




MilkTech International



## The Milking Unit Introduction Pulsation

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## Terminology of pulsation

 These terms describe pulsation

- ❶ Pulsation types
  - ✓ Simultaneous
  - ✓ Alternate
- ❷ Pulsation Rate
- ❸ Pulsation Phases
  - ✓ a, b, c, and d
- ❹ Pulsation Ratio


 Let's review what they mean

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## Types of pulsation

 Simultaneous

- ❶ The 4 liners of one cluster open and close at the same time.
- ❷ All 4 teatcups are attached via short pulse tubes to a common manifold and to a pulsator with a single valve.

 Alternate


- ❶ Liners open and close in pairs.
- ❷ Two liners open at the same time while the other two are closed.
  - ✓ Can alternate from 'front-to-rear' OR 'side-to-side'


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## Pulsation Rate

 = Number of pulsation cycles per minute (ppm)

- ❶ The number of times that the pulsator actuates (liners open and then close) in one minute.
-  Pulsation rates can range from 40 ppm to 70 ppm for cows but are most typically from about 55 ppm to 65 ppm.
- ❶ Pulsation rates can be as high as 90 ppm to 120 ppm for sheep and goats.

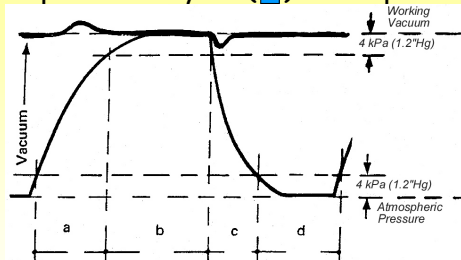
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## Pulsation Phases

Each pulsation cycle ( ) has 4 phases:



The transition between phases occurs 4 KPa (1.2" Hg) below the working vacuum or above atmospheric pressure.

Let's review what's happening in each phase.

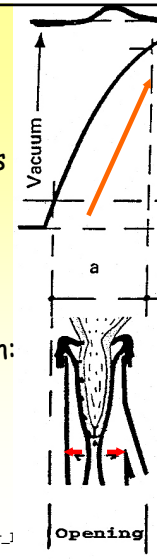
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## a phase

- ☞ Liner is **OPENING**.
- ☞ Pulsation chamber vacuum (PCV) goes from atmosphere to vacuum.
- ☞ Air is drawn from the pulsation chamber into the milking machine (pulsator air line).
- ☞ a phase duration depends primarily on:
  - ❶ Pulsation chamber volume
  - ❷ Length of long pulse tube
  - ❸ Size of pulsator air port



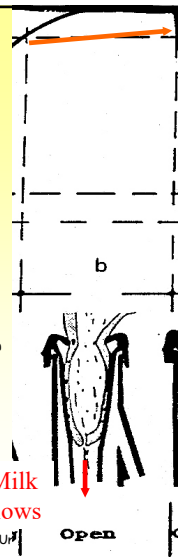
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## b phase

- ☞ The liner is **OPEN**.
  - ❶ Teat canal is open.
  - ❷ Milk flows out of teat.
  - ❸ Blood flows to teat end causing congestion.
- ☞ PCV is nearly steady and is near the working vacuum level.
  - ❶ No air movement into or out of pulsation chamber.



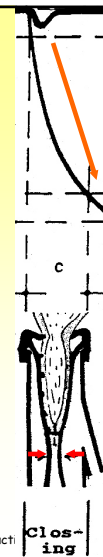
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## c phase

- ☞ Liner is **CLOSING**.
- ☞ Pulsation chamber vacuum goes from vacuum to atmosphere.
- ☞ Air is drawn from the atmosphere (or filtered air line) into the pulsation chamber.
- ☞ c phase duration depends primarily on:
  - ❶ Pulsation chamber volume
  - ❷ Length of long pulse tube
  - ❸ Size of pulsator air port



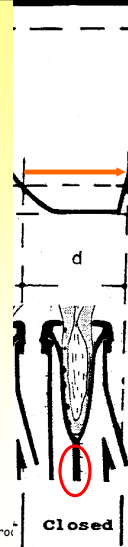
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## d phase

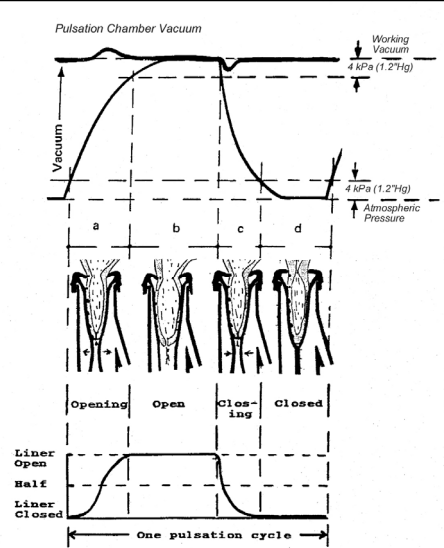
- 🐄 Liner is **CLOSED** or collapsed.
  - ❶ Vacuum at teat end (inside liner).
  - ❷ Atmospheric pressure in pulsation chamber (outside liner).
- 🐄 Liner applies massage force to teat end.
  - ❶ Closes teat canal and stops milk flow.
  - ❷ Removes blood and congestion from teat end.



Closed

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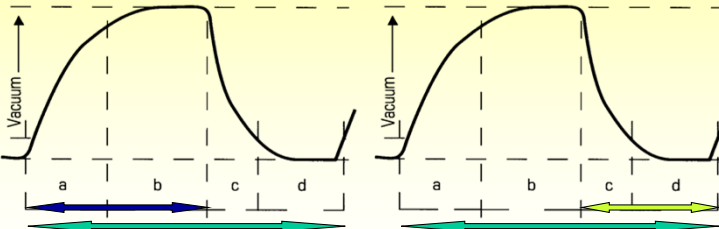
**4 phases make one cycle**

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## Pulsation Ratio

Is defined in international standards (ISO) as the ratio of opening and open phases (a+b) to the closing and closed phases (c+d).



$$= (a+b)/(a+b+c+d) : (c+d)/(a+b+c+d)$$

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## Example

- ✓ a = 150 ms
- ✓ b = 500 ms
- ✓ c = 130 ms
- ✓ d = 220 ms
- ✓ Total cycle = 1,000 ms

$$(a+b) / (a+b+c+d) = 650 / 1,000 = 65\%$$

$$(c+d) / (a+b+c+d) = 350 / 1,000 = 35\%$$

**(a+b) % : (c+d) % = 65 : 35**

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