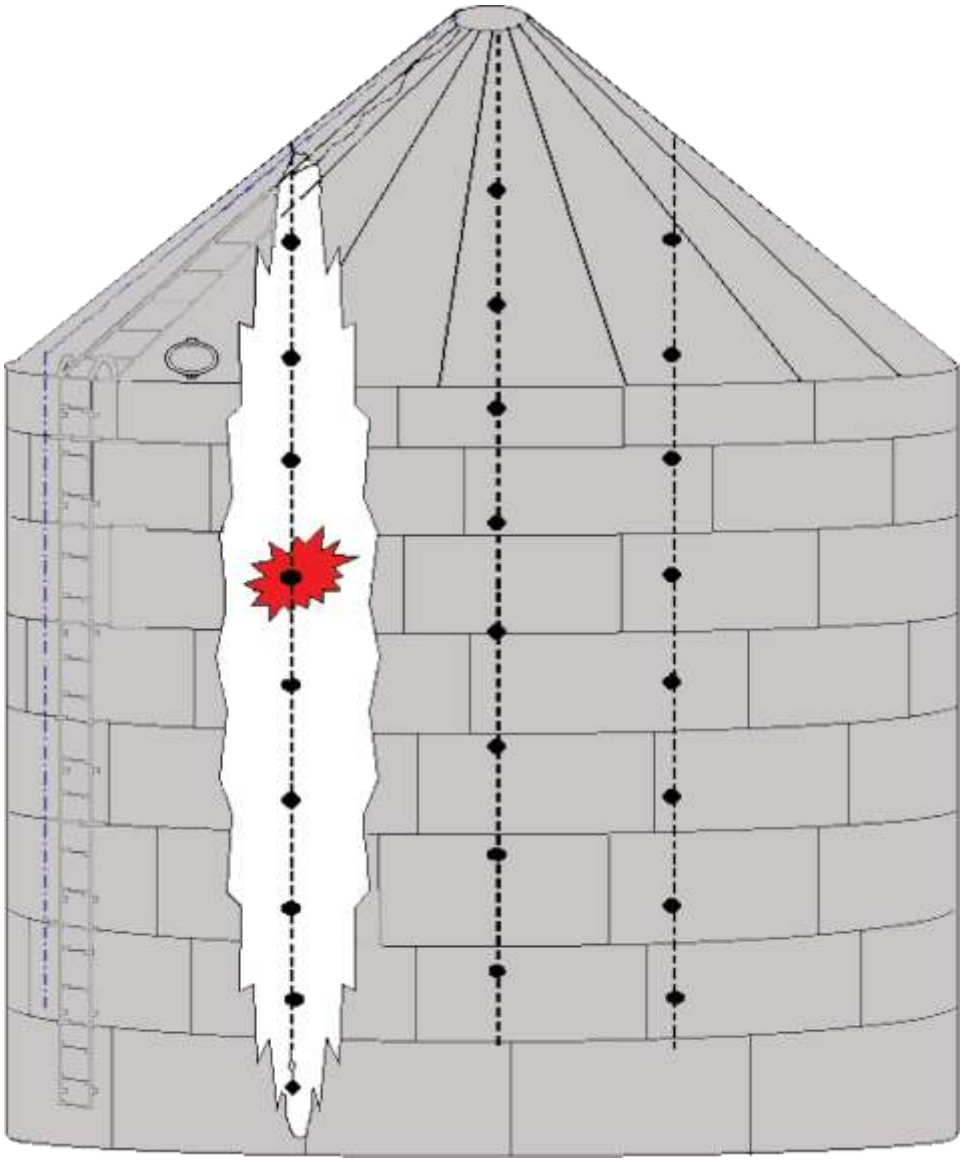
The Vital Link To Preserving Your Profits

Grain Temperature Monitoring Systems



WORLDWIDE SALES • SERVICE • INSTALLATION

TSGC INC

Tri-States Grain Conditioning, Inc.

P.O. Box 468 • 1600-A Hudson Avenue West
Spirit Lake, IA 51360
800-438-8367 • 712-336-0199 • Fax: 712-336-0299
Email: tsgc@TsgcInc.com • www.TsgcInc.com

PRESERVE YOUR PROFITS!

Grain Bin Temperature Monitoring - An Effective Management Tool

CONTROL ENERGY COSTS: 1 HP = 1 KW KW x (KW per hour) x KW per hour cost

Example: 10 HP motor run for 14 days (14 days x 24 hours) @ 10¢ cost = $336.00

Your Operation: _____ x _____ x _____ = _____
HP KW/hour KW/hour cost

The following table can be used as a rule of thumb for warning signals:

WARNING SIGNALS

When grain is reading	a rise of	is a warning
➤ **40º**	➤ **3º**	
➤ **50º**	➤ **5º**	
➤ **60º**	➤ **7º**	
➤ **70º**	➤ **9º**	
➤ **80º**	➤ **10º**	
➤ **90º**	➤ **11º**	
➤ **100º**	➤ **13º**	

WARNING SIGNALS

IMPORTANT: ***Any*** **rapid rise of temperature in a given location in the grain mass - no matter how small - is an indication that trouble is developing. The greater the rise within a given time, the greater the immediate danger.**

AERATION

- Aeration is essential for dry grain storage.
- An aeration system moves air through grain to control grain temperature and reduce biological activity.
- An aeration cycle is the time it takes to change the temperature of all the grain.
- Fall Aeration - cool grain to recommended temperature for your geographic location.
- Record Grain Temperature - grain temperature should be within 10 – 15° of the average outside air temperature, if not, start aeration cycle ***immediately.*** Operate aeration fans long enough to cool all grain or spoilage may occur.
- Number and Length of Cooling Cycles - depends on fan capacity, when grain was binned, at what temperature grain was binned, how fast average air temperature cools during the fall, how fast average air temperature warms during the spring.

- **To Be Sure of Complete Cooling or Warming Cycle, *You Must Monitor the Change in Grain Temperature***

- **Check Stored Grain Weekly During Critical Times**
  - Fall – cooling cycle
  - Winter - check every two weeks
  - Spring - warming cycle
  - Summer - during hot weeks

TEMPERATURE CABLES WILL TAKE THE GUESSWORK OUT OF THE AERATION PROCESS AND HELP YOU CONTROL YOUR ENERGY COSTS.

TSGC, Inc. 800-438-8367 www.TsgcInc.com

INITIAL COST PER BUSHEL

TSGC markets a complete line of grain temperature monitoring systems to fit any size facility or budget and would be happy to provide you with a custom quote for your operation. The information below is for demonstration purposes only.

18’ Diameter x 40’ Eave x 45’ Peak - 8,900 Bushels

1 Cable	*M.S.R.P.	$295	**$.033/Bushel**

24’ Diameter x 40’ Eave x 47’ Peak - 16,000 Bushels

1 Cable	*M.S.R.P.	$299	**$.018/Bushel**
3 Cables	*M.S.R.P.	$857	**$.053/Bushel**

30’ Diameter x 40’ Eave x 49’ Peak - 25,000 Bushels

1 Cable	*M.S.R.P.	$408	**$.016/Bushel**
3 Cables	*M.S.R.P.	$863	**$.034/Bushel**

36’ Diameter x 32’ Eave x 43’ Peak - 30,000 Bushels

1 Cable	*M.S.R.P.	$292	**$.009/Bushel**
3 Cables	*M.S.R.P.	$824	**$.028/Bushel**

42’ Diameter x 37’ Eave x 50’ Peak - 47,000 Bushels

1 Cable	*M.S.R.P.	$414	**$.009/Bushel**
3 Cables	*M.S.R.P.	$863	**$.018/Bushel**
5 Cables	*M.S.R.P.	$1,545	**$.033/Bushel**

48’ Diameter x 37’ Eave x 51’ Peak - 62,000 Bushels

1 Cable	*M.S.R.P.	$419	**$.007/Bushel**
3 Cables	*M.S.R.P.	$875	**$.014/Bushel**
7 Cables	*M.S.R.P.	$2,048	**$.033/Bushel**

60’ Diameter x 45’ Eave x 61’ Peak - 116,000 Bushels

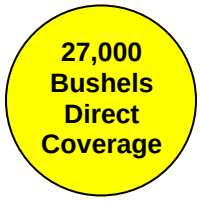
1 Cable	*M.S.R.P.	$445	**$.004/Bushel**
6 Cables	*M.S.R.P.	$2,405	**$.020/Bushel**
11 Cables	*M.S.R.P.	$4,240	**$.036/Bushel**

*** ALL PRICES AND COSTS ARE BASED ON MANUFACTURER’S SUGGESTED RETAIL PRICES**
PRICES ARE SUBJECT TO CHANGE WITHOUT NOTICE

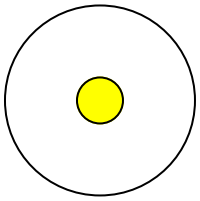
TSGC is one of the world’s largest suppliers of top-quality grain temperature monitoring products, marketed worldwide.

36’ Diameter x 30’ Eave x 40’ Peak
27,000 Bushels

3 Temperature Cables 100% Direct Coverage



1 Temperature Cable 23% Direct Coverage

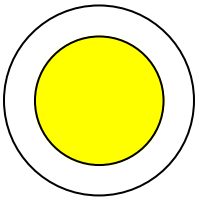


8,740 Bushels
Direct Coverage

42’ Diameter x 33’ Eave x 45’ Peak
42,000 Bushels

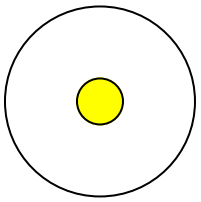
5 Temperature Cables 100% Direct Coverage

3 Temperature Cables 68% Direct Coverage



28,560 Bushels
Direct Coverage

1 Temperature Cable 23% Direct Coverage

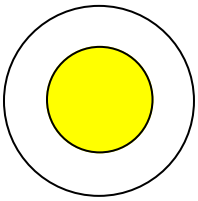


9,660 Bushels
Direct Coverage

48’ Diameter x 36’ Eave x 51’ Peak
60,000 Bushels

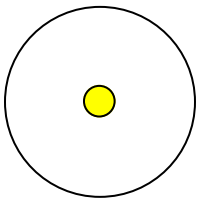
7 Temperature Cables 100% Direct Coverage

3 Temperature Cables 56% Direct Coverage



33,600 Bushels
Direct Coverage

1 Temperature Cable 17% Direct Coverage

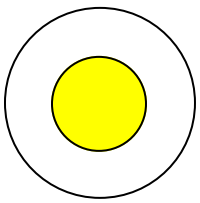


10,200 Bushels
Direct Coverage

60’ Diameter x 44’ Eave x 66’ Peak
105,000 Bushels

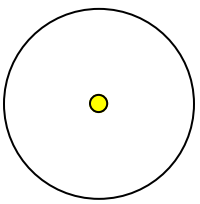
11 Temperature Cables 100% Direct Coverage

5 Temperature Cables 50% Direct Coverage



52,500 Bushels
Direct Coverage

1 Temperature Cable 10% Direct Coverage



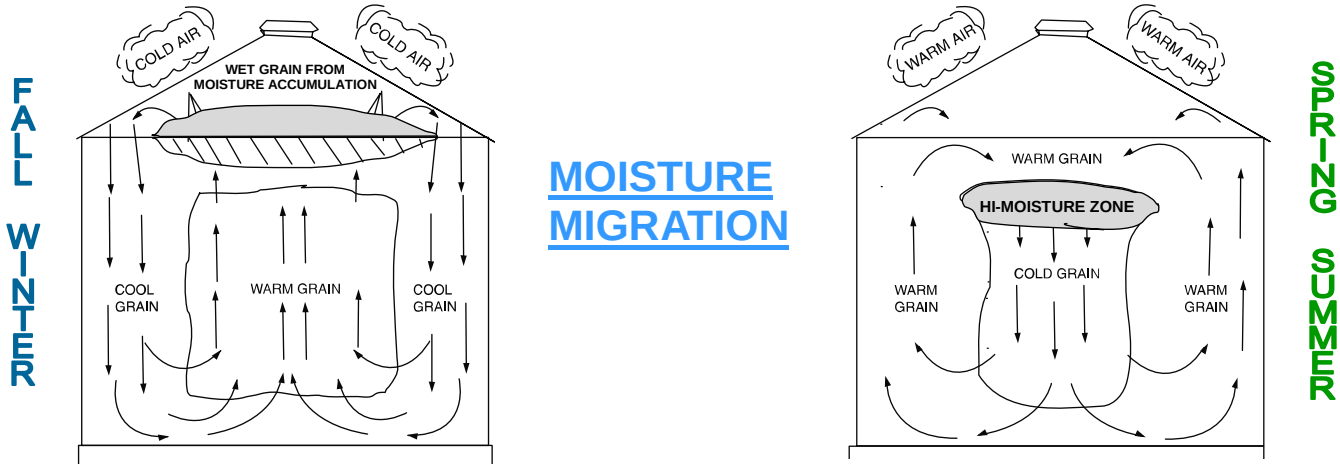
10,500 Bushels
Direct Coverage

7 IMPORTANT REASONS WHY GRAIN MANAGERS USE TEMPERATURE MONITORING

1. Maximum energy efficiency of aeration systems.
2. Provides accurate information for safe, long term storage.
3. Alerts managers more quickly to changing grain conditions.
4. Helps keep grain in highest quality condition.
5. Detection of mold growth.
6. Detection of insect activity.
7. Monitors the effectiveness of fumigation.

TEMPERATURE MONITORING

Temperature records help the grain manager to react quickly to changes occurring within the grain. Whether grain is warm or cool, changes in temperature can be the first sign of potential problems.



Grain is a very good insulator, thus the center stays warmer longer. Moisture migration may occur in any storage tank. It is caused by differences in grain air temperatures. Air currents always take the path of least resistance. In the Fall, the cold air on the outside of the bin, (cold air is heavier), pushes the warmer air into the center of the bin where it moves upward and eventually encounters the cool air at the top. This results in condensation and crusting. The opposite may take place in the Spring and Summer, with condensation and spoilage occurring at the bottom of the bin. Temperature monitoring cables provide the information needed to help keep temperatures uniform throughout the bin, eliminating moisture migration.

MOLD ACTIVITY

All stored grain is infected to a certain extent with various types of mold. Moisture and temperature will stimulate mold growth and lower the quality of stored grain. Poor quality grain, i.e. cracks or harvest damage, is more susceptible to mold activity.

INFESTATION

Insect activity always increases the temperature of stored grain. Insect reproduction accelerates in warm grain. Infestations may be arrested with fumigates, however, practically all insects become dormant when subject to low temperatures.

QUALITY GRAIN

The Key to Reducing Livestock Production Costs

Changes in the marketplace are placing greater importance on having quality stored grain. Much of a farmer's grain profitability will be based on the condition of the grain.

As our population grows and the demand for food products increases, grain quality becomes even more important. Poultry, livestock and dairy industries utilize vast amounts of feed grains. Animal feed must be of high quality to ensure a wholesome supply of meat, milk and eggs. Knowing the condition of grain is a very important part of the farming operation due to the cost of land and the price of grain.

Farmers are faced with many challenges in managing grain. Every year is different, based on many variables. What can you do as a feed grain producer? You can *hope* that months after harvest your grain will be of high quality. Or you can have peace of mind through the storage season by using technology such as grain temperature monitoring. Temperature control is one thing you can do something about. *"More grain goes out of condition because temperatures are not controlled than for any other reason."* (University of Purdue)

Monitoring the temperature of stored grain can detect hot spots, keep mold activity to a minimum, and ward off insect infestations. It also helps to keep kernel quality good while maximizing feed value. Temperature monitoring alerts the farmer to adverse conditions so remedial action can be taken, i.e. aeration or moving the grain.

Today's farmers are using technology more and more to increase yields in their fields. Grain temperature monitoring technology provides accurate information for safe storage and helps keep grain in the highest quality condition.

TSGC INC

SELLING CORN FOR ETHANOL

Ethanol plants are not an outlet for substandard corn. Yes, all corn can be turned into ethanol, but corn quality affects the ethanol yield and, to a lesser extent, the quality of the feed co-products.

For example, if the corn is 10% damaged, the conversion ratio will be diminished considerably. An equivalent 10% reduction in the plant's corn-ethanol conversion ratio can feasibly reduce plant profitability by 56 cents per bushel under current market conditions. When you consider a 45-million-gallon ethanol plant grinds approximately 1.45 million bushels per month, such losses can be catastrophic.

Does your damaged corn still make ethanol? Yes, but not nearly as much. As the industry matures and is better able to put exact numbers to this, discounts will increase.

Keep in mind, ethanol plants run 24-7, and the energy and expense to grind a bushel of corn does not vary with quality. The plant has no incentive to buy poor-quality corn. Unlike a grain dealer or an exporter, no amount of blending will hide the detrimental effects of poor quality.

If you plug up our system (wet corn, for instance), you put yourself at serious financial risk. Specifically, high-moisture corn doesn't grind well through a hammer mill. If a plant isn't grinding, it isn't making ethanol. A 45-million-gallon plant grinds two semi loads per hour and produces 2,500 gallons per load of corn. If your load causes just an hour of downtime, you could be liable for 5,000 gallons of lost products at $2 per gallon, or $10,000 of lost ethanol production. That doesn't even count the costs of fixing the equipment. You may think you're "putting it to the man". But as an owner, you are the man.

Source: Excerpts from "Selling Corn For Ethanol" article in Successful Farming, 2006. Matt Gerhold is commodity manager/grain buyer for Northeast Missouri Grain, a farmer-owned ethanol co-op at Macon, Missouri.

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Grain Management Update

Every growing season presents many challenges - from sky rocketing input costs to extreme weather. Unfortunately, we don't have much control over either of these factors. But when harvest begins, managing your stored grain properly is something you can control. Healthy grain can be the difference between a successful or not so successful year. The following information and examples demonstrate how incorporating temperature cables and a grain temperature monitoring system can help add to your bottom line, not only for this year, but for years to come.

Natural Air Drying & Storage

With increasing energy costs and the dry down capabilities of today's hybrids, many producers are harvesting 16 to 20% corn. The following charts provide you with information on storage life and equilibrium moisture content for corn and soybeans.

Grain will deteriorate faster as temperature and moisture content increase. Using corn as an example, the table below illustrates how fast grain can spoil even with proper aeration. Knowing temperature is vital.

Allowable Storage Time in Days for Shelled Corn

Corn Temp	Moisture Content* 15%	18%	20%	22%	24%	26%
35°	1174	242	120	71	48	35
40°	879	181	90	53	36	26
50°	492	101	50	30	20	15
60°	275	57	28	17	11	8

**Based on USDA research at Iowa State University - 0.5% dry matter decomposition.*

Corn is a perishable commodity with a limited shelf life that depends on the moisture content and temperature. "Shelf Life" is the length of time good quality, aerated shelled corn can be stored before losing 1/2% of dry matter. With this amount of dry matter decomposition, it is assumed that the corn loses some quality, but maintains its market grade. **For each 10°F increase in temperature, storage time is cut in about half when held at a given moisture content.** By knowing and controlling temperature, you can extend your storage time.

Equilibrium Moisture Content

Grain Moisture Content will change with the relative humidity of the surrounding air. The following Equilibrium Moisture Values chart shows the relationship between the moisture content of corn at various temperature and relative humidity.

Under certain conditions, no matter how long the fan is operated, the grain may not reach the desired moisture content that will allow it to be stored without spoilage. Keep in mind, the air temperature and relative humidity are not constant; however, use the daily average to determine the final moisture content.

Knowing temperature is vital to prevent over-drying and help reduce shrink and energy costs.

Equilibrium Moisture Values

Temp	20% C	20% SB	40% C	40% SB	60% C	60% SB	80% C	80% SB
40°	9.2	4.6	11.9	8.1	14.5	11.5	17.9	16.0
50°	8.5	4.2	11.2	7.8	13.8	11.2	17.3	15.7
60°	7.9	3.9	10.6	7.5	13.3	11.0	16.8	15.4
70°	7.3	3.6	10.0	7.2	12.7	10.7	16.3	15.2
80°	6.7	3.3	9.6	6.9	12.3	10.4	15.9	15.0

(C=shelled yellow dent corn; SB = soybeans)

Example

A farmer fills his 40,000 bushel bin. His goal is 15% moisture. He wants to make sure that the bin is cool so the grain stays in shape so he runs his fans until he *thinks* its cool. He is surprised when he unloads the bin and the corn is 12% moisture. What did not monitoring grain temperature cost him? See below:

OVERDRYING NET LOSS
15% to 12%

$$\frac{15.0 - 12}{100 - 12} = \frac{3}{88} \times 100 = 3.41\% \text{ Shrink}$$

.0341 x 1,000 BU = 34.1BU/1000 BU

34.1BU x 40 (40,000) = 1,364 BU

1,364BU x $4.00 =	$5,456
Energy Cost Running Fans	$ 336
Loss	$5,792

$ 5,792 / 40,000BU = 14.5¢/BU LOST or $5,800

Using a grain temperature monitoring system would have afforded this grower the opportunity to make an additional $14.5¢ BU.

APPROXIMATE GRAIN COOLING OR WARMING

Airflow Rate CFM/BU	Fall Cooling Hours	Winter Cooling Hours	Spring Cooling Hours
1/20	300	400	240
1/10	150	200	120
1/5	75	100	60
1/4	60	80	48
1/3	45	61	36
1/2	30	40	24
3/4	20	27	16
1	12	16	10
1 1/4	12	16	10
1 1/2	10	13	8

Be sure to continue each aeration cycle until the cooling front has moved completely through the grain. The table on the left shows the length of time required to change grain temperature. To be sure the cooling front has passed through the grain, check the grain and air temperature with a temperature cable system.

MY STORAGE

BIN	DIAMETER	BU	FAN SIZE	CFM	COMMENTS
Example Home Place	36′	27,000	10HP	1/5	Needs 3 temp cables - air dry bin.

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