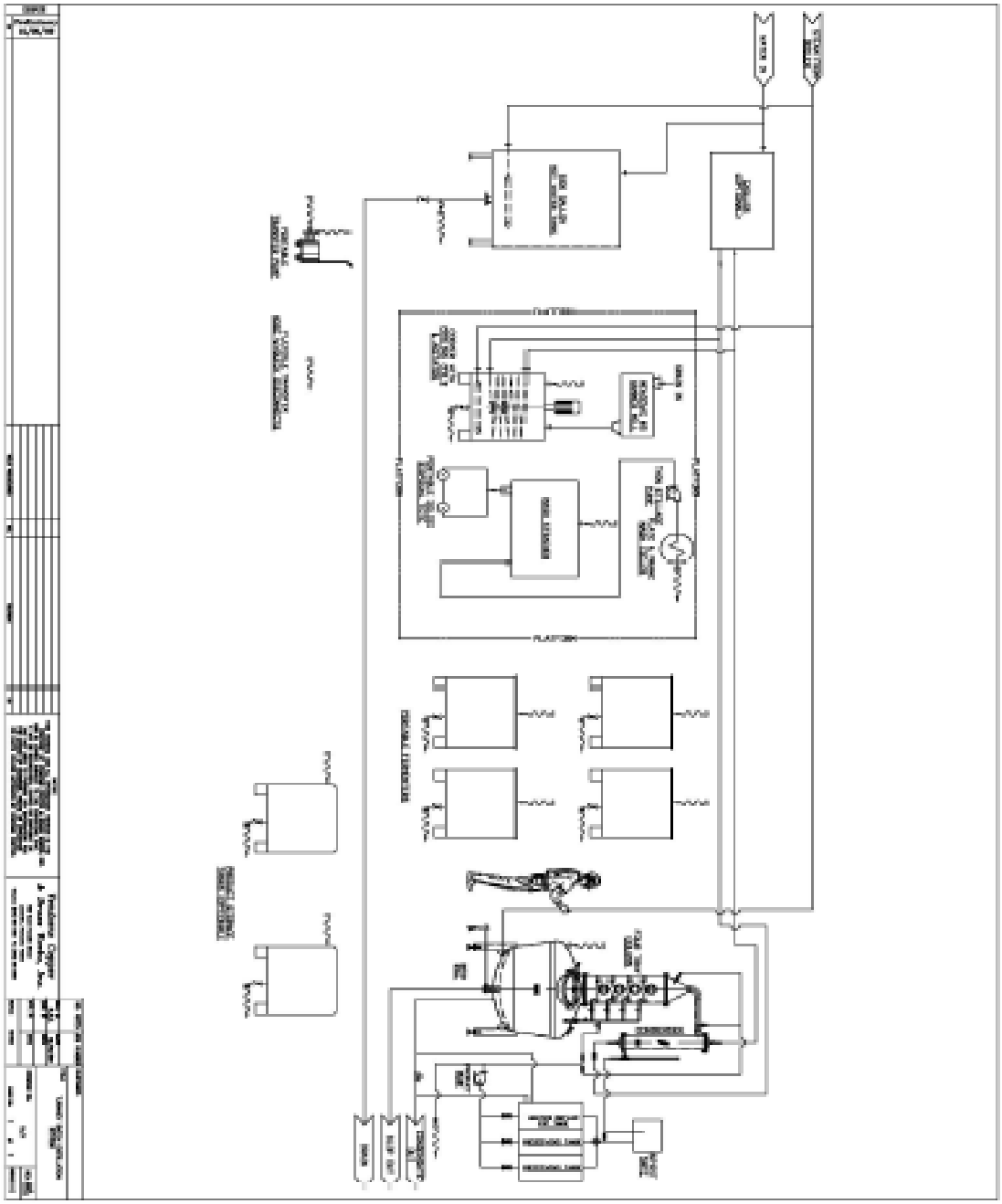
50 GALLON STEAM OR OIL



"NEW" 50 GAL. ELECTRIC



30 GALLON ELECTRIC



Vendome Batch

502-587-1930
FAX 502-589-9628

VENDOME COPPER & BRASS WORKS
INCORPORATED
DISTILLERY EQUIPMENT ● STAINLESS STEEL WORK
BREWERY EQUIPMENT ● PROCESS SYSTEMS
709 EAST FRANKLIN STREET
LOUISVILLE, KENTUCKY 40202
www.vendomecopper.com

Customer: Logan A. Rocha
Address: Worcester Polytechnic Institute
Chemical Engineering Class of 2015

Email: larocha@WPI.EDU
Phone:
Cell: (207)-671-8317
Fax:

Date Sent: 11/18/2014
Price Updated: 6/26/2014
Quoted By: Rob Sherman
Phone: 502-587-1930 x121
Email: robs@vendomecopper.com

The systems listed on the following pages are designed for low to middle proof whiskey, rum, brandy, or single distillation of GNS, for gin and vodka. All of the systems are capable of producing 190 proof in multiple runs. A vodka column is highly recommended if vodka is the desired product and will be produced from raw materials. Any custom pot still systems that are not listed or continuous distillation systems please inquire and pricing will be provided once the design has been established.

All of the batch still systems are custom designed and fabricated upon order. All equipment is for heavy industrial use and is fabricated in Louisville, Kentucky, USA by fourth generation coppersmiths. Vendome can fabricate any size or shape to meet your needs including partial systems. Any other related stainless steel or copper equipment can also be supplied, such as, fermenters, cookers, whiskey tanks, bottling tanks, etc. Shipping can be quoted once the design, delivery date, and destination are established.

Terms are 30% down, 60% upon receipt of major materials, remaining balance due before shipment. Prices do not include taxes, if any apply. After receipt of down payment, fabrication drawings will be supplied to the customer for approval prior to the start of fabrication. Pricing is subject to change once final design drawings are approved. Installation of systems by Vendome personnel is available with pricing provided upon request.

Vendome will supply serial numbers for all equipment prior to final shipping. It is the customer's responsibility to obtain all required permits and abide by all state and federal regulations.

Upon request, we can refer a consultant to help you with all of your startup and recipe development needs. We also can provide contacts if you require equipment financing. Vendome offers a 1-year standard warranty to original purchaser that equipment is free from defects in material and workmanship only under normal use and service for one year from date of receipt of equipment.

POT STILLS					
		Gallon Charge			
Item	Qty	125	250	500	750
Standard Copper Batch Still Steam Jacketed	1				
One (1) hand crafted ornate manway with sightport					
One (1) sightport for viewing pot contents					
One (1) 4" bottom outlet with valve					
Eight (8) couplings for heating, temperature, safety, spares					
All gauges and safety devices included					
Four (4) 4" cu pipe legs with adjustable feet, 6" painted steel on 500/750.					
All brass or stainless steel hardware					
One (1) copper lid with vapor outlet piping					
One (1) copper vertical condenser/product cooler with stainless steel hardware					
All piping for trey drains.					
17" dia pot mount copper column with four (4) bubble cap treys and four (4) easy open sightports					
Standard finish out side pot welds polished and acid washed satin finish					
CIP connections with spreybells (1) pot and (1) column					
Explosion Proof Agitator (motor starter not supplied)					
Option 1 - Simple Reflux		$82,240	$95,540	$133,520	$171,950
One dephlegmator with water line from condenser for trey reflux					
One (1) Spirit Cup					
Option 3 - Pumped Reflux with Dephlegmator		$107,320	$122,070	$163,150	$205,230
3-bay stainless reflux and receiving tank combo and CIP system					
One dephlegmator with water line from condenser for trey reflux					
One (1) 304 ss and glass Hydrometer station					
One 9GPM explosion proof alcohol / reflux / CIP pump, variable speed.					
Upgrade to stainless side stand with 3 bay tank		CALL FOR PRICING			
Deduct for Omission of Agitator		-$5,560	-$5,950	-$5,950	-$6,670
Reflux Onion for Batch Still					
Copper reflux onion with stainless flanges, gaskets, and bolting hardware, recommended for 125 and 250 gal		$5,140	$5,800	$5,800	$6,530
Mirror Finish		ADD 15% TO ANY OPTION ABOVE			
Standard system has outside welds polished only and an acid wash satin finish. Price is for polishing copper still, condenser and spirit safe.					
				PAGE TOTAL:	

FERMENTERS						
			Gallon Charge			
Item		Qty	125	250	500	750
Square Tote Design Without Cooling						
304 ss, Square, open top, 1-1/2" or 2" NPT drain with valve						
335 gallon	$3,430.00	4		$13,720		
540 gallon	$4,000.00	4			$16,000	
Square Tote Design with Cooling Jacket						
304 ss, Square, open top, 1-1/2" or 2" NPT drain with valve						
335 gallon	$4,356.00	4		$17,424		
540 gallon	$5,137.00	4			$20,548	

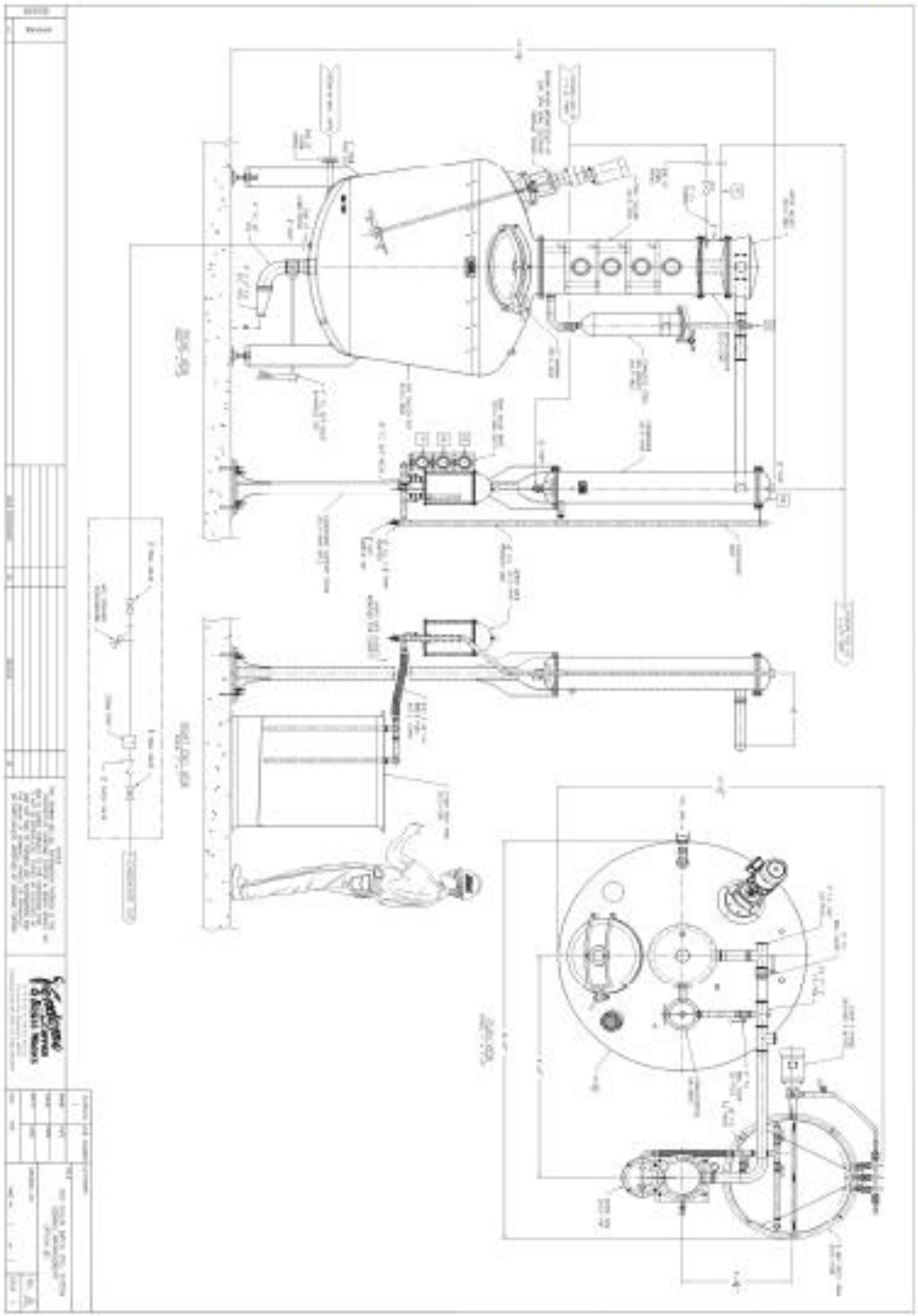
RECEIVING TANKS						
			Gallon Charge			
Item		Qty	125	250	500	750
Stainless Receiving Tanks - Square Economy						
Square tote style. Industrial finish. Stackable and forktruck movable. Top manway. 1-1/2" or 2" NPT drain with valve.						
250 gallon	$2,937.00	1	$2,937			
350 gallon	$3,212.00	1		$3,212		
550 gallon	$3,861.00	1			$3,861	
Stainless Receiving Tanks - Round Polished						
Round, closed flat top, manway, 1-1/2" drain with valve and hose connect. Polished #4 finish						
125 gallon	$5,489.00	1	$5,489			
250 gallon	$6,655.00	1		$6,655		
500 gallon	$8,030.00	1			$8,030	
700 gallon	$9,378.00	1				$9,378
Stainless Receiving Tanks - Square - Cooling Jacket						
Square tote style. Industrial finish. Stackable and forktruck movable. Top manway. 1-1/2" or 2" drain with valve With ex cooling jacket			CALL FOR PRICING			
350 gallon						
550 gallon						
700 gallon						
Stainless Receiving Tanks - Round - Cooling Jacket						
Round, closed flat top, manway, 1-1/2" drain with valve and hose connect. Polished #4 finish, with external cooling jacket.			CALL FOR PRICING			
125 gallon						
250 gallon						
500 gallon						
700 gallon						
Note:	Square Tanks will be priced at time of order. Prices subject to change. Any size available.					
					PAGE TOTAL:	

MASH COOKER					
		Gallon Charge			
Item	Qty	125	250	500	750
Mash Cooker - Round Style Economy Design	1	$23,540	$26,600	$31,060	$39,710
All Stainless steel, dished top and bottom					
Live steam sparger for cooking					
3" drain with valve and top mount electrical Agitator					
18" top manway					
External dimple jacket or coils for cooling					
Industrial 2B SS finish					
Motor Starter not supplied					
Mash Cooker - Option For False bottom	1		$9,060	$10,860	
V-Screen false bottom, for solid separation					
Includes side manway for easy manual removal of solids					
Includes water sparging internals					
Pricing being updated					
Mash Cooker - Option for Rakes and Scraper	1		$12,490	$14,030	
Add rakes and scraper design eliminating the need for manual clean out of solids					
Also includes recirculation pump					
False bottom above is required for this item.					
Pricing being updated					
				PAGE TOTAL:	

OPTIONS					
		Gallon Charge			
Item	Qty	125	250	500	750
Stainless Vodka Column with Structured Packing				$50,380	
Requires Batch still system to operate					
One (1) 12-3/4" dia x 14' tall stand alone column w/Deplegmator					
Contains Sulzer ethanol structured and engineered packing					
Recommended for changing recipes and flow rates at higher proofs					
Alcohol Reflux pump and piping					
Column Mount Dephlegmator for reflux					
Stainless Vodka Column with Structured Packing				$72,360	
Can operate as a stand alone unit					
Same item as above, but includes					
250 gallon steam jacketed 304 stainless pot					
Product cooler/ condenser and spirit cup					
Does not include alcohol pump (not required)					
Copper Vodka Column with 20 Plates				$59,240	
Requires Batch still system to operate					
One (1) 11-1/2" dia x 21' tall stand alone column w/Deplegmator					
Contains 20 copper selve bubble plates					
Recommended for changing recipes and flow rates at higher proofs					
Alcohol Reflux pump and piping					
Column Mount Dephlegmator for reflux					
Copper Vodka Column with 20 Plates				$80,250	
Can operate as a stand alone unit					
Same item as above, but includes					
250 gallon steam jacketed 304 stainless pot					
Product cooler/ condenser and spirit cup					
Does not include alcohol pump (not required)					
Vodka Column, Automated Water Control					
Controls dephlegmator water temperature for more consistent product			CALL FOR PRICING		
Hot Water Tank					
Insulated, square IBC tote design wit direct steam sparger					
Aids in speeding up the cooking process by heating and storing water					
drain, vent & temperature control valve					
250 gallon $6,700.00	1	$6,700			
350 gallon $7,040.00	1		$7,040		
550 gallon $8,170.00	1			$8,170	
Stand for Hot Water Tank				$2,150	
Elevates Hot Water Tank for Gravity Feeding of Hot Water to Cooker					
Grain Mill - 7.5hp Hammer Mill	1			$5,930	
Allows for fine grinding of corn and other grains					
Grain Mill -2HP Roller Mill w/Grain Boot	1			$6,340	
12ft pencil auger elevator to move milled grain up and in the	1			$2,840	
50 Gallon Portable Open Top Tank w/Cooling Jacket	1			$2,620	
100 Gallon Portable Open Top Tank w/Cooling Jacket	1			$2,970	
				PAGE TOTAL:	

NOTES AND ADDITIONAL OPTIONS				
	125	250	500	750
Gin Basket				
8" dia 304 ss, quick opening lid, lift out basket, connecting piping with valves. Pipes off of side of column and bypasses 4 trey, using main condenser	$5,450	$5,450		
Gin Basket				
12" dia 304 ss, quick opening lid, lift out basket, connecting piping with valves. Pipes off of side of column and bypasses 4 trey, using main condenser			$6,470	$6,470
Field Installation				
This can be priced after plant design and layout have been established				
Touch Screen Automated System Control Unit				
This can be priced after plant design and layout have been established				
ROLL-A-ROUND MASH TRANSFER PUMPS & ALCOHOL PUMPS				
Moves raw materials between the cooker, fermenters, and batch still				
1-1/2" XP Alcohol Pump w/VFD - 40 GPM	$4,790			
All Stainless Steel wetted parts. Tri-Clamp Connections				
Pump is supplied by itself. Customer responsible for setting & Wiring				
VFD is NOT XP				
2" Pneumatic Double Diaphragm FDA Pump	$6,510			
All Stainless Steel wetted parts. Filter, Regulator & Lubricator included.				
10' intake and 20' delivery EPDM hose with 2" camlocks couplings				
Requires 70psi @ 20scfm for 20gpm.				
Air compressor & air hose not included				
Suitable for Mash and High Proof Alcohol				
3HP Electric Pump Single or 3-Phase (recommended)	$5,990			
Stainless steel with TEFC motor, Stainless roll a round cart, VFD, Remote				
10' intake and 20' delivery EPDM hoses with 2" camlocks couplings				
208/240 volt, on/off fwd/rev. Suitable for Mash				
			PAGE TOTAL:	
			GRAND TOTAL:	

SPECIFICATIONS				
Package Boiler - propane or natural gas driven	**125**	**250**	**500**	**750**
We recommend you purchase boiler and have installed locally	(BTU/hr)			
Minimum recommended boiler sizing for batch still only	250000	500000	1000000	1500000
Minimum recommended boiler sizing for batch still and mash cooker running simultaneously	400000	750000	1500000	2250000
Estimated Product Output in Liters(based on 8% ABV Charge with 5 hour run time)	**Gallon Charge**			
	125	**250**	**500**	**750**
80 Proof	75	150	300	450
100 Proof	60	120	240	360
120 Proof	50	100	200	300
140 Proof	43	86	172	258
*(*multiple runs)* **190 Proof**	30	60	125	180
	**production liters after heads and tails cuts*			



Appendix E: Additional Vintner's Vault Quote Information

The Vintner Vault
3230 Riverside Ave Suite 140 Paso Robles, CA 93446
Ph: (805) 226-8100 Fax: (805) 226-8188
www.TheVintnerVault.com

Technical Characteristics: HAGYÓ Spirit 300

- **Kettle:** made of WNr. 1.4301 steel up to the filling level. Upper part is made of cylindrical roller compacted copper. The water or steam jacket on the kettle is made of WNr. 1.4301 steel, external insulated, surface is scaled. It is equipped with manometer, and safety valve, that will be opened by 0,5 bar pressure. There are on the kettle: a mash mixer of 0,55 kW capacity, installed on the top, NA 65 nozzle + ball valve filler for mash, rotation washing head (rotating 360°), 1 piece of seeing glass, with external lighting. Kettle door: Ø 418 mm, with WNr. 1.4301 stainless steel covering with 6 mm thick heat resistant glass. The kettle can be heated by steam, gas, wood or electricity. At gas heating the approval process for the gas burner is responsible of the buyer according to the local law. At steam heating the steam generator has to be obtained by the buyer separately.

- **Cap:** Made of cylindrical roller compacted copper. With foam catcher construction between the cap and the kettle, with installed washing head. Custom-designed lenticular cap. By this plate effect the contact time will be longer between the vapor and liquid phase, creating a harder reflux.

- **Refinery column:** with 2 refinery disc, with step less variable adjustment for the more careful gaining of the fruit aromas, by the refinery discs with two seeing glasses for each, with outside installed lightning, on top integrated – own developed – dephlegmator with increased copper surface. Controlling of the dephlegmator, with hydro-dynamic controlling system.

- **End-cooler:** condensator with pipes, height is 1300 mm. Material: WNr: 1.4301. Controlling of cooling water with hydro-dynamic controlling system.

- **Thermometers:** on the cap, on the refinery column one per discs, on the dew pipe, on the input cooling water of dephlegmator, on the cooling water streaming away from the dephlagmator, on the liquor line.

- **Epruvetta:** For the measuring of spirit content between 0-100°, with Ø 100 mm glass covering.

- **Hot water tank:** insulated tank for the gathering of cooling water, 150 l.

- **CIP pump:** pressure 4 bar pump for the washing system, 1,1 kW.

- **Tank for distillate gathering:** one 150 l tank for distillate gathering (for head-, and leg distillate).

- **Preparation for tax-bonding** (according to the local regulation): on the side with alcohol content 2 pieces per connections. On the water side one piece of plumb bonding.
The optical order of the equipment is of individual design, protected with form patent.
The purchase price contains the equipment for liquor distillation and the measuring and display units necessary for the manual operation.

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Mash Mixing Through Atomization: Optional

In the process of the distillation the mash in the boiler must be continuously kept in boiling condition. The mash in boiling condition must be mixed all the time, because through that the heat transfer can be increased on the wall of the boiler and at the same the created vapor from the mash can be ventilated, which is a pre-condition of the effective distillation.

According to the foregoing practice the mixing of the mash was generally made through shovel mixing construction. This method has its physical limitations, which are from a certain point not to be extended. In order to increase the efficiency of the distillation, the surface of heat transfer and efficiency of the mixing must be increased.

Through our patented process this will be realized in such a way that in the process of the distillation the mash in the boiler will be atomized and sprayed by means of a special pump from the bottom of the boiler to the vapor area above the mash. The atomized mash will be contacted with the heated steams in very large surface, realizing through that a very intensive heat transfer. Through the pumping of the mash from the lowest point of the boiler the efficiency of heat transfer on the boiler wall will be improved significantly. It can be easily seen, that this solution provides a much better mixing, thanks to the two elements. One of them is that the mash will be taken from the lower part of the boiler, and it will be fed back above. Through that the mash is in a continuous vertical streaming condition. Secondly, the mash is contacting the steams above, and through that the heat transfer is much better, as it would be through the fluid mash. Finally, the mash-atomizing device will increase the heat transfer between the steam and the fluid phase.

- There is no minimum limit of the mash loaded into the kettle, therefore small quantity can be distilled without problem.
- Intensive mash mixing at the wall of the kettle, better heat exchange, economical and quicker process.
- Quicker and homogenous heat exchange between the atomized mash and alcohol vapor.
- The increased evaporating surface and contact time – better reflux formation and by this better refinement.
- The distillation process could start at lower temperature, better aroma concentration.
- Higher yield.
- Less energy cost.
- No foaming up..

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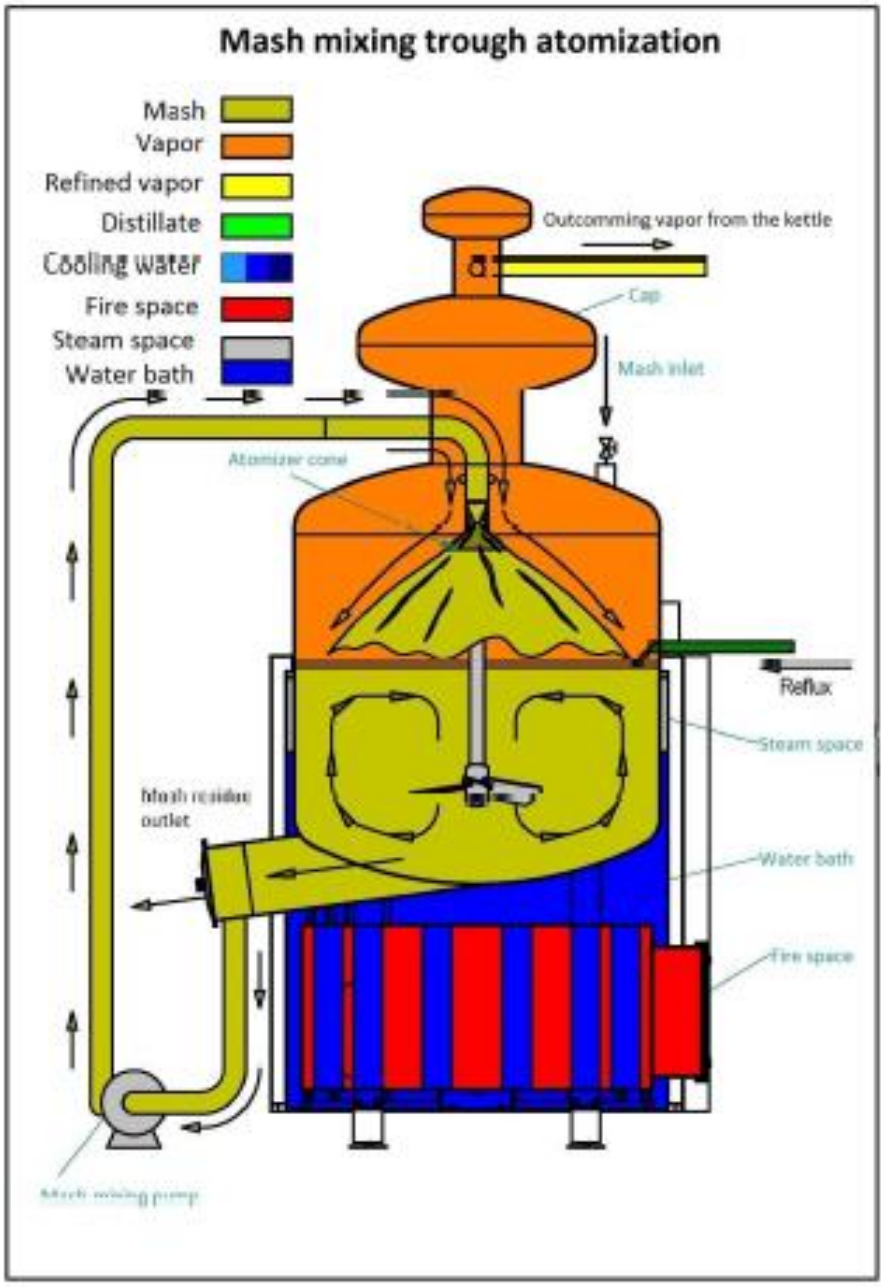

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Full Automatic Control System: Optional

System is controlled by industrial computer in IP 65 protected board.

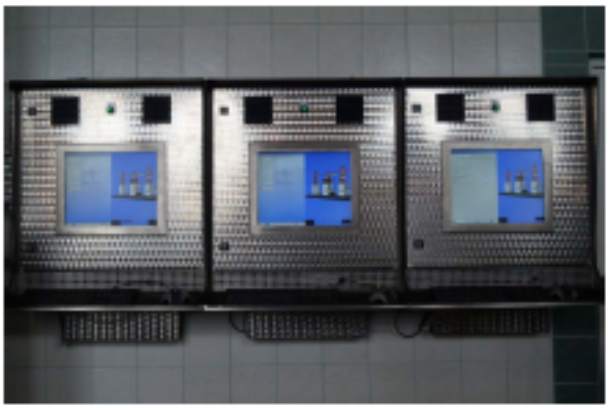
The control and process control system was developed by Hagyo for the complex control of the technology of the distillation equipment.

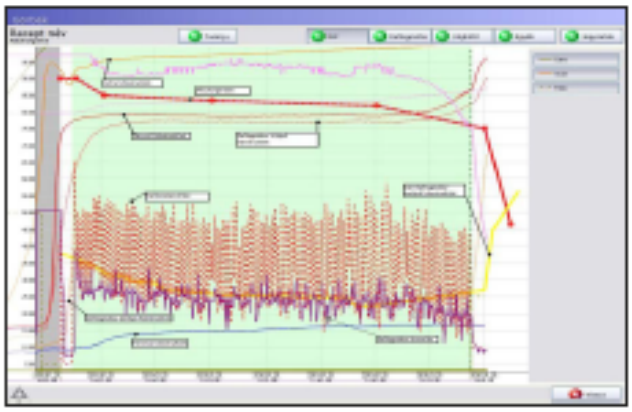
After the filling of the mash the distillation process will be fully automatically led on the basis of predefined parameters, by the supervision of the distillation master. Besides taking samples during the boiling, the distillation process can be completely controlled. If needed the parameters can be changed during the process so the whole process should be optimized for the high requirement of the product to be produced.

According to predefined formulas and taking into consideration the properties of the mash, the various quality requirements can be specified for the final product: alcohol content of pre-, middle-, and after distillates (V/V%), heating performance levels, temperature of the dephlegmator, and of the final cooling.

The enormous benefit of this system beside the price against similiar products on the market is that it's user surface contains all of the significant elements of the technology in 3D illustration. It has a dynamic user interface, therefore the operation is simple, easy to overview, and completely logical.

In it's basic design it contains the control board placed in the boiling house, the keyboard in the front, though which the paramenters of the distillation (variables) can be defined, respectively the boiling process can be casually followed. In case of wood heating not all the system does not have complete control of the heating.





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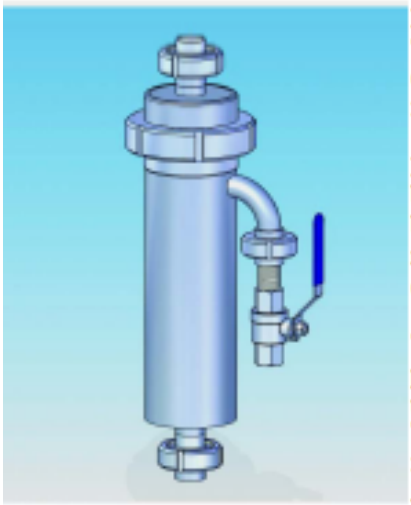
SVE Sampling Valve Equipment: Optional

The **SVE** is a modern and aesthetic looking sample taking equipment, developed by our company

Its helping for the brewer master in making a more accurate separation of the distillate and in the gradual control of the quality. Through that the product can represent a higher quality.

The equipment is suitable to install both in existing and also in newly built liquor brewer. It is compatible with any kind of brewers, with one, or with two stages. Our company has purposed to create such an equipment, which provides a better price / value ratio, than other products in the market and which fulfills the expectations and beside that is aesthetically also meets the requirement of a modern plant today.

FUSEL Oil Filter: Optional



Equipment for the separation of fusel-oil.
The FUSEL OIL filter is a modern filter equipment developed by our company, with a minor need of place, which is for the exemption from the fusel-oil of the distillation to be produced.

By the development of the equipment the first important aspect had been that by the end of the "cooking" phase the quantity of the distillation, which would become a lost, should be minimized. By the help of this guideline we could reach our goal. The filtering is made through a candle shaped cotton filter cartridge, which is placed inside the equipment.

The equipment is furnished with a globe valve, which can be sealed in closed position. Through this valve the accumulated fuel-oils can be drained from the upper part of the filter, so that the filtering efficiency will be restored.
This equipment corresponds to all kind of hygienic conditions and is also furnished with the sealing places, according to the requirement of the Custom Authorities that are necessary for the taking into operation.

The Vintner Vault
3230 Riverside Ave Suite 140 Paso Robles, CA 93446
Ph: (805) 226-8100 Fax: (805) 226-8188
www.TheVintnerVault.com

Mash Pre-Heater: Optional

Distilleries operate by using a significant heating energy, accordingly its expenses will increase the operating fees directly and the price of the product indirectly. The competition will expectedly intensify by the influence of the constantly growing number of new entrants to the market. Only those distillery plants will be able to reach a really good position, which take into consideration to the economic production, besides the quality of the product. In consequence of the above, the energy optimization of the distillery plants became basic requisite.

Due to the distillation principles it is necessary to input a lot of heating energy. It is a well-understood market interest to optimize its efficiency the best possible. Inspecting the usually applied routine, we have faced a quite disconcerting fact. What we have experienced in general that the distillery plants did not pay the appropriate heed to energy loss, so they've been operating fairly uneconomic from the aspect of energetic.

Current Practice:

1. Energy analysis of distillate coolers and dephlegmators.
Conventional distillers (two-stage systems) based on the current practice in the brewing process, the 35-50 °C water down linked from the end-cooler (total condenser) usually released into the canal, or without heat recovery just cooling back, significantly burdened with the environment.
The modern distilleries (one-step systems) are almost the same can be said about it, but at this system the 70-80 °C water down linked from the dephlegmator goes directly to the canal also burdened the environment.

2. Energy analysis of mash remnant
Furthermore, after the cooking process is complete, the hot mash remnant is leaving the system without heat recovery. Easy to realize that the hot mash removal right after the boiling process, what it means to energetically. In practice, from an average unit (approx. 500 liters) we pour an 90 °C mash into the canal, instead of use its heat energy for pre-heating the mash for the next boiling process or other technological process like building heating, domestic hot water, drying, etc.).

Summary:
Energy loss can be easily calculated from the temperature and the mass flow of the water, along with the money waste. Based on the above we can reveal that the plants operating without energy optimization will work uneconomic, so they can become easily non-competitive. However, due to the already evolved private sector, these expenses make a remarkable influence on their position on the market.
Apparently, those plants will be able to hold a good position that considers the economic production besides the quality.

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TERMS AND CONDITIONS:

- Prices are for goods Paso Robles, CA
- 50% Down at time of order, Remainder prior to Delivery
- Deposits are Not Refundable
- Applicable taxes Extra
- Delivery Not Included in This Quote
- Delivery Time: To be agreed upon

This Quotation expires 30 days from November 19, 2014
We hereby offer to purchase the items,
Described above under the general:

Please use our purchase order No.....

Date.....

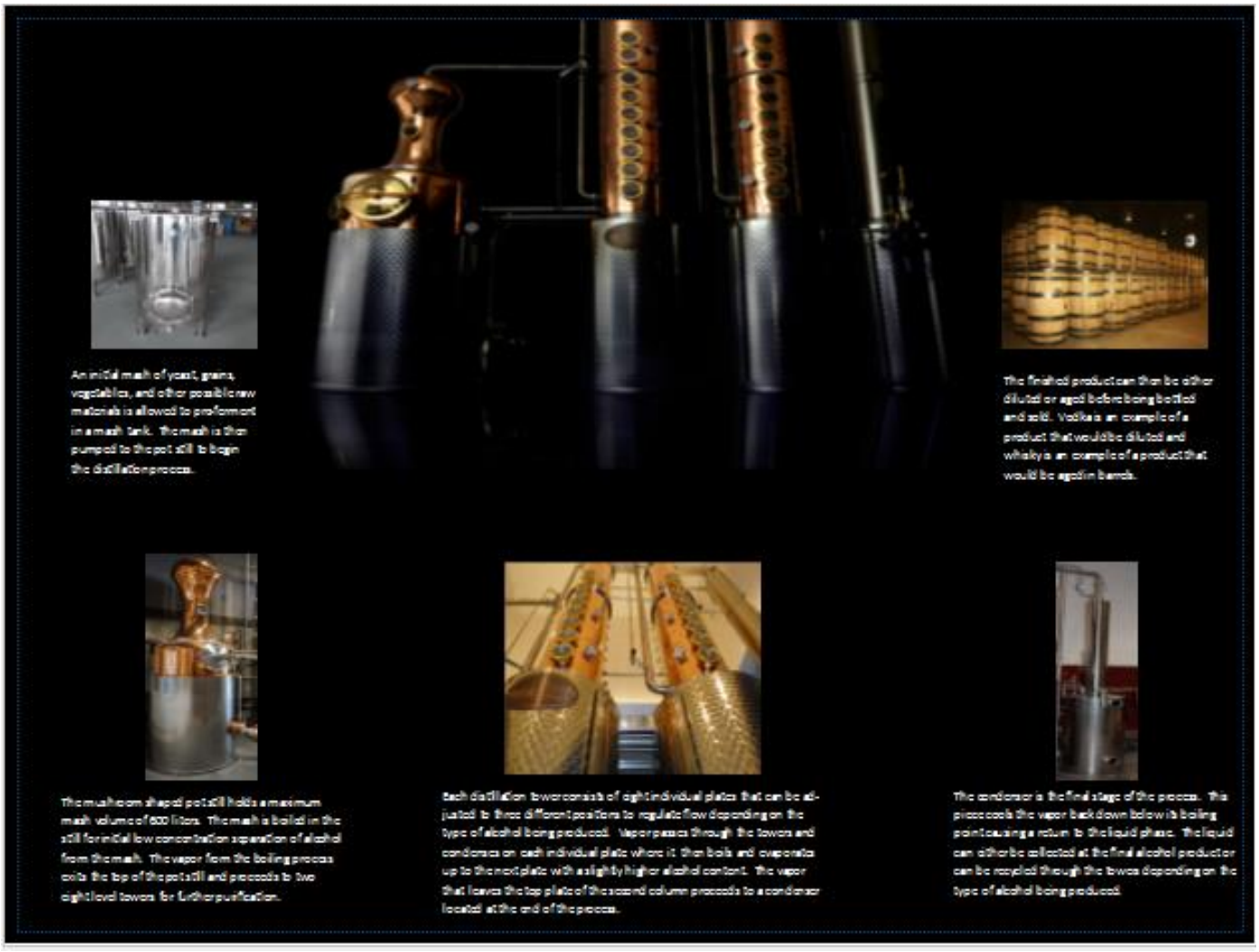
Company.....

Signature.....

This Quote was prepared by Andrew Berg

Appendix F: Kothe 600 L Twin Column Vodka Still Pictures

Appendix G: Kothe Unit Informational Poster



Poster Captions

Top Left: Mash Tank - An initial mash of yeast, grains, vegetables, and other possible raw materials is allowed to pre-ferment in a mash tank. The mash is then pumped to the pot still to begin the distillation process.

Bottom Left: Pot Still - The mushroom shaped pot still holds a maximum mash volume of 600 liters. The mash is boiled in the still for initial low concentration separation of alcohol from the mash. The vapor from the boiling process exits the top of the pot still and proceeds to two eight level towers for further purification.

Bottom Middle: Distillation Towers - Each distillation tower consists of eight individual plates that can be adjusted to three different positions to regulate flow depending on the type of alcohol being produced. Vapor passes through the towers and condenses on each individual plate where it then boils and evaporates up to the next plate with a slightly higher alcohol content. The vapor that leaves the top plate of the second column proceeds to a condenser located at the end of the process.

Bottom Right: Condenser - The condenser is the final stage of the process. This piece cools the vapor back down below its boiling point causing a return to the liquid phase. The liquid can either be collected at the final alcohol product or can be recycled through the towers depending on the type of alcohol being produced.

Top Right: Final Product - The finished product can then be either diluted or aged before being bottled and sold. Vodka is an example of a product that would be diluted and whisky is an example of a product that would be aged in barrels.