PARLOR DESIGN AND EQUIPMENT

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Introduction

Ewes are usually milked on an elevated platform from the rear. A bucket system is portable and suitable for smaller dairies. Larger dairies can usually justify the expense of a parlor milking system. There are several different designs for parlor milking systems. Parlors usually have a single row of stanchions, parallel stanchions, or are rotary-style. The Dairy Practices Council publishes several helpful guides specifically addressing small ruminant dairy farming. DPC Guideline 70 provides a practical discussion, for dairymen and certified equipment dealers, of the installation, cleaning, and sanitizing of small ruminant milking systems. The recommendations are kept in line with those of 3-A Accepted Practices for Design, Fabrication, and Installation of Milking and Milk Handling Equipment, and with the Milking Machine Manufacturers Council of the Farm and Industrial Equipment Institute. Subjects discussed pertaining to cleaning and sanitizing include: steps in cleaning mechanical cleaned pipeline systems, cleaning and sanitizing bucket milking machines, cleaning pulsation lines, cleaning farm milk tanks, and troubleshooting cleaning problems.

Careful planning needs to assure:

- Suitable potable water supply for sanitation as well as an ample supply for the animals.
- Plans for the disposal of waste from milk houses as it contains cleaning residues and milk waste (see Guidelines 15).
- Milkhouse and milking center plans including provision for adequate ventilation.
- Properly designed milking and milk cooling systems.
- Reliable electrical supply and back-up generator.

Milking Machine Function

Basic to the operation of any milking machines "negative" pressure between one-third and one-half of the atmosphere in a confined space (bucket, pipeline, tube and hose). This pressure differential moves milk away from the animal’s teats, or fluids away from any opening since air rushes in to equalize pressure. A continuous vacuum at the teat end would stress the teats so air is admitted between the shell and liner by an air vent in the claw or inflation. The pulsator allows the collapse of teatcup liners (inflations) and massage the teats. Milk should flow directly away from each teat preventing flooding or cross contamination between glands. Agitating milk during harvest leads to possible foaming and increased rancidity, so milk should flow gently through milk lines and not mix with air. Conversely, pulsing air and fluids are needed to create turbulent and fast moving slugs of rinsing, washing and sanitizing solutions to effectively clean milking systems.

Milking System Issues Unique to Small Ruminants

ISO standards specify the minimum requirements for milkline and vacuum pump sizing for small ruminant milking systems. Your local milking machine company representative can advise you on these specifications. Milking and milk storage facilities are also regulated by the Pasteurized Milk Ordinance (PMO). The PMO is a federal document enforced at the state level most often by the respective state department of agriculture. To avoid costly delays in construction and production any dairy start up or expansion of facilities, regulatory officials should be consulted to ensure compliance with the PMO. As a very rough guideline; 1 cow = 2 sheep or goats so that a milking parlor setup designed for 16 cows will accommodate 32 sheep or goats. Sheep and goat milking parlors are common in single and double-sided parallel (milking units attached through back legs) and rotary configurations (Reinemann, 2015).

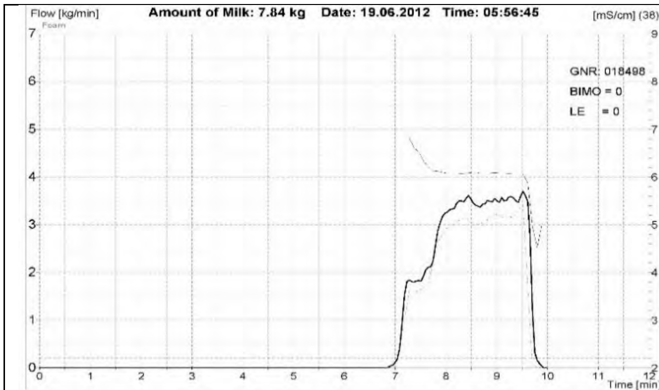

Figure 1. Uniform milk flow.

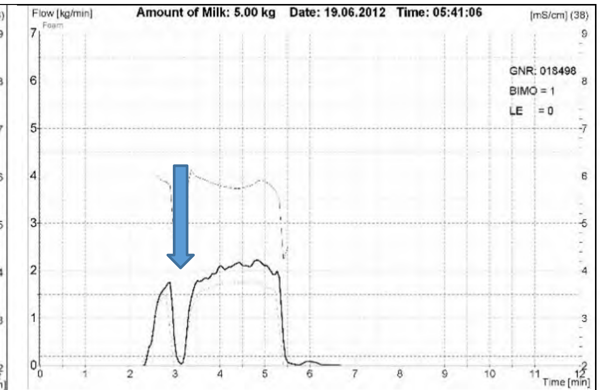

Figure 2. Bimodal milk flow.

Physical characteristics differ between cows, sheep and goats. Some differences are obvious such as that sheep have two teats and a cow has four and teats on sheep are smaller than those on cows or goats. The location of sheep's teats, often being on the side rather than the bottom of their udder, present interesting challenges for milking dynamics, milking unit and liner design. Variations such as these will dictate different operating parameters in the milking system including pulsation rates and ratios. Milk is stored in two different compartments of mammals, the gland cistern stores free milk which is readily harvested when the milking unit is attached. The alveolar compartment which is where milk is secreted. The alveolar compartment requires more time to harvest since milk let down has to be stimulated for the milk to be ejected from these tissues. The delay in milk ejection can be substantial (> 1.5 to 2 minutes). Cisternal storage of milk for diary sheep is about 50% as opposed to 10% to 20% for cattle. Cisternal milk can be removed without the presence of a milk ejection response from the animal. The removal of cisternal milk before a milk ejection response has occurred and results in a 'bimodal' milk harvest pattern (a first flush of milk from the cistern and a second flush of milk from the alveoli). The occurrence of bimodal milking depends on the relationship between the amount of milk in the gland cistern, the rate of milk removal, and the timing of the let-down response. If animals are well stimulated before unit attachment then milk letdown has occurred before unit attachment and bimodality will not occur. Because of the higher stimulation requirement in many sheep breeds bimodality of milk flow is common. Bimodality does not increase mastitis risk (Reinemann, 2015). In extreme cases it can, however, reduce the efficiency of the milking routine because of unduly long cups-on time, and promote discomfort and kicking at milking units. The prevalence of bimodal milk flow on farms where minimal stimulation of milk let down occurs has resulted in machine stripping or "double cupping" in ewes characterized by bimodal milk flow. Double cupping involves removing the milking claw when milk flow stops initially, after a period of 2 minutes the unit is reattached to capture alveolar milk when secondary milk ejection occurs. Machine stripping is discouraged because it will create significant vacuum fluctuation at the teat end which will increase mastitis infection risk.

Liner concerns

Milking units for sheep have 2 teatcups and longer 'short milk tubes' (connecting the teatcups with the claw) than cow clusters. Small ruminant clusters are also more often fitted with shutoff valves to reduce air admission during unit attachment and removal and to remove milking vacuum from the teat ends before unit removal. One of the most important aspects of the cluster is how it is positioned on the udder. The weight of each teatcup should be evenly distributed on the two teats. This can be very challenging for sheep with udder conformation resulting in teats protruding from the side of the udder rather than pointing downward from the bottom of the udder. The wider variety of udder conformation in small ruminants is one reason that the short milk tubes are longer than in cow clusters (Reinemann, 2015). This can be compared to the pre-milking length of teats in the herd. If teats are too short for the liner both teat barrels and teat ends will appear congested after unit removal (red or blue color with signs of swelling). The liner barrel diameter should also be reasonable matched to the mid barrel diameter of teats. This dimension is somewhat forgiving because teats can expand somewhat to fill the cross section of the liner. If the liner barrel diameter is too large the teats will not be able to expand to form a seal in the liner barrel and signs of teat congestion, as described above, will occur.

If animal comfort and gentle milking are your goals, it is better to have liners that are too small for some animals rather than liners that are too big for some animals.

Pulsation Settings

Pulsation rate and ratio are one of the major differences between cows and small ruminants although, as with cows there are no exact standards. The need for a faster pulsation rate is due in part to the portion of milk stored in the gland cistern of ewes. This means that the open phase of the pulsator does not need to be as long as with a cow for optimal milk flow. The rest phase also can be slightly shorter but care needs to be taken to assure sufficient rest time to protect teat end integrity. Speeding up a pulsator designed to operate in the 45 -65 PPM range for dairy cattle, to the 60 to 180 PPM range, used by small ruminants, may not give you the desired effect as the opening and closing times may take too much of the cycle.

Table 1. Milking system vacuum recommendations[1].

System	Mercury (in)	kPa
High line	12.5 to 13.5	42 to 46
Low line	10.5 to 12	36 to 41
Mid line	11.5 to 13	39 to 44

[1]Recommended claw vacuum at peak flow of 9.5 to 11.5 inches of mercury or 32.5 to 39 kPa.

Table 2. Generally recognized acceptable pulsation rates and ratios for sheep[1].

Typical Speed and Ratio		Acceptable speed and ratio	
120 PPM	50% milk	60 to180 PPM	50 to 70 % Milk

[1]CAUTION: Pulsation design and the opening and closing speeds affect, effective milk and rest times. Speeding up a cow pulsator, may or may not give adequate milk and rest times. Care needs to be taken to assure adequate rest phases so that damage to teat ends does not occur.

References

Dairy Practices Council Guidelines

02 Effective Installation, Cleaning and Sanitizing of Milking Systems
04 Installation, Cleaning and Sanitizing of Large Parlor Milking Systems
59 Production and Regulation of Quality Dairy Goat Milk
71 Farmers Guide to Somatic Cell Counts in Sheep
72 Farmers Guide to Somatic Cell Counts in Goats
73 Layout of Dairy Millhouses for Small Ruminant Operations

Available for purchase from Dairy Practices Council at dairypc@dairypc.org

2015 Pasteurized Milk Ordinance. http://www.idfa.org/docs/default-source/d-news/2015-pmo- final.pdf. Accessed November 2016.

Reinemann D. Milking machine basics and special considerations for small ruminants. Dairy sheep association of North America symposium. 2015. Madison,WI.