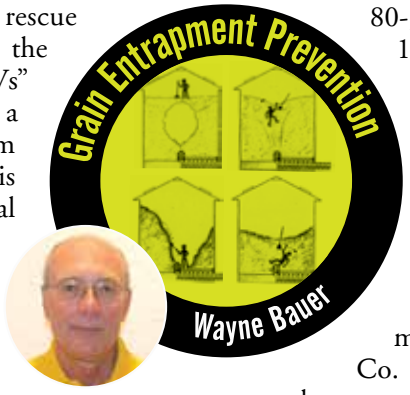
Cutting into Steel Bins

V-SHAPED CUTS MAY NOT BE AS PRACTICAL AS PREVIOUSLY THOUGHT



For years, various rescue groups have suggested the possibility of cutting "Vs" into the sidewalls of a steel bin to reach a victim engulfed in grain. This may not be as practical as it sounds.

Butler Mfg. Co. started building steel bins around 1908. These first bins were only 12 feet in diameter.

Over the course of the past 100 years, steel bins have been getting increasingly larger. The industry has been increasing the diameter and eave height of bins steadily.

Sheet Metal Specs

As a result, structural integrity and wall thickness also has had to increase. Steel bin manufacturers started using better grades of steel and started laminating sheets, which allowed them to build larger bins.

Up to about 1980, the largest steel tanks erected on farms were only 36 feet in diameter. Certain firms started erecting some 42-foot and 48-foot steel bins between 1981 and 1985. Chicago Eastern actually started playing around with 105-foot-diameter bins with unstructured roofs around 1980. Over the next 30 years, up to the present, most of the industry rapidly moved up to 80-, 105-, 132, and even 155-foot steel bins.

In reality, it is probably only practical to even consider cutting into farm bins that are 24 to 48 feet in diameter and have single sheet metal gauges between 9 and 18, if you hope to perform a successful rescue.

The thickness of sheet metal used in the sidewalls increased as the bin diameter and eave height both increased. The engineering department at Sioux Steel Co. pointed out to me how graphically the gauges of sheet metal and the number of sheets used change dramatically as you move from 24 to 42 to 60 to 78 to 105 and, finally, to 132-foot-diameter bins. As you move the eave height from 40 to 88 feet or more, the wall thickness must increase, as well.

You will notice that the wall thickness changes for most bins along the lines shown in **Table 1**.

Sioux Steel points out that the eave height will impact the wall thickness,

Method for cutting a "V"-shaped opening into a corrugated steel wall is demonstrated during a 2009 bin rescue workshop at Star of the West Milling Co. in Gera, MI. Photos by Ed Zdrojewski.

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as well as the diameter of the bins. For example, on a 78-foot-diameter bin, the wall is a double-laminated sheet metal at 15 tiers in height, and 25-tier bins will have the bottom 11 tiers as double-laminated with 11-13-gauge sheet at the bottom.

In larger bins, The GSI Group may use double-laminated 6-gauge sheets in the bottom, while certain other competitors may use thinner triple-laminated sheets. The type of alloy steel and gauge thickness used will affect both minimum yield strength and minimum tensile strength.

On a 105-foot-diameter bin, a 15-tier bin may have seven tiers of double laminates, and 25-tier bins may have 15 tiers of doubles and two rows of triples. Sheets are 8-11-gauge in the bottom.

As a reference, please note in **Table 2** how the thickness of these gauges vary.

In reality, it is probably only practical to even consider cutting into farm bins that are 24 to 48 feet in diameter and have single sheet metal gauges between 9 and 18 at the bottom, if you hope to perform a successful rescue. It will be much more difficult cutting into bins that are 80 to 105 feet in diameter.

The corrugation pattern in the sheets may vary from 2.66 to 4.0 inches, but this will not be a big consideration of whether you attempt cutting into the sheet or not.

Rules of Thumb

Suggestions relative to cutting Vs

Table 1

Bin	Wall/Sheet Thickness	Sheet Metal
Diameter	At the Bottom Ring	Thickness
24’	single sheet	(15-18 gauge)
42’	single sheet	(10-15 gauge)
60’	single sheet	(8-14 gauge)
78’	double laminated sheets	(11-13 gauge)
105’	double or triple	(8-11 gauge)
132’	triple laminated	----------

Table 2

18 gauge = 0.0478”	10 gauge = 0.1382”
15 gauge = 0.0673”	8 gauge = 0.1681”
12 gauge = 0.1084”	6 gauge = 0.201”
	5 gauge = 0.216”

into steel bins for bin rescue purposes:

1. Never cut simply a single hole for draining grain out of a steel bin.

2. Always cut a minimum of two holes 180 degrees from each other, and attempt to open them together. It will be useful to have a prying device to open these cut Vs. Drain the grain off evenly.

The thickness of sheet metal used in the sidewalls increased as the bin diameter and eave height both increased ... As you move the eave height from 40 to 88 feet or more, the wall thickness must increase, as well.

3. If the tank is over 30 feet in diameter, it would be better to utilize four holes 90 degrees apart.

4. If you are dealing with large-diameter bins, 60 to 105 feet, you may wish to start with two to four holes but end up with six to eight, depending upon the volume of grain you are trying to pull and the time frame you have to do it in. Are you trying to pull 5,000 bushels out or 250,000 bushels? How much time will it take to utilize four-plus openings?

5. Use a layered approach to curring Vs into bins over 12 rings tall, no matter the depth of the victim, in order to protect rescuers from a bin failure. Cut a layer of Vs every six to eight rings down from the top until reaching the bottom. ►

A layered approach is better for the bin structurally and allows the pile of grain to start farther from the bin because of the height and pressure of flow of the top layer.

The new training DVD from the Safety and Technical Rescue Association (SATRA), *Grain Entrapment Prevention and Rescue*, does an excellent job of demonstrating some of the techniques utilized when cutting into bins and mentions the following:

- Avoid cutting within one inch of any bolts.
- Typical sheet metal gauges you may encounter: 12-gauge with a 20,000-bushel bin, 10-gauge with a 35,000-bushel bin, and 8-gauge with a 50,000-bushel bin.
- When dealing with double- or triple-laminated walls, consider using a step cut to cut one sheet at a time.

Cut Size

I would suggest a minimum 30-inch width cut without cutting into additional seams between rings, connection splices, or stiffeners.

I have seen more people using a trapezoid as a pattern as opposed to a simple V or triangle. This cut clearly will let the grain drain out more quickly and potentially give you added room to reach a victim.

Another question you have to ask yourself is where will you move 100,000 to 300,000 bushels of grain? How much time do you have to move this kind of quantity or volume of grain? What are you going to move it with?

How full is the bin? Is it 100%, 75%, or 15% full? Keep in mind that when the center-discharge sump hole in a 105-foot bin is open, you still may have 80,000 to 120,000 bushels of grain in the bin. The normal angle of repose of 21 degrees actually can be much more steep, if the grain moisture level is higher, or the grain has started to spoil.

Today, many larger farms are erecting 48- to 60-foot-diameter bins, while most commercial off-farm grain elevators are erecting 72- to 105-foot-diameter bins or larger.

Bill Field at Purdue University has made the statement that in most cases, you probably want to reconsider cutting into a bin with over 100,000 bushels of grain in it.

I would support that position. How are you going to move 200,000 to 300,000 bushels of grain? How much time will that take? At that point in time, are we talking about an actual rescue or a simple body recovery?

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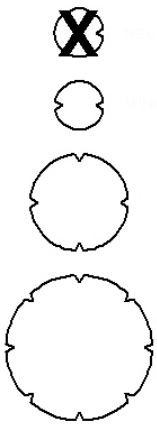
Hole-Cutting Patterns

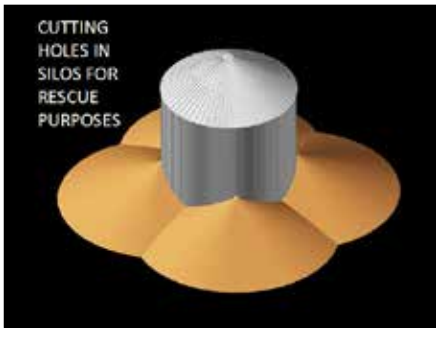


Never cut one hole in a bin

Minimum of 2 holes in bins 20 ft. or bigger, 180° apart

4 holes in 30 ft. bins or bigger, 90° apart

If bin is 60 ft. - 105 ft., start with 2-4 holes, end up with 8-10 holes



The most effective and safest means of emptying grain through steel bin walls is to cut four holes around the tank at exactly 90-degree intervals. Illustration courtesy of SCAFCO Grain Systems Co.