

PillGradeTM

Automated 3D Pilling & Fuzz Grading System

OPERATION MANUAL



LineTech Industries, Inc.

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SYSTEM REQUIREMENTS

POWER REQUIREMENTS:

Power requirements are to be specified at the time of order and are either 115 VAC @ 60Hz or 230 VAC @ 50Hz.

MINIMAL PC REQUIREMENTS:

DESKTOP PC:

- 5 GB HDD
- 1.5 GHz CPU
- 256MB RAM
- 2x USB ports OR 1x USB port and 1x 9 pin serial port
- 1 on-board IEEE-1394 (firewire) port OR 1 Adaptec PCI IEEE-1394 port
- Windows 2000 or Windows XPPro operating system
- Monitor needs 1024 x 768 resolution or larger

LAPTOP PC:

- 5 GB HDD
- 1.5 GHz CPU
- 256MB RAM
- 2x USB ports OR 1x USB port and 1x 9 pin serial port
- 1 on-board IEEE-1394 (firewire) port
- Windows 2000 or Windows XPPro operating system
- Monitor needs 1024 x 768 resolution or larger

COMPLIANCE TO ASTM & ISO TEST METHODS

PillGrade was developed to provide objective and repeatable pilling assessment measurement and grading in compliance with both ASTM and ISO test methods. PillGrade complies to the following test methods:

Method	Type	Specimen Size	PillGrade Scan Area
ASTM D3512	Random Tumble	4.13" x 4.13"	Center 2.0" x 2.0"
ASTM D4970	Martindale*	Ø1.5"	Center 0.8 x 0.8"
ISO 12945-1	Pilling Box	113mm x 113mm	Center 50mm x 50mm
ISO 12945-2	Martindale	Ø140mm	Center 50mm x 50mm
ASTM D3511	Brush Pilling Tester**	6" x 4.5"	Center 3.3" x 2.0"
ICI	same as ISO 12945-1	113mm x 113mm	Center 50mm x 50mm
BS-5811	same as ISO 12945-1	113mm x 113mm	Center 50mm x 50mm

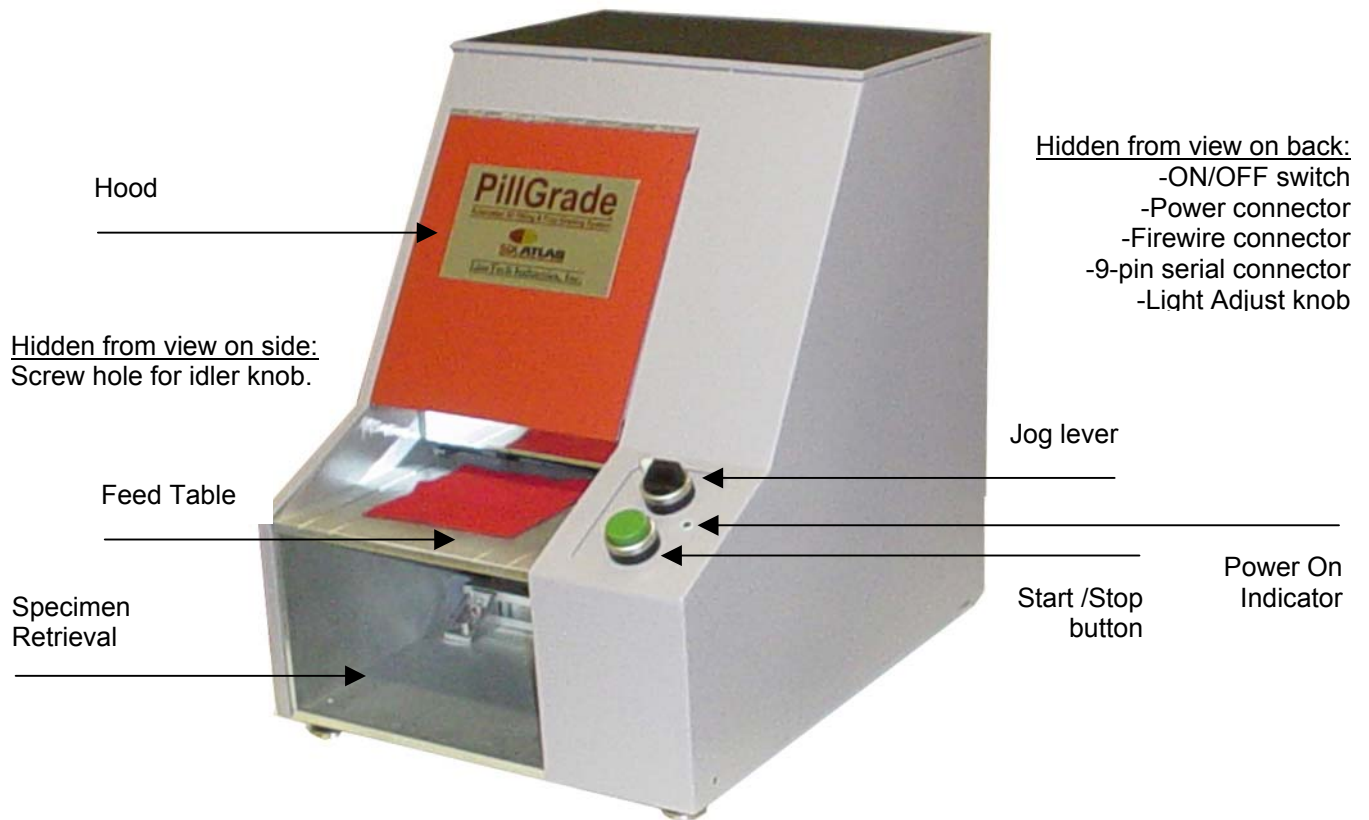
* specimen needs to be attached to carrying fabric.

** specimen needs to be cut down from larger specimen size.

PillGrade complies with the above ASTM and ISO test methods as follows:

- PillGrade outputs repeatable and objective 1.0-5.0 grade results, where 1=severe pilling, 2=distinct pilling, 3=moderate pilling, 4=slight pilling, and 5=no pilling, which also correspond to ASTM's photographic standards.
- The Multiple Specimen Averaging Function allows the user to average up to 4 test specimens as required under ASTM D3512 (3 result average), ASTM D4970 (2 result average) ISO 12945-1 (4 result average) and ISO 12945-2 (4 result average).
- Printouts containing grades and data are used for reporting purposes.

PARTS



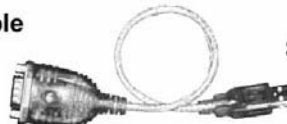
Installation CD
(this CD is specific to the PillGrade system it came with)



Firewire cable



Serial cable



USB-serial adapter
(for use only if the PC does not have a 9-pin serial port)



Firewire adapter
(for use only if the PC only has a 4-pin firewire connector)



Idle knob
(for use only if you run very thick fabrics, which sometimes need a little "kick- start" to get into the rollers)



SW dongle key



Power cable

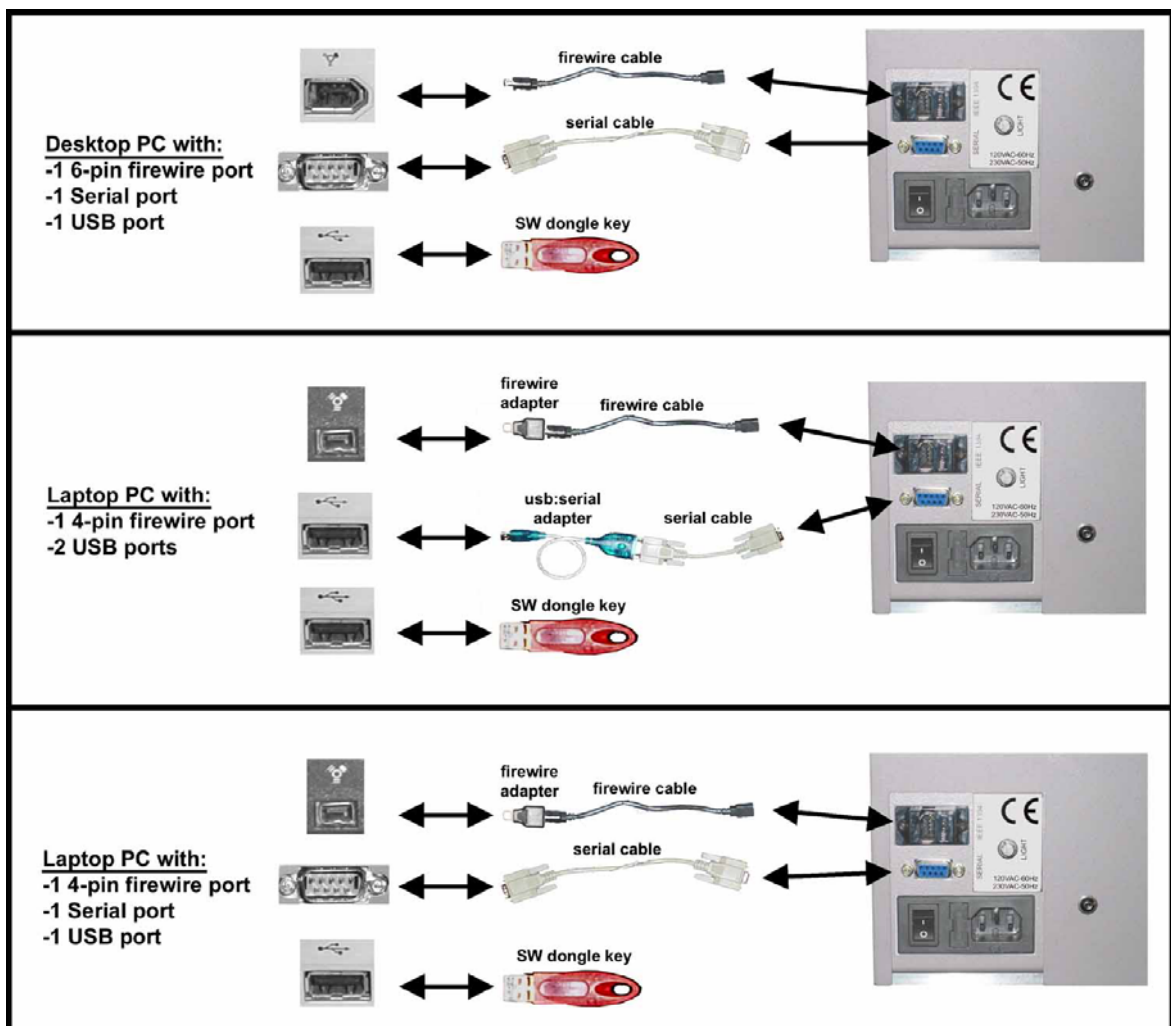
INSTALLATION PROCEDURE

Before connecting any cables to PillGrade, prepare Your PC as follows:

1. Set your display settings to normal fonts (for XP) or small fonts (for W2000), and set your screen area to 1024x768 or larger.
2. Verify that your firewire (IEEE 1394) connection is working properly: On the desktop, right click on My Computer, then click on Properties, then click on the Hardware tab, then click on Device Manager, then find the listing for "IEEE 1394 bus host controller" (or similar), then click on the "+" mark next to this listing to expand the list, then right click on the IEEE 1394 Host Controller (or similar), then click on Properties. Under the section entitled Device Status, the message should read "This device is working properly." If it does not read "This device is working properly, or you cannot locate the IEEE 1394 listing, please contact your technology specialist.
3. If your PC does not have a 9-pin serial port, then install the USB-serial adapter and driver (supplied with the PillGrade) to one of the USB ports.

To Install PillGrade:

1. Turn off both the PC and the PillGrade system. Connect the cables, adapters, and SW dongle key according to your PC type as follows:



2. Connect the firewire cable to the PillGrade system and to the PC. If your PC has only a small 4pin firewire connector, then use the 6pin:4pin firewire adapter (supplied with PillGrade).
3. Connect the 9-pin serial cable to the PillGrade system and to the PC.
4. Connect the USB dongle to your PC.
5. After confirming that the power and frequency indicated on the back panel of the PillGrade system is the same as the power voltage and frequency supplied at the wall outlet, connect the power connector to the PillGrade system and to the outlet. Turn on PillGrade's power switch. PillGrade's Power On Indicator should turn on.
6. Start up your PC, making sure to cancel any auto installation windows that pop up.
7. Insert the PillGrade Installation CD and double-click the file PillGradeSetup.exe and follow the instructions.
8. When prompted by the Sentinel Protection installer, chose "Complete" setup type.
9. If you should see a "Connect Devices" window that reads "*The wizard did not find any supported devices*," click Cancel and continue with the installation.
10. When prompted by the ICCapture installer, chose "Typical" setup type.
11. The installation will complete and you will be prompted to run PillGrade. Click OK to run PillGrade UNLESS you got the error message referenced in Step 9 above. If you got the error message in Step 9 above, uncheck the "Run PillGrade" checkbox and click OK. Then disconnect the power cord from PillGrade for 10 seconds minimum, then plug it back in, then Run PillGrade. The camera should be detected.

Specify ComPort:

If, after installing PillGrade, the green Start button is non-functional, then you will need to specify the Com Port that you have the serial cable connected to on your PC. (The PillGrade software is defaulted to Com Port 1.)

1. Enter into the advanced settings window by typing in "adve" in the text entry box at the bottom right of the screen. After entering in "adve", the Adv. Edit button will become active. Click on it.
2. In the Advanced Edit screen, DO NOT CHANGE ANY ENTRIES except change the Com Port entry from "1" to the correct Com Port number and then click on OK to save the change and exit the Advanced Edit window. The Start button should now be functional. If you do not know the correct Com Port number, keep changing the number (up to 9), clicking OK to save and exit, and then testing the green Start button. But your computer specialist will be able to easily determine the ComPort you are using.

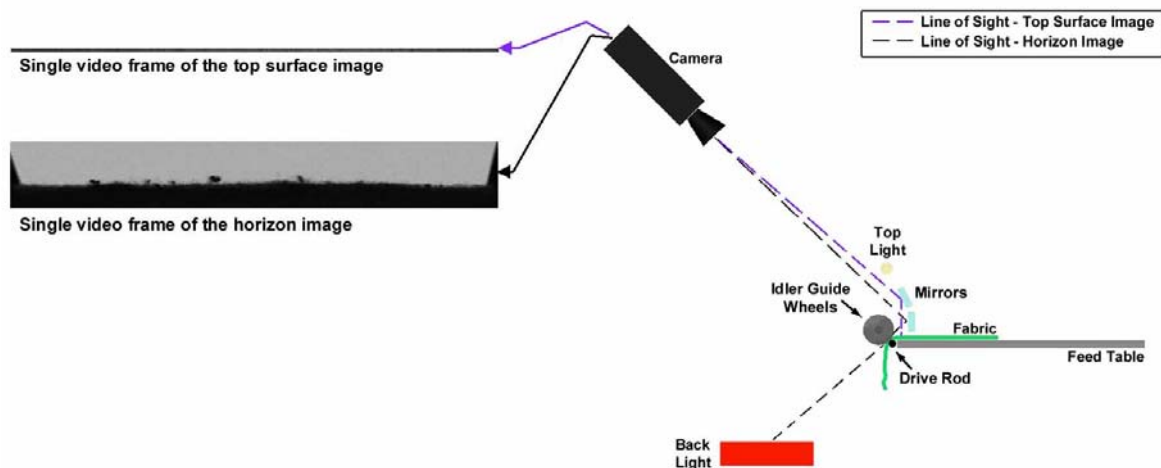
PRINCIPLE OF OPERATION

The PillGrade system is an automated pilling grading system developed to provide objective and repeatable pilling assessment in compliance with both ASTM and ISO test methods.

Because pills are fiber balls, or clumps, that sit on top of the fabric, straight down 2D imaging of the sample is insufficient to measure pills because:

- Pill height is a critical factor in determining the degree of pilling.
- Depending upon the degree of fuzzing, the pills can be camouflaged by the fuzz.
- Fabric patterns or the weave/knit structure can confuse pill detection, measures, and grading.

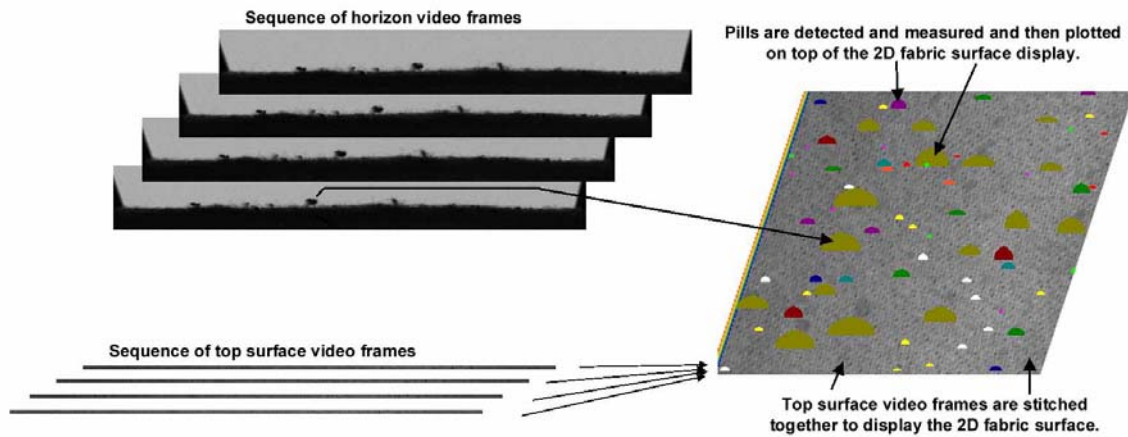
PillGrade detects, measures, and grades pills by scanning the specimen's horizon as the specimen is rolled over a rotating drive rod. By scanning the horizon of the fabric, the height of each pill can be measured, fuzzing can be measured, and fabric patterns and weave/knit structure is disregarded. The figure below shows the fabric specimen rolling over the drive rod while the video camera captures the video images.



It is important to realize that PillGrade is a video system, not a still 2D photographic system. The fabric specimen runs through the rollers at a speed of about 1"/second (25mm/sec). While the specimen runs through the rollers, the camera takes video of the fabric at a rate of 30 frames per second. So if the specimen is 4" (25mm) in length, the camera will capture a total of 120 video frames of the specimen as it runs through the rollers.

Every 1/30th of a second, the camera takes a single video frame. As shown above, two mirrors at different angles allow the camera to capture simultaneous images of both the horizon image and a slice of the fabric's top surface within each single video frame. By stitching together all of the video frames that are captured while the specimen runs through the rollers, a complete 3D topological map of the specimen is scanned into the PillGrade system.

After scanning the entire specimen, PillGrade analyzes each of the horizon images to detect and measure the pills, then plots each pill's XY location on the graph display using semi-circular markers color-coded by pill size, as shown in the figure below. Also, by stitching together each of the top surface images (as explained above), PillGrade also displays the surface scan of the specimen.



Therefore, PillGrade is a truly 3D scanning system by capturing the width, the height, and the length (the length corresponds to the video time during rolling) of the specimen.

After scanning the specimen and detecting and measuring each and every pill in the center area of the specimen, PillGrade uses the PillGrade Grading Formula to calculate a 1.0 – 5.0 grade, as explained in the section titled “PillGrade Grading Formula.” After the test, a test report can be printed, or the results can be added to the on-screen averaging study according to ASTM and ISO standards.

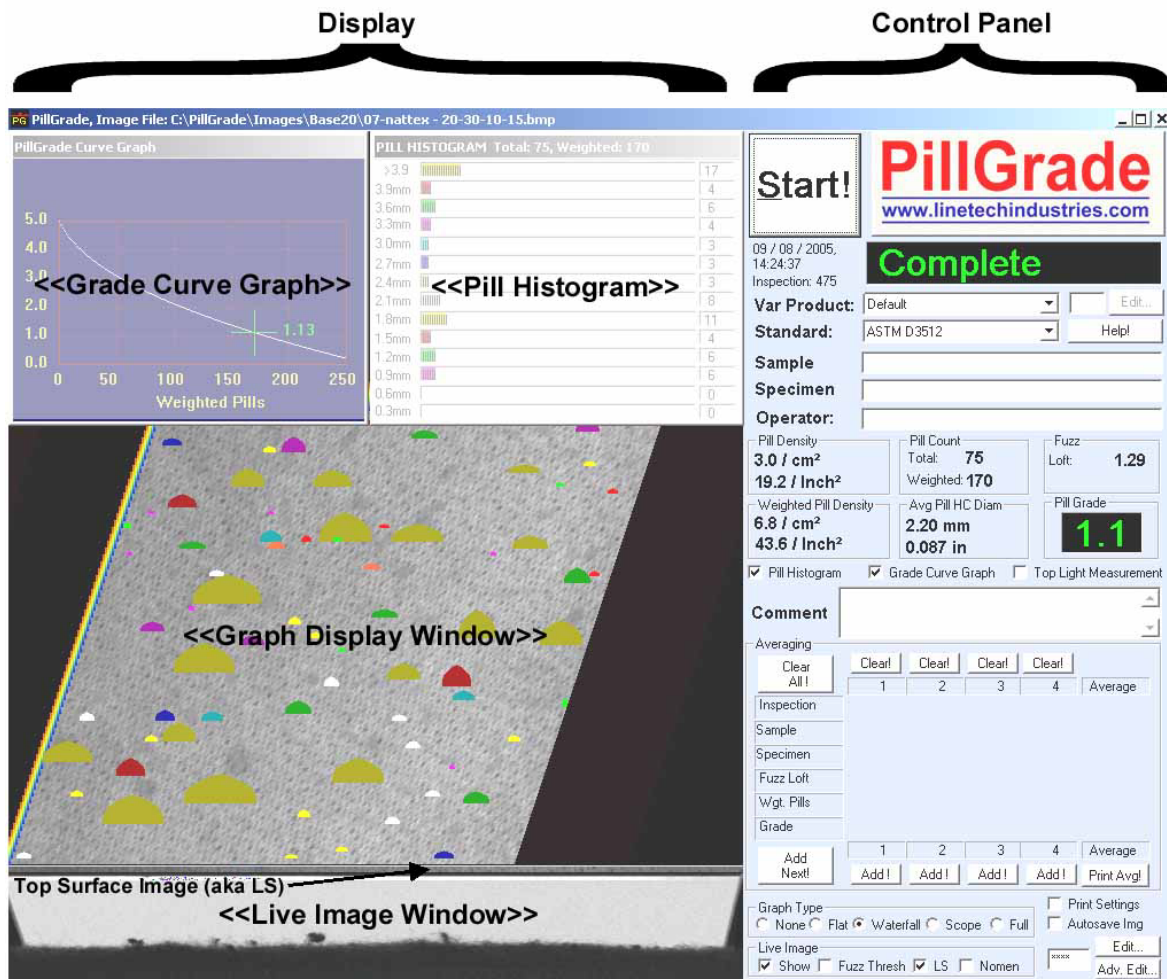
TURN ON THE SYSTEM

1. Turn ON PillGrade and PC: After connecting all cables as described in the above Installation Section, turn on the PillGrade power switch, then turn on your PC.

2. Start PillGrade software: Double click on PillGrade desktop icon. Software will start. If you get an error message that says “Cannot init video grabber” or “No camera found”, go to the troubleshooting section of this manual.

DESCRIPTION OF THE MAIN SCREEN

The main screen is split vertically into the Display on the left side and the Control Panel on the right side:



Please see the above section titled Principle of Operation for background information on the Display windows and how the Display windows integrate with one another. Definitions of the Display windows are as follows:

Live Image Window: This window displays the real time video captured by the camera. The Live Image includes both the Horizon Image and the Top Surface Image.

Horizon Image (not labeled above): The Horizon Image is the bottom 95% of the Live Image Window. It is the image of the specimen as it rolls and bends across the drive rod. As you can see in the image above, pills are easily detected in the horizon image.

Top Surface Image: The Top Surface Image is the top 5% slit at the top of the Live Image window. It is very narrow. It runs the width of the Live Image Window and during an inspection you can see the weave/knit pattern in this slit. It is also called the LS image which stands for linescan image.

Graph Display Window: Various views can be activated in this window. By default, the Graph Display window is the Waterfall display, which shows each pill's XY location using semi-circular markers color-coded by pill size combined with the top surface scan which is layered underneath the pill markers and shows the specimen's weave/knit structure.

Pill Histogram: After scanning the specimen then detecting and measuring each and every pill in the center area of the specimen, the pills are sorted into bins according to their size, as shown in the Pill Histogram display.

Grade Curve Graph: The quantity of weighted pills are plotted on the Grade Curve Graph to determine the 1.0 – 5.0 pilling grade.

The Control Panel details are detailed below.

CONTROL PANEL DETAILS

Product Drop-down list:
You can create unique Product Types with a unique Product name, all of which will then be listed in the Product drop-down list. You can assign either Standard or Custom PillGrade settings to each Product type.

If the label reads "Std Product" (as shown), it indicates that the active Product Type is assigned the Standard PillGrade settings.

If the label reads "VarProduct", it indicates that the active Product Type is assigned Custom PillGrade settings.

Standard Drop-down box:
Select the applicable Standard Test Method

Text Entry fields -
text entered into these fields are mapped to all reporting functions.

Pill Histogram Checkbox:
Turns visualization of the pill histogram window On/Off.

Grade Curve Graph Checkbox:
Turns visualization of the Grade Curve Graph window On/Off.

***AVERAGING STUDY TABLE**
See section titled "Averaging Study Table" for further information

Select the Graph Window Display Type:
None: none
Flat: simple 2D pill plot
Waterfall: sloped 3D look (default)
Scope: for advanced system diagnosis
Full: full video image, no graph

Select Live Image display options:
Show: Turns on the live image
Fuzz Thresh: Turns on the binary pill:fuzz image
LS: Turns on the Top Surface scan
Nomen: Turns on the live image nomenclature for troubleshooting

START/STOP Button:
Click on this button to Start and Stop Inspection

Date, Time, and Inspection Counter ReadOut

System Status ReadOut

The screenshot shows the PillGrade software interface. At the top, there's a 'Start!' button and a 'Press Start!' button. Below these are fields for 'Std Product' (ASTM D3512) and 'Operator'. The main display area shows various inspection parameters: Pill Count (Total: 0, Weighted: 0), Fuzz (Loft: N/A), Weighted Pill Density (0.0 / cm², 0.0 / Inch²), Avg Pill HC Diam (0.00 mm, 0.000 in), and Pill Grade (N/A). There are also checkboxes for 'Pill Histogram' and 'Grade Curve Graph'. At the bottom, there are buttons for 'Clear All', 'Add', 'Need', 'Print Settings', 'Autosave Img', and 'Edit...'. The interface is divided into several sections: 'Inspection', 'Sample', 'Specimen', 'Fuzz Loft', 'Wgt. Pills', 'Grade', and 'Live Image'.

Edit Product Settings password entry box:
In order to modify a Product's settings, enter the permanent password "prod" in the text entry box, which will activate the Edit button. Then click on the Edit button. See the section titled "Customizing PillGrade Settings" for further information.

HELP! Button:
Click on Help! to open pillgrademanual.pdf in Adobe reader.

TEST RESULT READOUTS:

Pill Density: Total number of pills in inspection area / total size of inspection area.
Pill Count, Total: Total number of pills in inspection area.
Pill Count, Weighted: Using a logarithmic scale, each pill is mathematically weighted according to its size, where the largest pills (>Ø3.9mm) are multiplied by a factor of 5.0 and the smallest pills (<Ø0.3mm) are multiplied by a factor of 0.6. The height of the dense layer of fabric fuzz, disregarding the single strands of fuzz sticking up out of the denser layer of fuzz.
Fuzz Loft: Total number of weighted pills in inspection area / total size of inspection area.
Weighted Pill Density: (Average Pill Height-Compensated Diameter)
Avg Pill HC Diam: The average "size" of all the pills in the inspection area. Because a pill is much more apparent if it rests higher up on a layer of fuzz, PillGrade uses a height-compensated pill diameter to measure the size of each pill.
PillGrade: The 1.0 - 5.0 grade.

Print Settings Checkbox:
Click to activate the Windows print settings dialog when printing.

Autosave Image Checkbox:
When clicked on, the next inspection video image (~20MB) will be automatically saved to the C:\PillGrade directory.

Edit Advanced Settings password entry boxes:
In order to modify the Advanced system settings, enter the permanent password "adve" in the text entry box, which will activate the Edit button. Then click on the Edit button. See the section titled "Advanced Settings" for further information.

Edit General Settings password entry boxes:
In order to modify the General system settings, enter the permanent password "line" in the text entry box, which will activate the Edit button. Then click on the Edit button. See the section titled "General Settings" for further information.

SYSTEM PASSWORDS

In addition to the main screen, there are 3 password-accessible windows. They are:

Edit Product Settings window: Changes to the variables in this window are for the purpose of customizing the PillGrade's grading formula on a product-by-product basis. Any deviation from the PillGrade standard grading formula will be printed in all report data and print-out so that any custom grading formula can be duplicated on other PillGrade machines. For more information, please see the section "Customizing the Grade Formula."

Edit General Settings window: Changes made in this window are basic level display settings edit variables and file loading commands. For more information, please see the section "General System Settings."

Edit Advanced Settings window: Changes in this window *can* effect measurements and data and can alter the operation of the system. Only advanced users should access this window. This window will be mostly removed from the upcoming PillGrade version, therefore, if you have any questions about this window, please contact LineTech or SDLAtlas.

In order to access these windows, enter the password into the text entry box as indicated below, then click on "Edit..."

The screenshot shows the PillGrade software interface. At the top, it says "Start!" and "PillGrade" with the website "www.linetechindustries.com". Below this, it displays the date "09 / 12 / 2005", time "13:58:41", and "Inspection: 478". A large "Press Start!" button is prominent. Below the button, there are several input fields: "Std Product:" (Default), "Standard:" (ASTM D3512), "Sample:", "Specimen:", and "Operator:". To the right of these fields are "Edit..." buttons. A callout box points to the "Edit..." button next to "Std Product:" with the text: "To access the Edit Product Settings window, enter 'prod' and then click 'Edit...'". Below the input fields, there are several numerical displays: "Pill Density" (0.0 / cm², 0.0 / Inch²), "Pill Count" (Total: 0, Weighted: 0), "Fuzz Loft" (N/A), "Weighted Pill Density" (0.0 / cm², 0.0 / Inch²), "Avg Pill HC Diam" (0.00 mm, 0.000 in), and "Pill Grade" (N/A). There are also checkboxes for "Pill Histogram" and "Grade Curve Graph". Below these, there is a "Comment" field. Further down, there is an "Averaging" section with "Clear All" and "Clear" buttons, and a table with columns 1, 2, 3, 4, and Average. Below the table, there are "Add Next!", "Add 1", "Add 2", "Add 3", "Add 4", and "Average" buttons. At the bottom, there is a "Graph Type" section with radio buttons for "None", "Flat", "Waterfall", "Scope", and "Full". There are also checkboxes for "Print Settings", "Live Image", "Show", "Fuzz Thresh", "LS", and "Nomen". A callout box points to the "Edit..." button next to the "Print Settings" checkbox with the text: "To access the Edit General Settings window, enter 'line' and then click 'Edit...'". At the very bottom, there is a callout box pointing to the "Adv. Edit..." button with the text: "To access the Edit Advanced Settings window, enter 'adve' and then click 'Edit...'".

PERFORMING AN INSPECTION

BEFORE RUNNING PILLGRADE, PLEASE READ THESE IMPORTANT NOTES:

1. Only operate PillGrade when the hood is closed.
2. The specimen cannot be placed close the slot opening before hitting the Start button. If you lay the specimen on the feed table before hitting the Start button, do not push the specimen near the slot opening.
3. Sometimes, the Auto Backlight Adjustment window will pop up after you press the Start button. This is a auto check to ensure system accuracy. If this happens, see the section below entitled "Auto Backlight Adjustment."
4. If you are running thick fabrics, it may be necessary to screw the Idler knob into the left side of PillGrade. This knob can be turned or just wiggled to run the thickest of fabrics. It is suggested that the idler knob not be installed because it is rare that it is useful, but it is, on rare occasions, beneficial.

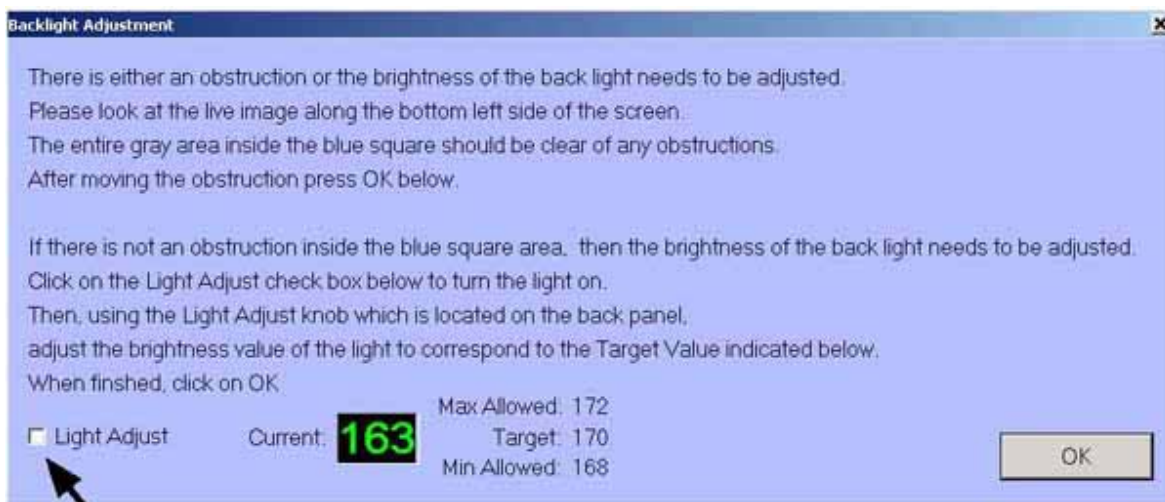
Step	Description	On-Screen	Machine
1	A. Select Product Type. (For an explanation of Product Types, see the section "Customizing the Grading Formula.") B. Select Applicable Standard. C. Fill in Sample, Specimen, Operator, Comment fields		n/a
2	Press the START button. (green button or on-screen button) (See note 3 above.)	PRESS START	
3	Center the specimen on the feed table using the grooves as a guide. Gently push the specimen into the slot opening until the rollers grab the specimen, then let go so the fabric does not get bunched up.	LOAD SPECIMEN	
4	Allow the specimen to get pulled through the rollers. Specimens should run straight through the rollers. If the specimen gets bent around or twisted, disregard the inspection results and run again.	PROCESSING	
5	It is necessary to remove the specimen from the specimen retrieval area after each inspection or else it can get in the way during later inspections.	COMPLETE	

AUTO BACKLIGHT ADJUSTMENT

PillGrade is equipped with an Auto Backlight Check feature which occurs on every inspection. It ensures that you will never perform an inspection when the backlight intensity level is over or under the intensity specification limits.

If the backlight is out of the intensity specification limits, the Auto Backlight Adjustment window will pop up immediately after pressing the Start button. When this happens, please follow the on-screen instructions, as follows:

1. Check to make sure there is no obstruction in the slot opening or on top of the backlight.
2. Click on the Light Adjust check box on the window, as shown below. The motor and red backlight will then turn on. And the "Current" backlight intensity value will be displayed in the green/black readout.



Light Adjust check box

3. Then turn the Light Adjust knob which is located on the back of PillGrade until the Current value equals the Target value.



Light Adjust knob

4. Click on OK, and Start the inspection again.
5. If you find that you have to repeat this step often, it is most likely because there is a minor obstruction or because the backlight is being turned on for long periods of time. If this is the case, please contact LineTech or SDLAtlas.

PILLGRADE GRADING FORMULA

After scanning the specimen, PillGrade displays various the measurement results on the main screen:

Pill Density 0.0 / cm² 0.0 / Inch²	Pill Count Total: 0 Weighted: 0	Fuzz Loft: N/A
Weighted Pill Density 0.0 / cm² 0.0 / Inch²	Avg Pill HC Diam 0.00 mm 0.000 in	Pill Grade N/A

The definitions of the results are:

Pill Density: Total number of pills in inspection area / total size of inspection area.

Pill Count, Total: Total number of pills in inspection area.

Pill Count, Weighted: Using a logarithmic scale, each pill is mathematically weighted according to its size, where the largest pills (>Ø3.9mm) are multiplied by a factor of 5.0 and the smallest pills (<Ø0.3mm) are multiplied by a factor of 0.6.

Fuzz Loft: The height of the dense layer of fabric fuzz, disregarding the single strands of fuzz sticking up out of the denser layer of fuzz.

Weighted Pill Density: Total number of weighted pills in inspection area / total size of inspection area.

Avg Pill HC Diam: (Average Pill Height-Compensated Diameter.) The average "size" of all the pills in the inspection area. Because a pill is much more apparent if it rests higher up on a layer of fuzz, PillGrade uses a height-compensated pill diameter to measure the size of each pill.

In order to obtain the above measurements, 2 variables are used. These 2 variables are always the same unless the user wishes to customize the Grade Formula:

Detect Threshold: The Detect Threshold can be considered to be the pill detection sensitivity. It is the height above the fabric baseline (in pixels) that a pill needs to be in order to be counted as a pill. (Default = 0.75).

Fuzz to Pill Thresh Mux: The Fuzz to Pill Threshold Multiplier is used to compensate for varying levels of fuzziness on specimens. LineTech has found that as the level of fuzz on any given fabric increases, the pills become more and more "hidden" or "camouflaged" by the fuzz. Therefore, the Fuzz to Pill Thresh Mux automatically adjusts the Detect Threshold by a variable amount directly proportional to the Fuzz Loft. (Default = 0.0035). Therefore, as fuzz loft increases, pill detection sensitivity decreases.

In order to calculate the 1.0-5.0 Grade, the following process occurs:

- Step 1: Analyze the video images to measure the Fuzz Loft, which in turn is used to increase or decrease the pill Detect Threshold.
- Step 2: Use the Detect Threshold to analyze the video images to obtain the Pill Count, Total.
- Step 3: Sort the pills into bins according to their Average Pill Height-Compensated Diameter, as shown in the Pill Histogram below:

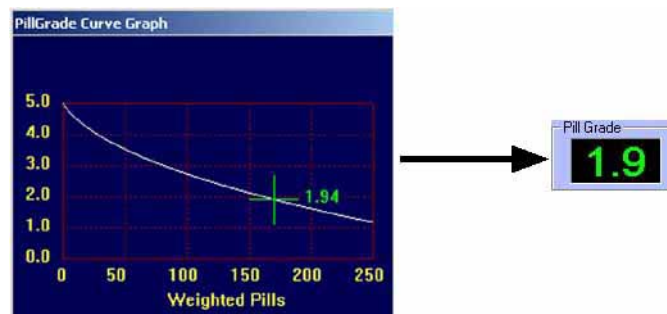


- Step 4: Using a logarithmic scale, mathematically weight each pill according to its size (Avg Pill HC Diam), where the largest pills (>Ø3.9mm) are multiplied by a factor of 5.0 and the smallest pills (<Ø0.3mm) are multiplied by a factor of 0.6. In the above histogram example, while there is a 130 Total Pill Count, there is a 292 Weighted Pill Count.
- Step 5: The Weighted Pill Count is then plugged into the PillGrade Grading Formula to obtain a 1.0-5.0 grade pertaining to both ASTM and ISO test methods.

$$\text{Grade} = 6 - (1 + \text{GradeMux} * (\text{WeightedPills}/\text{inch}^2))^{\text{POWER}}$$

(Where GradeMux is defaulted to 0.75 and POWER is defaulted 0.45)

The PillGrade Grading Formula is represented graphically by the PillGrade curve graph with weighted pills on the x-axis and the grade on the y-axis, and the resulting grade is prominently displayed on the main screen.

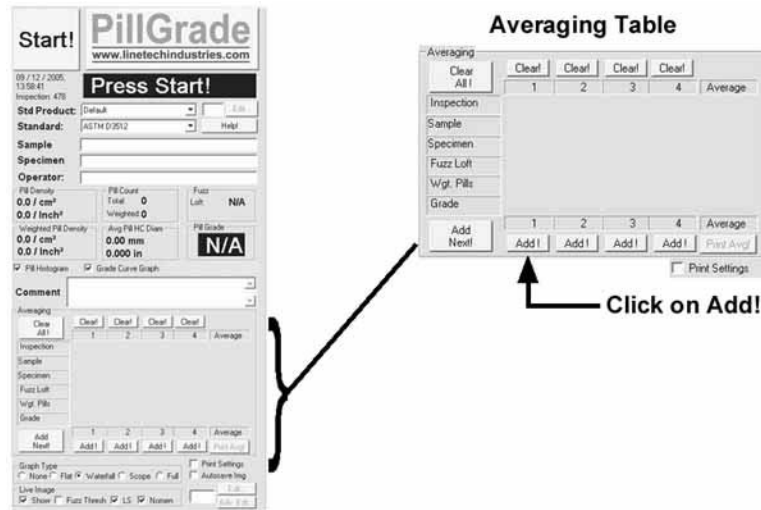


So as you can see, the 1.0-5.0 Grade depends upon a host of measurements including pill density, pill size, pill height, and fuzz loft. The PillGrade grading formula was developed over 2 years with various testing partners. For more information on the PillGrade grading formula and its development, please feel free to contact LineTech Industries, Inc.

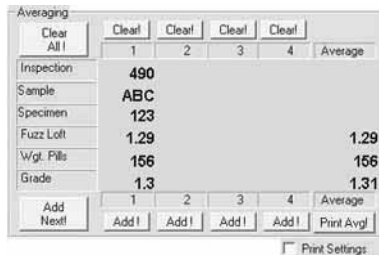
REPORTS

After each inspection, you can print out a report.

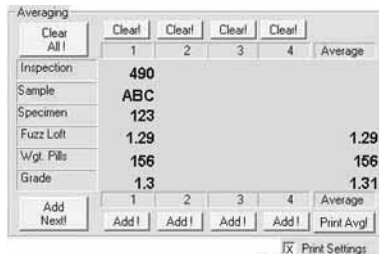
1. After running the inspection, click on Add! Button which is located underneath the first column in the Averaging Table.



2. This will add the inspection data to the first column, as shown below:



3. Turn on the Print Settings check box:



4. Click on the Print Avg! button:

The Averaging window displays a table with 4 columns and 7 rows of data. The columns are labeled 1, 2, 3, 4, and Average. The rows are labeled Inspection, Sample, Specimen, Fuzz Loft, Wgt. Pills, and Grade. The data is as follows:

	1	2	3	4	Average
Inspection	490				
Sample	ABC				
Specimen	123				
Fuzz Loft	1.29				1.29
Wgt. Pills	156				156
Grade	1.3				1.31

At the bottom of the window, there are buttons for 'Add Next!', 'Add!', 'Add!', 'Add!', 'Print Avg!', and 'Print Settings'. An arrow points to the 'Print Avg!' button.

Click Print Avg!

5. The print settings window will pop up. Select the print settings then click OK.

The Print dialog box shows the following settings:

- Printer: Samsung SCX4100 Series
- Status: Fair via eFax 3.5
- Type: Samsung SCX4100 Series
- Where: USB002
- Comment:
- Print range: ☒ All, ☐ Pages from 0 to 0, ☐ Selection
- Copies: Number of copies: 1
- Buttons: OK, Cancel

6. The report will print:

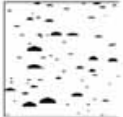
The printed report is titled "PillGrade" and contains the following information:

- Date/Time: 09/15/2005, 21:11:29
- Sample: ABC
- Specimen: 123
- Total Pills: 55
- Pills/min: 10.91
- Avg Pill HC Diam-in: 0.090
- Fuzz Loft: 1.29
- Weighted Pills: 156
- Pills/min: 2.62
- Avg Pill HC Diam-mm: 2.30
- GRADE: 1.31

At the bottom of the report, there is a large "1.31" and the text "Average Grade: 1.31". The report also includes a comment about the 500 character max. edit area and the SDL ATLAS logo.

After any inspection, the result data can be added to any column by clicking the appropriate Add! Button. The right most column always displays the averages of the result data that have been added to the Averaging Table. The individual and average results shown in the averaging table can be printed at any time g on the Print Avg! button. Here is a 3-specimen report as specified by the ASTM 3512 test method:

PillGrade
Advanced Pilling & Fuzz Testing System



Date/Time: 09/15/2006, 21:11:28

Sample Specimen: ABC 123

Total Pills: 55 Weighted Pills: 156
Pill/in2: 16.91 Pill/cm2: 2.62
Avg Pill HC Diam-in: 0.095 Avg Pill HC Diam-mm: 1.29
Fuzz Loft: 1.29

GRADE: 1.31

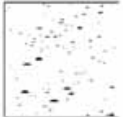


Date/Time: 09/15/2006, 21:17:50

Sample Specimen: ABC 456

Total Pills: 7 Weighted Pills: 10
Pill/in2: 1.79 Pill/cm2: 0.28
Avg Pill HC Diam-in: 0.053 Avg Pill HC Diam-mm: 1.33
Fuzz Loft: 0.98

GRADE: 4.36



Date/Time: 09/15/2006, 21:18:58

Sample Specimen: ABC 789

Total Pills: 88 Weighted Pills: 101
Pill/in2: 22.55 Pill/cm2: 3.49
Avg Pill HC Diam-in: 0.047 Avg Pill HC Diam-mm: 1.20
Fuzz Loft: 0.71

GRADE: 2.11

Comment: This is a 500 character max. edit area which has two visible lines and multiple line capability. Pressing Enter will not add another line.

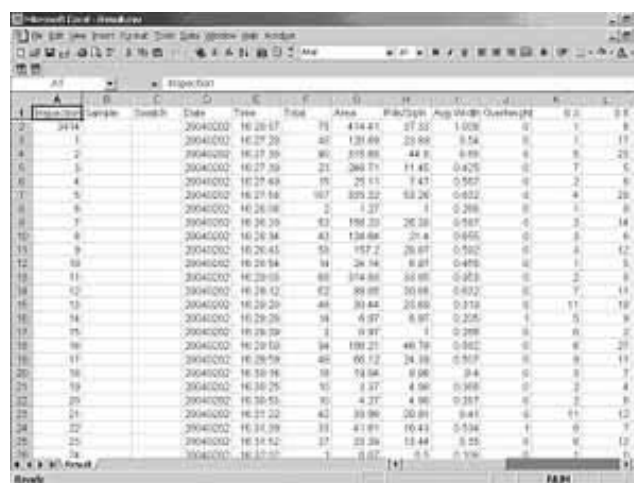
Operator: Joe Inspector
Standard: ASTM D5512
Product Type: Default
Grade Curve: Pill PillGrade Standard

Average Grade: 2.60



Line Tech Industries, Inc.

Furthermore, the result data from every inspection is saved to the end of a file called C:\PillGrade\result.csv which is a standard ascii database file format that can be viewed in almost every Windows-based database or spreadsheet application. It looks like this:



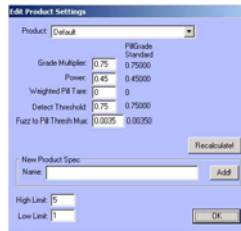
Sample	Date	Time	Area	Pills/in2	Avg Pill HC	Fuzz Loft
2414	2004/02/02	16:20:17	71	434.41	27.22	1.038
1	2004/02/02	16:20:20	45	139.69	23.99	0.54
4	2004/02/02	16:27:59	90	335.89	44.7	0.69
5	2004/02/02	16:27:59	21	264.71	11.45	0.425
4	2004/02/02	16:27:49	15	25.11	1.47	0.557
5	2004/02/02	16:27:54	107	335.22	53.26	0.622
6	2004/02/02	16:26:08	2	1.27	1	0.269
7	2004/02/02	16:26:39	43	189.33	26.39	0.517
6	2004/02/02	16:26:34	41	134.68	21.4	0.605
9	2004/02/02	16:26:45	58	157.2	26.97	0.502
59	2004/02/02	16:26:54	91	24.94	0.81	0.479
11	2004/02/02	16:29:08	69	374.89	36.95	0.623
12	2004/02/02	16:28:12	82	89.89	30.99	0.632
13	2004/02/02	16:29:20	44	30.44	25.69	0.319
14	2004/02/02	16:29:26	34	6.97	6.97	0.225
15	2004/02/02	16:29:39	1	0.97	1	0.299
16	2004/02/02	16:29:50	34	189.21	46.79	0.802
17	2004/02/02	16:29:58	40	65.12	34.39	0.519
18	2004/02/02	16:30:16	18	13.94	9.98	0.4
19	2004/02/02	16:30:25	10	3.37	4.99	0.309
20	2004/02/02	16:30:53	30	4.27	4.99	0.317
21	2004/02/02	16:31:22	42	39.99	20.81	0.41
22	2004/02/02	16:31:39	31	41.91	16.43	0.534
23	2004/02/02	16:31:52	37	32.39	13.44	0.23
24	2004/02/02	16:32:02	1	0.97	0.5	0.136

If you ever move or delete this file, a new file with the same name and location will automatically be created.

CREATING NEW PRODUCT TYPES

You can create and store unique Product Type names into the PillGrade system by accessing the Edit Product Settings window.

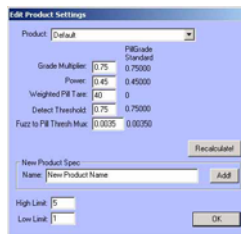
To access the Edit Product Settings window, enter the password “prod” into the Edit Product Settings window password entry box, then click Edit!. (See previous section entitled “System Passwords” if you need more help.) The Edit Product Settings window will pop up:



The screenshot shows the 'Edit Product Settings' window. At the top, there is a 'Product' dropdown menu set to 'Default'. Below this, a table lists several parameters with their current values and a 'Recalculate' button to the right. The parameters are: Grade Multiplier (0.75), Power (0.45), Unweighted PB Time (0), Detect Threshold (0.75), and Fuzz to PB Threshold (0.0035). Below the table, there is a 'New Product Spec' section with a 'Name' field and an 'Add' button. At the bottom, there are 'High Limit' (5) and 'Low Limit' (1) fields, and an 'OK' button.

Parameter	Value
Grade Multiplier	0.75
Power	0.45
Unweighted PB Time	0
Detect Threshold	0.75
Fuzz to PB Threshold	0.0035

To create a new product type, enter in a new product name, then Click Add!, then click OK, as shown below:



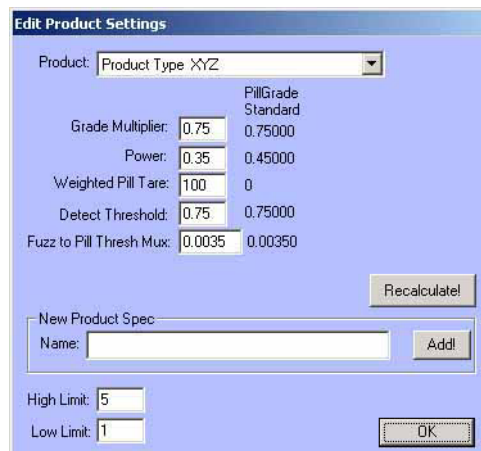
This screenshot is identical to the previous one, but the 'Name' field in the 'New Product Spec' section now contains the text 'New Product Name'. The 'Add' button is still present next to it.

CUSTOMIZING THE GRADING FORMULA

The primary benefit of PillGrade is not to be in agreement with every lab grader in the world - which is simply impossible. The primary benefit of PillGrade is to have objective and repeatable grading so that the textile supply chain can be in grading conformity on any and all textile product types.

Therefore, PillGrade employs a Standard Grading Formula that can and should be used for almost all product types. However, PillGrade also allows the user to customize the Grade Formula for any product type to match the user's specific grading requirements for any particular product type.

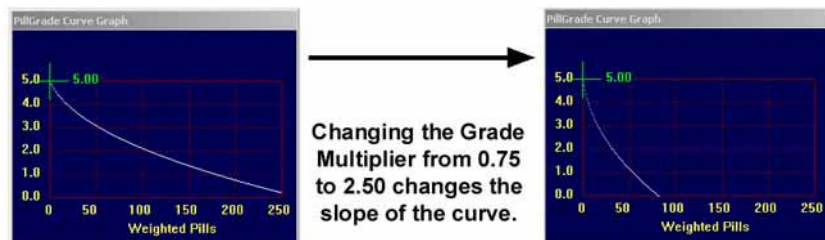
Each Product Type in the Product drop-down list is assigned a Grading Formula. The Grading Formula for any product type includes 5 variables which can be customized in the Edit Product Settings window, as shown below. (To access the Edit Product Settings window see the section titled "System Passwords.")



Select the product type you want to modify from the drop-down list, then modify any of the 5 variables, as defined below, to customize the Grade Formula.

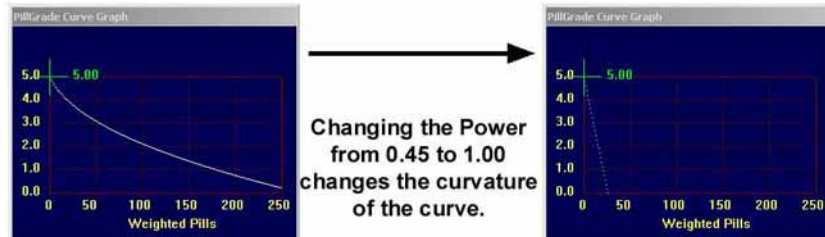
Grade Multiplier:

The Grade Multiplier variable in the PillGrade Formula represents the slope of the graph. Changing the Grade Multiplier from the default of 0.75 to 2.50 alters the slope of the graph as shown below. If you increase this variable then the slope of the graph gets steeper and the 1-5 Grade result will decrease.



Power:

The Power variable in the PillGrade Formula represents the curvature of the graph. Changing the Power from the default of 0.45 to 1.00 alters the curvature of the graph as shown below. Note that a Power of 1.00 results in a linear (straight) graph line. If this variable approaches 1 then the curvature of the graph gets straighter.



Weighted Pill Tare:

The Weighted Pill Tare variable allows the user to tare out any number of pills from the specimen. For instance, if you have a fabric that contained desirable slubs, desirable pills, or lumps, or patterns that were recognized by PillGrade as pills, then you would increase this variable in small increments until an unpilled specimen rated a 4.9. If you increase this variable then the number of weighted pills decreases and the 1-5 Grade will increase.

Detect Threshold:

The Detect Threshold can be considered to be the pill detection sensitivity. It is the height above the fabric baseline (in pixels) that a pill needs to be in order to be counted as a pill. (Default = 0.75). If you increase this variable then pill sensitivity will decrease and the 1-5 Grade result will increase, and vice versa.

Fuzz to Pill Thresh Mux:

The Fuzz to Pill Threshold Multiplier is used to compensate for varying levels of fuzziness on specimens. LineTech has found that as the level of fuzz on any given fabric increases, the pills become more and more "hidden" or "camouflaged" by the fuzz. Therefore, the Fuzz to Pill Thresh Mux automatically adjusts the Detect Threshold by a variable amount directly proportional to the Fuzz Loft. (Default = 0.0035). If you increase this variable then pill sensitivity will decrease and the 1-5 Grade result will increase, and vice versa.

If you perform an inspection on a specimen prior to accessing the Edit Product Settings window, then you can click on the "Recalculate" button to instantaneously see the effect that your change has on the result grade and other data.

How do I know if the selected product type is assigned the Standard PillGrade Grading Formula or a Custom PillGrade Grading Formula?

On-screen: The Product Drop-down list label will read “Std Product” if the Standard Grading Formula is assigned to the active product type, and the label will read “Var Product” if a Custom Grading Formula is assigned to the active product type. See below:



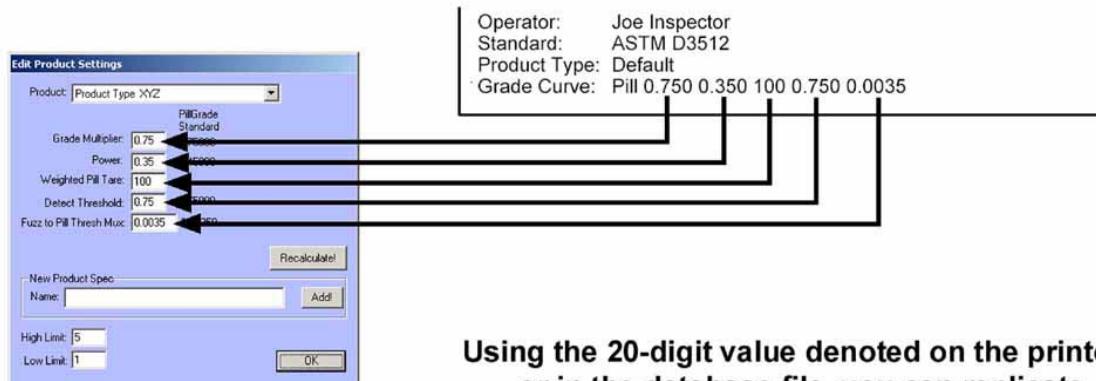
Printout: On the bottom of all printouts the entry for “Grade Curve” (Curve = Formula) denotes whether the product type is assigned the Standard PillGrade Grading Formula or a Custom PillGrade Grading Formula as follows:

The “Grade Curve” entry on the printout denotes whether the active product type is assigned the “PillGrade Standard” Formula or a Custom Formula. The Custom Formula is denoted by a 20-digit value as shown.

Comment: This is a 500 character max. edit area which has two visible lines and multiple line capability. Pressing Enter will not add another line.	LineTech Industries, Inc.
Operator: Joe Inspector	2.60
Standard: ASTM D3512	
Product Type: Default	
Grade Curve: PillGrade Standard	
Average Grade:	
Comment: This is a 500 character max. edit area which has two visible lines and multiple line capability. Pressing Enter will not add another line.	LineTech Industries, Inc.
Operator: Joe Inspector	3.63
Standard: ASTM D3512	
Product Type: Default	
Grade Curve: Pill 0.750 0.350 100 0.750 0.0035	
Average Grade:	

If a product uses a Custom Grade Formula, how can I replicate the settings in the future or on a different PillGrade machine?

The 20-digit value on the printout and on the result.csv file is actually the string of the 5 variables in the Custom Formula, as follows:



Using the 20-digit value denoted on the printout or in the database file, you can replicate a Custom Grade Formula on any other PillGrade machine by copying the values to the Edit Product Settings window for that product type.

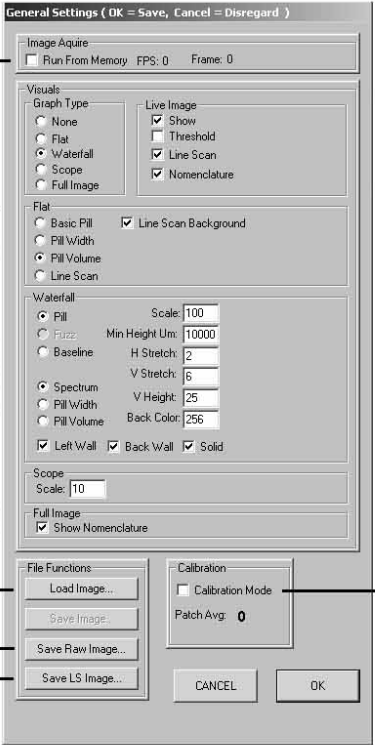
GENERAL SETTINGS SCREEN

The General Settings screen provides for display customization, calibration controls, and memory control. To access the General Settings screen see the section titled "System Passwords."

GENERAL SYSTEM SETTINGS

Image Acquire:
Check this box if you want to run a video inspection image from memory. PillGrade temporarily saves the entire video scan from the last inspection into RAM.
So if you do an inspection and you want see the inspection video run again, check this box, click OK to exit, then click Start on the main screen to see the video image run again. The check box needs to be unchecked to run inspections again.

(FPS - frames per second)



Graph Type & Live Image:
These controls are duplicated from the control panel on the main screen, see Control Panel Details

These display controls provide the ability to customize the main screen display. They are for display purposes only and will not effect measurement and grading results.

If you have PillGrade video inspection images saved to your harddrive, you can load them using this command AND by clicking on "Run from Memory" above.

Inactive

Click on Calibration Mode to turn on the lights and motor. The backlight intensity (Patch Avg) will be displayed. Further calibration procedures are forthcoming.

ADVANCED SETTINGS SCREEN

The Advanced Settings Screen will be removed from PillGrade shortly and all the functions will not be available with a few exceptions. Please contact LineTech if you have any specific questions.

SYSTEM CALIBRATION

The PillGrade system is very stable and has a self-calibrating routine that ensures repeatable measurement and grading. However, LineTech is currently developing a new calibration procedure that will be released shortly.

SYSTEM MAINTENANCE

PC Maintenance:

Typical industrial PC maintenance procedures should be followed.

Camera Lens:

The camera lens may require cleaning every 6 months or so. The best way to clean the lens is to buy a can of inexpensive clean compressed air from a local electronics shop (cost = ~ US\$ 5.00) and blow the can up onto the lens. Be sure to test spray the can first to get out any water spray.

TROUBLESHOOTING

The fabric feeds through the rollers but the inspection never completes AND the status window continually reads "Load Specimen".	Do not place the specimen on the feed table until AFTER you press the Start button.
Immediately after feeding the specimen into the rollers the inspection stops and the status window reads "Not enough Standby."	You are most likely pulling back on the specimen when it starts to get pulled by the rollers. Try to release your hold on the specimen a little earlier.
The specimen gets stuck in the rollers.	Use the JOG knob to jog the rollers forward and/or backward.
Status window reads "Not enough samples" after an inspection.	The specimen is too short; not enough specimen length to provide for an adequate inspection. Either rotate the specimen, cut a new specimen, or contact LineTech if you use a custom specimen size.
You disagree with the grade result.	See the section titled "Customizing the Grade Formula."
Other failures	Make certain to remove tested specimens from underneath the feed table after every single inspection. OR, if you want to mail a CD (or upload) with a video image of a specimen for LineTech to examine, then follow this procedure: a. Click "Autosave" on the main screen's control panel. b. Perform an inspection on the specimen. The video image will be automatically saved to your C:\PillGrade folder with the filename PillGradeImg_MMDDYYYY_HHMMSS.bmp c. Burn filename to CD or upload file.

IMPORTANT SAFETY INFORMATION

To avoid risk of personal injury or death due to electric shock:

- The system is equipped with a 3-prong plug for protection against possible shock hazards. DO NOT, under any circumstances, alter grounding plug on the system.
- The enclosure should be accessed only by a qualified electrician.

To avoid risk of injury to eyes:

- The system is equipped with an LED light plate. Avoid looking directly into either LED light for extended periods of time.