

Current Report

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COTTON CLASSING IN OKLAHOMA

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Cotton fiber quality is influenced by genetics (i.e., varietal differences), by environment (weather conditions, irrigation, etc.), and by interactions between them. Fiber of higher quality can be used to manufacture more valuable products than can fiber of poorer quality. Such fiber requires a higher level of management and is more costly to produce. Without some means to identify higher quality cotton and to reward its production, the marketing system would encourage mediocre cotton. Cotton classing is the mechanism, developed over time, to identify degree of quality for selected fiber characteristics of economic importance. The price differentials paid for cottons of differing qualities provide the reward. The size of that reward influences to a large extent the quantities and qualities of cotton fiber that will be produced in future years.

Classing's purpose is to determine the average quality of cotton in a bale as represented by a sample of lint taken from that bale. (The standard cotton bale is defined as 480 lbs. of lint plus bagging and ties.) The accuracy of the quality determinations is dependent upon how well the sample represents the bale. Thus, in effect, classing begins when the bale is sampled. The sample is taken by a USDA-licensed sampler (usually the ginner or warehouseman). Three ounces of lint (or slightly more) are traditionally taken from each side of a bale. Many bales are now automatically sampled during ginning. Care is taken to avoid losing contaminants present in the sample and to avoid adding to them. To prevent deterioration, samples should not be excessively dry, overly damp, or exposed to light.

Samples are placed in a container (usually a sack) with a bale identification tag (in bar code) placed between the two halves. The tag contains a "Gin Code Number" and a "Gin Bale Number" for that gin. The gin code number is composed of five digits; the first two numbers identify the classing office, and the last three identify the state and county in which the gin is located. Codes for each gin are assigned by the local classing office. Seven-digit bale numbers are consecutively assigned by the gin. The samples are then delivered to the classing office. After classing has been completed, the samples become the property of the U.S. government.

Cotton classing offices are located in the major cotton producing areas throughout the U.S. Cotton Belt. Cotton classing in Oklahoma has been done for many years in the USDA, Agricultural Marketing Service, Cotton Division Classing Office at Altus. All of the cotton produced in the state, as well as some from Texas and Kansas, is now classed at Altus.

Across the Cotton Belt, the classification of cotton has been undergoing a gradual transition from reliance upon the subjective human senses to the more objective utilization of machines. High Volume Instrument (HVI) testing in the state began in 1982; by 1987, 100% of Oklahoma's cotton was being tested in that manner; by 1991, the goal is to test all U.S. cotton with HVI. Classing information (grade, staple, and micronaire) in the past was traditionally recorded on a "green card". Only micronaire was determined using a machine. Now, classing information (for the above three characteristics plus for fiber color, trash, length, length uniformity, and strength) is being recorded on a "class card" (Figure 1). Only grade is still being determined in the traditional subjective manner. All other traits are being determined by machines. The class cards are computer cards which are readable by machine (holes are punched in them) and by eye (data are printed on them in the appropriate positions).

Upon arrival at the classing office, sample containers are opened; and the fiber is allowed "to condition" [i.e., become adjusted to the temperature ($70^{\circ} \text{F} \pm 1^{\circ}$) and humidity (65% relative humidity $\pm 2\%$) in the office]. Conditioning is necessary because temperature and humidity greatly influence the measurements of fiber length, length uniformity, and strength. The bar codes from the bale identification card for gin code number and gin bale number are read electronically and recorded on the class card. A space entitled "Producer Account Number" comes next on the card, but is not currently being used.

Grade

"Grade" is determined subjectively by the classer on appearance under standard lighting conditions and is based on comparisons with prepared physical and descriptive standards of American upland cotton. Grade is affected by type of weather and length of exposure after the bolls open, by plant characteristics, and by harvesting and ginning practices. Grade is comprised of "Color", "Leaf", and "Preparation".

Color affects the bleaching and dyeing properties of fabric and can cause streaks or unevenness in finished cloth. It is indicative of thin-walled, immature fiber or of some type of fiber damage. Color has three components, i.e., hue, lightness, and chroma. Hue is the name of the color of which five are recognized (white, light spotted, spotted, tinged, and yellow stained). Lightness refers to the lightness vs. darkness of the sample and is defined on a scale of neutral colors (white, gray, and black). Chroma designates the intensity or degree of color.

Leaf is a measure of the trash or foreign matter in the sample. It is an estimate of waste in the manufacturing process. Tiny particles


54000 0000011		51 33 40 11			/24 41 73072 04 103 80				083089				
LOT NO.	GIN SALE NO.	PRODUCER ACCT. NO.	GRADE	LENGTH (in 32nds)	MIKE	GRADE REMARKS	STRENGTH (lb/yard)	COLOR	TRASH	LENGTH (in 100ths)	NECESSITY	WHSE BALE NO.	DATE
U.S. DEPARTMENT OF AGRICULTURE AGRICULTURAL MARKETING SERVICE													
COTTON CLASSIFICATION MEMORANDUM FORM 1 (VII)													
													
<i>Jerry F. Ward</i> CERTIFYING OFFICIAL ALTUS, OKLAHOMA													
<small>FORM 1 (12-7-85)</small>													

Figure 1. Example of a Class Card Utilized in the USDA, AMS, Cotton Division Classing Office at Altus, OK (High Volume Instrument Fiber Measurements Including a Video Trashmeter).

can't be as easily removed from the fiber as can large ones, thus are considered more objectionable. Foreign matter lowers the quality and appearance of fabric. More processing is required to clean dirty cotton (thus adding to manufacturing costs), and each of the mechanical treatments used to remove foreign matter tends to damage the lint in some way. Leaf may be comprised of dry broken bracts, parts of leaves, stems, bark, grass, trash of all kinds, sand, dirt, dust, oil, motes (immature, underdeveloped seed), whole seed, seed coat fragments, hulls, pieces of burs, pieces of boll linings (shale), etc.

Harvesting and ginning preparation estimates the degree of smoothness of the sample. Normal "prep" means less waste and a slightly smoother, more uniform yarn. Stringy, rough, and tangled fiber usually indicates defective or improperly operated gin machinery or the ginning of wet cotton. A "nap" is a large clump of fiber while a "nep" is a small, tangled knot. Neps are considered the more objectionable of the two because they result in greater imperfections in the finished product.

The buyer generally prefers bright, white fiber with no foreign material and no harvesting or ginning damage.

Grades are designated on the class card by two-digit code numbers. The names of the grades (and their standard abbreviations) corresponding to those code numbers are provided in Table 1. To the noncotton person, the grade names at first appear somewhat strange; but they have developed over time and they do accomplish their purpose, that is, to communicate quality between buyer and seller. It's not really important what name is used for each grade so long as everyone concerned knows what is meant by that particular name. These grades are used mainly in the United States and by countries trading with the U.S.

A section on the class card is entitled "Grade Remarks". This section is used to identify reduction and special condition cotton because those items can cause processing problems, lower yarn quality, and/or increase waste. The evaluation of such bales is a matter of judgment. Those bales, referred to as "below grade", are often sold on the basis of a sample from them.

For reduction cotton, codes range from 01 to 74. The first digit of the code refers to the reason for the reduction (i.e., 0 = prep; 1 = bark; 2 = grass; 3 = not used; 4 = oil; 5 = spindle twist; 6 = dust; and 7 = other). The "other" category may be sand, whole seed, parts of seed, motes, stems, honeydew, etc. The second digit indicates the number of grades the bale was reduced. When the second digit is "3" for prep, "gin cut" cotton is indicated. When extraneous matter is one or more steps below grade, the second digit is a "4".

Certain remarks codes are reserved for special condition cotton as listed below:

- 75 - The other side of the bale was two grades higher than indicated in the grade section of the card.
- 78 - Both outsides of the bale were two grades higher than the inside.

Table 1. Grade Code Numbers, Names, and Standard Abbreviations.

Code Numbers	Grade Names	Standard Abbreviations
	<u>WHITE</u> * - 0 for Plus [†] , 1 for Full Grade	
11§	Good Middling	GM
21§	Strict Middling	SM
30	Middling Plus	Mid Plus
31§	Middling	Mid
40	Strict Low Middling Plus	SLM Plus
41§	Strict Low Middling	SLM
50	Low Middling Plus	LM Plus
51§	Low Middling	LM
60	Strict Good Ordinary Plus	SGO Plus
61§	Strict Good Ordinary	SGO
70	Good Ordinary Plus	GO Plus
71§	Good Ordinary	GO
	<u>LIGHT SPOTTED</u> * - 2	
12	Good Middling Light Spotted	GM Lt Sp
22	Strict Middling Light Spotted	SM Lt Sp
32	Middling Light Spotted	Mid Lt Sp
42	Strict Low Middling Light Spotted	SLM Lt Sp
52	Low Middling Light Spotted	LM Lt Sp
62	Strict Good Ordinary Light Spotted	SGO Lt Sp
	<u>SPOTTED</u> * - 3	
13	Good Middling Spotted	GM Sp
23§	Strict Middling Spotted	SM Sp
33§	Middling Spotted	Mid Sp
43§	Strict Low Middling Spotted	SLM Sp
53§	Low Middling Spotted	LM Sp
63§	Strict Good Ordinary Spotted	SGO Sp
	<u>TINGED</u> * - 4	
24	Strict Middling Tinged	SM Tg
34§	Middling Tinged	Mid Tg
44§	Strict Low Middling Tinged	SLM Tg
54§	Low Middling Tinged	LM Tg
	<u>YELLOW STAINED</u> * - 5	
25	Strict Middling Yellow Stained	SM YS
35	Middling Yellow Stained	Mid YS
	<u>LIGHT GRAY</u> [†] - 6	
16	Good Middling Light Gray	GM Lt Gray
26	Strict Middling Light Gray	SM Lt Gray
36	Middling Light Gray	Mid Lt Gray
46	Strict Low Middling Light Gray	SLM Lt Gray
	<u>GRAY</u> [†] - 7	
17	Good Middling Gray	GM Gray
27	Strict Middling Gray	SM Gray
37	Middling Gray	Mid Gray
47	Strict Low Middling Gray	SLM Gray
	<u>BELOW GRADE</u> - 8	
81	Below Grade (Below Good Ordinary)	BG
82	Below Grade (Below Strict Good Ordinary Light Spotted)	BG
83	Below Grade (Below Strict Good Ordinary Spotted)	BG
84	Below Grade (Below Low Middling Tinged)	BG
85	Below Grade (Below Middling Yellow Stained)	BG
87	Below Grade (Below Strict Low Middling Gray)	BG

* Recognized colors of lint.

+ "Plus" indicates a split (intermediate) grade.

† Different combinations of color and leaf than those normally found in the white grades.

§ Grades represented by physical standards; remaining grades are descriptive.

- 80 - Appearance of repacked (i.e., appears that cotton from two or more smaller bales, parts of bales, or miscellaneous samples were baled).
- 81 - Repacked (See code 80.).
- 82 - Appearance of fire damaged (i.e., appears that cotton had been on fire or was exposed to the heat and/or smoke of a fire).
- 83 - Water damaged plate (i.e., an external layer of the bale was damaged by water).
- 84 - Old crop cotton (i.e., cotton from a previous crop year).
- 85 - The average rule was used - Leaf low factor (grade is one level higher than justified by leaf).
- 86 - The average rule was used - Color low factor (grade is one level higher than justified by color).
- 87 - Mixed packed - The other side of the bale was more than two grades higher, more than two color groups difference, or 1/8-inch staple length or longer than indicated.
- 88 - Mixed packed - Same as code 87 except both outsides of the bale were higher.
- 91 - Upland cotton ginned on a roller gin (will look more stringy and lumpy than normal).
- 92 - American Pima cotton ginned on a saw gin (more cutting of fiber and smoother in appearance than normal).

Certain grade codes are also reserved for special condition cotton as listed below:

- 96 - Mixture of upland and American Pima cotton.
- 97 - Fire damaged (See code 82.).
- 98 - Water packed (interior of bale penetrated by water).

Classer's terms reflect the properties of the bale, but not as precise terms. If the two sides of a bale differ by one grade, the lower grade is assigned to the bale as a whole.

Grade Components

Two components of grade (i.e., "Color" and leaf or "Trash") are also measured on instruments and are shown individually on the class card.

Color is measured in terms of grayness and yellowness, and the results are shown on the class card as a two-digit code, followed by a blank space, then followed by two- and three-digit codes without an intervening blank space between them. Discussion of the first two-digit code will temporarily be suspended until the two components of it are considered. The two-digit code after the blank space designates grayness (Rd) or how light vs. dark the sample is. Numbers for Rd usually range from 48% reflectance (darkest) to 82% reflectance (least dark and more desirable). The three-digit code which follows designates yellowness (Hunter's +b). Numbers for +b are shown on the card without decimals and range from 5.0 (least yellow and more desirable) to 17.0 (most yellow). Usually, cotton will have an Rd of 70% or higher and a +b of 9.0 or lower.

Values obtained for Rd and +b are then used in conjunction with Figure 2 on the following page to obtain the first two-digit code which designates the grade ordinarily determined by those two respective color values. For example, a code of "41 73072" would mean that a straight edge connecting Rd values of 73% on the right- and left-hand sides of the figure and that another straight edge connecting +b values of 7.2 at the top and bottom of the figure would intersect in the area of the figure coded as grade 41 (i.e., as Strict Low Middling, a white grade). See Table 1 for the meaning of codes and abbreviations used in the figure.

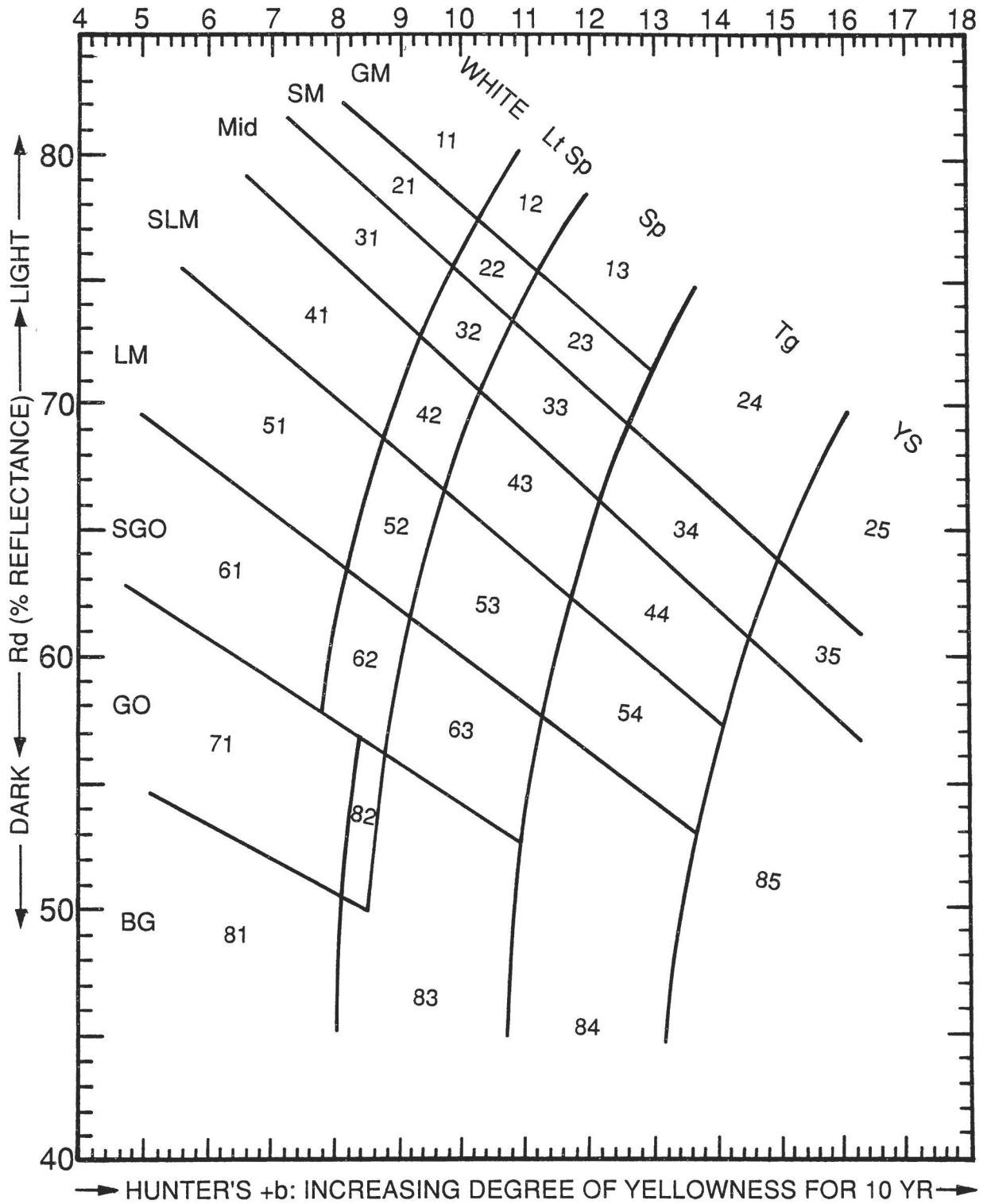
Trash is determined by a video scanner and is expressed as the percent of the sample surface covered by nonlint particles. Percent is given as a two-digit code (without a decimal place). For example, 04 indicates a surface trash level of 0.4%. The scanner can detect trash up to 5.0%. Extraneous matter is included within the trash; and if judged to be sufficient by the classer, it will be identified under "Grade Remarks". The chart below provides typical trashmeter readings for selected grades of upland cotton.

Grade Code Numbers and Names	Trashmeter Readings
21 - Strict Middling	0.1
31 - Middling	0.2
41 - Strict Low Middling	0.4
51 - Low Middling	0.7
61 - Strict Good Ordinary	1.1
71 - Good Ordinary	1.5

Fiber Length

An instrument is now used to measure fiber length; whereas, formerly the trait was determined by the classer. "Length" appears on the card in two places as (1) inches in hundredths (no decimal places shown) as determined on the machine and as (2) the above measurements converted into 32nds of an inch using the conversion chart which follows:

HVI Length (Inches)	Length (32nds)	HVI Length (Inches)	Length (32nds)
0.79 and Below	24	1.11 - 1.13	36
0.80 - 0.85	26	1.14 - 1.17	37
0.86 - 0.89	28	1.18 - 1.20	38
0.90 - 0.92	29	1.21 - 1.23	39
0.93 - 0.95	30	1.24 - 1.26	40
0.96 - 0.98	31	1.27 - 1.29	41
0.99 - 1.01	32	1.30 - 1.32	42
1.02 - 1.04	33	1.33 - 1.35	43
1.05 - 1.07	34	1.36 and Above	44 and Longer
1.08 - 1.10	35		



USDA, AMS,
 COTTON DIVISION
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Figure 2. Color Diagram Based on Universal Standards for Grade of American Upland Cotton. (For Meaning of Numerical Codes and Abbreviations, See Table 1.).

To gain a general idea of what those readings mean, the producer is referred to the chart below:

<u>HVI Length (32nds)</u>	<u>General Level of Length</u>
32 and Below	Very Short
33 - 34	Short
35 - 37	Average
38 - 39	Long
40 and Above	Very Long

Longer fibers generally produce stronger, finer, more durable yarn. The size of yarn spun from cotton is limited to a large degree by length. Long fiber is used to make more valuable products (e.g., shirts, sheets, handkerchiefs, etc.); whereas, shorter fiber is used to make those less valuable (e.g., rugs, blankets, ropes, denims, etc.). Thus, fiber length is one of the most important fiber properties relative to spinning quality.

Uniformity

"Uniformity" on the class card designates length uniformity. The measurements used in its calculation are obtained on the same machine used to measure fiber length. The higher the uniformity, the fewer short fibers in the sample. To gain a general idea of what those readings mean, the producer is referred to the chart below:

<u>HVI Length Uniformity (%)</u>	<u>General Level of Uniformity</u>
76 and Below	Very Low
77 - 79	Low
80 - 82	Average
83 - 85	High
86 and Above	Very High

The lower the uniformity, the more short fibers are removed as waste during manufacturing (especially during combing). Yarn spun from fiber with lower uniformity tends to be thicker in some places, thinner in others, and is more likely to break.

Mike (Fiber Fineness)

An instrument is used to measure fiber fineness vs. coarseness in combination with fiber immaturity vs. maturity. The measurements from it are called "micronaire" or "Mike" for short. Readings are obtained in standard micronaire units and are shown on the card as two-digit numbers (without the usual one decimal place). Micronaire is acceptable anywhere within the range of 3.5 to 4.9. If the fiber is too fine (below 3.5) or too coarse (above 4.9), price penalties are levied. However, the

penalties are generally more severe for micronaires below 3.5 than for those above 4.9.

Low micronaire may indicate an immature fiber. Fine fiber can result in dyeing irregularities (tending toward lighter shades), increased waste in manufacturing (especially during picking and carding), inferior appearance of fabric due to an excessive number of neps, increased difficulty in removing trash, and a greater tendency to break (thus, in effect, reducing fiber length). Fine fibers cause difficulties in manufacturing on the picker and draw frame rolls (particularly with high humidity) as well as on the roving and spinning frame rolls. Finer fibers can be used (within limits) to manufacture finer, stronger yarn. Coarse fibers are easy to clean and card, but they are more difficult to spin. Coarse fibers cannot be spun into fine yarns and have a greater tendency to break.

Fiber Strength

An instrument is used to measure fiber strength in grams-force per tex, i.e., the force required to break a bundle of fibers. (A "tex" is the weight in grams of 1,000 meters of fiber.) To gain a general idea of what those readings mean, the producer is referred to the chart below:

<u>HVI Strength</u> <u>(Grams-Force/Tex)</u>	<u>General Level</u> <u>of Strength</u>
20 and Below	Very Weak
21 - 23	Weak
24 - 26	Average
27 - 29	Strong
30 and Above	Very Strong

The stronger the fiber, the stronger the yarn and fabric that can be made from it. Also, manufacturing costs are reduced with high strength fiber because mill machinery can be operated at higher rates of speed with fewer breaks in the yarn during spinning and weaving. Strong fibers tend to have a higher sheen when dyed than do medium to weak fibers.

Exceeded Limits

Ordinarily, if a bale varies slightly from one side to the other, the lower quality side determines the class of the bale. When the "greater than" (>) or "slash" (/) symbols appear before any HVI measurement (except micronaire) on the class card, the measurements for that fiber character (between the two sides of the bale) exceeded the control limits previously established. When control limits are exceeded in initial testing, the sample is retested; and the results of the remeasurement are printed. If the remeasurements remain outside the control limits, a symbol is printed beside the values indicating the lower side of a two-sided bale. Control limits for the fiber measurements are as follows:

<u>HVI Fiber Measurement</u>	<u>Difference Between Sides of Bale</u>
Grayness (Rd)	7%
Yellowness (+b)	2
Trash	0.4%
Fiber Length	0.06 Inches
Uniformity	5%
Fiber Strength	4 Grams- Force/Tex

Warehouse Bale Number

A space is provided on the class card for a warehouse bale number to be added at a later time. The classing office leaves that space blank.

Date

The date the bale was classed in the classing office is shown. For example, a date of 083089 indicates the bale was classed on August 30, 1989.

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