WINPAK

CUP FILLING MACHINE

BUYERS GUIDE

This guide provides an overview of pre-made cup filling operations, available technologies, and key questions to ask manufacturers to align machine capabilities with your company's needs.

TYPES OF CUP FILLING MACHINES

Pre-made cup-filling machines' design and operation are completed with one of two different technologies: a rotary filling design and an in-line design build.

Rotary Filling Machines

With rotary filling, the cups are usually guided along a conveyor, moved to a single file for control purposes, then the cups are moved onto the outside of the first rotary wheel, or placed in an opening where they are secured. As the wheel slowly rotates, on larger high-speed lines, over each slot, there is a filling tube that dispenses the product into the cup, then the cup is moved to a secondary wheel for the sealing process.

On smaller rotary lines, both the filling and the sealing operations are completed on the same wheel, but in separate locations where the cups are advanced to situate under the filling and sealing stations respectively. At the designated point, the cups are ejected and exit the machine. Single-wheel rotary systems are considered 'entry-level' due to the low output per minute during production. The multiple-wheel rotary systems are typically for high-speed production, taking up considerable space or 'footprint' for their operation. We typically see these huge machines in the beverage industries filling carbonated soft drinks, ice teas, beer, seltzers, and many types of bottled waters.

In-Line Filling Machines

In-line systems, commonly known as HFS (Horizontal, Fill, Seal) machines, pre-made rigid cups are delivered 'stacked', one on top of each other, in groups of 100, 150, 200, etc. The Operator loads the stacks into columns, each representing one lane on the machine. Machines will typically have 4 to 8 lanes, however with up to 16 lanes for smaller cups. Each pre-made cup is mechanically denested (separated) from the stack and falls into specific openings on a carrier plate, a long rectangular plate designed to securely hold and support the specific diameter of the cup to be filled. The row of cups advances where a single row or multiple rows are simultaneously filled with the liquid product. After filling, the cups are either sealed by individual die-cut lids which are picked and placed or sealed with lids that come from a roll stock of partially pre-cut lids, called a daisy chain. Each lid is still connected end to end, but the material is cut just after the seal is made. This is called a 'daisy chain' and it is quite common in lid sealing for coffee creamer cups, where the cups are small, and the daisy chain provides added control for precision placement and sealing of the lid as well as economic advantages.

Products in premade rigid cups are sold in numerous markets around the world with products such as Jams and Jellies, Sauces and Dips, Condiments, Dressings and Spreads, Butters and Margarine, Applesauce, Peanut Butter, Yogurts and Syrups. In the Dairy markets, you see Coffee Creamers, Cream Cheese, and Sour Cream, plus you'll find desserts like Puddings in cups along with Juices and other Beverages.

Due to their limited output, and larger footprint requirements, rotary-type cup-filling machines are commonly used as entry-level machines. Whereas in-line cup-filling machines are significantly more viable for moderate to higher-volume needs.

LIQUID FILLING

Both rotary and inline systems, when filling low viscose to high viscous products, work by pumping the liquid into the cups through a series of pipes into specific filling nozzles.

Depending on the product's nature when filling, some systems' fill nozzles move down and then up when filling to minimize splashing or foaming whereas other products are simply fine for stationary filling. There are several different methods of filling liquids such as Gravity Fillers, Pump Fillers, Overflow, Vacuum, Net Weight, and Piston Fillers. The majority of liquids that are filled in the Food industry are volumetric piston fillers where the focus is on the precise volume of product being dispensed. For products where the accurate weight of the product is more than the requirement, filling technologies can be switched to Net Weight Fillers or 'slug deposit' fillers.

Gravity Fillers

In a gravity filler, liquid products flow from a hopper tank into a cup or container by the force of gravity. This type of volumetric filler relies on time-based control of the flow valve, allowing for dispensing of the same volume of liquid, however limited to low to medium viscosities. Accuracy is not as high as other options. Pressure systems can be added to increase capabilities to manage higher viscosities.

Pump Fillers

Pump filling machines are also a type of volumetric filler, however, as in the name, use a pump mechanism (rotary or peristaltic design) to measure and move the required volume of the liquid from the Hopper tank to a smaller reservoir or directly into the cups. The viscosity range for pump fillers is higher than Gravity types and can run at higher output speeds. However, they are usually limited to homogenous products because they struggle with accuracy and operation depending on the type and size of particulates.

Net Weight Fillers

Net weight filling machines, again just like the name says, fill cups or containers by weight, not volume. The system is designed utilizing weighing scales to monitor the liquid's weight inside the cup throughout the filling process stopping once the target weight level is reached, providing a highly accurate fill.

Piston Fillers

Another highly accurate technology for volumetric liquid filling is Piston fillers. The process works by the liquid product being drawn into a cylinder via negative pressure or suction, as the piston withdraws, then the product is pushed into the cups/ containers as the piston advances. Volumetric Piston Fillers are widely used throughout the Food Industry as they are highly accurate, and can manage the widest range of product viscosities, including the challenges with particulates. An Operator should be able to quickly modify the piston's stroke length, given the flexibility to decrease or increase the fill volume required.

FINDING THE RIGHT CUP FILLING MACHINE FOR YOU

It is important to note that not all cup-filling machines are made the same. Depending on the manufacturer, there could be significant differences when it comes to the design and quality of the materials used, such as using SAE-304 and SAE-316 stainless steel for all food contact surfaces or were some components or parts of the frame has been replaced with lightweight aluminum which is ill advisable for all 'wet' production environments or the machine needs to have full wash-down capabilities.

These choices limit the longevity, durability, functionality, production up-time, and overall efficiencies of the system, which is your investment.

Four very important topics that must be looked at very closely are the company's reputation for building high-quality and durable machinery, the machine's overall speed/ output range, the reputation of the manufacturer with regards to their level of skilled Technical Service or do they farm it out to other companies, and last but not least, is the accuracy of the filling system. If the accuracy of the filling is not where it needs to be, your product could be consistently underfilled, where you could have product labeling complaints, or it could be overfilling. For example, instead of 3 oz. fill the filler is dispensing 3.1 oz, basically giving away 1 cup to every 30 cups produced as a loss.

You need to have a thorough conversation about your products, packaging, and production needs with each manufacturer and they need to reciprocate how their respective systems will address your needs. Through this 'discovery process', you need to document the process to ensure both parties gain a better understanding of the needs and wants, the specifications, and requirements. This is important as mistakes, assumptions, omissions, or misunderstood information can lead to production delays, incorrect final package results, operational machine inefficiencies, and ultimately product and financial loss, hopefully not losing contracts or customers along the way!

LIDDING - UNDERSTANDING THE DIFFERENT OPTIONS

There are three typical types of lidding applications for the sealing of pre-made rigid cups after the filling process which are daisy chain, roll stock and die cut lidding techniques.

DAISY CHAIN LIDDING

Daisy Chain lidding is provided in a roll stock format where the lids, plain or pre-printed, are already precut to the required dimension to the cup they are to be sealed onto, however each lid remains connected, 'end-to-end', forming a single, continuous line, which resembles a chain. They are cut post-sealing depending on customer requirements.

Consumers typically handle cups sealed with a daisy chain lid when they open up products such as coffee creamers or small butter cups.

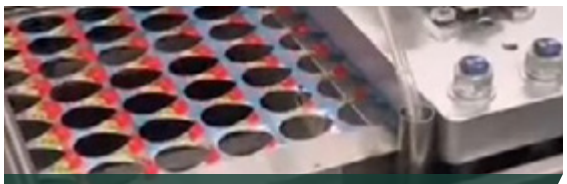
Typical daisy chain diameters are 34mm, 37mm, 41mm, 51mm, and 60mm and they run on higher-speed fill/seal packaging machines like the WTL In-line Creamer machine and the WVF In-line Vari-fill Cup Machine.

ROLL STOCK LIDDING

Roll Stock Lidding utilizes high quality film wound onto a 3" or 6" paperboard core. The rolls are mounted onto the filling machine and the lids are 'punched out' on the filling machine.

The roll stock material can be structures such as nylon, polypropylene, polyester, polyethylene and cellophane, with most structures available with a barrier layer for greater protection and longer shelf life.

With using a cup filling machine that utilizes roll stock lidding, the machine Operator/Owner becomes responsible for the accuracy and cleanliness of the cut, the maintenance cost of the cutting blades/punches, and disposal cost of the 25% to 35% scrap materials which unfortunately typically end up in a landfill.



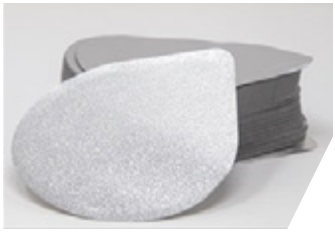
SCRAP WEB FROM PRE-PRINTED LID ROLL STOCK

SCRAP FILM COLLECTED ON A FILM REWIND

DIE CUT LIDDING

Die-cut lids are cut from high-precision dies at the manufacturing plant to ensure accuracy and cleanliness of the cut, providing exceptionally smooth edges. Top quality suppliers will provide a wide variety of sealant options to specifically match the application, as well as provide several printing options, and custom size/ shaped die-cut lid options.

Typical diameters for die-cut flexible lid typically range in sizes from 40mm to 169 mm, with various lid shapes.



Aluminum foil-based die-cut lidding is quite common in the packaging for products such as yogurts, butters, sour creams, and soft cheese type products as the structure is an excellent barrier to prevent light, moisture and oxygen penetration. The structure is also exceptionally durable to protect the product against physical challenges within shipping and handling as the material is tear and puncture resistant. The aluminum foil layer is coated or laminated on both sides, typically using an adhesive 'tie layer' to bond the layers together. The top layer is usually printed, either directly onto the layer or reverse printed.

One of the benefits and cost savings advantages of pre-made Die cut lids relates to the fact that the cutting is handled at the manufacturing facility, whereas at Winpak, all the scrap material is recaptured by grinding it up, compacting it and sold to the recyclers where the materials re-enter the aluminum recycle stream. This eliminates the operational costs, lost time, and waste issues at the Operator site.

LET'S LOOK AT YOUR NEEDS:

Your company needs to keep up with ever-changing market demands with cost-effective and reliable production by providing in-demand packaging formats. Although there are several machine manufacturers and models available in the marketplace today, navigating that sea of choices might feel a little daunting, but arming yourself with the key information you need to know, and asking the right questions, will empower you to make a well-informed decision that suits your company's needs and makes a sound investment.

If this is not your first machine, then the below questions are second nature to you! But for the 'first timers', the below list will be helpful in preparation for your conversations with the machine manufacturers to better understand your needs and requirements.

Let's review the *4 Ps...Product, Package, Production, and Project.*

PRODUCT

- What types of products do you want to package?
  - Liquid or dry
  - For liquids:
    - High Acid and/or Low Acid
    - Thin and/or viscous products
    - Products with particulates
      - Composition
      - Size
    - Product temperature at filling
- Shelf-life requirement
- Storage requirements
- Distribution requirements
- Channel to be sold in
- How many different products/ SKUs/ recipes do you wish to package?
- Future/ forward- Are there any new products in R&D that need to be considered?

PACKAGING

- One size for all of your products or different sizes needed across the product range.
  - Best to have the same cup diameter with different lengths for different fill levels
  - If it comes to different diameters and sizes, you'll need to invest in the change parts and schedule the appropriate downtime to perform the changeovers.
- Some systems are more flexible than others to accommodate different cup diameters, however, all seem to operate at dramatically slower speeds, up to 50% slower.

PRODUCTION

- How many packages do you need to make for each SKU?
  - Over what period...in one day/shift/week
- Are you currently experiencing any of the capacity problems listed below and need to add a machine?
  - It is increasingly harder and more expensive to maintain aged machines.
  - Reached scalability limits.
  - Need to lower COGS.
  - Increased Quality Control issues: machines are not as dependable.
- Do you need to sterilize the equipment before each new production run?
- Location
  - You need to confirm there is adequate space for the machine with proper clearances for door openings, or access to key areas.
  - Need to confirm the required utilities present for operation.
  - What is the production environment like?
    - Wet or dry,
    - Cold, ambient, warm

PROJECT

- **Timeline**: What is the required date that the new Cup filling machine needs to be operational with your team trained and ready for production?
  - Packaging materials (Cups and Lids) need to be there too; check your lead times!
  - Good OEM manufacturers can offer both base machines, with numerous upgrade options, as well as the engineering prowess to provide customized solutions.
  - Typically, every machine needs to be tweaked and tailored to your packaging requirements and specifications.
- **Budget:**
  - **For 600 to 700 cups per minute output:**
    - Expect a quality-built pre-made cup-filling machine, which can last up to 20-30 years, the investment will range from between $700,000 to $900,000. Additional functionality, tooling, etc. will naturally increase the investment amount.
  - **For 1,400 to 1,600 cups per minute output:**
    - Anticipate a budget between $1.4MM to $1.9MM. Additional functionality, tooling, etc. will naturally increase the investment amount.
  - *Financing- consider working with only the top-tier manufacturers at this point as the major players can offer special programs to make your opportunity a reality.*
- **Support:**
  - What type of training do you need?
  - Do you have on-site maintenance personnel, or plan to have or will you need start-up support and perhaps a Preventative Maintenance Program?
  - Is the machine manufactured domestically or is the machine imported?
  - Does the manufacturer have local support/ certified technicians?

SELECTING

YOUR PRE-MADE CUP FILLING MACHINE

CONSIDERATIONS:

1. **Buying Process:**
    - Discovery process-
        - Did they conduct a thorough needs assessment?
        - Did they cover all of the questions in your checklist?
            - Experience - how long has the company been packaging your type of products?

2. **Manufacturing:**
    - **Location: Made locally in the USA or manufactured overseas?**
        - Foreign Built:
            - What certifications do they have?
            - Lead time:
                - From PO to installation for foreign-made machine?
                - For common spare parts
                - For uncommon parts, engineered rebuild.

    - **Build: Durability**
        - ***Stainless Steel***- standard or an upgrade?
        - Frame SAE 304 and product contact parts SAE 316?
            - ***Note:*** Aluminum components are softer, lighter-weight, more prone to corrosion and rusting, breaking welded joints. Avoid if wet environment, a full washdown is required. Stainless steel is superior in strength, corrosion resistance, and durability.
        - What are the oldest machines still in operation today?
        - Does the company have a good reputation, and well known throughout industry?

- **Operations:**
  - Easy to view and use HMI for most effective operations.
  - Easy to access major components.
  - Seamless changeovers that are tool-free
  - Pneumatics vs. Servo controlled.
    - Pneumatics: cheaper upfront cost, compressed gas is the most expensive utility, cost for regular service & replace parts. Higher product waste and undetected leaks reduce efficiency and productivity. Poor energy efficiency rating.
    - Servo motors are far more accurate, have lower operating costs, have high uptime, and are energy efficient.

3. **Service & Support**
   - ***Does the company manufacture and supply the Cups & Lidding as well?***
   - The company is financially sound so you can depend on them in the future.
   - Training and educational programs, at OEM facility or on-site.
   - Phone and remote service support, 24-hour coverage.
   - Manufacturer in-person support (or farmed out to third party (best to avoid))
   - Certified technicians
   - Large spare parts supply and overnight shipping support.

IN CONCLUSION:

As discussed, there are fundamental key elements when selecting the right pre-made cup-filling machine for your application as well as selecting the optimal packaging materials. The system needs to not only be the best to present your brand/products to the marketplace but also work and perform well in your production facility.

Winpak can be an ideal partner for your business as not only does Winpak operate 12 state-of-the-art production facilities throughout North America, utilizing leading edge production technologies, but Winpak also develops and produces all of their packaging materials, and all of the filling machinery is designed and manufactured in California.