Swing Parlors

by

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Buying a milking parlor is similar to buying any major item; a house, a farm, or a car. Determining your likes and dislikes is the most important part of the exercise and will affect whether the resulting facility is something you love or something you tolerate. The first step is to develop a list of goals. This includes not only parlor design issues, but business and personal goals as well. Use this list and follow it during the design process. When decisions need to be made, use this list of goals to help decide if this particular decision accomplishes those goals.

History

New Zealand has a lot of swing parlors but so does Ireland. The United States has had swing parlors as well. During the mid 1950's and into the 1970's swing parlor equipment was common in the US. Where did it go? I am not sure anyone has an answer, but the fact is that technology changes and sometimes an old idea that had problems gets some better technology to correct it and the new "old" idea works again!

Terminology

One area of confusion in passing information along from other parts of the world is the use of different terms. Words may not be familiar or have different meanings than we are accustomed to. At the end of this paper is a start on a list of terms and their different uses in New Zealand and US.

The term "New Zealand" parlor is a good example. It is not very descriptive or specific. New Zealand has all kinds of parlors, including herringbones, parallels, and rotaries. The "New Zealand" parlor term commonly used among graziers describes a parlor where the cows stand in a herringbone arrangement with a parking angle of around 70 degrees. The milking system uses a high milkline over the operator pit with one cluster shared between two stalls. The cluster is swung from one side of the parlor to the other and is usually attached to the udder from the rear. The “New Zealand “ parlor also describes a parlor that

has a simple design, with high cow throughput, and low labor requirements.

Key Factors in Milking Center Design

The milking center should be designed for the cow first and the person milking second. The design should also be as flexible as possible and anticipate new technological changes. The discussion that follows assumes Holstein cows. If Jerseys are to be milked some of the design dimensions should be adjusted as indicated.

Economics of Swing Parlors

It is estimated that the milking center accounts for 40-50% of the total capital investment in the grazing dairy. So there is ample opportunity to manage the cost of the parlor. How can a farmer spend less money for a parlor? One way is to provide sweat equity for parlor construction. Another way is to reuse existing equipment, buy used equipment, remodel an existing building shell, or reduce the amount of equipment required in the new design. Minimizing the building shell can be achieved in a seasonal parlor. However, the additional cost of winterizing the building shell for northern climates should be considered.

These are not new ideas. The opportunity for dairies in transition is that the time may be available at this stage of the business to take advantage of some of these opportunities without sacrificing the dairy operation. Just be aware of the other side of the coin. If the time is not available or the expertise is not available, then it is probably better for the farmer to hire someone who knows what they are doing, or buy the right type of equipment to fit with the new design.

Farmers have to decide for themselves how much they are willing to budget for construction of a parlor. Ball park figures for a new swing 16 parlor in an open shed without the bulk tank is $2,000-$3,000 per milking stall. Using the methods described above can cut that cost additionally. On the high end with everything new in a closed shell and including the bulk tank, the cost can rise to $4,000-5,000 per stall. Even if these figures are low, the point in determining a budget is to critically determine what the farmer wants, and the minimum cost of achieving the design.

Siting

The milking center should be as close as possible to the middle of the grazed land. In a lot of cases this is not where the present farm buildings are located. Compromising on the site may affect other design issues like the holding area, feeding area or animal handling area. Give due consideration to alternate sites.

Factors that Affect Cow Throughput

There are several factors that can affect cow throughput performance of a parlor including: milk

production level, milking routine, number of milkers, and parlor design. Production level will affect how long it takes to harvest the milk from the cow, or how long the cluster is attached to the animal. Since the milking routine has a large affect on the time the cow is in the parlor there are several changes in the routine that can affect the cow throughput.

The milking routine typically includes:

Action	Average time
Cow entry	10 sec
Udder wash/preparation	20 sec
Attach cluster	14 sec
Cluster on time (milkout)	360 sec
Post milk procedure	8 sec
Cow exit	7 sec

For example if udder preparation is minimized, it can reduce the milking routine time, and increase cow throughput. In parlor time studies washing and udder preparation decreased parlor throughput by 20%. Clean cows increase cow throughput. If cattle flow is poor and it takes a long time for cows to enter and exit, it can increase milking routine time and reduce cow throughput. If you have fast milking cows the cow through put will increase. If you have one slow milker in the line, the cow through put decreases.

To be most labor efficient, it is recommended the parlor be sized to have only one person milking. However when first starting up the parlor in the spring or when training a group of heifers, it is a good idea to have the extra person there to help during this stressful time (stressful for both the milker and the cows!).

With swing equipment it is estimated that one person can handle 14-16 clusters with no takeoffs, and up to 20 clusters with takeoffs. Two persons can handle 32 clusters with no takeoffs and 40 clusters with takeoffs. An additional operator increases parlor throughput capacity by 10-20%.

It is estimated that swing equipment (2 stalls per cluster) parlors are equivalent in performance to conventional doubled up equipment (1 stall per cluster) parlors with 50% more clusters than the swing parlor. For example a swing 16 parlor (16 clusters/ 32 stalls) is approximately equivalent in cow throughput to a double 12 parlor (24 clusters/ 24 stalls). Table 1 shows parlor performance for different styles of parlors.

Observations from farmers suggest that there is more variability in cow throughput with swing parlors because of season of use, stage of lactation, seasonal herd, and cleanliness of the cow. Slowest throughput is likely to be at beginning of the grazing season or parlor startup as animals and operator are training, and fastest throughput at peak milk production. Parlors operated year round with steady milking herd numbers probably will not have the variability in throughput nor the high throughput some seasonal graziers experience.

Table 1. Cow throughput for different style parlors. (cows per hour)[1]

Number Stalls per Side (assumes double sided parlors)	Herringbone [2] Swing			Herringbone [3] Doubled up		Parallel [3] Doubled up		Side Opening [3] Doubled up		Flat barn [2]	
	Min	Average	Max	Min	Max	Min	Max	Min	Max	Min	Max
3	18	24	30					50	63		
4	24	32	40	34	47			56	70	40	60
5	30	40	50					71	82		
6	36	48	60	55	71			75	90	40	60
7	42	56	70								
8	48	64	80	69 [2]	87 [2]					45	65
9	54	72	90								
10	**56**	**69**	**92**	60	101	84	91			50	70
12	72	96	120	88	110	72	106				
14	84	112	140			110[2]	121[2]				
16	**94**	**109**	**124**	123	128	108 [2]	161 [2]				
18	108	144	180								
20	120	160	200	145 [2]	180 [2]	122[2]	128[2]				
24	**179 [2]**	**195 [2]**	**224 [2]**	170 [2]	205 [2]	143 [2]	235 [2]				
26	**139 [2]**	**182 [2]**	**238 [2]**			175 [2]	240 [2]				

[1] Super script in table value indicates number of milkers, otherwise table values are for one (1) milker.
[2] Estimated, **Bold are measured in parlors summer of 1994**, minimal cow prep.
[3] Data from Armstrong 1994, with cow prep.

Table 2. Parlor performance of swing equipment parlors [1]

	Parlor						
	A	B	C	D	E	F	G
Milkers	2	1	2	1	3	3	2
Clusters	16	16	26	11	26	24	16
Stalls	32	32	52	22	52	48	32
Cycle Times (Time to turn one side) (minutes:seconds)							
Maximum	20:28	21:55	22:30	23:38	21:52	16:05	33:25
Average	17:39	17:37	17:07	19:09	18:40	14:44	21:24
Minimum	15:30	13:58	13:08	14:23	14:35	12:50	13:00
Turns per Hour (Number of times a side turns in one hour)							
Maximum	3.9	4.3	4.6	4.2	4.1	4.7	4.6
Average	3.4	3.4	3.5	3.1	3.2	4.1	2.8
Minimum	2.9	2.7	2.7	2.5	2.7	3.7	1.8
Sides per Hour (Number of sides turned in one hour)							
Maximum	7.7	8.6	9.1	8.3	8.2	9.4	9.2
Average	6.8	6.8	7	6.3	6.4	8.1	5.6
Minimum	5.9	5.5	5.3	5.1	5.5	7.5	3.6
Cow throughput per hour (cows/hour)							
Maximum	124	137	238	92	214	224	148
Average	109	109	182	69	167	195	90
Minimum	94	88	139	56	143	179	57
Cow throughput per person per hour (cows/person/hour)							
Maximum	62	137	119	92	71	75	74
Average	54	109	91	69	56	65	45
Minimum	47	88	69	56	48	60	29

[1] Times taken from video of one milking early in grazing season.

Sizing the Swing Parlor

Most graziers suggest the parlor be sized to have a milking chore time of two hours or less per milking including setup and cleanup. This translates into an approximate milking time of 1 to 1-1/2. New Zealanders say you should not spend more than 1 ½ hours in the milking shed. One way to look at cow throughput is to determine the time it takes to milk a side. A turn (cycle) is defined as the time measured from the entrance of the first cow on a side to the next time the first cow enters the same side. A well designed parlor can turn a side (cycle) in 15 minutes, or provide 4 turns (cycles) per hour (8 sides per hour). A cycle time of 10 minutes or 6 turns per hour per side (12 sides per hour) can probably be achieved with minimal udder preparation and very good cow flow. New Zealand information suggests parlors be designed to have 4-6 turns per hour per side (8-12 sides per hour), with an average of 10 sides per hour. This means that the cycle time ranges from 10 to 15 minutes, with an average of 12 minutes. These recommendations are comparable to parlor performances shown in Table 1. Table 2 on page 7 shows the results of time studies from several parlors early in the 1994 milking season fairly soon after construction.

To determine the parlor size assuming 4 turns per hour (8 sides per hour), take the number of cows to be milked and divide by 8 for a one hour milking time or 12 for a 1-1/2 hour milking time. This will be the number of stalls needed per side. For example for a 100 cow divided by 8 is 13 per side for a one hour milk time and 9 per side for a 1-1/2 hour milk time. If 5 turns per hour is used as a design value the values would be 10 per side for a one hour milking time and 7 per side for a 1-1/2 hour milking time. Table 3 shows parlor sizes for two different herd sizes at different cycle times and milking times to help compare other assumptions.

Table 3. Parlor Sizing for Swing Parlors

			Group Size			
			50 cows		100 cows	
Turns per Hour	Sides per Hour	Cycle Time (minutes)	Milking time		Milking time	
			1 hour	1 ½ hour	1 hour	1 ½ hour
			Number of stalls per side [1]			
3	6	20	9	6	17	12
4	8	15	7	5	13	9
5	10	12	5	4	10	7
6	12	10	5	3	9	6

[1] Number of stalls per side are rounded up.

Milk Line Sizing

One way to keep the cost of the parlor down is to use existing or used equipment as much as possible. Work at the UW Milking Research Lab has helped to establish proper milk line sizing for milking and cleaning. Table 4 shows line size for a swing high line and the number of clusters that can be used on the line. With a 2 inch looped milk line, a swing 10 parlor (5 clusters on each slope with the proper line slope) could be designed. The largest parlor with a 2.5 inch milk line is a swing 20 parlor.

Table 4. Milk Line Size and Number of Clusters Used.

Looped Milk Line with Clusters Attached Simultaneously by Careful Operator					
Nominal Line Size	Milk line Slope (%)				
	0.8 %	1.0 %	1.2 %	1.5 %	2.0 %
	Maximum Number of Clusters/Slope				
2 inch	2	3	3	4	5
2.5 inch	6	6	7	9	10
3 inch	11	13	14	16	19
4 inch	27	30	34	38	45

Note: A slope of 0.8 % is equivalent to 1" drop in 10'. A slope of 1.2 % is equivalent to 1½" drop in 10'. Milk line slopes greater than 1.6 % (2" per 10') are not recommended unless the cow platform is sloped in the same direction as the milk line. Table by Douglas Reinemann and Graeme Mein, UW Milking Research Lab. (Mein, 1995)

Sizing Airlines

Differences in vacuum levels between the pump and the receiver should not exceed 0.6" Hg (mercury). Recommendations for sizing the main airline relative to pump capacity, line length, and fittings are given in Table 5.

Table 5. Recommended minimum pipe size (inches internal diameter) for the main airline of a milking system. (Mein, 1995)

Vacuum Pump Capacity, cfm	Approximate length of main airline (feet)				
	10	20	40	60	80
	Pipe Size (inches internal diameter)				
50	2	2	3	3	3
70	3	3	3	3	3
100	3	3	3	3	3
150	4	4	4	4	4
200	4	4	4	4	4
250	4	4	6	6	6
300	6	6	6	6	6
350	6	6	6	6	6
400	6	6	6	6	6

Notes: The main airline is defined as the pipeline between the vacuum pump and the sanitary trap near the receiver. Calculations are based on a maximum vacuum drop of 0.5" Hg between the receiver and vacuum pump. The table includes an allowance for the equivalent length (feet of straight pipe) of one distribution tank, one sanitary trap, and 8 elbows.

Vacuum Pump Sizing

The simple guideline for minimum pump capacity can be estimated by using a basic reserve of 35 cfm, plus an additional 3 cfm per milking unit. This estimate provides enough pump capacity to cover allowances for system leakage, pump wear, and regulator leakage. The guidelines shown in Table 6 provide adequate airflow for efficient cleaning of properly designed CIP systems. Vacuum pump size is based on cleaning needs and is usually satisfactory for milking as well.

Table 6. Pump horsepower and number of milking units. Based on 10 cfm per HP for oil or lobe pumps and 7.5 cfm per HP for water ring pumps. (Bray, 1992)

Horsepower, HP	Oil or lobe pump		Water pump	
	Number of Milking Units	Pump Capacity, CFM	Number of Milking Units	Pump Capacity, CFM
5	1-5	50	1	37
7.5	6-12	75	2-6	56
10	13-20	100	7-12	75
15	21-35	150	13-24	112
20	36-50	200	25-35	150
25	51-67	250	36-47	188
30	68-80	300	48-57	225

Parlor Design:

The milking parlor is the heart of the entire milking center complex and is the most important part of a dairy operation. The area is quite complex and has a wide range of design options and alternatives. Figure 1 shows the different areas of the parlor which are described below. Figure 2 and Figure 3 show a plan and cross section view of the swing parlor with dimensions.

Operator pit

The width of the pit can vary between 5-8 feet. Swing parlors use a 4'6" foot width for a one person parlor and up to a 6 foot width for a 2-3 person parlor. The extra width allows the operator to pass more conveniently and does not increase walking distance that much since most of the operator movement is over the length of the parlor and not the width of the parlor. Table 5 shows the length of the pit for different sizes of parlors and cluster spacings. The center of the pit floor should be crowned 2 inches and slope down toward the pit wall. The cow platform should cantilever 6 inches past the pit wall to provide an operator toe kick. Figure 3 shows a cross section of the swing parlor. All controls for entrance and exit gates should be placed in the pit for easy access by workers. The pit should also contain adequate hoses and drains for cleaning and cow prep including low pressure hoses for udder prep spray, post spray, and high volume low pressure hoses for clean-up.

Cow platform

The cow platform should be at a comfortable work level above the operator pit floor. The milker should not have to bend or stoop during the milking routine, but where the milker spends only a few hours in the pit a lower platform height may be satisfactory. Udder visibility is improved with a higher platform height.

The pit depth or cow platform height is mainly dependant on the height of the operator. For worker comfort it has been found that the most comfortable work position is between 0-4 inches below the standing elbow height of the worker. One rule of thumb is to have a platform height that is 0-2 inches less than half the height of the worker. The average male is 5'-9" and the average female is 5'-6" which would make a pit that is 32-35 inches. New Zealand information says that the platform should be 27-28 inches for a person 5'-8" to 5'-10" tall. Many recently built parlors use a pit depth that ranges from 38-42 inches. Parlor mats will improve worker comfort and can decrease the platform height if needed.

Cluster spacings vary between 24 inches@ 90 degrees parking angle (parallel stall) to 36 inches@ 45 degrees (herringbone). A common arrangement is that cows are parked at approximately a 70 degree angle and the clusters are spaced 27-28 inches depending on the size of the cow and the position of the breast rail. Table 7 shows the dimensions for the pit and holding area at several different cluster spacings. Since the cluster is attached from behind the cow between the back legs the likely-hood of a cluster being kicked off is reduced. It is recommended that the cow platform be extended 2-3 cows beyond the pit into the holding area to position these cows behind the last cow to be milked, and in many cases no back gate is used. This arrangement helps cow flow for the next loading. A pendulum gate or chop gate is used at the front gate location on the platform to allow quick stopping of the first cow during the next platform loading.

Table 7. Operator pit length and holding area size.

Number of stalls per side	Cluster Spacing @ Parking Angle [1] (inches)			Holding Area [2] (square feet)	Cows in Holding Area after Parlor is Loaded
	27" @ 85°	30" @ 70°	36" @ 45°		
	Operator Pit Length (feet, inches)				
4	10' 6"	11' 3"	12' 9"	480	32
6	15' 0"	16' 3"	18' 9"	720	48
8	19' 6"	21' 3"	24' 9"	960	64
10	24' 0"	26' 3"	30' 9"	1200	80
12	28' 6"	31' 3"	36' 9"	1440	96
14	33' 0"	36' 3"	42' 9"	1680	112
16	37' 6"	41' 3"	48' 9"	1920	128
18	42' 0"	46' 3"	54' 9"	2160	144
20	46' 6"	51' 3"	60' 9"	2400	160
22	51' 0"	56' 3"	66' 9"	2640	176
24	55' 6"	61' 3"	72' 9"	2880	192
26	60' 0"	66' 3"	78' 9"	3120	208
28	64' 6"	71' 3"	84' 9"	3360	224
30	69' 0"	76' 3"	90' 9"	3600	240
32	73' 6"	81' 3"	96' 9"	3840	256

[1] Parking angle is approximate, [2] Assuming parlor loaded on both sides and remaining cows in holding area for approximately 1hour.

Adjustable breast rail

The breast rail is approximately 30 inches above the cow platform for Holsteins and 27 inches for Jerseys. It should fit into hollow below the point of the shoulder. The adjustable rail allows adjustment of the line of cows to position the rump up against the rump rail to position the udder as close as possible to the operator pit. Once the breast rail is adjusted it is unlikely that its position will be changed during the rest of the milking season. The breast rail should be adjustable because the distance between the rump rail and the breast rail will vary between 54 and 60 inches for Holsteins and between 48 and 54 inches for Jerseys. There are several options on installing the breast rail shown on Figure 3.

Rump rail

The rump rail positions of the line of cow's rumps. It should be the same height as the breast rail at approximately 30 inches. The rump rail can be a straight rail or an "S" rail and is usually located directly above the edge of the cow platform. Figure 1 shows two options for a rump rail. The straight rail is simple and used with angle parking of 70 degrees or more where the cluster spacing is 27-30 inches. The "S" rail or "zig zag" rail may be of benefit when the cow parking angle is less than 70 degrees. It positions the cows rumps and separates individual cows. A straight rail saves costs and aids cow flow. Figure 4 shows three options for the frames that support the rump rail.

Hock (Kick) rail

The hock rail is placed approximately 8 inches below the rump rail. This option can help prevent cows kicking backward and also helps position the cows legs so that they are not likely to step back and slip off the cow platform.

Nib rail or platform curb

To keep the platform simple no curb is used. Reasons to include a curb are to keep a cow's (especially heifers) foot/leg from slipping off the platform and into the pit or to act as a manure splash guard for the worker. A 6 inch steel plate with a ½" diameter pipe welded to the top or a preformed stainless steel plate are options.

Manure splash guard

In a well run parlor with minimal agitation of the cows, only 1 or 2 cows per hundred are likely to drop urine or manure in the parlor. A manure splash guard can be placed above the rump rail to direct manure to the platform instead of the pit. Providing a nib rail or a grate at the edge of the platform next to the pit can reduce manure splatter. Cows may hesitate to walk on the grate which can reduce cow throughput.

Holding Area

Circular yards are very popular in New Zealand. However, in the United States rectangular yards seem to be the choice. This is in part due to the use of crowd gates which work very well in rectangular holding areas. A crowd gate is necessary to train cows to enter the parlor for the first couple of weeks and may not be required after the training period. Many graziers are using a light weight electrified crowd gate for approximately two weeks and then may still use the gate but with out electricity. Milkers should not be leaving the pit to bring cows into the parlor, but a pass through at ramp exit to holding area should be available when it is necessary to go into the holding area.

For maximum cow walk through rate cows should move in a straight line from the holding area into the parlor and exit straight out. The holding area should be sloped 3-6% up toward the parlor entrance and sized for at least 15 square feet per cow and a holding time of 1 to 1-1/2 hours maximum. Table 6 shows the size of holding area needed assuming the cows are loaded onto both platforms and the remaining cows are held one hour or less. Cows should be in single file just before entering parlor. Narrow down the entrance and have 2-3 cows on the platform lined up behind the last cow being milked. This may eliminate the need for a back gate since the 2-3 cows will hold the last cow being milked in place. Use a common area between the parlor and the holding area instead of doors, or use an overhead door and plastic strips if necessary to cut down drafts. A shaded holding area can reduce heat stress during the summer. This might be as simple as shade cloth suspended over the area or a roofed building with no walls constructed over the holding area.

Parlor Startup

Parlor startup and training is a high stress activity for both the cow and the operator. In seasonally calved herds, it may come at calving which only adds to the stress. Minimizing the stress will help reduce potential problems but will not eliminate them. The new milking routine should be defined before hand so that everyone milking is familiar with the steps. In a seasonal herd the training of new heifers may be more difficult than with the older cows.

It has been suggested that the parlor be wet down to ease cleanup and that manure be spread around a new parlor to cut the odd smells of new concrete and equipment. On the initial visit, cows should be allowed to enter the holding area and parlor on their own. This could be done for several days, increasing the pressure to move through the parlor. At some point in this training the cows should be held in the line but not milked, released and allowed to exit the parlor. On the first day of milking additional help should be available to move cows into and out of the parlor if necessary. The goal should be to have the parlor operating with the correct number of operators in the first month if at all possible.

Feeding Area

A common question asked regarding parlors is whether to feed in the parlor or not. It is simpler to deal with the two issues separately. Feeding in the parlor is also one more job that has to be done that takes time away from the milker which can reduce cow throughput.

Milk in the parlor and feed in a post holding or feeding area. Parlor feeding may improve cow entrance but it hinders cow exit which can affect cow throughput. Time and motion studies showed that cow throughput was severely compromised when feed was given in the parlor. Cows tend to stand quieter when not fed in the parlor. Cows may not spend enough time in parlor to eat all grain needed, so if grain is fed in the parlor feed only a small amount (3-4 lbs) to all the cows. The parlor can stay cleaner and has less equipment in the way which can hinder cow flow.

The feeding area/post holding area is extremely important because after milking and walking in from the field the cows will be extremely thirsty and hungry. The time just after milking is the highest rate of dry matter intake and associated water intake of the day. If the cows are watered as a group, have plenty of access to water spaces to make sure that cows are allowed to drink what they want. Other feeding options include feeding in a wagon at the paddock or under a fence line.

How to control what the cows eat is another matter. Sizing the post holding should allow space for animals of from two to four times the capacity of one side of the parlor at 25-30 ft^2 per head. Allow 2' to 2 ½' of feed space per cow. This will help reduce cow stress and ensure that all cows have adequate access to feed. Lockups can be used not only for feeding but also as a handling facility.

There is still a lot of discussion on the reasons to feed in a parlor or not. Much of the reasoning behind the decision is personal reference and/or site specific to the farm. Below is a list of farmer comments on the pros and cons of feeding in the parlor or feeding outside:

Feeding in the parlor Pros	Feeding outside Pros
cheap to install	flexible ration possible
automatic feeding possible	intake not limited
cows not on concrete for a long time	increase parlor throughput
competition reduced	working/handling area can be incorporated
manure handling in place	drive by feeding possible
less time for manuring	fenceline feeding

Feeding in the parlor Cons	Feeding outside Cons
decrease parlor throughput	manure handling required
cleaning feed troughs	extra labor needed
limited intake	capital investment
limited feed ration options	additional concrete area
dust	

Terminology

Misunderstandings arise because of terms we use or interpret from New Zealand information. The accompanying list summarizes some of the terms used in discussion of milking centers and parlors. Here is a start on a parlor terminology for NZ/US terms. Figure 1 shows location of parts of the parlor discussed below.

NZ Term	US Term
Auto detachers, cup removers	Automatic takeoffs
Backing gate	Crowd gate
Bail, line, row	Cow platform or side
Breech rail	Rump rail
"S" rail, "Zig Zag" rail	Type of rump rail (looks like a continuous S, or a zig zag line)
Cluster, cups, set of cups	Milking cluster or unit
Doubled Up	1 cluster per stall
Drafting gate, Draughting gate	Cutting gate
Fall	Slope
Head rail	Breast Rail
Herringbone	Herringbone
Kick rail	Hock rail
Man pass	Man pass, pass thru
Milk silo	Bulk tank
Mob	Group or herd of animals
Muck	Manure
New Zealand parlor	Swing equipment parlor
Nib wall or nib rail	Low curb, platform curb
Parking angle	Parking angle
Pendulum gate, guillotine gate	Chop gate
Milking pit	Milking pit, operator pit
Milking Shed	Parlor
Splash sheet	Manure guard

NZ Term	US Term
Sump	Drain
Swing equipment	1 cluster per two stalls
Yard	Holding area

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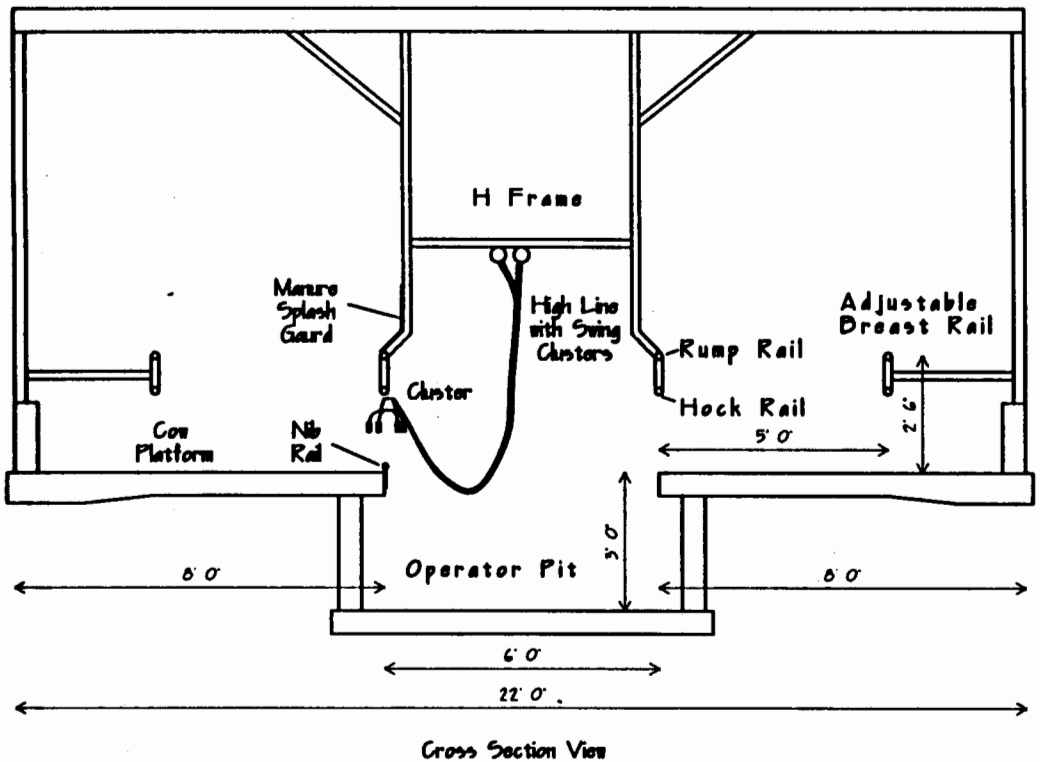

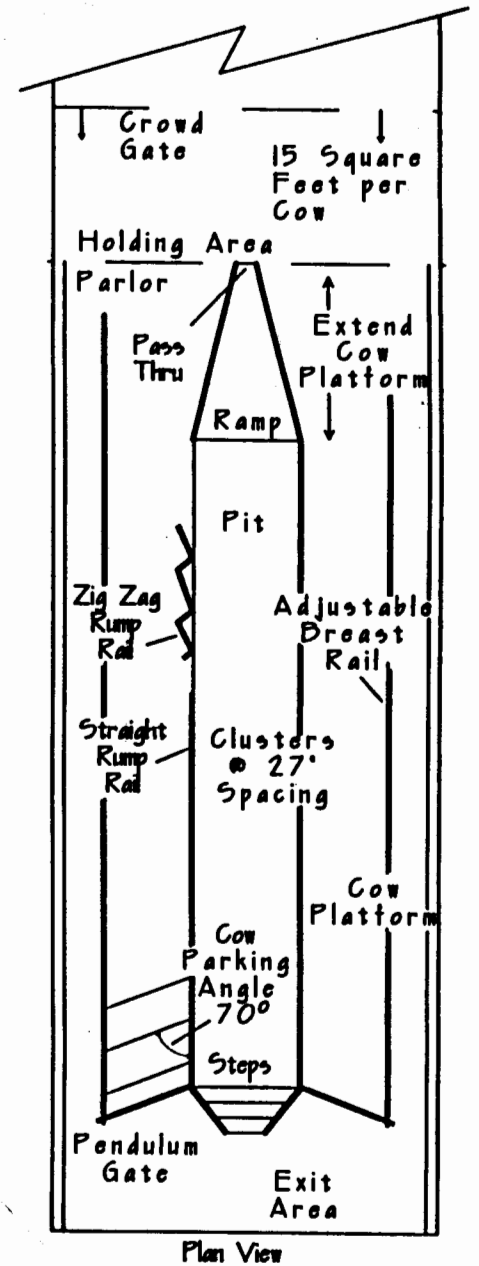

Figure 1. Swing Parlor Plan and Cross Section Views

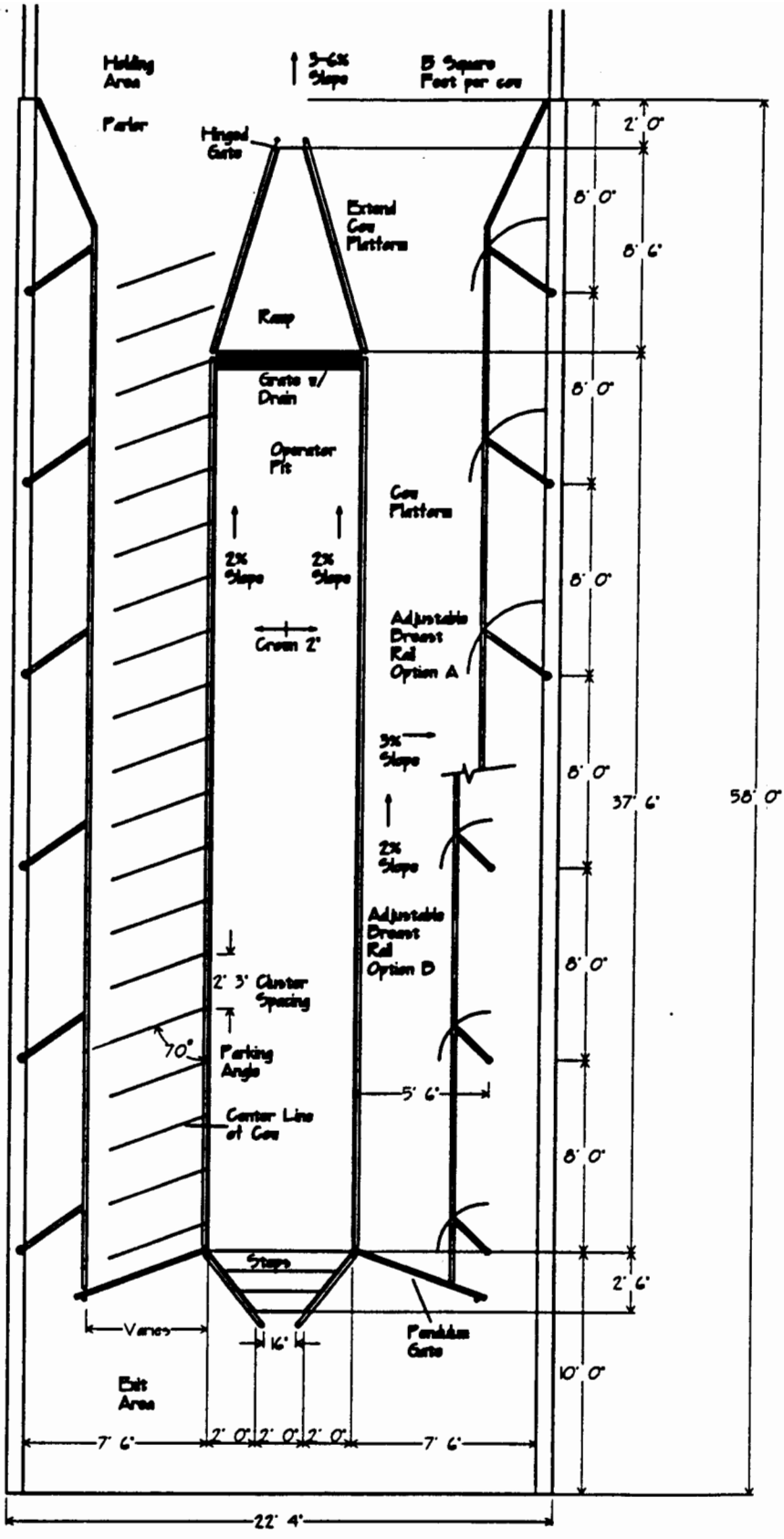

Figure 2. Swing Parlor Plan

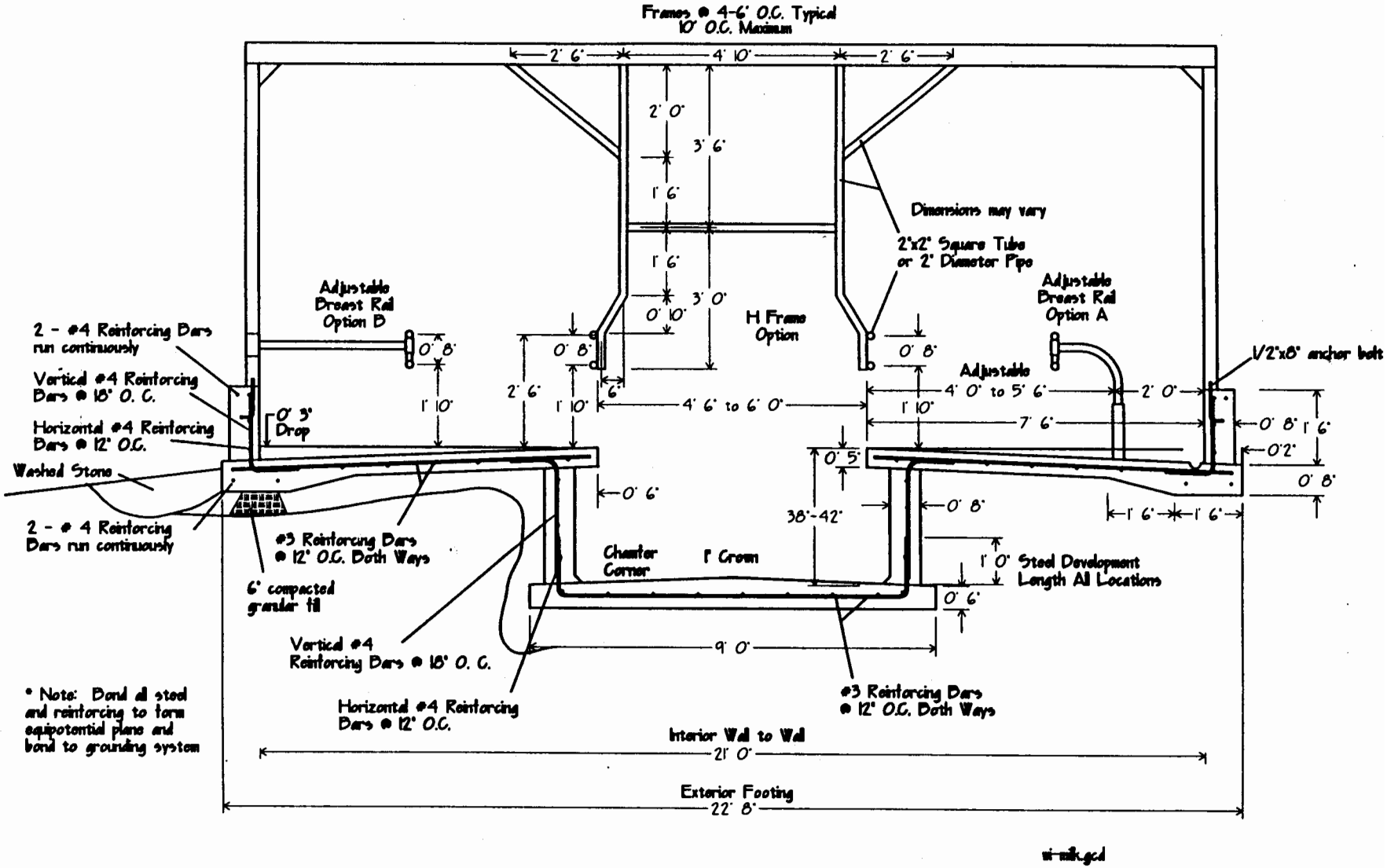

Figure 3. Swing Parlor Cross Section

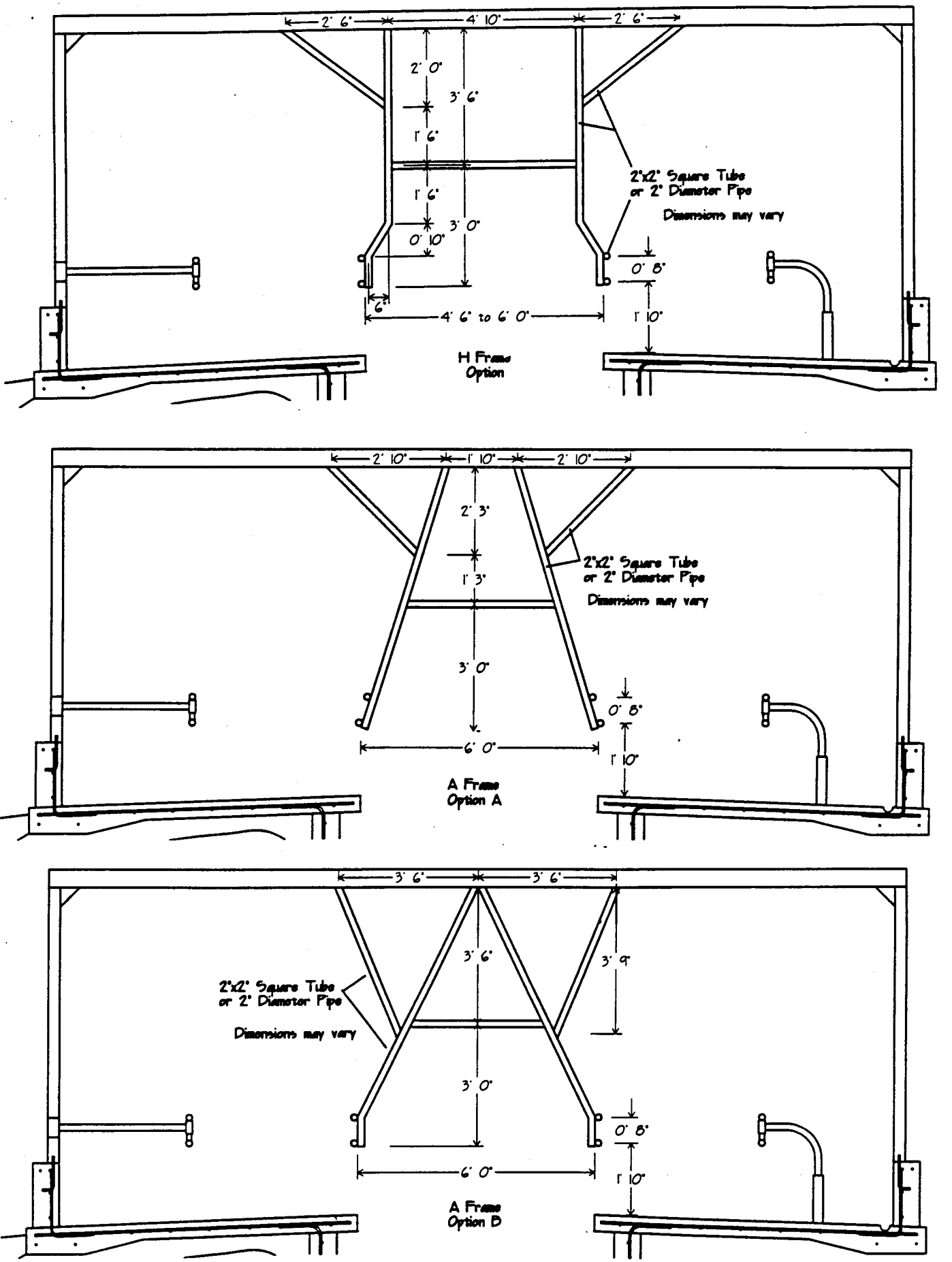

Figure 4. Frame Options