

Automatic Wine Pouching Machine

Engineering Specification Document

UCCS MAE Senior Design Team

Hayden McLaughlin
Ryan Beckman
Jackson Taylor
Brock Martin
Grace Wenham

Evergood Sponsor and Faculty Advisors

Mr. Matthew Hexter
Dr. Lynnane George
Dr. William Michael

Project Specification Intent

Evergood Adventure Wines (“Customer”) is a craft winery located in Palmer Lake. The company makes wine from lemons and is distributed to over 250 locations throughout Colorado. Evergood was launched in 2018 and is reliant on volunteers to pouch their bestselling and seasonally sold wine, Heart Warmer. However, over 6,000 units are projected to be sold in 2022 and the current volunteer pouching system limits the supply of this product, limiting sales and company growth.

Evergood has requested UCCS MAE Senior Design to create an automated wine pouch filling machine to decrease reliance on volunteers and increase output of wine pouches. The machine will be run by a small staff team to increase production output and efficiency. Current solutions only offer semi-automatic filling, so the goal of this project is to automate this process as much as possible.

Project Requirements with Target Values

Regulatory Specifications

- The prototype shall be compliant with FDA (Federal Drug Administration) and ATF (Bureau of Alcohol, Tobacco, Firearms and Explosives) regulations
- The parts of prototype that come in contact with wine shall be made of components that are GRAS (Generally Recognized As Safe) according to the FDA

- The prototype shall fill within a percentage error of the target volume, as defined by the Alcohol and Tobacco Tax and Trade Bureau (TTB):
 - 750mL
 - Acceptable range: 2% or 735mL – 765mL
 - 1.5mL
 - Acceptable range: 1.5% or 1.4775L – 1.5225L

Specifications

- Mechanisms that can: catch, pinch, smash, cut, or otherwise harm personnel that operate machinery shall be shielded from personnel.
- All electronics shall be sealed to the IP65 standard or be above cleaning height (height of the wine filling nozzle) to avoid electrical shock.

Material/Cleaning and Maintenance Specifications

- The prototype shall be constructed of materials that:
 - Are durable (able to hold 1.5kg pouches without deforming)
 - Can withstand hot water (up to 100°C) for parts that may encounter wine spillage
 - Can withstand PBW cleaner (Powdered Brewery Wash is an alkali-based cleaner specifically made to sanitize and clean brewing equipment) for parts that may encounter wine spillage
 - Do not deform from the force used for sealing the cap
 - Cap will be attached by applying a force (which will be determined during testing) that seals the pouch (a cap is fully attached/sealed when the brim on the cap is flush with the lip of the pouch; fully attaching the cap so that it is sealed will make two clicks which may be heard by the user for confirmation)
- The prototype shall be waterproof below and water resistant above the height of the filling nozzle
- The prototype shall not have any permanently sealed/glued components

Personnel Specifications

- The prototype shall require only 1 user to operate
- The entire process shall require only 2 users for depalletization, labelling, loading, operation, and palletization

Calibration Specifications

- The user shall be able to set the machine settings to match the pouch size
- The user shall be able to manually calibrate the flow rate for fine adjustment via manually adjusted compression of the filling tube
- The user shall be able to calibrate the filling speed/flow rate of the pump to maximize efficiency

Usage Specifications (from user's perspective)

- The prototype shall be mobile so that it can be moved to a new location with 2 or less people
 - The prototype shall weigh less than 440lb
- The prototype shall be able to fill both 750mL and 1.5L Astrapouch pouches
- The user shall be able to load a pouch into the machine and the machine shall indicate the pouch has been loaded and is ready for filling
- The prototype shall automatically open the pouch with N₂ gas
 - A puff of gas shall be released to fill pouch with N₂ (Testing will be done to quantify time, given the flowrate of gas and volume of pouch)
 - Approximately 3 psi or adjustable valve shall be used to puff pouches
- The prototype shall have less than 1% spillage (no spillage is ideal)
 - Spillage shall be measured during testing. The percentage shall be a ratio of the number of pouches that experience spillage to the total number of pouches
- The prototype shall orient the cap so that the cap faces downward and then apply pressure to snap the cap onto the pouch
- The machine shall confirm a cap is attached in correct orientation before offloading the pouch
- The prototype shall release the pouch into a contained offloading area where it may be picked up for boxing by the user
- The prototype shall have a means of detecting and displaying fault/error message to the user
- The prototype shall have an emergency off-switch that cuts power to the entire system
- The prototype shall include a manual detailing instruction for operation and maintenance

Additional Features – (user stories that are not required but can be added if time/materials allow)

- The prototype may apply sticky a label to the pouch
- The user may be able to load multiple pouches at once
- The user may be able to control each mechanism manually with product controls in case of malfunction
- The prototype may wash the outgoing pouches
- The prototype may dry outgoing pouches with air flow
- The prototype may be made of modular sections to assist with mobility/maneuverability requirements
- The prototype may produce more than 250 pouches every 1.5 hours
 - Maximize flowrate and machine efficiency to maximize output

Materials and Cost Requirements:

- The prototype shall not exceed a cost of \$30,000 while meeting all requirements in this document.

Use of Additional Equipment

- Prototype shall not require wine to be above ground level (as opposed to in the air on a forklift)
- Prototype may use existing facility equipment: pump/pressure regulator & tank of gaseous nitrogen.

Project Sponsors

Matthew Hexter

Matthew Hexter

11/27/22

Signature

Print Name

Date

Signature

Print Name

Date

Signature

Print Name

Date

UCCS Design Team Representatives

Grace Wenham

Grace Wenham

12/4/2022

Signature

Print Name

Date

Brock Martin

Brock Martin

12/4/2022

Signature

Print Name

Date

Hayden McLaughlin

Hayden McLaughlin

12/4/2022

Signature

Print Name

Date

Ryan Beckman

Ryan Beckman

12/4/2022

Signature

Print Name

Date

Jackson Taylor

Jackson Taylor

12/4/2022

Signature

Print Name

Date