Fiji TechNote 3 – Milking Machine Parts and their Function

The following is a list of common milking machine parts and their function. The actual item will be different on different milking machines but generally the principle of milking is simple with milking machine companies making different products or components according to their own ideas of how cows can and should be milked.

Vacuum Pump: Pulls air from the whole machine reducing the vacuum level to around half an atmosphere or 50 kPa. If a liner is then connected to the teat, the vacuum opens the teat sphincter and milk flows out.

Oiler: Distributes oil into the vaccum pump to lubricate the veins inside it that move in and out to create the vaccum

Vacuum Regulator: This device controls the vacuum at a pre-determined level and this is decided by the height the milk has to be lifted, e.g., a low lift, a low vacuum, a high lift a higher vacuum level. Some regulators are simple and good such at the Waikato 170A but others such as 'poppet' valves are cheap but very poor and unable to keep the vacuum stable. A vacuum level/milk line height table is available.

FDIDI would like to acknowledge New Zealand company QCONZ and consultant Mel Eden for supplying some of the information and images contained in the TechNote series.

Vacuum Gauge: A device to measure vacuum and often mounted on a milking machine. They are quite simple but wear out reasonably quickly. They provide a good guide to check before every milking to see the system is working as one expects.[Vacuum regulator shown on the right of photo and vacuum gauge close by on the left].

Vacuum Can/Reserve Can: Allows a reserve of vacuum to allow for loses due to air getting in due to cup changing, cups being kicked off or rubbers coming off. Without this reserve every time a small amount of air gets in the vacuum would drop too low and set of cups would fall off.

Receiving Can: Milk flows into the receiving can from the milk line under vacuum and from here is sucked out by the milk pump into the milk vat or can.

Sanitary Trap: If fitted is above the receiving can and helps prevent milk or water getting into the pulsator line. Usually has a float system that cuts off the vacuum when there is an overflow.

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Pulsator: An absolutely vital part of all milking machines. Pulsators restore then stop the vacuum between the liner and shell about once every second, 60 times/ minute, give the cow a 'rest' from milking.

It is more complicated than that over-simple explanation. The **'squeeze phase'**, when the space under the teat is under full vacuum but the space between the liner and the shell is at atmospheric pressure, flattens the liner against the teat pushing teat fluids back up the teat enabling the teat orifice to open wide again at the next vacuum phase. This amazingly incredible device makes milking quicker and avoids hurting the cow making her much more comfortable. Setting the **pulsation rate** to 50-60 pulses per minute is normal and recommended. The **pulsation ratio**, the vacuum phase to rest phase ration is normally between 50% and 65%, again very important. The rest time when the liner is fully collapsed should be at least 20% to minimize mastitis spread.

Claw: a simple device to collect milk from 4 quarters and allow it to be drawn up to the milk line or into a bucket.

The air admission hole: This tiny hole in the claw, 0.8 to 1.0 mm in diameter, allows air into the claw to drive the milk up to the milk line.

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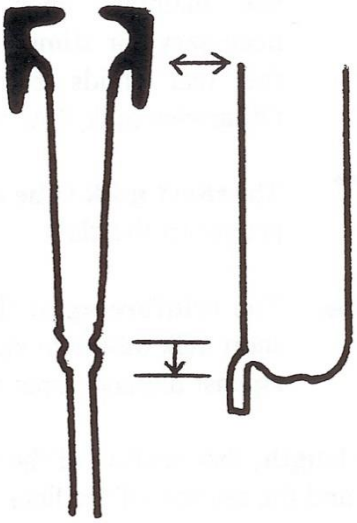
Liner: A very important part of the system, joining the milking machine to the cow's teats. Liners have been subject to many decades of research to find the 'best' design. Its parts:

- **The lip and mouthpiece cavity** : They seal and hold the liner on to the cow's teat.
- **The liner barrel:** The width of the liner is more-or-less matched to the teat size so bigger cow's teats would normally have bigger barrel diameter liners. [Compromises are essential as teat sizes vary across a herd and with cows of differing ages].
- **Tension rings:** The tension rings match the liner to the shell to make a seal. Otherwise the cavity between the shell and the liner would leak and pulsation would not happen.
- **Liner stretch:** Liners need to be stretched inside the shell so they milk properly, normally around 10%.



Teat Cups: Hold the liner in place allowing the vacuum and pulsation to squeeze the liner in and out to extract the milk.

Milk filter barrel: Holds the milk filter in place. The milk flows through the filter to remove any debris and dirt form the milk before going into the vat or can. The filter cage holds the milk filter which is then inserted into the barrel.

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Sight glasses: These devices are used to help milkers decide when the cow is finished milking and also to see clearly is there is blood in the milk. Unfortunately, they are never very good apart from the far better clear claw. Instead see the end of milking better by looking at the cow's udder and feeling that the stainless steel pipe between claw and milk line is becoming cold.

Plate Cooler or Plate Heat Exchanger (PHE): Liquids – milk and water, move in opposite directions to transfer heat for one to the other to pre cool the milk before entering the vat or can. If the water entering a PHE is 15^0C then the milk coming out should be no more the 18^0C if the correct volume of water is used (3x water compared to milk volume), and the correct number of plates are installed. For a diaphragm milk lift pump the number of plates should be twice the number of cups. Centrifugal milk lift pumps require more plates.

Milk Pump: Either diaphragm or centrifugal to move the milk from the receiving can to the vat or can.

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Jetters: These are fitted to make the cleaning of the plant easier. The cups are attached to these like milking the cow, but instead of milk going through it is water.

Milk meters: very clever devices to help one measure milk yield.

Refrigeration Unit: Keeps milk in the vat cold until picked up by the milk truck. Should be 7^{O}C within 3 hours after milking.

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Milk Vat/Bulk Tank: Where milk is stored in bulk under refrigeration until the milk truck comes to take it to the factory for processing. The sight glass is used to measure the milk or if no sight glass a dipper is used.

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