CIP CLEANING GUIDELINES

In order to provide a high quality milk to the marketplace a pipeline milking system must clean up perfectly after each milking. The ability to clean a pipeline milking system depends on these factors:

1. Adequate hot water
2. Proper engineering & system design
3. Adequate surface contact by the chemical solution

HOT WATER NEEDS:

Due to OSHA rules a household heater may not deliver water at a temperature greater than 140°F. For this reason a dairy farm will be required to use a commercial electric, gas or oil fired water to meet its' hot water requirements. It is recommended that electric hot water heaters be quipped with two 6000 KW heating elements if they are available.

The actual amount of 165°F hot water available from any hot water heater is about 70% of its' capacity. Thus an 80 gallon water heater will only provide 56 gallons of 165°F hot water when it is needed to clean the milk pipeline and the bulk milk tank. Each water heater has a recovery rate based on a rise in heat per hour.

Michigan Dairy Laws require the hot water needs to be calculated for each dairy farm. Most modern automatic washers have three cycles. Warm rinse, hot wash, and cold or warm acid rinse. The warm rinses are usually at a temperature of 95°F to 110°F. The hot wash is normally 165°F or hotter.

HOT WATER FOR BULK TANK WASH

Water needed for a bulk milk tank will vary according to size and manufacturer. **Check with the dealer or operator's manual for actual water volumes and temperature of each cycle.**

TABLE A-1 -- HOT WATER ESTIMATOR FOR BULK TANK WASH

CYCLE	CYCLE TEMP	CYCLE GALLONS	MULTIPLIER	GALLONS OF HOT WATER
RINSE	HOT (165° - 170°)		1	
	WARM (95° - 110°)		0.5	
WASH	HOT (165° - 170°)		1	
ACID	WARM (95° - 110°)		0.5	
RINSE	COLD			
TOTAL **HOT** WATER NEEDED				

HOT WATER FOR PIPELINE CIP

Because CIP cycles may utilize all cold water, all hot water, or a blend of hot and cold water we must first calculate the water volume needed per CIP cycle. Then we can calculate the hot water needed based on the desired temperature of each cycle.

Most manufacturers agree on a formula to determine the minimum water volume required per cycle for proper flow dynamics in air-injected milking systems.

Use this estimator to size wash sinks in new systems or to check if the actual water used per cycle is higher or lower than the minimum requirement.

- The requirement for milk meters, wash vat and pre-coolers are approximate and may vary with different component designs.
- If air injection is not used, multiply the total gallons for the milk line by 3.
- If weight jars are used, multiply the milk meter gallons by 4.

TABLE A-2 -- HOT WATER ESTIMATOR FOR PIPELINE WASHING

	QUANTITY	SIZE	MULTIPLIER	GALLONS
MILKLINE (ft)		4"	0.12	
		3"	0.07	
		2.5"	0.05	
		2"	0.03	
		1.5"	0.02	
WASH DRAW LINES (ft) MILK TRANSFER LINES (ft)		3"	0.34	
		2.5"	0.23	
		2"	0.15	
		1.5"	0.09	
RECEIVER(S) VOLUME		xxxxxxxx	0.33	
IN GALLONS		xxxxxxxx	0.33	
MILKING UNITS		xxxxxxxx	0.25	
MILK METERS		xxxxxxxx	0.25	
MILK HOSE (ft)		3/4"	0.012	
		5/8"	0.016	
		9/16	0.023	
PRECOOLERS		LARGE	5.0	
		SMALL	2.0	
WASH SINK RESERVE	UP TO 36" HORIZONTAL		5.0	
	UP TO 60" HORIZONTAL		7.5	
	ABOVE 60" HORIZONTAL		10	
	VERTICAL-SMALL		10	
	VERTICAL-LARGE		15	
TOTAL VOLUME PER CYCLE				
TOTAL **HOT** WATER NEEDED FOR PIPELINE WASHING (CYCLE VOLUME X 1.5)				**

**ASSUMPTIONS:

HOT WATER -	165° - 170°F	FIRST RINSE -	95° - 110°F
COLD WATER -	45° - 50°F	WASH -	165° - 170°F
		LAST RINSE -	45° - 50°F

**DOES NOT INCLUDE HOT WATER USED FOR BULK TANK WASHING, FEEDING CALVES, ETC.

TOTAL HOT WATER NEEDED

_____ Hot water for bulk milk tank wash (Table A-1)

_____ Hot water for pipeline wash (Table A-2)

_____ Total hot water for equipment wash (Table A-1 + A-2)

_____ Minimum hot water heater **size** (= total hot water needed X 1.4)

CIP WASH DYNAMICS

The successful CIP cleaning of a milking system with a water and chemical solution depends on:

1. Proper temperature
2. Sufficient circulation time
3. Proper concentration
4. Contact with all surfaces
5. Sufficient velocity of solution

TEMPERATURE

The temperature of water for the wash cycle must be adequate to insure that the solution temperature at the end of the cycle is not below 110° (for low temperature cleaners, check manufacturers recommendations). Since unplanned air admissions into the milking systems cool the wash solution very rapidly…

- Maintain water level in the CIP vat so that the suction line(s) never draw air.
- Locate the return line to the CIP vat as far away from the suction line(s) as possible. This prevents turbulence in the wash vat that would allow extra air admission.
- The pipeline must be free of air leaks at joints and milk inlets.
- Eliminate vented jetters if adequate turbulence can be maintained in the claw assembly.

CIRCULATION TIME

Experience has shown that not more than 10 minutes of circulation time is needed for each wash cycle.

- Excessive circulation times cool wash solutions below acceptable temperatures.

CHEMICAL CONCENTRATIONS

While concentration depends on water conditions and manufacturer formulations, in order to maintain acceptable concentrations through the complete wash cycle.

- All secondary drains, especially in the receiver group, must be large enough to drain quickly to remove residual water from previous cycles.
- Use of a pre-rinse diverter valve will eliminate the recirculation of milk soil, reducing the soil load that must be removed by the wash solution.
- All milk lines are installed with adequate, continuous slope with no sags or risers that prevent complete drainage between cycles.

SUFFICIENT CONTACT TIME WITH ALL SURFACES AND SUFFICIENT VELOCITY (PHYSICAL ACTION) OF SOLUTION

These are two important factors in the flow dynamics necessary to provide adequate circulation of the cleaning solution. These factors can be satisfactorily achieved by using different flow velocities and flow patterns (slug and flood) in different parts of the system. These differences are necessary because of the vast differences in the internal diameters of the system components to be cleaned. These differences can be addressed with a combination of properly controlled air injection along with properly located and sized restrictors and supply lines.

- Air injector type: Use an air injector that allows adjustment of the air admission rate, injector open time, and closed time, so the injector can be set for the system size.
- Location of the air injector: On the wash manifold if the milker units are washed in the milkhouse. On the water add line in those parlors where the milker units are washed in place. Not on the jetter supply line unless it is needed to wash milk meters or weigh jars; then a second air injector should be used, and its operation sequenced with the milk line air injector.
- Two air injectors, sequencing: If a second air injector is used and placed on the jetter supply line in order to wash milk meters, it should be sequenced with the milk line air injector. The milk line air injector is activated first, with the jetter line injector being activated second while the milk line air injector is closed.
- Water add line: Should *not* branch off the jetter supply line and should originate in the CIP wash vat.
- Air injector open time: Determines the slug travel distance. The slug travel distance is measured from the point of air injection to the receiver. Injector open time is estimated by dividing the slug travel distance by 25 ft/sec., the open time should be long enough to cause the slug to travel to the receiver just before it breaks up.
- Air injector closed time: Determines the amount of water drawn in and the initial length of the slug. That slug volume should be equal to approximately 1/3 of the receiver volume, if the slug volume is too great, the sanitary trap will flood.
- Air admission rate (CFM): The air injector determines the slug velocity (speed). Ideal slug velocity is between 23-33 ft. per sec. The CFM's needed to achieve the desired slug velocity depends on the milk line diameter. (See ASAE S518.2, ANNEX A, A-3)
- Water flow restrictors at the units with no air injection makes possible an even distribution of water to all units.
- Water flow restrictor in the water add line, located between the air injector and the CIP vat reduces flow to milk line, helps manage slug size, and allows the milk pump to keep up.
- Milk pump capacity: The water introduced during each air injection cycle must be removed by the milk pump or the sanitary trap will flood. The milk pump capacity divided by the water introduced per cycle will yield the minimum total air injection cycle time (open plus closed times). The system should be operated near this level to maximize cleaning in the shortest time.
- Vacuum pump capacity: With proper system design and control of air and liquid flow rates, the vacuum pump capacity required for efficient cleaning of air-injected CIP cleaning systems is less than that required for efficient milking. The use of two air injectors, if they are not sequenced, and some vented jetters may require a greater vacuum pump capacity to properly clean. (See ASAE S18.2, ANNEX A, A-3)

- Wash line sizing: Suction line and jetter line diameters of the wash system depend on the wash line configuration. The factors involved in sizing include system vacuum, maximum lift of the wash solution, length of the suction line, flow rate to each cluster, the number of clusters, and others. Refer to manufacturers guidelines to determine suction line and jetter line diameters needed.

PLATE COOLER CLEANING

The use of a plate cooler presents a little different problem. The wash solution must go through the plate at a rate of 5 feet per second. You can measure the velocity of the wash solution at the discharge end of the swing pipe leading to the bulk milk tank. Take a ten-gallon can, turn on the receiver pump and determine the time it takes to fill the milk can. The velocity is correct if the following specifications are met:

1 ½" s/s tubing	25 seconds for 10 gallons
2" s/s tubing	14 seconds
2 ½" s/s tubing	9 seconds

Be sure to turn the plate cooler coolant off before washing the unit.

To keep the plate cooler free of debris it is necessary to use a clean filter sock for the washing operation. After washing the cooler another clean filter sock is used for each milking.

Do not add more plates to a plate cooler frame than it was designed for. Plate coolers are single pass regenerators, and more plates reduce the amount of cleaning solution per plate causing inadequate cleaning in areas of low flow.