



Antibacterial Proficiency Testing Program

April 2018 Testing Results

About AATCC

The American Association of Textile Chemists and Colorists is the world's largest technical and scientific society devoted to the advancement of textile chemistry. The Association has some thousands individual members and hundreds corporate members in the U.S. and in more than 60 countries.

Since its inception in 1921, the Association has been dedicated to three objectives:

Education: To promote increase of knowledge of the application of dyes and chemicals in the textile industry.

Research: To encourage in any practical way research work on chemical processes and materials of importance to the textile industry.

Communication: To establish for the members channels by which the interchange of professional knowledge among them may be increased.

AATCC accomplishes these objectives through a variety of activities: publications including but not limited to the magazine *AATCC Review* and the annual AATCC Technical Manual, workshops and symposia, the annual International Conference, and member participation in research and technology committees. AATCC is also actively involved developing ISO standards that pertain to the textile testing field.

Members of AATCC represent industry segments ranging from apparel, home fashions, and retail design and merchandising, to high-performance technical fabrics and nonwovens, to dyeing, printing and finishing. This range provides a strong foundation for the AATCC Proficiency Testing Program.

AATCC is dedicated to being recognized as the global agent for education, technology transfer and test methods development for the textile wet processing industry, responding to its membership needs, functioning as an information disseminator, and providing services globally.

For more information about AATCC, please visit <http://www.aatcc.org>.



June 11, 2018

Dear AATCC Proficiency Testing Program Participants,

I would like to thank each of the laboratories that participated in the **AATCC Antibacterial Proficiency Testing Program**. There were fifteen laboratories registered for participation in this round of testing. Please be sure to read through the introduction of the booklet as it gives a brief summary and explanation of what the report contains.

Laboratories were provided treated and untreated fabric yardage of unknown bacterial resistance and asked to perform AATCC Test Method(s) 100 & 147 to determine the degree of antibacterial activity on each fabric.

Enclosed you will find the report for the treated and untreated (control) fabric tested in April 2018.

Best regards,

A handwritten signature in black ink, appearing to read 'Garry Atkinson', is written over a light gray rectangular background.

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Introduction

AATCC Proficiency Testing Programs have been designed so that laboratories can compare their test results to those of other laboratories around the world. In essence, each AATCC Proficiency Testing Program is a series of variability studies. In a variability study, different summary statistics can be used to analyze the variance of the data. To detect shifts in variance, enough data must be collected to make statistical conclusions. In the AATCC Proficiency Testing Programs, a total of nine observations (three specimens by three raters) have been collected for each test category. Within a test method there may be a single test category or multiple test categories (e.g. a staining test method would have a test category for every fiber type in a multifiber strip). By collecting enough data, labs can not only compare their data averages, but also their data variances. Both components are important for test method proficiency. For instance, a lab may be comparable in their average value but have a large variance (standard deviation). This could indicate that a rater needs retraining on performing a particular test method. Likewise, a lab may be comparable in their standard deviation but have a significantly different average value. This could indicate that there is an equipment problem or that all raters are consistently performing the test method incorrectly. For all AATCC Proficiency Testing Program reports, variability charts and summary statistics tables have been provided for each test category within a test method.

This summary is the compilation of data reported by each laboratory that participated in the AATCC Proficiency Testing Program. Each laboratory was assigned a randomly selected number to be used for identification purposes. All results throughout this report are listed by these identification numbers and referred to as 'Lab Code'.

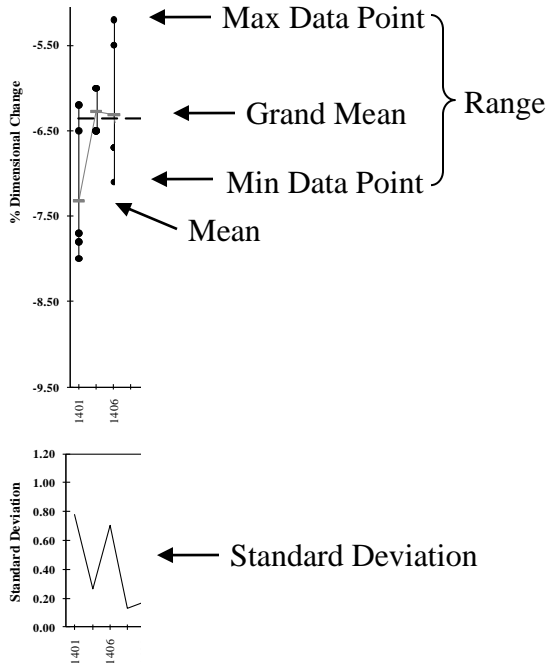
Antibacterial Proficiency Testing Program

Specimens from treated and untreated control fabric yardage of unknown antibacterial finish and activity were evaluated regarding the degree of antibacterial activity by each participating lab using AATCC Test Method(s) 100 – Antibacterial Finishes on Textile Materials: Assessment of, and 147 – Antibacterial Activity Assessment of Textile Materials: Parallel Streak Method. AATCC used the data from these specimens in this report summary to evaluate interlab and intralab variations.

Variability Charts

Variability charts are used to study how a measurement varies across categories. For the Proficiency Testing Programs, these categories are lab codes. In addition to showing all data points for a category, the mean, range, and standard deviation can also be viewed.

Figure 1: Variability Chart Example



- Variability charts visually show all data points by lab so that comparisons can be made between mean values and standard deviation.
- The nine observations are plotted vertically for each lab. If nine points are not visible, it is because some points with the same values appear on top of each other.
- Two y-axes are presented. The y-axis on top is scaled for the value of the data points, as well as the averages. The y-axis on bottom is scaled for standard deviation. Both x-axes are scaled to show individual lab codes.

Summary Statistics

Summary statistics, a type of descriptive statistics, are used to summarize the observations, or data, numerically in the simplest manner possible. The two types of summary statistics used in this report are mean value and standard deviation.

- **Median** – The value separating the higher half of a sample set from the lower half (i.e. the number in the middle). It is calculated by arranging all values in a sample set from lowest to highest and picking the middle value. If there is an odd count of values in the sample set, the median will be exactly the number in the middle. If there is an even count of values in the sample set, the median will be the mean of the middle two values.
- **Mean** – The average. It is calculated by summing all values in the sample set and dividing

$$\bar{x} = \frac{1}{n} \sum_{i=1}^n x_i$$

the sum by the count of values in the sample set.

- **Standard Deviation** – The root-mean-square (RMS) deviation of the values from their mean or the square root of the variance. It is a measure of the dispersion of data from the mean or how much the data varies around the mean. The variance is first calculated as one divided by the count of values in the data set, multiplied by the sum of each value minus the mean, squared. Taking the square root of this calculation yields a measure of variability that

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is in the same scale as the average.

$$\sigma = \sqrt{\frac{1}{n} \sum_{i=1}^n (x_i - \bar{x})^2}$$

$$\sigma = \sqrt{\frac{1}{n} \sum_{i=1}^n (x_i - \bar{x})^2}$$

- **Minimum** – The smallest value in the sample set. It is calculated by arranging all values in a sample set from lowest to highest and picking the first value.
- **Maximum** – The largest value in the sample set. It is calculated by arranging all values in a sample set from lowest to highest and picking the last value.
- **Range** – The length of the smallest interval which contains all of the values from the sample set. It is calculated by subtracting the minimum value from the maximum value.

In the summary statistics above, the sample set is made up of the nine observations *for each* lab code. The grand summary statistics are calculated in the same method as above, but the sample set is made up of the nine observations *for every* lab code, e.g. the grand minimum would be calculated as the lowest value from the data of all lab codes.

Z-Score

AATCC does not provide Z-scores for Proficiency Testing Program(s) data. Z-scores are only valid with continuous data sets. Electronic copies of the report tables are available in Excel format, upon request, for any laboratory that wishes to perform additional statistical analysis.

The data points reported for AATCC TM100 and TM147 are continuous. AATCC is currently considering incorporation of z-scores into the statistical analysis for this program. However, there is no specific timeline for a decision on this matter.

Participating Laboratories

(This is an **alphabetical listing** and does not correspond to the individual laboratory numbers)

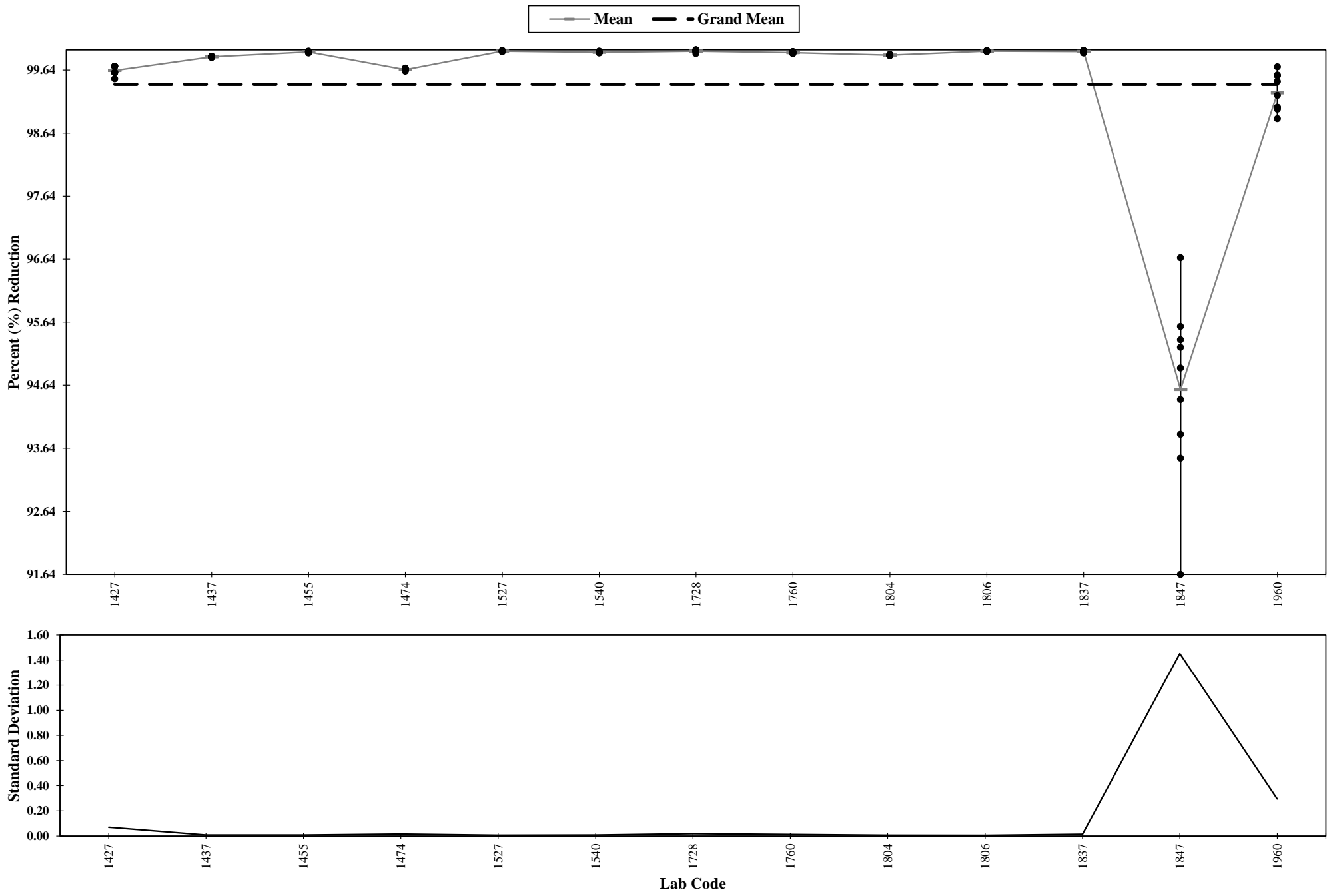
LAB NAME	COUNTRY
Boken Quality Evaluation Institute Shanghai Testing Center	China
Boken Quality Evaluation Institute-Osaka	Japan
Boken Quality Evaluation Institute-Tokyo	Japan
Bureau Veritas Hong Kong Limited	HONG KONG
Bureau Veritas Korea Consumer Products Services	South Korea
CITEVE	PORTUGAL
Ekoteks Laboratory	Turkey
Intertek de Guatemala, S.A.	Guatemala
Intertek Testing Services Thailand Ltd.	THAILAND
Nyce Laboratorios S.C.	Mexico
SGS Korea Co., Ltd.	South Korea
SGS Taiwan, Ltd.	Taiwan
Taiwan Textile Research Institute (TTRI)	Taiwan
UL-ICQ Italy	Italy
Vartest Laboratories, Inc	United States

**AATCC TM 100: Antibacterial Finishes on Textile Materials: Assessment of
Gram Positive - Percent (%) Reduction
Percent (%) Reduction**

	Median	Mean	St. Dev.	Minimum	Maximum	Range
Data Summary	99.43	99.41	0.15	99.13	99.62	0.49

Lab Code	Median	Mean	St. Dev.	Minimum	Maximum	Range
1427	99.60	99.63	0.07	99.50	99.70	0.20
1437	99.85	99.85	0.01	99.84	99.86	0.02
1455	99.93	99.93	0.01	99.91	99.94	0.03
1474	99.64	99.65	0.02	99.62	99.67	0.05
1527	99.94	99.94	0.01	99.93	99.95	0.02
1540	99.92	99.92	0.01	99.91	99.94	0.03
1728	99.94	99.94	0.02	99.90	99.96	0.06
1760	99.92	99.92	0.01	99.90	99.93	0.03
1804	99.87	99.88	0.01	99.87	99.89	0.02
1806	99.94	99.94	0.01	99.93	99.95	0.02
1837	99.94	99.93	0.02	99.91	99.95	0.04
1847	94.91	94.57	1.45	91.64	96.66	5.02
1960	99.24	99.28	0.29	98.87	99.69	0.82

AATCC TM 100: Antibacterial Finishes on Textile Materials: Assessment of Gram Positive - Percent (%) Reduction

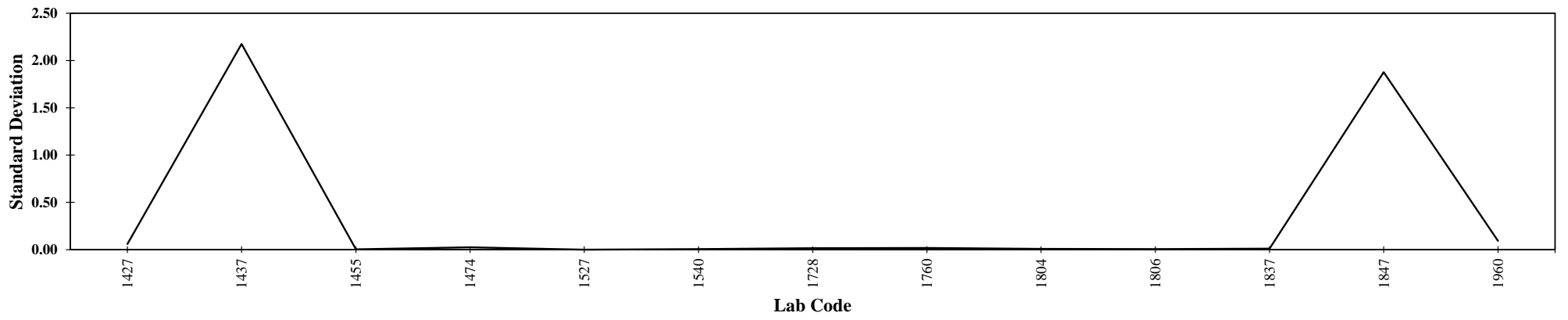
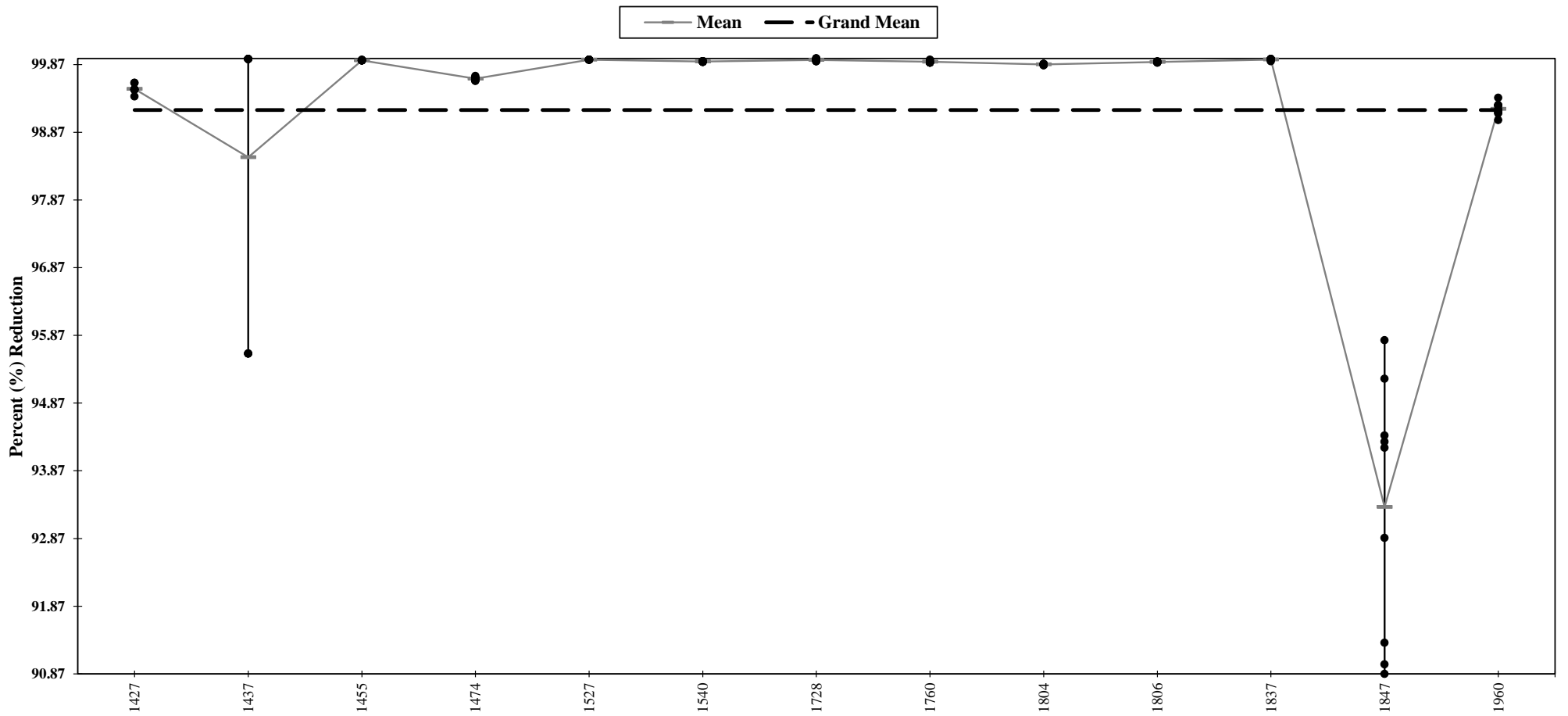


**AATCC TM 100: Antibacterial Finishes on Textile Materials: Assessment of
Gram Negative - Percent (%) Reduction
Percent (%) Reduction**

	Median	Mean	St. Dev.	Minimum	Maximum	Range
Data Summary	99.38	99.20	0.33	98.76	99.53	0.77

Lab Code	Median	Mean	St. Dev.	Minimum	Maximum	Range
1427	99.50	99.51	0.06	99.40	99.60	0.20
1437	99.95	98.50	2.18	95.60	99.95	4.35
1455	99.93	99.93	0.00	99.93	99.94	0.01
1474	99.67	99.66	0.02	99.63	99.70	0.07
1527	99.94	99.94	0.00	99.94	99.94	0.00
1540	99.92	99.92	0.01	99.91	99.92	0.01
1728	99.94	99.94	0.02	99.92	99.96	0.04
1760	99.90	99.91	0.02	99.90	99.94	0.04
1804	99.87	99.87	0.01	99.86	99.88	0.02
1806	99.91	99.91	0.01	99.90	99.92	0.02
1837	99.95	99.94	0.01	99.92	99.95	0.03
1847	94.21	93.34	1.88	90.87	95.80	4.93
1960	99.21	99.22	0.09	99.05	99.38	0.33

AATCC TM 100: Antibacterial Finishes on Textile Materials: Assessment of Gram Negative - Percent (%) Reduction



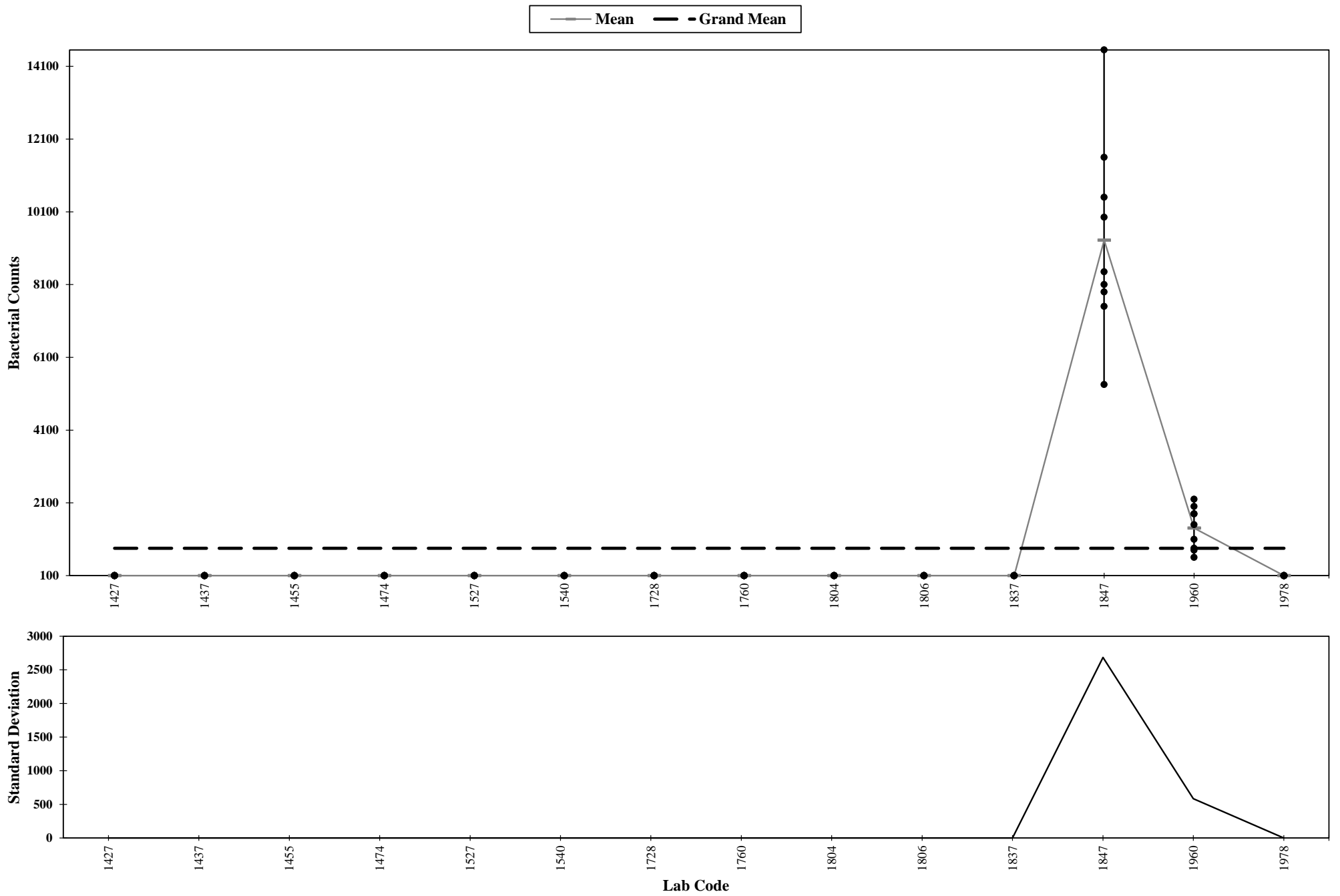
**AATCC TM 100: Antibacterial Finishes on Textile Materials: Assessment of
Gram Positive - Treated Bacterial Counts**

Bacterial Counts

	Median	Mean	St. Dev.	Minimum	Maximum	Range
Data Summary	796	852	233	511	1282	771

Lab Code	Median	Mean	St. Dev.	Minimum	Maximum	Range
1427	100	100	0	100	100	0
1437	100	100	0	100	100	0
1455	100	100	0	100	100	0
1474	100	100	0	100	100	0
1527	100	100	0	100	100	0
1540	100	100	0	100	100	0
1728	100	100	0	100	100	0
1760	100	100	0	100	100	0
1804	100	100	0	100	100	0
1806	100	100	0	100	100	0
1837	100	100	0	100	100	0
1847	8450	9322	2685	5350	14550	9200
1960	1500	1406	583	600	2200	1600
1978	100	100	0	100	100	0

AATCC TM 100: Antibacterial Finishes on Textile Materials: Assessment of Gram Positive - Treated Bacterial Counts

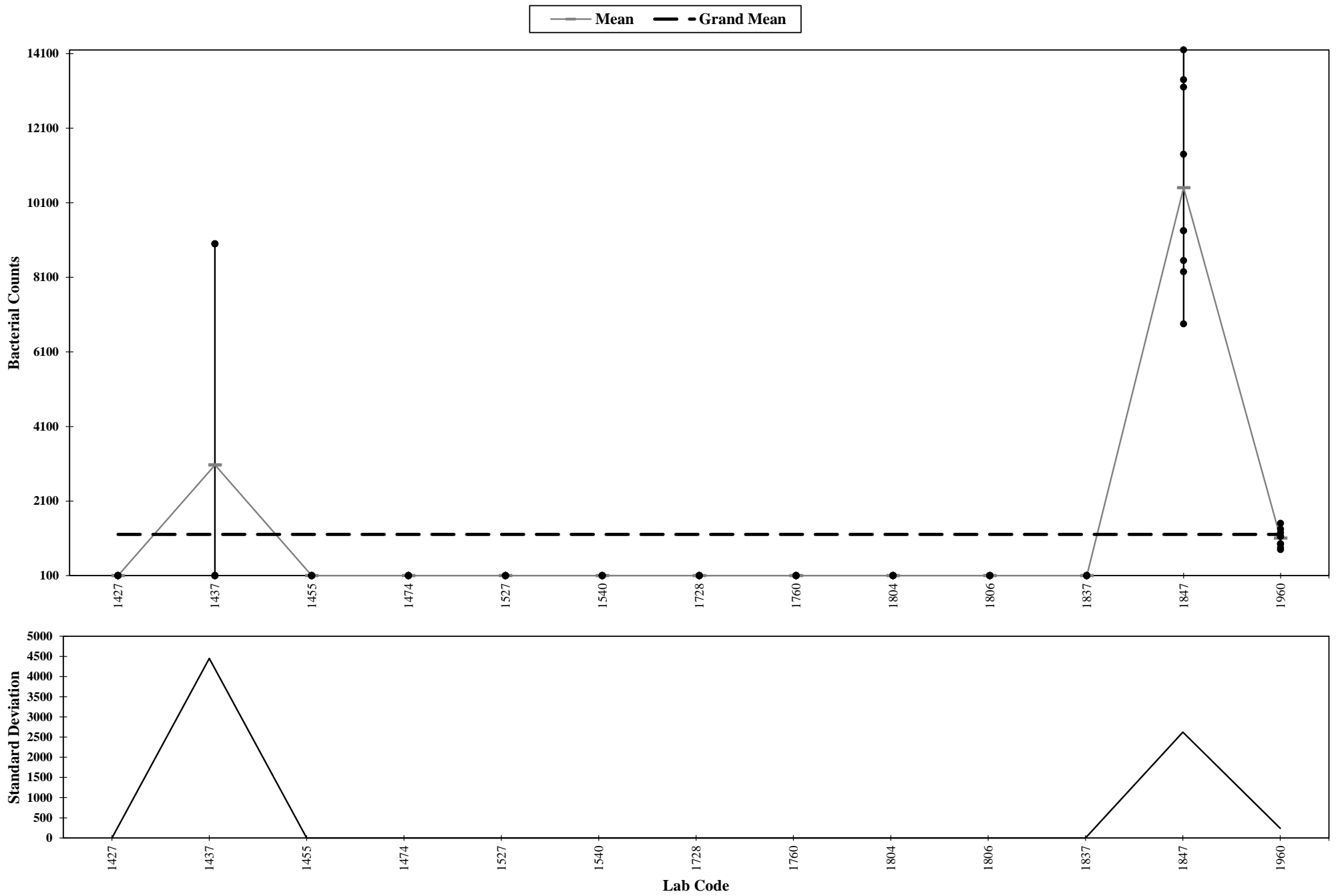


**AATCC TM 100: Antibacterial Finishes on Textile Materials: Assessment of
Gram Negative - Treated Bacterial Counts
Bacterial Counts**

	Median	Mean	St. Dev.	Minimum	Maximum	Range
Data Summary	892	1206	562	673	1977	1304

Lab Code	Median	Mean	St. Dev.	Minimum	Maximum	Range
1427	100	100	0	100	100	0
1437	100	3067	4450	100	9000	8900
1455	100	100	0	100	100	0
1474	100	100	0	100	100	0
1527	100	100	0	100	100	0
1540	100	100	0	100	100	0
1728	100	100	0	100	100	0
1760	100	100	0	100	100	0
1804	100	100	0	100	100	0
1806	100	100	0	100	100	0
1837	100	100	0	100	100	0
1847	9350	10506	2623	6850	14200	7350
1960	1150	1106	236	800	1500	700

AATCC TM 100: Antibacterial Finishes on Textile Materials: Assessment of Gram Negative - Treated Bacterial Counts

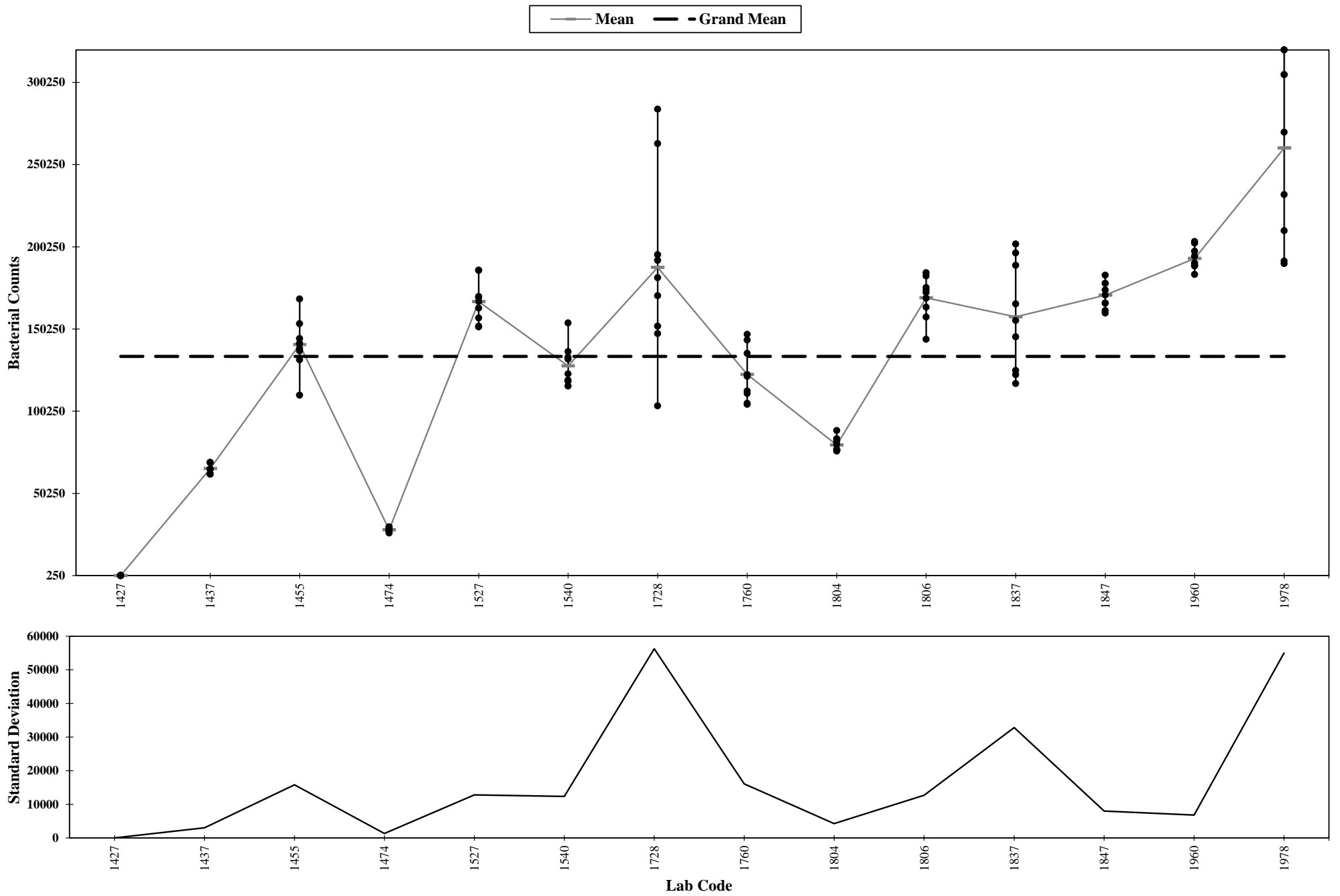


**AATCC TM 100: Antibacterial Finishes on Textile Materials: Assessment of
Gram Positive - Untreated Control Bacterial Counts
Bacterial Counts**

	Median	Mean	St. Dev.	Minimum	Maximum	Range
Data Summary	133136	133596	16958	110275	158587	48312

Lab Code	Median	Mean	St. Dev.	Minimum	Maximum	Range
1427	300	289	23	250	320	70
1437	65000	65333	3041	62000	69000	7000
1455	141500	140722	15804	110000	168500	58500
1474	27600	28117	1314	26100	29900	3800
1527	167000	166889	12837	151500	186000	34500
1540	123000	127833	12362	115500	154000	38500
1728	181500	187722	56278	103500	284000	180500
1760	121500	122556	16100	104500	147000	42500
1804	77000	79667	4272	76000	88500	12500
1806	172500	169222	12694	144000	184500	40500
1837	155500	157611	32838	117000	202000	85000
1847	171000	170833	8000	160000	183000	23000
1960	190500	193167	6815	183500	203500	20000
1978	270000	260389	55028	190000	320000	130000

AATCC TM 100: Antibacterial Finishes on Textile Materials: Assessment of Gram Positive - Untreated Control Bacterial Counts

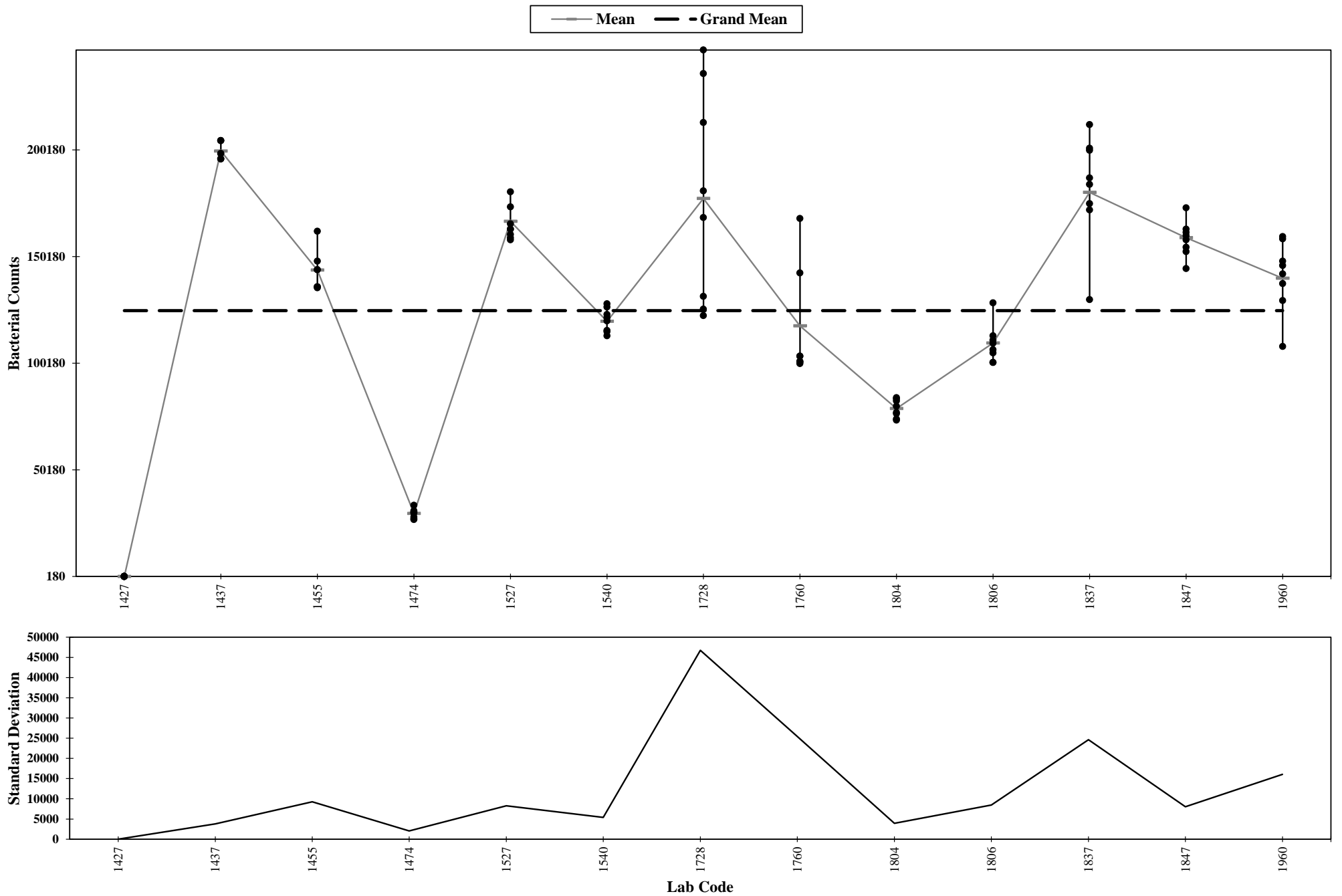


**AATCC TM 100: Antibacterial Finishes on Textile Materials: Assessment of
Gram Negative - Untreated Control Bacterial Counts
Bacterial Counts**

	Median	Mean	St. Dev.	Minimum	Maximum	Range
Data Summary	123473	124816	12466	108348	144675	36326

Lab Code	Median	Mean	St. Dev.	Minimum	Maximum	Range
1427	195	198	14	180	220	40
1437	198500	199667	3783	196000	204500	8500
1455	144000	143833	9253	135500	162000	26500
1474	29950	29689	2072	26850	33550	6700
1527	163000	166667	8254	158000	180500	22500
1540	120000	119778	5380	113000	128000	15000
1728	171500	177389	46753	122500	247000	124500
1760	103500	117667	25419	100000	168000	68000
1804	79000	78889	3935	73500	84000	10500
1806	109500	109611	8462	100500	128500	28000
1837	184000	180278	24649	130000	212000	82000
1847	160000	159000	8047	144500	173000	28500
1960	142000	139944	16036	108000	159500	51500

AATCC TM 100: Antibacterial Finishes on Textile Materials: Assessment of Gram Negative - Untreated Control Bacterial Counts

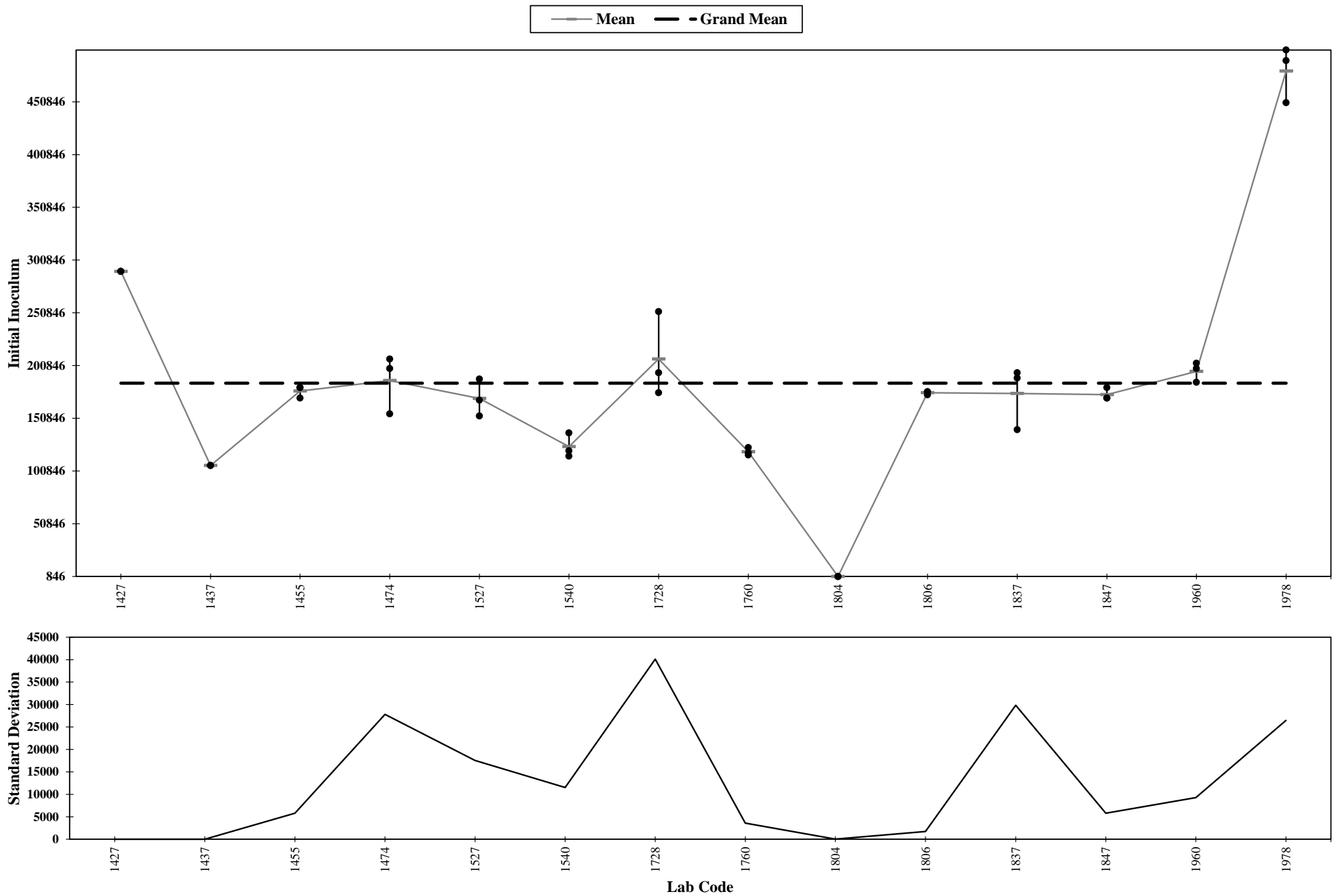


**AATCC TM 100: Antibacterial Finishes on Textile Materials: Assessment of
Gram Positive - Initial Inoculum
Initial Inoculum**

	Median	Mean	St. Dev.	Minimum	Maximum	Range
Data Summary	185563	184133	12820	171346	195491	24145

Lab Code	Median	Mean	St. Dev.	Minimum	Maximum	Range
1427	290000	290000	0	290000	290000	0
1437	106000	106000	0	106000	106000	0
1455	180000	176667	5774	170000	180000	10000
1474	198000	186667	27791	155000	207000	52000
1527	168000	169667	17559	153000	188000	35000
1540	120000	124000	11533	115000	137000	22000
1728	194000	207000	40112	175000	252000	77000
1760	118000	119000	3606	116000	123000	7000
1804	877	868	19	846	880	34
1806	176000	175000	1732	173000	176000	3000
1837	189000	174333	29838	140000	194000	54000
1847	170000	173333	5774	170000	180000	10000
1960	198000	195333	9292	185000	203000	18000
1978	490000	480000	26458	450000	500000	50000

AATCC TM 100: Antibacterial Finishes on Textile Materials: Assessment of Gram Positive - Initial Inoculum

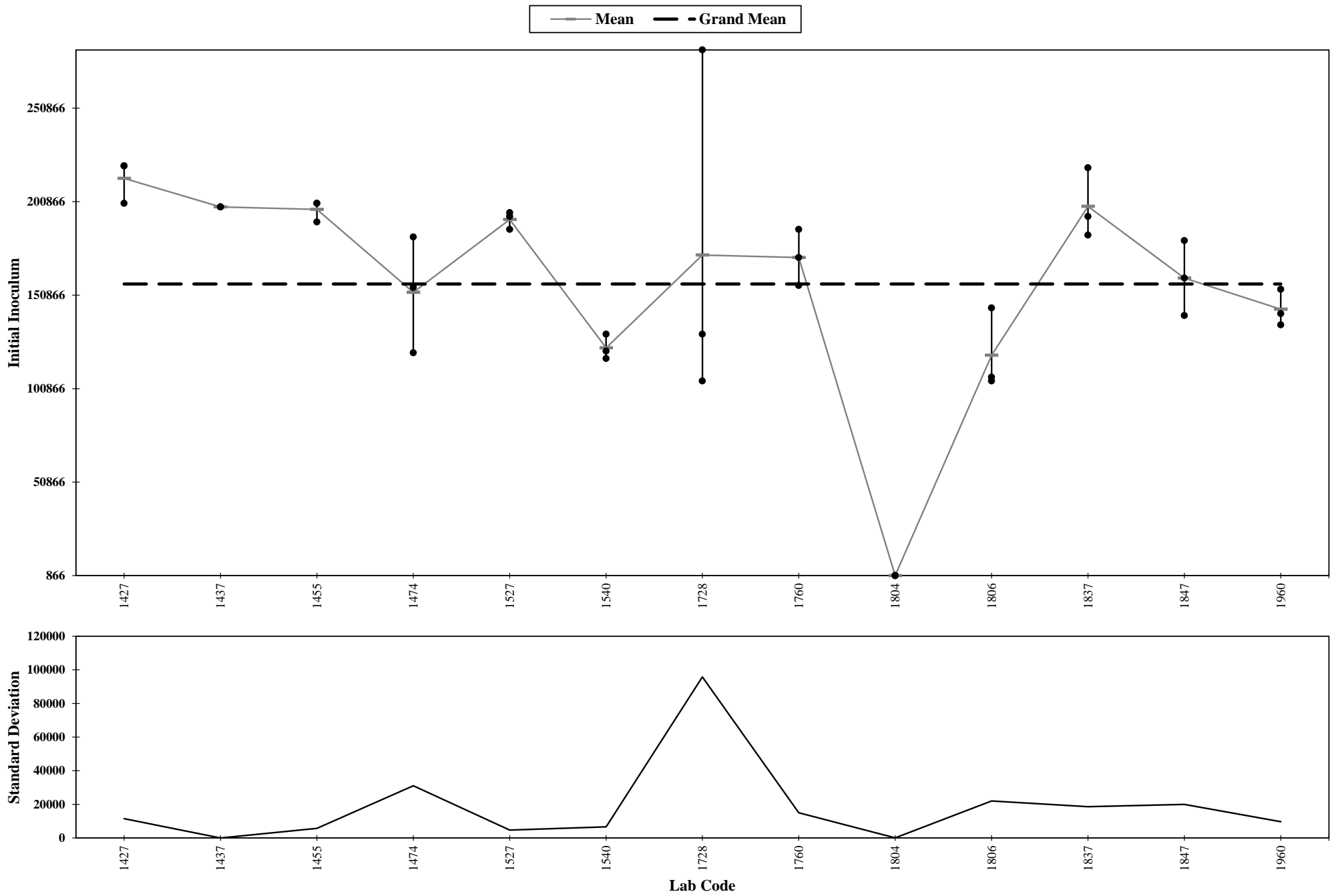


**AATCC TM 100: Antibacterial Finishes on Textile Materials: Assessment of
Gram Negative - Initial Inoculum
Initial Inoculum**

	Median	Mean	St. Dev.	Minimum	Maximum	Range
Data Summary	153069	156838	18529	141220	176225	35004

Lab Code	Median	Mean	St. Dev.	Minimum	Maximum	Range
1427	220000	213333	11547	200000	220000	20000
1437	198000	198000	0	198000	198000	0
1455	200000	196667	5774	190000	200000	10000
1474	155000	152333	31086	120000	182000	62000
1527	193000	191333	4726	186000	195000	9000
1540	121000	122667	6658	117000	130000	13000
1728	130000	172333	95793	105000	282000	177000
1760	171000	171000	15000	156000	186000	30000
1804	895	895	29	866	924	58
1806	107000	118667	21962	105000	144000	39000
1837	193000	198333	18583	183000	219000	36000
1847	160000	160000	20000	140000	180000	40000
1960	141000	143333	9713	135000	154000	19000

AATCC TM 100: Antibacterial Finishes on Textile Materials: Assessment of Gram Negative - Initial Inoculum



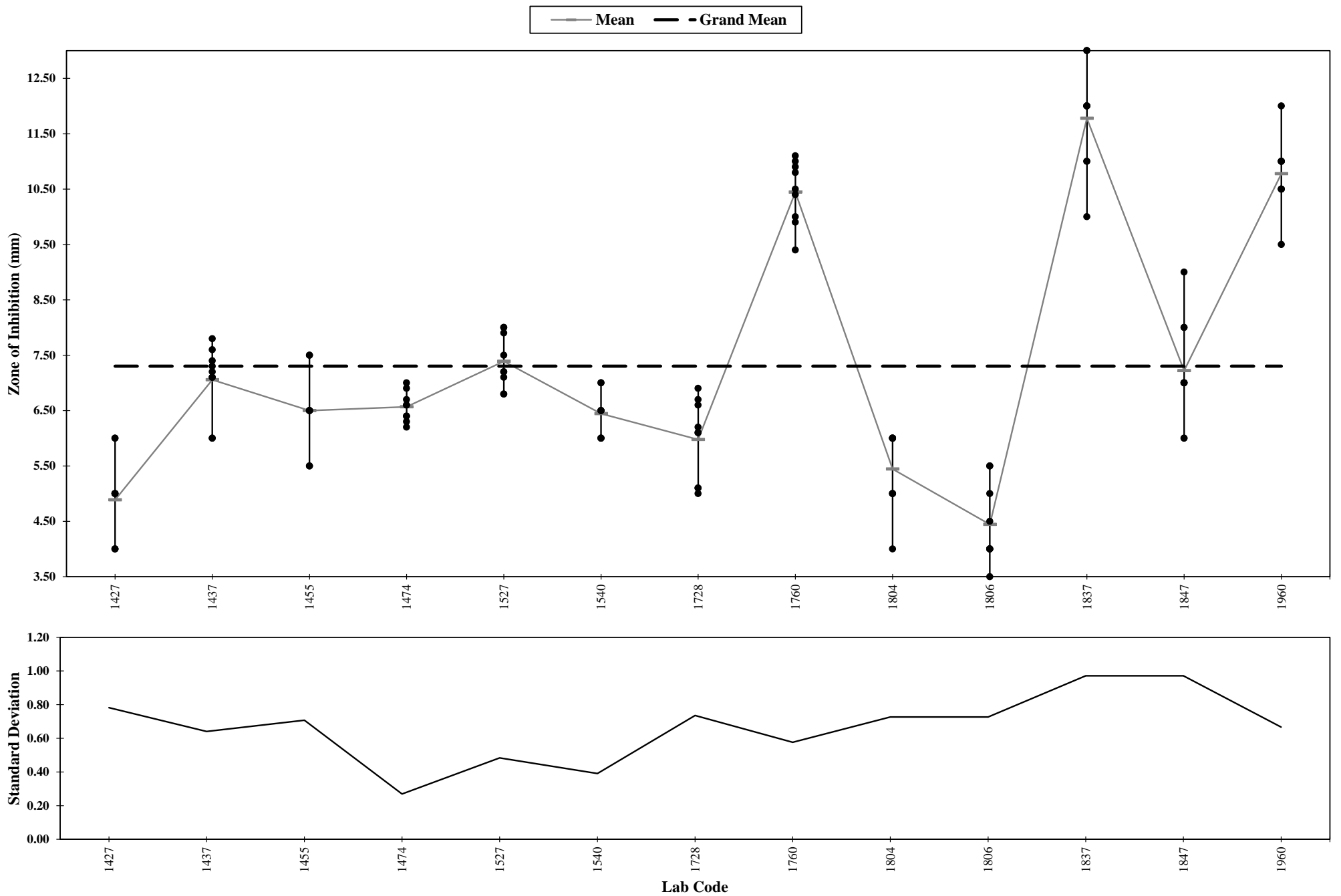
ATCC TM 147: Antibacterial Activity Assessment of Textile Materials: Parallel Streak Method
Gram Positive - Treated Zone of Inhibition
Zone of Inhibition (mm)

	Median	Mean	St. Dev.	Minimum	Maximum	Range
Data Summary	7.35	7.30	0.67	6.30	8.22	1.92

Lab Code	Median	Mean	St. Dev.	Minimum	Maximum	Range
1427	5.00	4.89	0.78	4.00	6.00	2.00
1437	7.20	7.06	0.64	6.00	7.80	1.80
1455	6.50	6.50	0.71	5.50	7.50	2.00
1474	6.60	6.57	0.27	6.20	7.00	0.80
1527	7.20	7.39	0.48	6.80	8.00	1.20
1540	6.50	6.44	0.39	6.00	7.00	1.00
1728	6.10	5.98	0.74	5.00	6.90	1.90
1760	10.50	10.44	0.58	9.40	11.10	1.70
1804	6.00	5.44	0.73	4.00	6.00	2.00
1806	4.00	4.44	0.73	3.50	5.50	2.00
1837	12.00	11.78	0.97	10.00	13.00	3.00
1847	7.00	7.22	0.97	6.00	9.00	3.00
1960	11.00	10.78	0.67	9.50	12.00	2.50

AATCC TM 147: Antibacterial Activity Assessment of Textile Materials: Parallel Streak Method

Gram Positive - Treated Zone of Inhibition



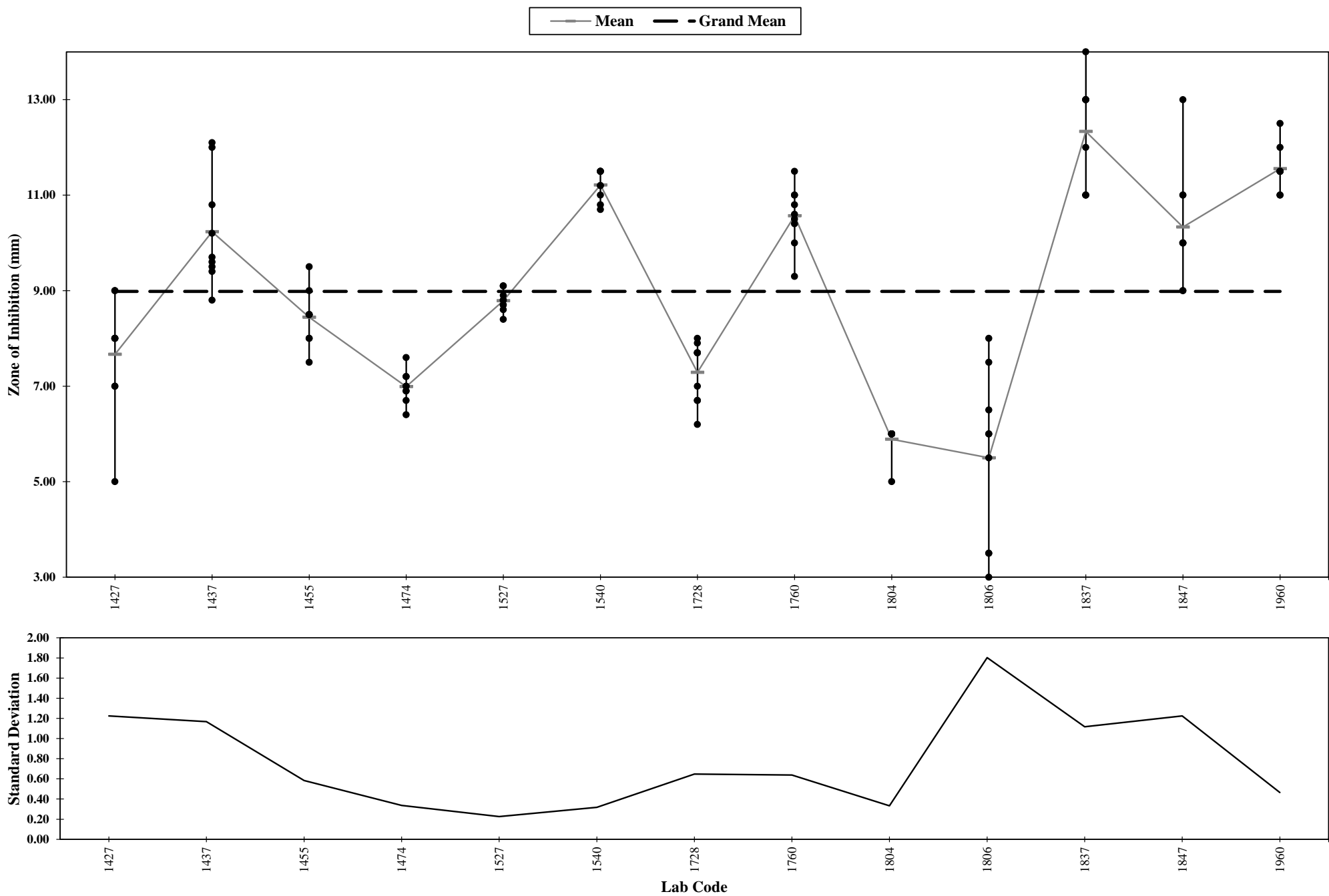
ATCC TM 147: Antibacterial Activity Assessment of Textile Materials: Parallel Streak Method
Gram Negative - Treated Zone of Inhibition
Zone of Inhibition (mm)

	Median	Mean	St. Dev.	Minimum	Maximum	Range
Data Summary	9.08	8.98	0.78	7.79	10.14	2.35

Lab Code	Median	Mean	St. Dev.	Minimum	Maximum	Range
1427	8.00	7.67	1.22	5.00	9.00	4.00
1437	9.70	10.23	1.17	8.80	12.10	3.30
1455	8.50	8.44	0.58	7.50	9.50	2.00
1474	7.00	6.99	0.34	6.40	7.60	1.20
1527	8.80	8.79	0.23	8.40	9.10	0.70
1540	11.20	11.21	0.32	10.70	11.50	0.80
1728	7.70	7.29	0.65	6.20	8.00	1.80
1760	10.60	10.57	0.64	9.30	11.50	2.20
1804	6.00	5.89	0.33	5.00	6.00	1.00
1806	6.00	5.50	1.80	3.00	8.00	5.00
1837	13.00	12.33	1.12	11.00	14.00	3.00
1847	10.00	10.33	1.22	9.00	13.00	4.00
1960	11.50	11.56	0.46	11.00	12.50	1.50

AATCC TM 147: Antibacterial Activity Assessment of Textile Materials: Parallel Streak Method

Gram Negative - Treated Zone of Inhibition



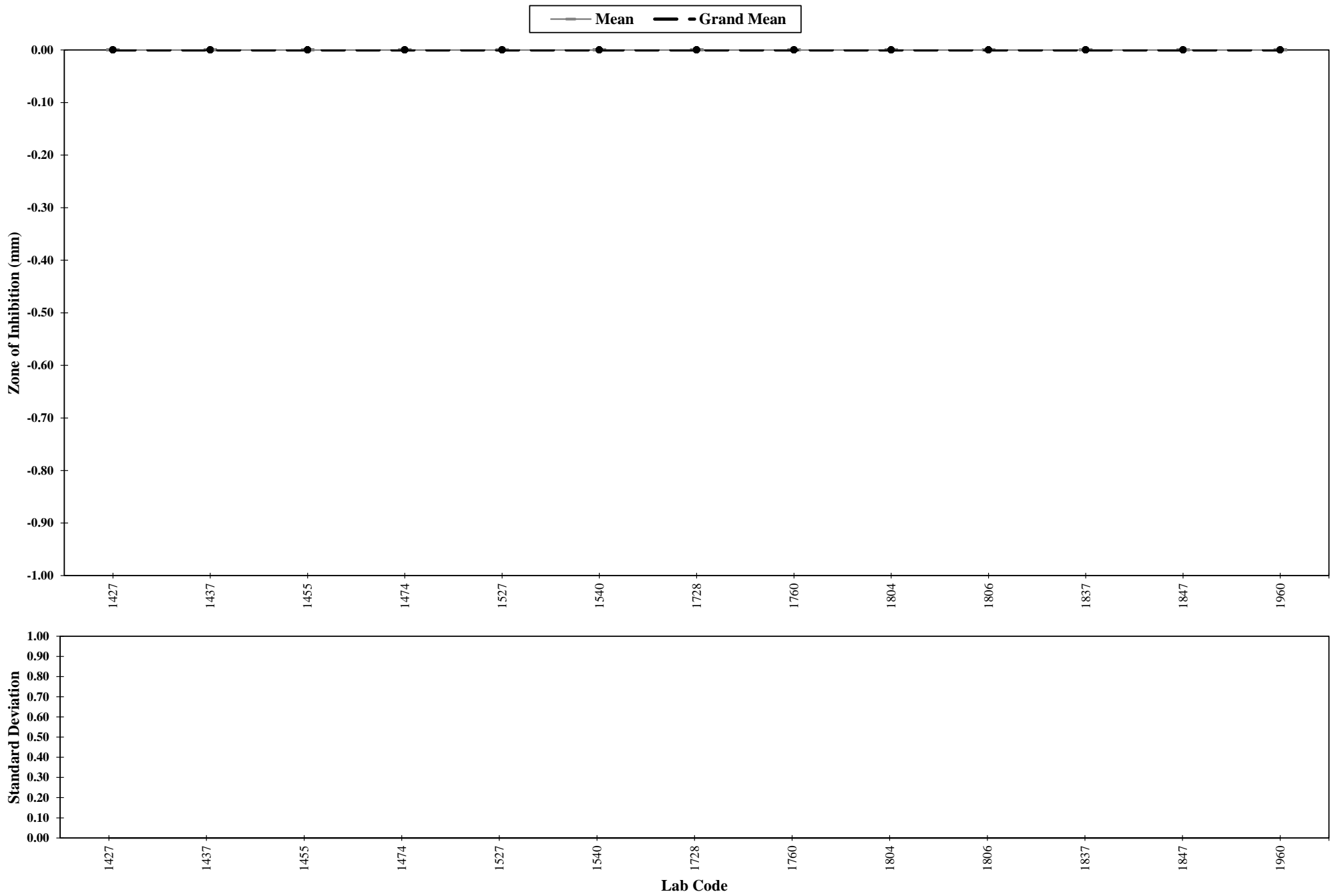
**ATCC TM 147: Antibacterial Activity Assessment of Textile Materials: Parallel Streak Method
Gram Positive - Untreated Control Zone of Inhibition
Zone of Inhibition (mm)**

	Median	Mean	St. Dev.	Minimum	Maximum	Range
Data Summary	0.00	0.00	0.00	0.00	0.00	0.00

Lab Code	Median	Mean	St. Dev.	Minimum	Maximum	Range
1427	0.00	0.00	0.00	0.00	0.00	0.00
1437	0.00	0.00	0.00	0.00	0.00	0.00
1455	0.00	0.00	0.00	0.00	0.00	0.00
1474	0.00	0.00	0.00	0.00	0.00	0.00
1527	0.00	0.00	0.00	0.00	0.00	0.00
1540	0.00	0.00	0.00	0.00	0.00	0.00
1728	0.00	0.00	0.00	0.00	0.00	0.00
1760	0.00	0.00	0.00	0.00	0.00	0.00
1804	0.00	0.00	0.00	0.00	0.00	0.00
1806	0.00	0.00	0.00	0.00	0.00	0.00
1837	0.00	0.00	0.00	0.00	0.00	0.00
1847	0.00	0.00	0.00	0.00	0.00	0.00
1960	0.00	0.00	0.00	0.00	0.00	0.00

AATCC TM 147: Antibacterial Activity Assessment of Textile Materials: Parallel Streak Method

Gram Positive - Untreated Control Zone of Inhibition



ATCC TM 147: Antibacterial Activity Assessment of Textile Materials: Parallel Streak Method
Gram Negative - Untreated Control Zone of Inhibition
Zone of Inhibition (mm)

Data Summary	Median	Mean	St. Dev.	Minimum	Maximum	Range
Total Averages	0.00	0.00	0.00	0.00	0.00	0.00

Lab Code	Median	Mean	St. Dev.	Minimum	Maximum	Range
1427	0.00	0.00	0.00	0.00	0.00	0.00
1437	0.00	0.00	0.00	0.00	0.00	0.00
1455	0.00	0.00	0.00	0.00	0.00	0.00
1474	0.00	0.00	0.00	0.00	0.00	0.00
1527	0.00	0.00	0.00	0.00	0.00	0.00
1540	0.00	0.00	0.00	0.00	0.00	0.00
1728	0.00	0.00	0.00	0.00	0.00	0.00
1760	0.00	0.00	0.00	0.00	0.00	0.00
1804	0.00	0.00	0.00	0.00	0.00	0.00
1806	0.00	0.00	0.00	0.00	0.00	0.00
1837	0.00	0.00	0.00	0.00	0.00	0.00
1847	0.00	0.00	0.00	0.00	0.00	0.00
1960	0.00	0.00	0.00	0.00	0.00	0.00

AATCC TM 147: Antibacterial Activity Assessment of Textile Materials: Parallel Streak Method

Gram Negative - Untreated Control Zone of Inhibition

