Acquisition and Assessment of Teatcup Cluster Vacuum Records in Milking-Time Tests

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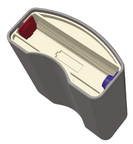
The only contact between the cow and the milking machine during milking is within the teatcups. All impact from the machine on the animal has to work through this interface. Vacuum acting on parts of the teat and mechanical pressure from the liner on the teat constitute the main elements. These influence milk flow, and possible damage to the teat tissue. Modern measuring equipment has made it possible to record conditions in the teatcup throughout a full milking, and make benchmarking of the milking process. In the Nordic countries such systems have been utilized in the milking advisory services for more than a decade, and an upgraded system is to be launched in near future.

NEW VADIM2

4 vacuum inputs and USB port

small and light



battery operated

connection to milk þow (future development)

SCIENTIFIC BASIS

Vacuum recording equipment included tubes etc. for connection to measuring points has to fulfill basic requirements to accuracy and dynamic response. This can be achieved by following guidelines for minimum step response and sampling frequency for various kinds of measurements in milking machine installations, published by Rasmussen et *al.* (2003).

Mouthpiece chamber (MPC) vacuum
A MPC vacuum level close to the teat end vacuum is likely to cause tissue changes in the teat base region. A very low MPC vacuum is associated with liner slips and unstable milking unit. The MPC vacuum is influenced by teatcup cluster properties, but also by teat properties (Borkhus and Rønningen, 2003). In a herd, the MPC vacuum will show wide variation. Research has shown (Rønningen and Rasmussen, 2008) that the proportion of cows milked with a medium MPC vacuum (10 – 30 kPa) in the peak flow period is strongly associated with the mastitis status.

Teat end vacuum
The average teat end vacuum during milking, or the average vacuum during milk flow phases of each pulsation cycle, is regarded as an important tuning parameter for milking machines. The teat end vacuum can also be used to indicate the amount of compressive load from the liner on the teat during the rest phase of the pulsation cycle (Rønningen and Rasmussen, 2008). Another aspect of the teat end vacuum is vacuum stability. This is associated with udder health, and can be quantified as irregular vacuum fluctuations (Davis and Reinemann, 2001). Still one measure found to be important for udder health is teat end vacuum instantaneously lower than the MPC vacuum (Rasmussen, 1998).

Duration of milking
The vacuum records also supply information about the duration of the whole milking of a cow and for parts of a milking, like the peak flow period or the overmilking period. Supplemented with the milk yield, duration of milking can produce figures for milk flow rate.

VADIM IN THE ADVISORY SERVICE

The Norwegian milking-time test is based on the Vadim vacuum logging unit. It is a small self-contained vacuum logging unit, during milking attached to a teat-cup and connected to the mouthpiece chamber and short milk tube with silicon tubes. The advisor observes the milking, and after end of milking the data accumulated in the logging unit are downloaded to the computer and analyzed in an expert program.
The total assessment of the milking takes in the cow, the milker, the milking machine and the interaction between those. The most common finding is that things work correctly. Unfavourable findings can be: Teat end vacuum is too high/low; Liners used are not suitable for the teats; Cows are not sufficiently stimulated before cluster attachment; High degree of overmilking; Cluster attachment or detachment with air inlet causing vacuum fluctuations.

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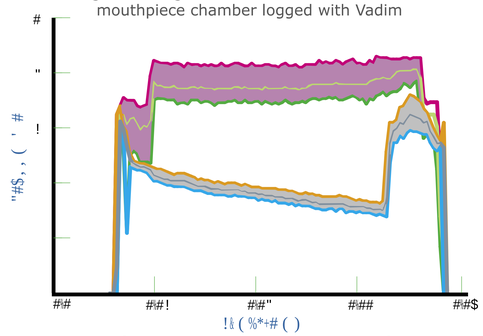
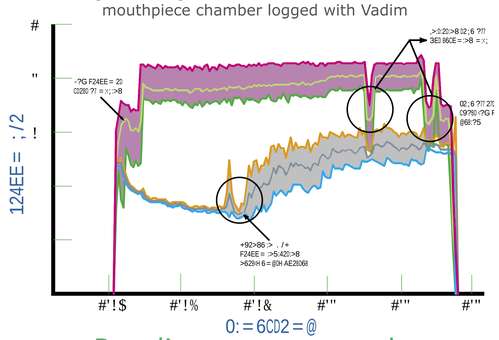
Average and range of vacuum in short milk tube and mouthpiece chamber logged with Vadim



Ordinary vacuum graph

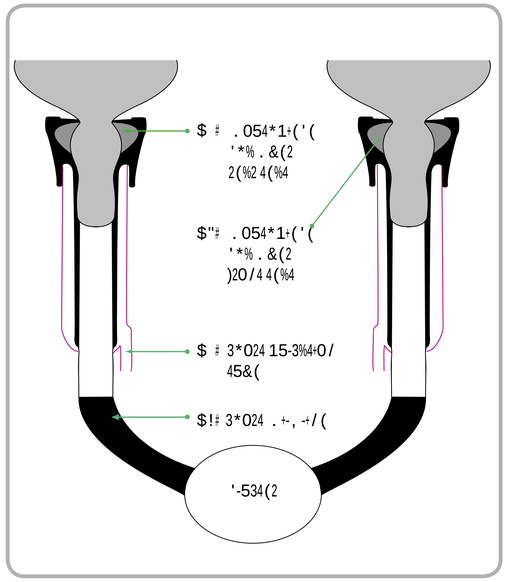
Average and range of vacuum in short milk tube and mouthpiece chamber logged with Vadim



Peculiar vacuum graph

NEW DATA ACQUISITION UNIT ï VADIM2 VACUUM LOGGER

A project group under the International Dairy Federation (IDF) works with the basic measurements and assessments for milking-time tests of machine milking. A part of this work has been to specify requirements for a vacuum recording unit. The Norwegian company Biocontrol AS has now designed a vacuum recording unit which shall meet these requirements. The new Vacuum logging unit Vadim2 has the following features: 4 channels; up to 60 kPa vacuum; sampling frequency 200 Hz per channel; powered from rechargeable battery; wired or wireless communication for control and data transfer; data transfer in real-time or storage of data for later downloading. Existing expert programs will be refined to utilize the capacity of this new hardware and new methods of vacuum records assessment. A possible further step will be to integrate a milk flow recorder, which is being developed by other persons in the IDF group.



In co-operation with: