PIPELINE DESIGN PROCEDURE

Information to collect

1) Type of Livestock: _____

2) Number of Livestock: _____

3) Water needed: gal / day / head: (2) (4) (15) (20) (25) (_____) **Circle one**

Compute Minimum Flow Rate[1] (item 2 x item 3) ÷ (60 x 8) = _____ gal / min

4) Grazing months: From _____ To _____

5) Type of stock tank shut off: (Manual) (Float) **Circle one**

6) Stock tank Size: _____ gal

7) Sketch possible pipeline route on plan map or USGS topographic map.

8) Utilities Present (Yes) (No) **Circle one**

9) Existing Pressure Tank: (Yes) (No) **Circle one**

Size _____ Gal

On Pressure _____ PSI

Off Pressure _____ PSI

10) Other information if new well will be constructed, a new pressure tank is installed, or expansion of herd is planned.

Pump Capacity: _____ Gal / Min

Other uses of the well:
household: _____ (35 - 50 gal/day/person)
farm: _____
milkhouse: _____
other: _____

Total Gal/Day: _____

Source of Information (Circle One)
Ground Water Handbook
Landowner
AWMFH Chapter 10

_____

_____

_____

[1] 8 Hours used for calculation. Assumption is that cattle will place peak demand during these hours. Actual hours range between 8 and 12.

PROCEDURE FOR DETERMINING EXISTING PUMP CAPACITY OF SYSTEM

No water should be used by the operator during this process.

1) Open any faucet and run until the pump turns "on". This should cause the pressure tank to be at minimum pressure.

2) Close the faucet and let the pump fill the pressure tank and it turns "off". The pressure tank is now recharged and should be at the maximum pressure set by the pressure switch.

3) Open the faucet closest to the pressure tank and collect all the water discharged until the pump turns "on". This is the water volume provided by the pressure tank.

4) When the pump turns "on" close the faucet and start timing the pump cycle. (Pump "on" to pump "off") This is the time it takes the pump to fill the pressure tank, also called the “pumping time per cycle”.

5) Record the pumping time per cycle. _____ seconds

6) Measure the gallons collected in step 3. _____ gal

7) Average pumping capacity: (item 6 ÷ item 5) x 60 = _____ gal / min

Example:

9 gals collected in 72 seconds (1 min 12 sec)

(9 ÷ 72) x 60 = 7.5 gal / min (average)

PRESSURE TANK DESIGN PROCEDURE EXAMPLE

The Desired Outcome:
Provide a pressure tank which will cause the pump to recycle not more that 6 times per hour when pumping the average rate needed to supply the maximum daily use.

What pressure tank size is needed for an average pump rate of 14 gal / min
and given pressure tank settings of: 50 psi on, 70 psi off ?

Max daily use:
175 beef cows at (15 gal / day / head) = 2625 gal / day

House 360 gal / day

Total use = 2625 + 360 = 2985 gal / day

Average daily rate[2] 2985 / (10 * 60) = 5 gal / min

Given :
In one cycle inflow = outflow

6 cycle / hour = 10 min / cycle

Then one cycle (10 min) yields 50 gal. (given by 10 min. x average daily rate of 5 gal / min.)

With an average pumping rate of 14 gal / min, one cycle will have 3.6 minutes of pumping and 6.4 minutes of rest. During this 6.4 minutes, the pump rests but water is delivered.

50 gal / 14 gal/min = 3.6 min
10 min – 3.6 min = 6.4 min

Therefore:
6.4 min * 5 gal / min = 32 gal usable storage in the pressure tank.

This needs to be increased by the efficiency of the tank at a given operating pressure range.

(See Figure 1) 50 psi on - 70 psi off gives 23% efficiency

Tank size = 32 / .23 = 139 gal pressure tank required.

Other pressure tank sizing charts and graphs may also be used, like Midwest Plan Service Publications - 14.

[2] 10 Hours used for calculation. Assumption is that cattle will place peak demand during these hours. Actual hours range between 8 and 12.

Figure 1 - Typical Pressure Tank Efficiency (acceptance factor)

Off Pressure	On Pressure - Minimum System Pressure																		
	20	**25**	**30**	**35**	**40**	**45**	**50**	**55**	**60**	**65**	**70**	**75**	**80**	**85**	**90**	**95**	**100**	**105**	**110**
30	0.21																		
35	0.28	0.19																	
40	0.34	0.26	0.17																
45	0.39	0.32	0.24	0.16															
50	0.44	0.37	0.30	0.22	0.15														
55	0.47	0.41	0.34	0.28	0.21	0.14													
60	0.50	0.44	0.38	0.32	0.26	0.19	0.13												
65	0.53	0.48	0.42	0.36	0.30	0.24	0.18	0.12											
70	0.56	0.50	0.45	0.40	0.34	0.29	0.23	0.17	0.11										
75		0.53	0.48	0.43	0.38	0.32	0.27	0.22	0.16	0.11									
80			0.50	0.46	0.41	0.36	0.31	0.26	0.21	0.15	0.10								
85				0.48	0.43	0.39	0.34	0.29	0.24	0.20	0.15	0.10							
90					0.46	0.42	0.37	0.32	0.28	0.23	0.19	0.14	0.09						
95						0.44	0.40	0.35	0.31	0.27	0.22	0.18	0.13	0.09					
100							0.42	0.38	0.34	0.30	0.26	0.21	0.17	0.13	0.09				
105								0.41	0.37	0.33	0.29	0.25	0.20	0.16	0.13	0.08			
110									0.39	0.35	0.31	0.27	0.24	0.20	0.16	0.12	0.08		
115										0.38	0.34	0.30	0.26	0.23	0.19	0.15	0.11	0.08	
120											0.36	0.33	0.29	0.25	0.22	0.18	0.15	0.11	0.07
125												0.35	0.32	0.28	0.25	0.21	0.18	0.14	0.11

Numbers based on the follow equation: P(precharge) = P(on) – 2 psi 14.7 psi is atmospheric pressure at sea level

$$Acceptance\ Factor = \frac{P(precharge) + 14.7}{P(on) + 14.7} - \frac{P(precharge) + 14.7}{P(off) + 14.7}$$

Properly filling and sealing unused well information can be found on the Wisconsin Department of Natural Resources web site for Well Filling and Sealing at:

http://dnr.wi.gov/topic/Wells/FillingSealing.html

State law (as of June 1, 2008) requires that only licensed well drillers or pump installers or their employees may fill and seal unused wells.

The web site contains brochures, publications, and forms for well owners including:

1. WDNR publication DG-016, “Answers to Your Questions on Well Filling and Sealing.”
2. Wisconsin Administrative Code NR 812, “Well Construction and Pump Installation,” which contains Table C, Acceptable Material and Methods for Well Abandonment.
3. Frequently Asked Questions about well Filling and sealing
4. Other useful material.