

**Title:** Increased Flow Breast Pump

**Function:**

There are numerous reasons nursing women choose to use breast pumps over naturally breastfeeding. One huge advantage is the convenience of collecting milk while away from the baby, allowing opportunity to pump milk at a convenient time and place to store for later infant consumption. It is quite common for mothers to use a breast pump at work so that they have milk readily available later in the day, which opens up time to spend on other activities. However, breast pumps do have some disadvantages compared to natural breastfeeding. They can be uncomfortable to use, even causing pain and distress at times. Furthermore, it takes significantly more time to collect milk when pumping as opposed to breastfeeding. Breast pumps currently on the market focus on suction magnitude, rate, and cycle, but do not take into consideration the inherent behavior of the baby's mouth while feeding. The baby's tongue massages the nipple, which increases the milk flow rate from the breast. Some breast pump designs attempt to mimic the movement of the infant's tongue by altering pressure in the breast shield, but there is still ample room for improvement in the industry to increase breast milk flow using massaging and stimulation [1]. Enhancing this mechanical aspect of a breast pump design will decrease the time a mother has to spend pumping, while at the same time lowering the discomfort and pain a mother experiences during the pumping process.

**Client Needs and Requirements:**

**Design Requirements:**

**1. Physical and Operational Characteristics:**

*a. Performance Requirements*

The breast pump must function faster and more efficiently than current products on the market, utilizing a massage or stimulation to increase flow rate.

*b. Safety*

The device will exhibit massage apparatus stability to ensure the mechanical stimulus does no harm to the breast. It will have a maximum suction magnitude to prevent over-suction, which could result in discomfort. There will be no exposed wires or moving parts, and the motor used will have a safety factor ensuring its normal operating conditions are much lower than its maximum operating specifications to prevent overheating and malfunction.

*c. Accuracy and Reliability*

The massage function must work properly for the duration of each pumping session, accurately applying stimulation as close to infant tongue massaging as possible.

*d. Life in Service*

The device will function at its optimal performance rate for one year [5].

*e. Shelf Life*

The breast pump can be stored before use indefinitely.

*f. Operating Environment*

The breast pump will be portable and will be mainly used at home or in an office setting.

*g. Ergonomics*

The breast pump will be comfortable to wear and use and will maintain its durability throughout its lifetime of one year. It will be used in a sitting position, but will weigh light enough for easy transport.

*h. Size*

The breast pump will be made in one size (24mm and 27mm are standard size). However, the size could be altered for future application to 21, 30, or 36mm.

*i. Weight*

It is expected to weigh between 7 and 9 pounds.

*j. Materials*

The current list of materials include:

- Silicone cups for breast shield
- Pre-assembled, purchased breast pump
- Motor
- Materials for massage apparatus to come

*k. Aesthetics, Appearance, and Finish*

The breast pump will be portable, have a discreet and lightweight massage insert, and will have a pleasant and comfortable looking finish.

**2. Production Characteristics:**

*a. Quantity:*

The product consists of one breast pump.

*b. Target Product Cost:*

The top-rated breast pumps on the market range from \$100-\$400.

### 3. Miscellaneous:

#### a. *Standards and Specifications:*

The breast pump device will mimic an infant suckling onto the nipple. It will be competitively priced with current models on the market, and will pump the same amount of milk as a current model does in less time. Breast pumps are medical devices that are regulated by the Food and Drug Administration [4].

#### b. *Customer:*

Nursing women are the customers.

#### c. *Patient-Related Concerns:*

Concerns include nipple irritation, mastitis (infection of the breast tissue), milk quantity, and pumping duration.

#### d. *Competition:*

##### **Philips Avent Comfort Double Electric**

The Philips Avent breast pump offers a gentle stimulation mode that simulates a baby suckling with cyclic pressure changes in 5 circles around the breast shield. This product is \$199.99 [1].

##### **Medela Freestyle**

The Medela Freestyle is a light and portable breast pump that is on the market today. It includes "2-Phase Expression" technology that offers a faster initial pumping speed, similar to a baby's actions when first latched on, and a slower let-down phase. This product costs \$399.99 [3].

##### **NUK Double Electric Breast Pump**

The NUK breast pump is a portable system with silicone breast shields instead of hard plastic. This breast pump has multi-phase settings and memory to store them. This product costs \$204.99 [2].

### References

1. "Avent Comfort Double Electric Breast Pump." *Comfort Double Electric Breast Pump SCF334/04*. Philips Electronics N.V., n.d. Web. 14 Sept. 2015. <[http://www.usa.philips.com/c-p/SCF334\\_04/avent-comfort-double-electric-breast-pump/](http://www.usa.philips.com/c-p/SCF334_04/avent-comfort-double-electric-breast-pump/)>.
2. "Double Electric Breast Pump." *NUK*. NUK USA LLC, 2015. Web. 14 Sept. 2015. <<http://www.nuk-usa.com/breastfeeding/double-electric-breast-pump/>>.
3. "Freestyle® Breastpump | Medela." *Freestyle® Breastpump | Medela*. Medela, Inc., n.d. Web. 14 Sept. 2015. <<http://www.medelabreastfeedingus.com/products/463/freestyle-breastpump/>>.

4. "U.S. Food and Drug Administration." *Breast Pumps*. N.p., n.d. Web. 18 Sept. 2015.
5. Whit, Angela. "How Do I Know My Breast Pump Has Worn Out?" *Blisstree RSS*. Blisstree, Fall 2009. Web. 14 Sept. 2015. <<http://www.blisstree.com/2009/12/28/sex-relationships/how-do-i-know-my-breast-pump-has-worn-out/>>.