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Converting Tower Silos for Dry Grain Storage

There are a lot of unused tower silos on farms in the upper Midwest. Can these tower silos that were once used for haylage, silage, or high-moisture grain be converted for storage of dry grain? Yes, many farmers have successfully stored dry grain in tower silos, and you can, too, but you'll have to meet the following challenges in making the conversion.

Make sure the walls will withstand the pressure of dry grain. Dry grain exerts more pressure on walls than does corn silage. Pressure levels can be especially high during unloading from the bottom of the silo if dry grain slides along the sides of the silo as it flows downward. Many newer silos are designed to handle the pressure of dry grain, but some older ones are not. You can use the information in tables 1 and 2 to check whether silos have adequate reinforcing rods, but consider that existing rods have probably corroded and weakened over time. Carefully examine the condition of the silo walls and reinforcing rods, and if necessary, contact the manufacturer to find out if the silo is currently strong enough, or can be made strong enough to hold dry grain. Concrete stave silos that have only enough reinforcing rods to handle silage, but are in good physical condition, can usually be filled with dry grain to within 15 ft of the maximum silage depth. Pressures for dry grain and silage should be about the same if the dry grain depth is 15 ft less than the silage depth.

It is important to evaluate wall strength carefully; a number of concrete stave silos in Minnesota have failed during unloading of dry grain. The failures resulted in major property damage and narrow misses for people working around the silo.

Make sure the silo is watertight. First, check the roof and repair or replace it to prevent water leaks. Then, examine the sidewalls for evidence of leaks. It might be possible to plaster the inside of concrete or concrete stave silos that have cracks and leaks. Some farmers have attempted to hang plastic liners inside of silo walls to protect dry grain from moisture; this can work, but it is difficult to keep the plastic in place - especially during unloading. Grain can be stored through winter with silo walls that are in fair condition, but storage beyond spring requires walls that are completely weatherproof. Finally, make sure you have a good floor that is well above the ground surface outside of the silo. If the silo has an earthen floor that is below grade, consider adding fill, putting in a plastic vapor barrier, and pouring a new concrete floor at least several weeks before harvest. (Give the concrete time to cure before you place dry grain on it.)

Develop a plan for filling the silo. Believe it or not, getting grain into silos can be one of the biggest obstacles to their use for dry grain storage. Silage blowers cause a lot of impact damage to grain kernels, so dry grain should not be run through a silage blower unless the grain will be fed relatively soon after harvest. Silage blowers can be modified for use with dry grain by running an auger into the pipe just above the blower, but because silage blowers really throw rather than blow silage, they don't generate much air pressure and the handling capacity (bushels per hour) of modified blowers is very low. Most transport augers will not reach the tops of silos, but you might be able to partially fill silos that have side doors by running an auger into the highest door that the auger will reach. One of the best options for filling silos with dry grain is to use a pneumatic grain conveyor. These types of conveyors are slow and require a lot of power, but they should get dry grain up to the top of a silo with relatively little kernel damage. Pneumatic conveyors can sometimes be rented from equipment dealers, elevators, or other farmers.

Make sure grain is dry enough for storage. Because high fan power is required to blow large quantities of air through deep beds of grain, it is expensive to dry grain in silos. It is probably best to make sure grain is dry enough for the intended storage period before it is moved into the silo. Corn that will be fed through the winter months can be held at up to 18% moisture, but corn to be stored into the following spring should be no more than 15% moisture. Use 14% moisture for corn storage into summer, and 13% for a year or more of storage. Small grains should be about 13% moisture. Soybeans should be about 13% moisture for storage into the following summer, but 11% for a year or more of storage.

Install some type of aeration equipment. Even if grain is dry when moved into the silo, it should still be aerated so that you can control grain temperature to reduce mold and insect activity and to prevent moisture migration. You could install full perforated floors for silo aeration, but you can probably get by just using perforated metal over the unloading trench, or simple perforated ducts. You can also get by with relatively small fans if you design for a low airflow per bushel (0.1 cubic foot of air per minute per bushel of grain (cfm/bu) might be a good target). Either positive pressure (air blowing into bottom of silo) or negative pressure (air pulled out bottom of silo) aeration can be used; either system will work if managed properly. In addition to installing fans and ducts at the bottom of the silo, you'll need to provide some open area at the top to let air in or out of the silo when the fan is running. Provide about one square foot of open area for each 1000 cfm of airflow.

Unload from the center! It is especially important to unload silos from the center so that you don't end up with grain piled higher on one side and uneven wall pressures that can lead to structural damage. Either install a conventional grain-unloading sump in the center of the silo floor, or simply run an unloading auger from one of the lower doors into the center of the silo. Some farmers have had success with inserting an open-ended aeration tube into the center of the silo and then unbolting the fan and sticking an unloading auger in through the aeration tube when it's time to unload the silo.

In some cases, silos are not in a convenient location for dry grain storage, or it turns out that it would be cheaper to build a new metal grain bin rather than convert an old, dilapidated silo. But in many other cases, silo conversion is relatively simple and can provide economical dry grain storage.

This article is also available on the Web at www.bae.umn.edu/extens/postharvest/tempstor.html

Table 1. Reinforcing rods[1] needed for dry grain in concrete stave silos.
(Information comes from the out of print MidWest Plan Service *Structures and Environment Handbook, MWPS-1*.)

Distance from top	Vertical spacing between horizontal rods (in.) Silo diameter (ft)					
(ft)	10	12	14	16	18	20
0 to 5	30	30	30	30	30	30
5 to 10	30	30	30	30	15	15
10 to 15	30	15	15	15	15	15
15 to 20	15	15	15	15	10	10
20 to 25	15	15	15	10	10	10
25 to 30	15	15	10	10	10	7.5
30 to 35	15	10	10	10	7.5	7.5
35 to 40	10	10	7.5	7.5	7.5	6
40 to 45		10	7.5	7.5	6	6
45 to 50		7.5	7.5	6	6	6[2]
50 to 55			6	6	5	6[2]
55 to 60			6	6	5	5[2]

[1] 9/16-in. diameter galvanized steel rods with rolled threads.
[2] 5/8-in. diameter galvanized steel rods with rolled threads.

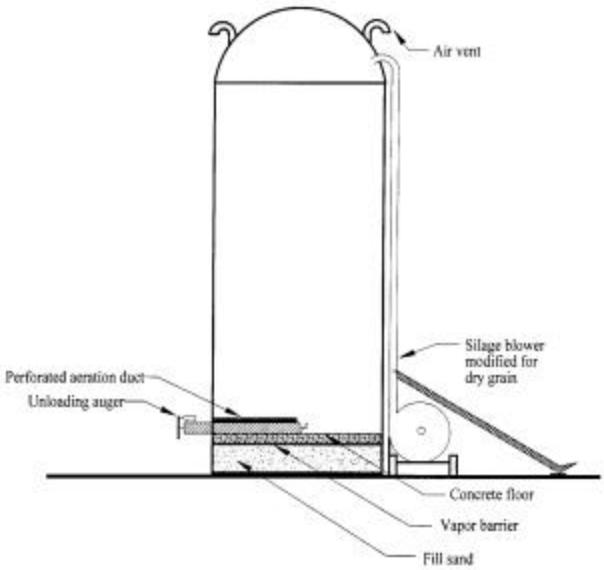

Table 2. Reinforcing rods needed for dry grain in cast-in-place concrete silos.[1]
(Information comes from the out of print MidWest Plan Service *Structures and Environment Handbook, MWPS-1*.)

Distance from top	Vertical spacing between horizontal rods (in) Silo diameter (ft)					
(ft)	10[2]	12[2]	14[2]	16[3]	18[3]	20[3]
0 to 5	24	24	24	24	24	24
5 to 10	24	24	24	24	24	24
10 to 15	24	24	20	24	24	22
15 to 20	22	18	15	20	18	16
20 to 25	17	14	12	17	15	13
25 to 30	14	12	10	14	12	11
30 to 35	12	10	9	12	11	9
35 to 40	10	9	8	10	9	8
40 to 45		8	7	9	8	7
45 to 50		7	6	8	7	6
50 to 55			5	7	6	6
55 to 60			5	7	6	5

[1] It is assumed that silo walls are 6-in. thick and horizontal rods are centered within the walls and overlap 2 ft at splices. In addition to horizontal rods, vertical 3/8-in. diameter rods are needed every 30 in. around the perimeter. If you cannot determine the size and number of rods contained in the wall, it would be wise to add the rods shown in this table outside the wall.
[2] 1/2-in. rods
[3] 5/8-in. rods