TSGC INC.

PRODUCT INFORMATION
FOR

Console Instrument

TEMPERATURE DETECTION SYSTEM

Tri-States Grain Conditioning, Inc.

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SALES ◆ SERVICE ◆ INSTALLATION ◆ MANUFACTURING

INTRODUCTION

TSGC, Inc. offers a complete line of grain temperature monitoring equipment and instrumentation. This complete line of equipment allows us to approach each requirement with practical and versatile solutions. Our extensive background and continuous research and development programs enable us to offer *cost-effective* and *user-oriented* solutions. This packet provides information about yet another example of TSGC's innovative programs: Reliable and cost-effective Grain Temperature Monitoring for *on-the-farm* or for *commercial* storage.

UNDERSTANDING THE USES OF GRAIN TEMPERATURE DETECTION SYSTEMS

A knowledge of the causes of deterioration and spoilage in stored grain is essential to those who store grain. Although more is yet to be learned, grain professionals and scientific researchers have jointly produced much sound information with which to work.

Stored grain is constantly threatened by the hazards of insect manifestation, mold activity, and moisture migration. When grain goes out of condition, regardless of the cause, there is almost always an unusual rise in temperature in the critical area. Given this factor, we can see that it is imperative that the grain manager has complete, accurate and up-to-date grain temperature information. ***Temperature detection monitoring*** is the only accurate indication of the conditioning inside a stored grain mass.

With the proper use and understanding of such systems, the chances of excessive damage are greatly minimized and, in most cases, non-existent. However, it is necessary for the operator to properly gather, interpret, and evaluate the information given by the system and, if necessary, implement the proper steps to alleviate the problem. These steps may include aerating, fumigating, and/or turning the problem area(s).

THERMOCOUPLE SENSOR THEORY

One of the most widely used temperature sensors available today is the **thermocouple sensor.** In its simplest form, a thermocouple consists of two dissimilar metals bonded together to form a connection; in this case, copper and constantan. Constantan is a copper/nickel alloy.

When these two metals are joined together, they create a voltage. This voltage will vary with the temperature that surrounds it. The voltage is then converted into temperature form and digitally displayed on the portable instrument.

HOW DOES THE CONSOLE SYSTEM WORK?

There are basically three parts to a console grain temperature system:

1. Thermocouple Cable
2. Leadwire (or extension wire)
3. Remote Switches
4. Console Instrument

The first part consists of a **thermocouple sensing cable** with thermocouples (or sensors) spaced 5, 6,7 or 8 feet apart. This cable is suspended from the roof of the bin and extends to 3 ft. above the floor; then it is connected to the **remote switch** by the

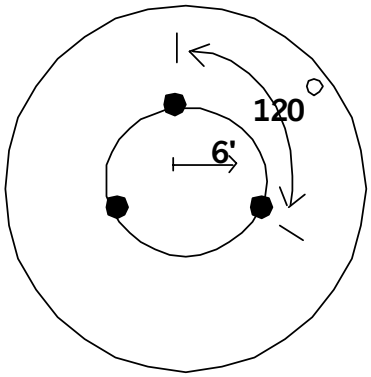
leadwire, often called extension wire. The **console instrument** is generally located in the office or just about anywhere that you might like it. The remote switch contains the multiplexing cards that make it possible to read the temperature of the grain with the **thermocouple sensing cables.**

The thermocouple sensors that are built into the cables read out to an approximate 10 foot radius. The *number of **cables*** in a bin is determined by the bin's diameter. The *number of **thermocouples*** on a given cable is determined by its length. Generally, a cable for a farm bin will have a maximum of six (6) readings with larger, commercial bins having up to 18 readings. The number one thermocouple is located approximately one foot from the bottom of the cable. The cables read from bottom to top.

In bins less than 20 ft. diameter, a single cable installed in the center of the bin is adequate coverage. (In larger diameter bins, multiple cables are recommended; but depending on roof strength, multiple cables may not be possible). A single center cable can and should be installed in every bin, as this is where the greatest concentration of foreign material would be expected to accumulate, creating the most problems. The chart below is an example of how many cables per bin are recommended, based on diameter of bins.

Recommended Round Tank Temperature Cable Pattern (No. of Cables)

EXAMPLE: 30' BIN TOP VIEW



TANK DIAMETER	TOTAL CABLES	CENTER CABLES	RADIUS FT.	RADIUS NO.	RADIUS DEG.
20'	1	1			
24'	3	0	4	3	120
27'	3	0	5	3	120
30'	3	0	6	3	120
33'	3	0	8	3	120
36'	3	0	8	3	120
40'	4	1	10	3	120
42'	5	1	11	4	90
48'	7	1	16	6	60

OPERATING INSTRUCTIONS

SYSTEM OPERATION

Temperature readings should be taken at regular intervals. The frequency of reading can depend on many things; including type of grain being stored, grain condition, location, and time of year. The temperatures should be logged and maintained as a semi-permanent record to be reviewed for abnormal changes and comparisons of previously recorded temperatures. A log book is provided with each console instrument. *(See example below.)*

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

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712-336-0199
SPIRIT LAKE, IOWA 51360

GRAIN TEMPERATURE RECORD

THERMOCOUPLES ARE NUMBERED FROM BOTTOM TO TOP

BIN NO. 1 TC SPACING (FT.) 5
CABLE NO 1 REMARKS: 31 ft. Cable

DATE	1	2	3	4	5	6	7	8	9	10	11	12	OUTSIDE TEMP.
11/15/95	34	34	35	35	35	34							
11/27/95	33	34	34	35	37	35							
11/29/95	34	34	34	36	40	35							

SAMPLE

Cable #1 indicates a possible hot spot on the #5 TC

WARNING SIGNALS

(**NOTE:** *The following temperatures are shown in Fahrenheit.*)

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

IMPORTANT: <u>Any</u> 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.

DETERMINING THE LOCATION OF A TROUBLE SPOT

Locating a trouble spot is rather simple if the following instructions are followed. The cable number, its location, and the thermocouple spacing must be known.

1. Multiply the thermocouple number with the trouble spot by the thermocouple spacing.

2. Deduct one spacing.

3. Add 3 ft. (this is the approximate distance the cable should be off the floor of the bin).

   EXAMPLE: Using the information from the log sheet (example on previous page):
   #5 thermocouple is reading hot

   #5 T/C **X** 5 ft. spacing **=** 25 ft. **-** 5 ft. **+** 3 ft. **=** 23 ft.
   The *trouble spot* is approximately 23 ft. up from the bottom.

HIGH MOISTURE
GRAIN TEMPERATURE MONITORING

1) Read temperatures 3 (three) times per week, (*i.e.,* Monday, Wednesday, and Friday.)

2) Read temperatures approximately the same time each day, preferably 8:00 A.M. to 10:00 A.M.

3) Record temperatures accurately with each cable on its own record sheet. This will greatly increase the possibility of finding potential problems should the grain begin to go out of condition.

4) If the aeration fans are being used, turn off the fans 6 (six) hours **prior** to reading the temperatures. This will give an accurate temperature reading of the grain, rather than the likelihood of reading the temperature of the air flowing through the grain.

CONSOLE
OPERATING INSTRUCTIONS

There are three control knobs on the front of the instrument. The first from the left is "SECTION". This is used to turn on the specific "REMOTE SWITCH" desired.

The second control knob—"CABLE" —is used to dial in a particular cable.

The third control knob—"T/C"—is used to dial in a particular thermocouple in whichever cable may be dialed in.

As you turn the T/C knob you will notice that the digital display to the right of the knobs will sometimes change to different numbers, the numbers displayed are the temperatures of the grain on the particular cable and T/C that are dialed in. These temperatures can be recorded on the record sheets provided with this console instrument. Use these recorded temperatures by comparing them with past temperatures to watch for temperature rises.