Detection, Correction, and Prevention of Milking Equipment Problems on Dairy Farms

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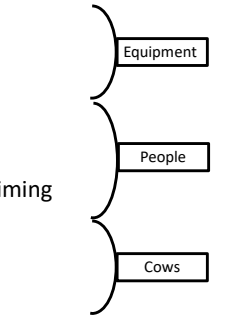
Learning Objectives

- Understand the process of evaluating a milking center specifically looking for equipment issues
- Explore the challenges with how to implement corrections for milking equipment issues
- Appreciate the need to help farms in developing their own system of identifying milking equipment problems through training and an effective communication channel

What do we measure?

- Average claw vacuum at peak flow
- Pulsation under load
- Milkline vacuum for 30 minutes
- Unit alignment scoring
- Milking routine timing
- Milk flow rate analysis
- Milking efficiency and throughput timing
- Strip yields
- Teat scoring
- Teat end cleanliness
- Udder cleanliness
- Environmental assessment



Perform full NMC evaluation if >6 months since previous

Additional Observations of Milking Equipment

- Score retraction event in 3 categories
  - Unit hits deck, good retraction, unit hangs on teats
- Documentation of units not functioning correctly
- Check all claw vents or spot check liner vents

Commonly Observed Milking System Opportunity Areas

- Inappropriate claw vacuum settings
- Unstable milkline vacuum
- Issues after claw or liner change
- Challenges with the retraction event
- Inappropriate use of manual mode

Inappropriate Claw Vacuum Settings

- Has the average claw vacuum at peak flow for a 5 to 20 second interval been accurately measured on at least 10 cows?
- Is it appropriate for this herd?
  - Goals of the dairy
  - Liners
  - Risk of over milking (milking routine, ATO settings, unit alignment, etc)

Inappropriate Claw Vacuum Settings

- 1000 cow herd with a double 20 parallel parlor
- Increasing clinical mastitis and bulk tank somatic cell count (SCC)
- Hardness at teat end = 50% abnormal
- Teat end score = 35% abnormal
- Farm vacuum gauge broken

Inappropriate Claw Vacuum Settings

- Average claw vacuum was 13.3”Hg (45.1 kPa)
- Liner manufacturer wants 11.5”Hg (39 kPa)
- Conference call with owner and equipment dealer before leaving farm
  - Plan to drop vacuum 1”Hg (3.4 kPa) in 2 steps
- Recheck claw vacuum

Unstable Milkline Vacuum Levels

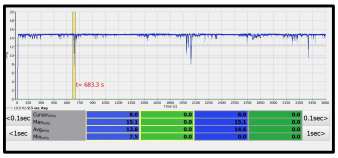
- Has the milkline vacuum level been recorded for at least three turns of a milking parlor or fifteen minutes in a tiestall?
- Does it meet NMC recommendations?
  - Greater than 95% of the time the vacuum level does not exceed 0.6”Hg (2 kPa) in a drop or a rise

Unstable Milkline Vacuum Levels

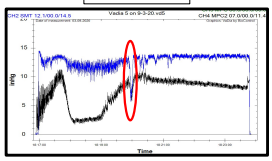
- 100 cow herd in a swing 12 parallel parlor
- Primary complaint is high SCC
- System passes a 1 unit fall-off test and has enough effective reserve.
- Pump capacity is adequate and system loss is 5%.
- 6 units per slope with a 2.5” (60 mm) milkline

Unstable Milkline Vacuum Levels

Milkline Vacuum



Claw Vacuum



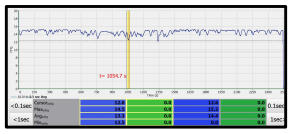
- Large fluctuations in milkline vacuum during milking and also seen in claw vacuum recordings
- Issue with slope of milkline leading to flooding
- Corrected by re-sloping line

Unstable Milkline Vacuum Levels

- 100 cow herd in a tiestall with a highline
- Higher SCC than desired
- System fails a 1 unit fall-off test and does not have enough effective reserve.
- Pump capacity is adequate but system loss is 63%.

Unstable Milkline Vacuum Levels

Milkline Vacuum



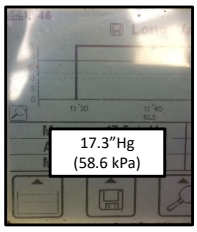
- Replaced worn hoses and o-rings on stall cocks
- System then passed a 1 unit fall off and had adequate reserve

Unstable Milkline Vacuum Levels

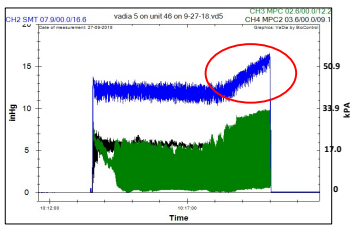
- 1400 cows in a double 24 parallel parlor
- Issue is SCC is higher than the farm wants
- Short term teat scores showed 43% with hardness at teat end
- Milkline vacuum at 13.6”Hg (46.1 kPa)

Unstable Milkline Vacuum Levels

Milkline Vacuum



Claw Vacuum



- Installed weep hole to allow VFD to work correctly

New Claw or Liner Install

- Have the pulsation parameters been accurately measured before and after change?
- Have claw vacuum levels been accurately measured before and after change?

New Claw and Liner Install

- 700 cow herd with double 10 parabone parlor
- Increase in clinical mastitis and SCC
- New claw and liners ~1 month ago with changes made by dealer but no check on vacuum or pulsation

New Claw and Liner Install

	Previous set-up	New claws, shells, and liners	After adjustments
Claw vacuum ("Hg/kPa)	12.2/41.4	12.1/41	11.8/40
Pulsator rate	60	60	60
Pulsator ratio	60:40	65:35	60:40
b phase (ms)	450	496	442
d phase (ms)	235	186	226

- Data discussed with owner and manager and decided to make adjustments

Retraction Event

- Has someone watched the retraction event in both first lactation and mature cow pens?

Inappropriate Retraction Event

- 950 cow herd milking in a double 16 parallel parlor
- Short term teat scores showed 46% with hardness at teat end
- Retraction event was a problem on 9 out of 32 units

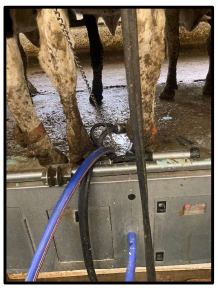
Inappropriate Retraction Event

- Dealership contacted that day to work on shut-offs

Inappropriate Retraction Event

- 1400 cows in a double 24 parallel parlor
- Issue is SCC is higher than the farm wants
- Milking time audit showed milkers struggling to get retraction chain to release on some units
- Retraction chain catching on some units during retraction and cluster hitting the deck

Inappropriate Retraction Event



- Multiple fixes attempted over 6 month period but took 1.5 years to get fully corrected.

Inappropriate Retraction Event

Left Side	
Unit #	Retraction Time
1	1.72
2	1.94
3	1.25
4	2.04
5	1.31
6	1.65
7	2.06
8	1.44
9	3.87
10	1.91
11	1.84
12	1.97
13	1.62
14	2.41
15	1.53
16	1.75
17	3.97
18	2.22
19	3.72
20	1.84
21	3.00
22	retracts w/help
23	2.00
24	1.84

Right Side	
Unit #	Retraction Time
25	0.81
26	0.84
27	1.06
28	0.94
29	0.85
30	1.31
31	1.22
32	0.90
33	1.19
34	0.90
35	0.84
36	1.13
37	1.59
38	0.88
39	0.84
40	0.97
41	1.16
42	0.93
43	0.84
44	1.00
45	1.00
46	0.78
47	0.84
48	1.28

Inappropriate Retraction Event

- 1300 cow dairy with double 20 parallel parlor
- Increase in SCC is primary complaint
- Switched to liners with vents in mouthpiece chamber a while ago
- Many units hit the deck on retraction
- Vacuum decay time set to zero

Inappropriate Retraction Event

- Still have not fully corrected the problem but next slide shows not a full system problem

Inappropriate Retraction Event

Left Side		Right Side	
Unit #	Retraction Time	Unit #	Retraction Time
1	3.78	21	3.07
2	3.00	22	2.22
3	2.90	23	4.04
4	2.72	24	3.60
5	2.65	25	3.63
6	None	26	4.25
7	4.84	27	2.93
8	2.81	28	3.00
9	3.87	29	2.25
10	3.47	30	2.19
11	3.31	31	2.47
12	3.91	32	2.38
13	2.63	33	2.75
14	4.50	34	3.34
15	3.85	35	4.50
16	2.94	36	2.44
17	2.57	37	3.75
18	3.69	38	2.72
19	3.31	39	3.03
20	4.72	40	3.97

Inappropriate Retraction Event

Nov 2023

Left Side		Right Side	
Unit #	Retraction Time	Unit #	Retraction Time
1	No retract	37	3.56
2	4.72	38	5.65
3	No retract	39	4.00
4	3.28	40	2.87
5	3.79	41	3.28
6	3.25	42	No retract
7	3.57	43	3.34
8	4.19	44	3.28
9	Retract w/help	45	No retract
10	3.44	46	4.09
11	3.13	47	3.47
12	No retract	48	3.50
13	No retract	49	Retract w/help
14	4.28	50	3.44
15	3.00	51	3.38
16	3.00	52	3.38
17	No retract	53	3.41
18	2.88	54	No retract
19	2.96	55	3.56
20	2.91	56	3.56
21	2.38	57	3.15
22	2.88	58	3.53
23	3.84	59	3.28
24	3.44	60	3.37
25	3.18	61	3.88
26	3.00	62	No retract
27	3.03	63	3.50
28	4.03	64	3.28
29	4.00	65	2.88
30	2.84	66	4.78
31	3.37	67	3.53
32	3.56	68	3.34
33	3.03	69	3.68
34	4.37	70	3.63
35	4.53	71	4.34
36	No retract	72	3.56

Nov 2024

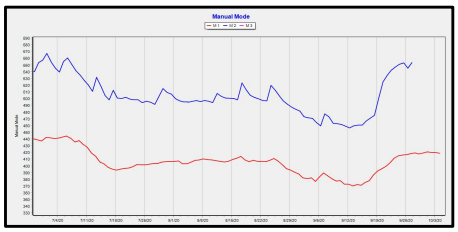
Left Side		Right Side	
Unit #	Retraction Time	Unit #	Retraction Time
1	2.56	37	Retract w/help
2	3.25	38	3.19
3	2.47	39	1/2 way
4	No retract	40	2.31
5	3.10	41	2.81
6	3.97	42	4.72
7	4.38	43	2.03
8	2.94	44	2.50
9	Retract w/help	45	3.88
10	2.75 1/2 way	46	2.38
11	No retract	47	2.44
12	1.94	48	3.34
13	3.37	49	3.65
14	4.03	50	2.28
15	3.35	51	2.79
16	2.44	52	1.84
17	Retract w/help	53	2.13
18	2.75	54	2.35
19	1.28	55	3.12
20	1.56 1/2 way	56	1.85
21	2.47	57	3.16
22	4.85	58	2.69
23	No retract	59	2.91
24	No retract	60	3.31
25	2.97	61	Retract w/help
26	2.56	62	4.22
27	2.75	63	2.66
28	No retract	64	2.34
29	1.85	65	2.69
30	Off	66	No retract
31	1.72 1/2 way	67	Retract w/help
32	3.10	68	2.37
33	Retract w/help	69	2.00
34	No retract	70	2.25
35	2.97	71	3.07
36	2.69	72	No retract

- 72 stall rotary with very poor preventative maintenance

Inappropriate Use of Manual Mode

- 700 cows in a double 16 parallel parlor
- Issue is increasing clinical mastitis and cows kicking at units
- Milking time audit showed majority of units being put on manual in the pens we watched
- Farm has struggled with individual milking point control (MPC) electronic boards going bad

Inappropriate Use of Manual Mode



- Milker meeting to outline:
  - Manager will mark units that are not functioning and correct as soon as possible
  - Milkers agreed to only put the designated units on manual

Correction of Problems

- Collect reliable documentation that problem is significant
  - Not just a single unit problem
  - Repeatable throughout milking
- Prioritize list of equipment problems
- Share documentation and discuss in meeting with owner and equipment dealer
- Follow-up to make sure the problem is resolved

Prevention of Problems

- Training of employees on milking equipment problems
- Grant over one year to develop an online training course
- 95 milkers on 15 farms completed training
- Over 40% of milkers reported no training or unsatisfied with the training on milking equipment

Alanis, V.M., Recker, W., Ospina, P.A., Heuwieser, W., and Virkler, P.D.: 2022. Dairy farm worker milking equipment training with an E-learning system. JDS Commun. Jul 14;3(5):322-327. DOI:10.3168/jdsc.2022-0217

Prevention of Problems

- Set up a communication protocol for equipment issues
  - How do milkers notify management?
    - Written preferred, permanent log
    - White board example
  - Who in management is responsible for fixing the issue?
  - What is the priority and time frame to resolution

Prevention of Problems

- **Scheduled** maintenance needs to happen!
  - Equipment runs 24/7
  - Insurance policy
  - Internal vs External
  - Another set of eyes
  - Communication of findings

Prevention of Problems

- Pre-Milking Checklist
  - Record system vacuum
  - Check that liners are pulsating and properly aligned in the shell
  - Open all claw/liner vents with appropriate tool
  - Listen for any air leaks
  - Check for any torn hoses, gaskets, etc
    - Make sure that milkers have access to replacement supplies

Prevention of Problems

- Is someone in management checking critical areas on a regular basis?
  - Checklist with sign off
- Is someone monitoring the error reports out of the parlor management software?

Stall	Cows	Dev	Milk	Time	Flow	Cond	Peak	Fall	Mode	MDet	Wash	NoID
3	62										58	2
12	62									16		3
17	51								5			3
26	9		21		5.8							0
33	58									17		0
Average	59	-16	36	4.4	8.3	4.9	11	1	1	7	12	
Tolerance	18	12	2	1.2	1.2	5.2	4	2	2	8	40	

Summary

- Perform a detailed analysis on a regular basis to provide accurate data to the milk quality team meetings
- Prioritize the equipment issues detected and work with owner and dealership to get them corrected
- Help the farm train employees on detecting equipment problems and establishing a good communication channel for these problems

Questions?