SmartSAMM Powered by DairyNZ

REVIEW & PLAN

TECHNOTE 25

Test, service and up-grade milking machines

Virtually all infections enter the udder through the teat orifice. In typical New Zealand dairy herds, use of milking equipment is estimated to be implicated in as many as 40-50% of new clinical cases. Potential mastitis problems are likely to increase as the average milk production per cow continues to increase.

Numerous studies, mostly involving artificial challenge with a high concentration of mastitis pathogens, have helped to elucidate the main milking-related mechanisms of spread of mastitis infections. These are:

- spreading organisms via contaminated liner surfaces, and teat lesions;
- assisting the passage of organisms into the teat canal via impacts and possibly via reverse pressure gradients;
- decreasing the effectiveness of the teat canal as a barrier due to teat damage and loss of keratin lining of teat canal; and
- less frequent emptying of the udder.

25.1

Fully test and service your milking machine twice per year.

Regular testing, service and maintenance of milking equipment are essential to maintain good mechanical performance, to improve the speed and completeness of milking, and to improve mastitis control.

Routine monitoring of key indicators at milking-time (such as teat condition, cow behaviour, milking-time and completeness of milking and occurrence of teat cup slips and falls) will provide an early alert to problems emerging in the milking system.

Do not rely **only** on an annual service. Other, more frequent test procedures are outlined in 25.2. Immediate additional testing and service are recommended if any of the following are observed:

Confidence – High

Potential mastitis problems are likely to increase (especially as the average milk production per cow continues to increase) if milking machines are not regularly tested, serviced and maintained.

Research priority – Low

- cows appear to milk slowly or incompletely;
- teat cups slip or fall frequently;
- teat condition is poor; or
- cows show signs of discomfort.

Technote 6 describes how to monitor and maintain milking machine function and monitor key indicators, including KiSt.

25.2

Use a milking machine technician who tests to NZMPTA standards.

Machine tests should be performed and reported by technicians who hold a current New Zealand Milking and Pumping Trade Association (MPTA) testing certificate.

Confidence – Moderate

Much new scientific and technical information has been published. Fully certified technicians are more likely to know about the recent information, and they are more likely to know how to apply this knowledge to testing, servicing and trouble-shooting.

Types of milking machine tests

Milking machine tests have been classified into five types by the International Dairy Federation (International Dairy Federation, 2000): physical measurements, dry tests, wet tests, milking-time tests, and cleaning-time tests.

1 Physical measurements

Physical measurements describe the dimensions of the installation and its components. These measurements are done without the machine running. Examples of these measurements include length, diameter and slope of pipelines, and the weight and volume of components such as clusters. Such physical measurements should be performed as a standard part of the initial acceptance test for any new installation, or after a major upgrade of an existing installation, to ensure compliance with the contract of sale or service.

A complete MPTA test should be conducted:

- As an acceptance test for a new milking system (before final payment!).
- After major service work or major upgrade on an existing installation.
- At least twice per year for all systems (or after each 1,500 to 2,000 hours of operation).

2 Dry tests

Dry tests are conducted with the machine running but not milking, and with only air flowing through the machine. This type of test has been described loosely, but incorrectly, as “static testing”. Examples of dry tests include vacuum levels and vacuum fluctuations in various parts of the system, vacuum pump and reserve capacity, and testing of pulsators. The standard MPTA test procedure is a comprehensive series of dry tests plus some physical measurements.

These quick dry tests should be performed after each 500-1,000 hours of operation as part of a regular testing and maintenance contract:

- Vacuum level in receiver with no units open.
- Equilibrium vacuum level in receiver with 1 or 2 units open to admit air.
- Initial ‘undershoot’ or ‘overshoot’ in receiver vacuum when one unit is opened and then closed (this is a simple test for a dirty or sticking regulator).
- Effective Reserve and Manual Reserve.
- Vacuum recordings of pulsation characteristics (all pulsators tested, with teat cup plugs in each milking unit as it is tested).

3 Wet tests

Wet tests are performed with the machine running without milking the cows, but having both air and liquid (water, milk, or artificial milk) flowing through the machine. Equipment manufacturers or testing authorities typically perform wet tests in a laboratory. Examples of wet tests include vacuum level and fluctuations in pipelines and clusters, vacuum drop across components, tests of the threshold milk flow rate for automatic detachers, and measurement of liquid discharge rate from a releaser milk pump.

Some wet tests are suitable for field use and are valuable diagnostic tools for trouble-shooting (International Dairy Federation 2000). The choice of a particular wet test procedure, and the frequency of on-farm testing, depends on the problem to be resolved. One of the most useful wet test procedures involves an artificial udder which is connected to one or more milking units (one at a time) to help diagnose problems of slow milking or

frequent cup falling, and to optimise the system vacuum settings (Stewart *et al* 1996).

4 Milking-time tests

Milking-time tests describe measurements or observations made while milking cows. The results of milking-time tests are the best and most direct indicator of the performance of any milking system (Mein 1992). Measurement of milk flow rates, or measurement of vacuum in the milkline, receiver, claw, short milk tube, and the liner mouthpiece are examples of these tests.

To systematically assess milking time observations, use the guides and record sheets from the SmartSAMM Mastitis Investigation Kit.

Three of the most practical and useful milking-time test measurements are:

- mean vacuum and vacuum fluctuations in the milkline.
- mean vacuum and vacuum fluctuations in or near the receiver (not necessary if the milkline vacuum recording indicates vacuum changes less than 2 kPa); and
- mean vacuum in the claw during peak milk flow for a representative sample of cows.

These practical vacuum measurements should be conducted:

- Within one month after first milking in a new milking system, when cows and operators have settled into a regular milking routine.
- After any major service work or system upgrade.
- If the dairy manager complains of problems of slow or incomplete milking, frequent liner slippage or cups falling, poor teat condition or cow behaviour.

Five of the most practical and useful milking-time observations for evaluating performance of milking units are:

- average milking time per cow (relative to the average yield per cow per milking);
- frequency of liner slips and cup falls requiring corrective action by the milker;
- amount of 'available' milk left in the quarters of an udder when cups are removed (that is, a frequency distribution of strip yield for individual quarters in a representative sample of cows);
- teat condition score immediately before and after milking; and
- cow behaviour:
  - are cows showing signs of discomfort (Kick Step or KiSt response) when teat cups are attached or removed?
  - are teats unusually sensitive to touch after milking?

Technote 6.1 describes the five milking-time observations in detail.

Technote 9 summarises changes in teat condition that may be seen when milking machines or liners are not performing optimally.

5 Cleaning-time tests

Cleaning-time tests are carried out during the cleaning of the milking machine or bulk tank. Examples of these tests include: temperature, chemical concentration, water quality, water and air-flow velocities, and cleaning cycle times. Such tests should be conducted:

- when a new cleaning system is installed; and
- whenever cleaning problems occur or milk test results indicate poor quality

Observations about performance tests of milking machines can be recorded on Sheet F of the Mastitis Investigation Kit.

Observations about cluster alignment at milking can be recorded on Sheet K of the Mastitis Investigation Kit

25.3

Insist that the technician provides and explains a full written report.

Dry test reports

In NZ, milking machines are tested via a modified method to that recommended by ISO (ISO, 2007). In simple terms, this involves carrying out some basic testing, then disassembling the machine into its separate components. As the machine is re-assembled, airflow tests are conducted as each component is re-connected. At the completion of the test, the machine should be fully re-assembled and working as it would normally.

The tester's reports should always include:

1. Visual Faults Check

The Visual Check allows the tester to assess the way the plant has been installed and to check this against industry and OEM (original equipment manufacturers) guidelines. The Visual Check will include the way the machine is mounted, pipeline sizes, liner/shell compatibilities, milk line slope, drain points, obvious maintenance problems and obvious safety problems.

The Visual Check is largely carried out while the machine is not running but some of it can be assessed while the machine is warming up. This means the machinery is more likely to be operating in a stable manner once the air flow and vacuum readings are carried out.

Faults are marked on the test report with a cross (X) and comments/recommendations are carried forward to the Summary form. Often these faults will also provide a helpful clue as to what may show up as faults when the vacuum and airflow readings are taken.

2. Test Report

The Test Report is used mainly to record the required performance tests. These will include airflow and vacuum readings, vacuum pump and releaser milk pump tests and tests of the machines vacuum gauge.

These readings are then compared against industry and OEM standards and guidelines so that subsequent recommendations can be made where the machine set up falls short of requirements.

The Test Report is set up so that the tester can record readings from a standard regulated milking machine or from a machine that has a variable speed drive system installed.

The Test Report should also show pulsation tests and may have graphs attached.

3. Summary

The Summary form is used to record recommendations for each fault identified in the visual observations and/or test report observations. Recommendations should be brief but clear enough for either the farm manager or a subsequent machinery technician to understand.

25.4

Carry out all recommendations.

Make sure the qualified technician has grouped the recommendations for service or upgrading into categories such as urgent and immediate changes, important but not urgent improvements, and cosmetic or other improvements. If not, discuss with the technician or seek guidance from others, then set target dates for the service work or system upgrades.

All things being equal, the best use of a limited budget will come from fixing or upgrading those components that directly affect the forces applied to cows' teats.

Therefore, the most cost-effective sequence for upgrading inadequate components is likely to be:

- fix or replace regulator (or its sensor), and move it to correct position, if necessary (to improve vacuum control, milking speed, liner slips and teat condition);
- fix or upgrade the pulsation system (to improve reliability, milking speed, comfort and mastitis);
- upgrade liners and shells, or improve compatibility (to improve speed and completeness of milking, liner slips, comfort, teat condition and mastitis);
- upgrade claws and long milk tubes if necessary (to reduce uneven milk-out, liner slips and cup fall by improving weight balance between quarters).
- upgrade milkline and receiver tank (to increase milk flow and discharge capacity, and/or improve system cleaning performance); and
- upgrade vacuum pump and airlines (to improve air-flow, energy efficiency, and system cleaning performance).

However, this sequence would need to be modified for individual systems. The best way to set priorities would be to identify the key mechanical factor (or factors) that limit the desired rate of improvement in the major problem area. The problem area may be the speed or completeness of milking, cow comfort or teat condition, cell counts or mastitis, or poor cleaning.

Acknowledgements

DairyNZ and NMAC (National Mastitis Advisory Committee) acknowledge the huge contribution of Dairy Australia's Countdown Downunder as the original source material from which SmartSAMM Technotes are derived, being updated and adapted for NZ dairy farming in 2011.

These SmartSAMM adapted resources are made available to NZ dairy farmers and advisors through a Memorandum of Understanding between Dairy Australia and DairyNZ.

The SmartSAMM programme is funded by DairyNZ, and supported by the MPI Sustainable Farming Fund.

Key papers

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