Handling Milk in Bulk on the Farm
Michigan State University Extension Service
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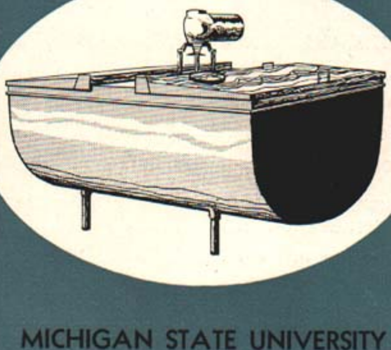
HANDLING MILK IN BULK ON THE FARM



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Handling Milk in Bulk on the Farm

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INTRODUCTION

Farmers have used bulk tanks for several years to cool and store milk. Dairymen in many areas of the United States have adopted this more efficient and sanitary method of handling milk.

The first tank was installed in Michigan for research studies at Michigan State University in October 1951. The first commercial bulk pickup route was established in the Clare area early in 1952. Since then, bulk handling of milk has developed in many dairy-plant areas of the state. Today, several plants have completely shifted their system of milk pickup to bulk handling. In the next few years, the shift to farm bulk tanks will be much faster.

Where does the demand for bulk tanks start? Producers often ask this question when they discuss this new milk handling method. Pressure for bulk tank milk handling seems to come from both producers and dairy plant operators.

Producers, especially those for the bottled milk markets, usually recognize that the system is more efficient and sanitary than cans. As can coolers need replacing, the producers buy tanks, with the idea of canning off the milk until bulk pickup is provided. Canning off the milk soon becomes tiresome. Producers urge the dairy plant to put on a tank truck, or, if another market has this service, they may consider making a change. The dairy plant operator wants to keep his patrons and realizes that he can save money on bulk pickup. Therefore, he buys equipment to serve present producers who have installed tanks and aims at complete plant conversion.

Top savings result when all producers have bulk tanks. Routes are then reorganized for efficient travel, and receiving-room costs can be eliminated at the plant. These savings to the plant and the hauler determine the amount that can be paid the producer as a bonus or a saving in hauling cost.

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The producer who is thinking of buying a bulk tank must have enough time to make a change in his dairy-farm program. Size of farm, size of herd, other available markets, age of the operator, and future plans must be figured in the investment. If he decides to buy a tank, the operator must consider such items as size and type of tank, installation, operation, and sanitation. This publication includes information to help in these decisions.

ECONOMICS OF HANDLING MILK IN BULK TANKS

The basic economic question milk producers ask about bulk milk tanks is: "Will the savings and/or premiums more than make up for the costs involved over the life of the tank?" Even though gains or savings for some producers may be less than expected costs, these producers may still decide to switch to bulk tanks rather than to sell to a poorer market. Such producers are trying to hold losses down, rather than boosting profits.

It is nearly impossible to say that a bulk tank will pay for a farmer with more than a certain number of cows or level of milk production. Nor can you say that he will lose on a bulk tank if he has fewer cows or less production.

You can answer the question of whether or not to buy a bulk tank only after studying the situation on your own farm. Besides the costs of a bulk tank and the gains you expect from it, you must consider such things as: The life of your present cooler, possible loss of your market, future plans for the milking herd, results of not shifting to a tank, and possible returns from other investments of the same money.

Although the bulk tank question has to be answered on an individual farm basis, some general statements can be made about possible costs and savings with a bulk tank installation.

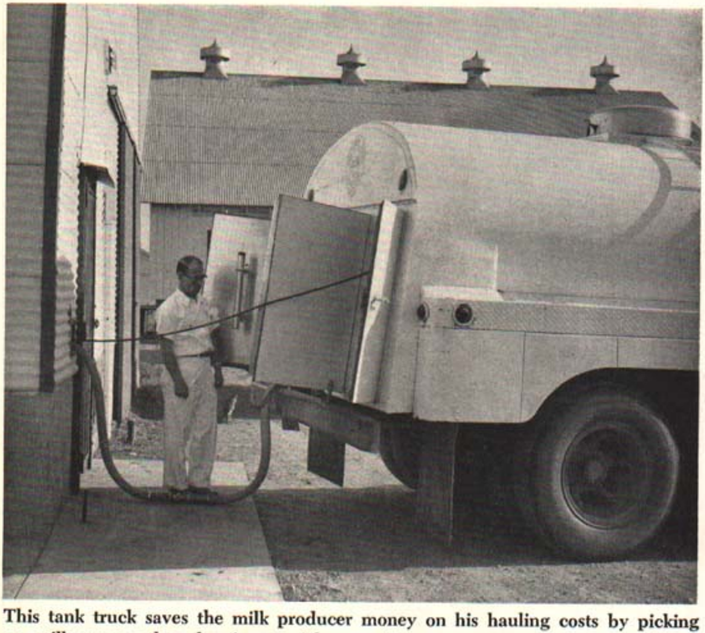
What are the prospective gains?	**Savings or gain per hundredweight**
1. **Savings in labor:** Unless a bulk tank is combined with a pipeline milker, chances for savings in labor are slim. Labor, however, may be easier since handling heavy cans is reduced or, with a pipeline, cut out.	0

2. **Gains from figuring the quantity of milk at the farm:** This results in payment for milk that was formerly lost in and on the way to the plant, or for milk which remained in the cans after dumping. 2-4 cents

3. **Savings from eliminating 10-gallon milk cans:** Cans are costly to buy and maintain. 2 cents

4. **Higher butterfat test:** Tests have not been consistently higher in the past with a bulk tank. Tests may, however, be more uniform because of better mixing. 0

5. **Savings in hauling costs:** This is based on efficient bulk route on every-other-day pickup. If milk is picked up every day, hauling costs may actually be higher than on a can route. As more



This tank truck saves the milk producer money on his hauling costs by picking up milk every other day in a quick operation.

bulk routes come into an area, can routes may become more costly. If this happens, the savings in hauling by converting to bulk tanks may become greater. 0-10 cents

6. **Premiums paid by the plant:** This will vary a lot, from nothing at some plants to a sizeable amount at others. If a plant receives both can and bulk milk, there are few actual savings to pass on to the producer. If, however, the plant has converted entirely to bulk receiving, the plant should be able to pay a premium, since expensive receiving-room and can-washing operations can be dropped. The exact amount of premium will depend on the degree to which a plant has converted to bulk receiving and on competition in the area. 0-15 cents

Total prospective gains or savings

The total prospective gains or savings may range somewhere between 4 and 31 cents per hundredweight. By multiplying the amount of milk (number of hundredweight) produced on your farm in a year times the expected saving, you can figure the amount of expected gains or savings per year.

What are the costs?

1. **Cash outlay for the tank itself:** This depends on size of the tank (see Table 1), type of tank, and how good a deal you are able to make. Trade-in value of the old cooler also affects net price. If you will have to replace the old cooler soon anyhow, charge to

TABLE 1—Prices of farm bulk milk tanks; including compressor

Size of tank	Range of prices
(gallons)	(dollars)
100	1,180-1,700
150	1,480-1,930
200	1,830-2,300
300	1,890-2,750
400	2,600-3,030
500	3,000-3,400
700	3,350-4,100

*TABLE 2—Bulk milk tank and compressor expenses per hundredweight for different sized herds**

Herd size	Tank capacity (Every-other-day pickup)	Expense per cwt. of milk
12 cows.....	100-150 gallons...........	16 cents
20 cows.....	150-200 gallons...........	11 cents
30 cows.....	300-400 gallons...........	8 cents

*Based on a 10-year tank life and 4 percent interest on investment.

the cost of the bulk tank only the **difference** between the price of the bulk tank and the price of a new can cooler.

2. **Installation expenses or expenses tied in closely with installation:** This would include such items as fixing up the barnyard, changing electrical service, remodeling the milkhouse or building a new one, a better water and hot water system, and other similar costs. These items will vary widely from farm to farm.

3. **Interest and other expenses:** Interest, taxes, repairs, and other expenses must also be estimated. Charge to the cost of the bulk tank only those items which have increased. These will vary during the life of the tank. Actually, part of this expense (such as interest) will be heavier in the earlier years than in the later years of the tank's life. The reverse may be true for repairs. Repairs and maintenance for a year will average about 1 percent of the price of the tank.

Total estimated increase in expenses

The total expense involved in shifting to a bulk tank will vary widely from farm to farm because of differences in condition of the old cooler, installation costs, and other added investments. In all cases, however, think of expenses in terms of net **added** investment. Remember, there are also some costs connected with the operation of the can cooler now in use. This added figure is a total for the life of the tank. By estimating the life of the tank, you can figure the added expense per year. Tank life is usually somewhere between 10 and 20 years.

A look at the price of the bulk cooler itself for different sized tanks and herds shows that total expenses per hundredweight are lower for larger herds (Table 2). To these expenses, add the other costs connected with a bulk tank installation.

Since there is so much variation from farm to farm, perhaps the best way to figure out whether a bulk tank belongs on your farm is to put down your own figures in the following form. You must also figure the value of keeping your present market. This is especially true if loss of your present market would result in lower prices or greater hauling costs.

Prospective gains	Reported gains or savings per cwt.	Your farm (cents per cwt.)
1. Savings in labor (this can be a combination of cash savings and the value you place on easier labor)	(0)	______
2. Reduced stickage and spillage	(2-4 cents)	______
3. Elimination of milk cans	(2 cents)	______
4. Increase in butterfat test	(0)	______
5. Reduction in hauling expense	(0-10 cents)	______
6. Premium paid by the plant	(0-15 cents)	______
7. Difference between bulk and next best market		______
Total gains or savings per hundredweight		______
Hundredweight of milk produced per year		______
Total gains or savings per year (hundredweight of milk times savings per hundredweight)		______

Added costs or expenses			
Price of the tank	$______		
Installation expenses	______		
Total		$______	
Less: a) Trade-in for old cooler	$______		
b) Any immediate added investment you would have to make for replacing old cooler (make this deduction only if can cooler needs replacement soon)	______		
Total deductions		$______	
NET ADDED INVESTMENT		$______	
Extra interest or carrying charges incurred during life of tank		______	
Other extra expenses expected during life of tank, such as repairs, etc.		______	
TOTAL ADDED INVESTMENT AND EXPENSE OVER LIFE OF TANK		$______	
Expected life of tank (usually estimated between 10 and 20 years): ______years			
ADDED INVESTMENT AND EXPENSE PER YEAR OF TANK LIFE			$______

A comparison of gains and costs should show whether or not a bulk tank would pay on your farm. Another way of looking at this would be to estimate the net added investment needed on your farm to convert to a bulk tank, determine the prospective gains per year, then figure how many years it would take you to pay off the investment at, say, 5 percent interest. If you could pay off the investment in fewer years than you estimate the tank would last, buying a bulk tank would pay. The opposite would be true if it looked like it would take longer than the life of the tank to pay for it out of earnings.

In a shift to bulk tank operation, the dairyman who produces a larger quantity of milk has a cost advantage over one who produces a smaller volume. This is because the cost of the tank does not go up as fast as size. In other words, a 700-gallon tank costs only two or three times as much as a 100-gallon tank, not seven times as much (Table 1, page 6).

Assuming that both the larger and smaller producers get the same premium or gain, this means that the larger producer is in a position to pay off his investment faster from added income than the one who produces less milk.

You must consider all these things in deciding whether or not to buy a bulk milk tank for your farm. For some farmers it will pay. Others may be forced to buy a tank or lose their market; switching to a tank may mean a net loss or a reduction in the price of milk, but it will still result in a better price than they can get elsewhere for milk in cans.

Some milk producers will be unable or unwilling to invest in a bulk tank. In the long run, they may have a poorer market for milk in cans and pay higher transportation costs for their milk. These producers may find other alternatives more profitable than dairying.

BULK HANDLING OF MILK

Choosing a Bulk Milk Tank

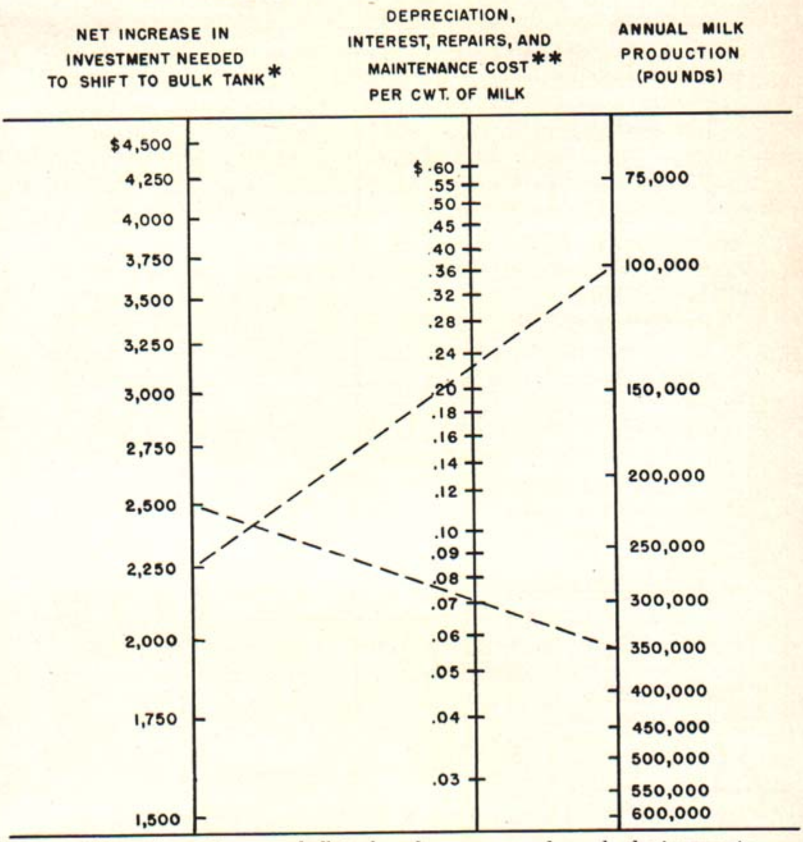
After you decide a bulk tank will pay on your farm, you must consider several things in deciding which tank to buy.

Size

The buyer should gauge his tank size needs by present production and expected future needs. Increasing the size of his herd after going

Approximate costs of a bulk tank for your farm

(Lay a ruler or straightedge between your net added investment and annual milk production and read approximate cost per hundredweight on center scale. The dotted lines are examples of how to read the chart.)



*Since, in most cases, a bulk tank replaces a can cooler, only the **increase** in investment can rightfully be charged to the cost of the bulk tank. If the old can cooler would need replacement soon, deduct the cost of a new can cooler from the bulk tank cost to arrive at a net increase in investment. Likewise, deduct trade-in allowance on the old cooler from bulk cooler costs.

**Depreciation is figured on the basis of a 15-year tank life, or 6⅔ percent per year. Interest is figured at 5 percent of the average value of the added investment, or 2½ percent per year. One percent is allowed for repairs and maintenance.

into the bulk handling system would require a larger bulk tank than would be necessary for present needs. The most common tank size used in the Midwest is from 250 to 400 gallons.

For irregular production, the dairyman should choose a tank on the basis of peak production (See Table 3). A smaller tank is enough for uniform daily production throughout the year, while a larger tank is needed for the same total annual production with seasonal high peaks.

TABLE 3—Recommended minimum sizes of bulk milk tanks

Daily peak production		Minimum size of tank in gallons	
10 gal. cans	Gal.	Every-day pickup (ED)	Every-other-day pickup (EOD)
4	40	60	100
5	50	75	125
6	60	90	150
7	70	105	175
8	80	120	200
9	90	135	225
10	100	150	250
12	120	180	300
14	140	210	350
16	160	240	400
18	180	270	450
20	200	300	500
22	220	330	550
24	240	360	600
26	260	390	650
28	280	420	700
30	300	450	750

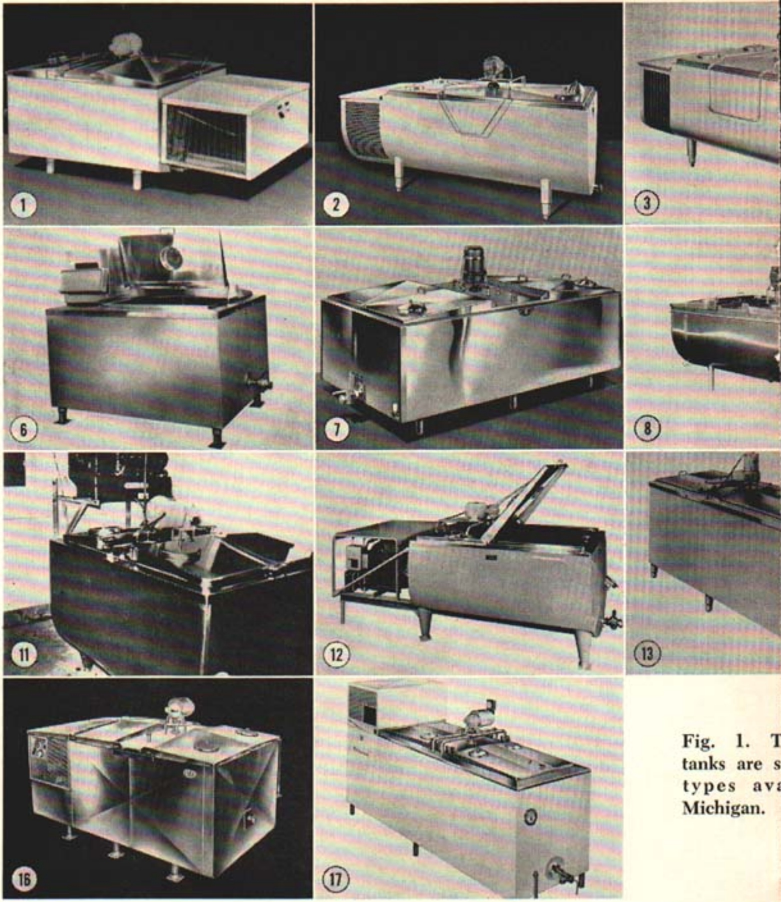


Fig. 1. T
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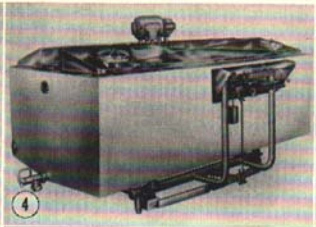
DIRECT-EXPANSION TANKS

1. Cherry-Burrell, 300 gal, 102″ L x 46″ W x 48″ H
2. Creamery Package, 250 gal, 98⅜″ L x 41½″ W x 35½″ H
3. DeLaval, 250 gal, 89⅝″ L x 43½″ W x 35½″ H
4. Girton, 300 gal, 93″ L x 56½″ W x 35″ H
5. Groen, 250 gal, 89″ L x 50″ W x 39″ H
6. Haverly, 160 gal, 62″ L x 53″ W x 39″ H
7. Kupfer, 350 gal, 88½″
8. Mojonnier, 250 gal, 80
9. Solar Milkminder, 240
10. Steinhorst, 300 gal, 106
11. Sunset, 200 gal, 54″ L
12. Unico, 300 gal, 68″ L x

ICE-BANK TANKS

13. Cherry-Burrell, 285 gal,



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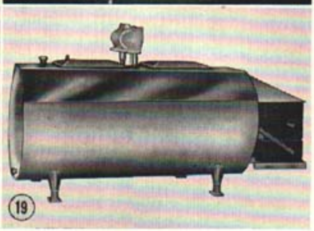


L x 49½″ W x 32″ H
½″ L x 52½″ W x 35″ H
al, 74″ L x 44″ W x 31″ H
″ L x 51″ W x 36″ H
x 42″ W x 38½″ H
51″ W x 39″ H

111″ L x 35″ W x 41″ H

14. Craft, 265 gal, 87¾″ L x 49″ W x 33⅜″ H
15. Dari-Kool, 250 gal, 85″ L x 47″ W x 35″ H
16. Esco, 235 gal, 110″ L x 46″ W x 37″ H
17. Wilson, 260 gal, 108½″ L x 36 1/16″ W x 37¾″ H

VACUUM (DIRECT-EXPANSION) TANKS

18. Mojonnier, 300 gal, 86″ L x 43″ W x 46″ H
19. Zero, 250 gal, 114″ x 36″ in diameter (including compressor)

TABLE 4—Summary of characteristics of two types of bulk milk tanks

Item	Direct expansion	Ice bank (sweetwater)
Inner milk liner cooled by	Refrigerant (Freon)	Chilled water
Size of compressor, per 100 gallons of milk daily	2/3 to 1 horsepower	1/3 to 1/2 horsepower
Electric motors for operating unit	Compressor, agitator	Compressor, agitator, chilled water pump
Hours of operation per day	3 to 6	12 to 20
Electrical requirements, kw.-hr. per 100 lb., EOD*	0.80 to 1.1	1.3 to 1.6
Original cost	Usually higher for capacities under 500 gallons	Usually lower for capacities under 500 gallons

*Every-other-day pickup.

Thus, a herd (of 26 to 28 cows) with a daily peak production of 12 cans requires a 180-gallon tank for every-day pickup and a 300-gallon tank for every-other-day pickup.

Cooling method

The two basic tank cooling methods used are: (1) ice-bank or sweetwater tanks; and (2) direct-expansion tanks (Table 4). Some tanks are cooled by a combination of these two methods.

In the ice bank, cold water is circulated around the outside surface of the tank liner and back to the evaporator coils of the refrigerator system; there it is cooled, forms an ice bank, and is recirculated. Direct-expansion tanks cool the milk directly with the refrigeration system. About the same numbers of each type of tank are used in Michigan; both have worked satisfactorily.

Most tanks operate with milk exposed to atmospheric pressure conditions. Tanks are available which operate under the same amount of vacuum as that in the milk line and at the milker head, so that a vacuum releaser is not needed for the pipeline. All vacuum tanks now available use the direct-expansion method of refrigeration.

Electric motors

The size of the compressor and its motor depend on the size of tank, temperature of condensor operation, and regularity of milk pickup. For an ice-bank (sweetwater) tank, 1/3 to 1/2 horsepower per 100 gallons of daily production is best. Direct-expansion refrigeration requires from 2/3 to 1 horsepower per 100 gallons of daily production (Table 5).

Agitators with one or two speeds mix the fat and milk. They operate when the refrigeration system is on, or when started by a separate switch for mixing the milk and fat before sampling. The agitator on a 250-gallon tank is driven by a 1/8- to 1/4-horsepower motor and operates 30 to 50 revolutions per minute while cooling.

Ice-bank tanks have an additional pump and motor for circulating the sweetwater. (A 300-gallon ice-bank tank uses a 1/3-horsepower motor for circulating the water.)

Condenser ventilation

Heat removed from milk by a refrigeration system is given off at a condenser. The usual types of refrigeration condensers on both direct-expansion and ice-bank bulk milk tanks are air-, air-water-, or water-cooled.

The air-cooled condenser is the simplest and needs the least attention. However, the temperature of the air around the condenser greatly affects the efficiency of the refrigeration unit, and good ventilation is necessary. The air-cooled condenser is usually available on systems up to 5 horsepower in size.

TABLE 5—Sizes of compressor motors for bulk milk tanks

Tank size (gallons)	Horsepower Every-day (ED) pickup		Horsepower Every-other-day (EOD) pickup	
	IB	DX	IB	DX
100	⅓-½	⅔-1	..	....
200	⅔-1	1⅓-2	..	1
300	1-1½	2-3	..	1-1½
400	1⅓-2	2⅔-4	1	1⅓-2
500	2-2½	3⅓-5	1	1⅔-2½
600	....	4-6	1	2-3
700	....	4⅔-7	1	2⅓-3½
800	....	5⅓-8	..	2⅔-4

IB = ice bank.
DX = direct expansion.

The combination air-water condenser uses air for cooling the condenser in winter and sometimes during the summer. Water is added on hot days; the cost of running the refrigeration system is cut by the use of water. The combination air-water condenser is usually available on compressors with 2-horsepower motors and larger. However, either heat must be provided to prevent freezing in winter, or the condenser must be drained to make sure that freezing does not crack the unit.

The water-cooled condenser is available in units requiring 2-horsepower motors and larger. Again, the water must be kept from freezing in winter.

Compared with the air-cooled type, both the air-water- and water-cooled condensers cost less to operate during hot weather; they are especially economical if from 1½ to 2½ gallons of clean soft water can be circulated to cool the condenser for each gallon of milk. (A 26- to 28-cow herd requires about 125 gallons of water per milking to cool the milk.)

Electrical costs

Operating a direct-expansion tank requires from .80 to 1.1 kilowatt-hour (kw.-hr.) per 100 pounds of milk. An ice-bank or sweetwater tank uses from 1.3 to 1.6 kw.-hr. per 100 pounds of milk. The electricity is for cooling warm milk to 38°F. and holding it for every-other-day pickup. A can cooler requires from 1.0 to 1.3 kw.-hr. per 100 pounds for cooling warm milk to 45°F. and holding for every-day pickup.

Electric demand charges are sometimes made if the maximum load on the electric line exceeds some set value, or if electrical equipment costing more than a certain price, such as a 5-horsepower motor, requires considerable energy during short periods of time.

The cost of electricity per 100 pounds of milk is usually higher for the ice-bank tank than for direct expansion. In a few cases, demand charges might be made for large electric loads such as those caused by direct-expansion units. This might make the cost of electricity for the two types of tanks about the same, even though the electrical needs differ.

General considerations

The inside milk liner of a bulk milk tank should be made of stainless steel. Based on present knowledge, longer life can be expected

The dairyman who produces a large quantity of milk stands to gain more from installing a bulk tank than the small producer. The bulk tank can fatten a milk check in several ways for a dairyman with the right kind of operation.

if the outside of the tank is also made from stainless steel. Galvanized steel is used in some ice-bank tanks to hold the water which circulates around the stainless steel tank. Plastics are being used for outer coverings and have been satisfactory so far, although they have not been used over a long time period on farms.

The water in an ice bank system is used over and over; and, once treated for hardness, it should perform satisfactorily. You will know from earlier farm experience with can coolers whether you will have any water problems with an ice-bank bulk milk tank. If there was considerable corrosion, consider only stainless steel for the ice-bank enclosure tank.

Select a tank which meets 3A* standards and state regulations. Tanks which meet 3A standards must cool warm milk to 50°F. or

*Three Associations:
United States Public Health Commission
Dairy Industries Committees
International Association of Milk and Food Sanitarians

lower within 1 hour after milking and to 40°F. or lower within 2 hours after milking. A tank with an air-cooled condenser will meet this cooling rate when operating in 90°F. air.

The height of bulk milk tanks varies considerably. If you carry your milk in buckets, choose a bulk tank which is low enough so you can pour the milk into a strainer on top easily. With this method of handling, the farmer often devotes more time and labor to milk handling than he did with can operation.

Fig. 1, pages 12 and 13, shows tanks available in Michigan. Notice differences in size, shape, and appearance.

Installation

The size of the bulk tank unit largely determines its position in the milkhouse. The size of bulk milk tanks varies greatly. Dimensions for a 300-gallon bulk milk tank range from 7 to 9 feet long and from 36 inches to 58 inches wide. The dimensions of the bulk tank are sometimes given without including the compressor. The compressor is usually located in the milkhouse, and the space requirements must be considered (Table 6).

You can place the compressor outside the milkhouse in order to use a small milkhouse for bulk milk handling. This is called a remote

TABLE 6—Milkhouse dimensions (ft. x ft.)

Daily production, gallons	Can requirements, absolute minimum for bulk	Satisfactory for bulk, recommended for cans*	Future or desirable milkhouse for bulk, ED or EOD
Under 20...	10 x 8	12 x 10	....
20 to 50....	10 x 10	12 x 12	12 x 14
50 to 100...	10 x 12	12 x 14	12 x 16
100 to 160..	10 x 14	12 x 16	14 x 16
160 to 225..	......	.....	14 x 17
225 to 300..	......	.....	14 x 18†

*If 18-inch clearance is allowed.
†Add .2 sq. ft. for each gallon over 300-gallon production to get proper area.

installation. Provide a 3-foot door in a frame with a 1-foot side panel, so that a 4-foot clearance for moving bulk tanks through the door can be made by removing the frame. Although some tanks are wider than 4 feet, these can usually be turned on their side and moved through the door because they are less than 4 feet high.

The clearance required around a bulk tank varies from one area to another, depending on local regulations. In most areas of Michigan, a 24-inch clearance is required around the tank. Check with your local authorities. If the milk is carried, the opening through which the milk is dumped should be closest to the stall or milking room.

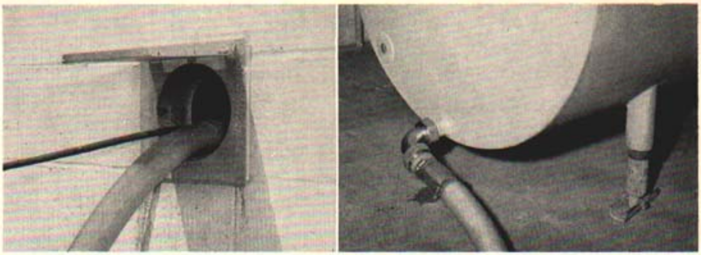
All bulk tanks over 100 gallons require 230-volt electrical outlets. Also, 230-volt services are required for the electric water heater and tanker pump. Lighting must be good enough to permit inspection of all milk surfaces and proper cleaning of utensils. To reduce the possibility of flies, insects, dust, and water dropping into the milk or the tank, do not place light bulbs, water lines, or refrigerator lines directly over the tank.

Many floors in milkhouses will not support the concentrated load of four or six legs of the bulk tank when it is full. You may have to build a new floor; if so, use 10 inches of gravel covered with at least 5 inches of concrete and reinforced with 6-by-6 No. 10 wire located near the bottom of the concrete.

If the floor is otherwise in good condition, you can remove a small section and install concrete pillars shaped like a pyramid or cone, extending 1 to 2 feet into the ground, where the tank legs will be. Use of pillars is not generally recommended—their position changes more easily than a continuous floor. Also, the pillars might not be in the correct position to support a different bulk tank or the same tank if you change the milkhouse arrangement.

The graduated stick provides a way to determine the quantity of milk accurately if your tank is installed and kept in a level position. You can check the levelness of the tank in several ways: with a bullseye level which is mounted on some tanks, by placing a carpenter's level on a prescribed location on the tank, by using a plumb bob, or by placing liquid in the tank and noting whether the liquid touches four corner scribe marks at the same time.

Install a deep-water seal-type floor drain 4 inches in diameter. Put it where you can clean it easily, rather than under the tank.



A port (left) for the hose and electric cord from the truck aid sanitation at the milkhouse, since windows and doors stay closed while the farmer's tank is emptied (right).

Provide a self-closing hose port through which the hose and, if necessary, the electric wiring for the tanker pump can be placed so that windows and doors will not be open while the farm tank is being emptied. Locate the port at least 12 inches above the floor. (Check with local authorities.) Provide a 4- by 4-foot concrete loading platform at the front of the milkhouse.

Operation

For the proper cooling rate, do not load tanks designed for every-other-day pickup to more than one-quarter of tank capacity at one loading. Tanks designed for every-day pickup are often used for every-other-day pickup, but not the opposite, due to lack of refrigeration capacity.

With an air-cooled condenser, the heat removed from the milk is given off in the milkhouse. Ventilation is needed around the air-cooled condensor, especially in the summer, to remove the heat and keep operating costs low. It is desirable to have the heat in the milkhouse in the winter. A ventilation rate of 500 cubic feet per minute of air for each horsepower (ton of refrigeration) is recommended. Insulating the ceiling and walls will help prevent condensation and possible dripping on or into the cooler. Electrical needs for operating the bulk milk cooler at 85°F. can be cut about 30 percent by using an air-water or water-cooled condensor instead of air. The heat given off by the refrigeration system helps prevent freezing in the milkhouse in winter.

With an ice-bank system, you can use a time clock to permit the cooler to build its ice bank before you work in the milkhouse in the morning, rather than after the milk is cooled at night. By building the ice bank from midnight to 6 o'clock in the morning, the cooler will give off enough heat to prevent freezing and to keep the milkhouse at a better temperature for working. The actual time needed will depend upon the amount of ice bank to be built; work it out for your own installation by trial and error. Make sure that enough ice is built up to cool the next loading of milk.

Standby electric power sources are available for emergency needs. The main ones are: (1) power-takeoff tractor-driven units, (2) stationary engine-driven generators, and (3) integral tractor-generator units. In deciding whether you should have one, consider cost vs. outages. If you already have one, keep your separate stationary engine in operating condition, and contact your power supplier to be sure proper connections are made.

The expected life of the bulk milk tank is from 10 to 20 years. Within that period, though, some parts will no doubt need replacing. The cost for repairs is not predictable. A guarantee and warranty should be provided with the unit. This should include free service and parts, usually for 1 to 5 years, with replacement of parts for any piece of the system, not just for one part. Replacement parts are usually free after 1 year but a service charge is made. There is often a separate warranty on the tank and the compressor unit.

WASHING BULK COOLING TANKS AND PIPELINE MILKERS

Washing bulk milk cooling tanks is no different from washing other dairy utensils. Usually, the milk hauler rinses out the tank after emptying it. The milk valve must be disconnected before rinsing to avoid the possibility of adding water to the milk. A daily deadline for washing the tank will allow regular inspection of the tank for cleanliness.

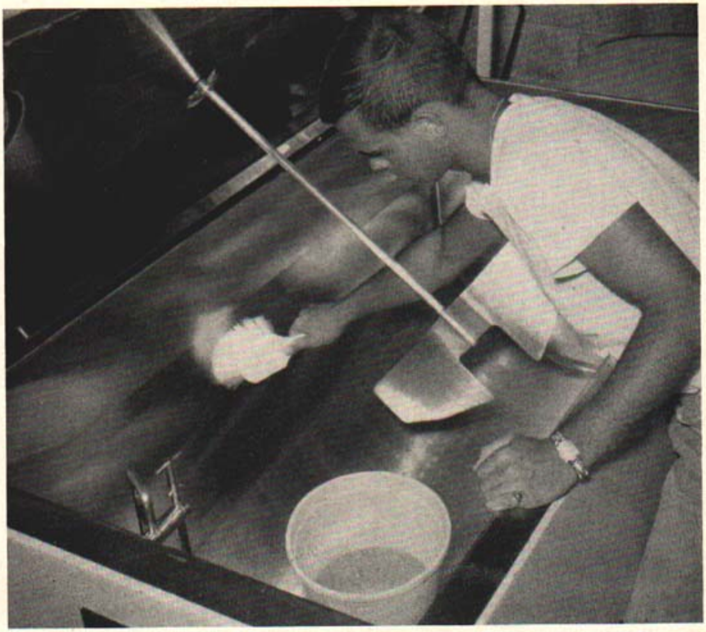
Rinsing tank

Use a cold water jet, applied under pressure from a hose nozzle, to loosen milk films from the metal surface of your bulk tank. Continue rinsing until all traces of milky films are gone and the discharge water runs clear. The hose, equipped with a nozzle, should be long enough to reach all parts of the bulk tank.

Washing tank

Prepare a washing solution in a polyethylene or other suitable plastic container. Three to four gallons are usually enough. The wash-water should be warm but does not need to exceed 125°F. You can get excellent detergent materials either from dairy plants or direct from dairy supply houses. Either liquid or powder detergent products work well.

Apply the washing solution with a brushing action. Use a nylon brush with a handle to reach all the inside milk contact surfaces. Scrub the tank thoroughly at every washing. The covers and the bridge of bulk tanks are easily neglected; therefore, they need special washing care. Remove the milk outlet valve, and clean the tank outside as well as inside. All of these cleaning details can be done with one pail of washing solution.



Using a soft brush and a plastic pail while washing the bulk tank prevents scratches on the stainless steel surface inside the tank.

Rinsing after washing

After scrubbing the tank, rinse it with warm water until all traces of the washing solution are gone. Leave covers open to allow drying. The tank should smell clean, and it should show no milkstone when dry.

Milkstone

If milkstone appears, remove it with an organic acid milkstone remover. Some washing powders and hard water form milkstone fairly regularly unless you use an acid detergent about once a week.

Germicidal treatment

Just before putting milk in a clean tank, fog the bulk tank with a chlorine solution of 100 parts per millon strength. When fogging equipment is not available, chlorinate the tank by placing 3 gallons of 100 parts per million solution in the bottom of the tank; then apply the solution over the entire inside area with a nylon brush. Let the chlorine solution drain from the tank without further rinsing.

Do not chlorinate immediately after washing. Stainless steel is corroded by too much exposure to chlorine solution. Hot water is not recommended for germicidal treatment of tanks, since large surface areas have to be treated and not enough hot water can be provided for good results.

Cleaning pipeline milkers

To clean pipeline milkers, you should usually follow the manufacturer's instructions. Some conditions for good cleaning results are mentioned below.

Use only pipeline systems that will allow continuous circulation of washing solutions. Use permanent-type nonabsorbent gaskets between joints. Wash by circulation cleaning, either by vacuum or by pump circulation. Both washing procedures are equally effective.

Wash according to the following schedule:

1. Prerinse with 120°F. water until the exhaust runs clear.
2. Wash, using the amount of detergent solution needed to maintain continuous circulation (about 12 to 30 gallons). Figure on 1 gallon per 12½ feet of line, plus the capacity of the pump and weigh jar.

   The temperature of the detergent solution depends on the detergent products you use. Generally, water as it comes from the hot water tank (140 to 160°F.) is hot enough. Continue circulation 15 minutes or more.

Wash all milk valves in the lines in place during each washing operation, using a suitable brush.

3. Rinse the line free of washing solution with 140 to 160°F. water. Six to eight gallons are needed, depending on the length of the line.

   Rinse all lines with 12 to 15 gallons of 100 p.p.m. chlorine solution before using.

CONTROLLING RANCIDITY

Rancidity in milk can occur as a result of cows giving milk that naturally becomes rancid during cooling. In a herd where rancidity is a problem, it is usually caused by only one or two cows.

Rancidity may also be caused by a condition known as **activation** —the milk becoming rancid by adding warm milk to cold milk, by too much stirring, or by otherwise causing warm milk to foam.

In bulk-tank cooling, warm milk is added to cold milk. However, activation rancidity will not occur if the temperature of the main body of milk from earlier milkings can be held below 50°F. during milking. It is, therefore, unusual for milk to turn rancid as a result of bulk-tank cooling.

Pipeline installations have been responsible for many cases of milk rancidity. The cause can usually be traced to one of these conditions, with the worst ones listed first: (1) Too much air intake; (2) air leaks in the milk line; (3) too many or too high risers; and (4) too long a pipeline.

It is not possible to move milk in the line without some air intake, such as through teat cups or air vents in the teat cup claw. You should control the air inlet, though, so that foaming of warm milk and turbulence of milk within the line is kept at a minimum.

Too much slope in milk lines in permanent installations may cause **activation rancidity,** especially if enough air is let in to keep the milk moving continuously toward risers. The least rancidity of milk seems to occur when milk is allowed to dam up in the line, then move in full flow through it.