CEMENT AND CONCRETE REFERENCE LABORATORY

PROFICIENCY SAMPLE PROGRAM

Final Report
Portland Cement Proficiency Samples
Number 167 and Number 168

March 2008

CCRL CEMENT AND CONCRETE REFERENCE LABORATORY

March 28, 2008

TO: Participants in the CCRL Portland Cement Proficiency Sample Program

SUBJECT: Final Report on Portland Cement Proficiency Samples No. 167 and No. 168

Following is the final report for the current pair of CCRL **Portland Cement** Proficiency Samples which were distributed in January 2008. Portland Cement Sample No. 167 was an ASTM C150 Type I and No. 168 was an ASTM C150 Type III.

This report consists of a statistical Summary of Results, a set of general Scatter Diagrams, and associated detailed information. The Table of Results with individualized information for participating laboratories can be downloaded at our website located at: http://ccrl.us/. Additional information is provided in the following pages.

The CCRL Proficiency Sample Programs are intended for internal use by the laboratory as a tool to identify potential problems in laboratory procedures or test equipment and to initiate remedial actions. These programs are designed to complement the CCRL Laboratory Inspection Program as part of a total quality system. Care should be taken when using this program for any other purpose.

Additional samples of these two cements and other CCRL samples are available for purchase. These samples may be useful for equipment verification, technician training, and research. Contact CCRL for availability and price.

It is presently anticipated that the next Portland Cement Proficiency Samples will be distributed in June 2008.

Sincerely,

Robin K. Haupt

Robin K. Haupt
Supervisor, Proficiency Sample Programs
Cement and Concrete Reference Laboratory

TO: Participants in the CCRL Portland Cement Proficiency Sample Program

FROM: Robin K. Haupt, Supervisor, PSP

SUBJECT: Explanation of Final Report on Results of Tests for Portland Cement Proficiency Samples No. 167 and No. 168

This letter, and the material included with it, constitute the final report, and summary of results for the current pair of Portland Cement Proficiency Samples, which were distributed in January 2008. This material includes a Table of Results for individual laboratory data, a statistical Summary of Results, and a set of general Scatter Diagrams. Your unique laboratory number is displayed at the top of the individual Table of Results.

An explanation of the program is contained in the paper: "Statistical Evaluation of Interlaboratory Cement Tests" by J. R. Crandall and R. L. Blaine View document, and "Statistical Aspects of the Cement Testing Program" by W.J. Youden View document, which can be found in Volume 59, Proceedings of the 62nd Annual Meeting of the Society, June 25, 1959, American Society for Testing and Materials.

Each laboratory receives an individualized Table of Results. The Table of Results shows the, test title, and the reporting unit in the first two columns. After that it lists in order, the laboratory's results for the odd and even numbered samples, overall averages for the odd and even numbered samples, and the laboratory's ratings for the odd and even samples.

Laboratory ratings, shown in the Table of Results for the individual laboratory, were determined in the manner described by Crandall and Blaine using a rating scale of 1 to 5 instead of 0 to 4. The ratings have no valid standing beyond showing the difference between the individual laboratory result and the average for a particular test.

The following table details the relationship between the ratings and the averages.

Ratings	Range (Number of Standard Deviations)	Number (Per 100) of Laboratories achieving the rating [1]
5	Less than 1	69
4	1 to 1.5	18
3	1.5 to 2	9
2	2 to 2.5	3
1	Greater than 2.5	1

The sign of the rating merely shows whether the result reported was greater or less than the average obtained.

Participants subscribing to the primary chemical analysis portion of this report should note that the statistics were calculated using data obtained by wet methods, and rapid methods of chemical analysis. Participants in the secondary chemical analysis should note that laboratory ratings are assigned using primary chemical statistics.
Please note that individual laboratory ratings were not given for the flow of air content mortar (test no. 190) and compressive strength mortar (test no. 230). Air content flows in the range of 87.5 ± 7.5 are satisfactory,

[1]Youden, W.J., "Statistical Aspects of the Cement Testing Program",Volume 59, *Proceedings of the 62nd Annual Meeting of the Society, June 25, 1959, American Society for Testing and Materials.*

labs with flow values outside this range will be flagged as a “Labs Eliminated” or “Labs Off Diagram” on the scatter diagram. Averages, standard deviations, and a scatter diagram are provided for your information. This information may be a helpful indicator of a problem with flow table apparatus or mortar mixing procedures. Flow values of 151 were assigned to laboratories reporting a mortar flow off the flow table top.

In cases where some laboratories' results are eliminated, averages, standard deviations, coefficients of variation, and the ratings of the other laboratories' results, are recalculated using the data remaining after the elimination. Since the laboratory ratings given are the results from this one series of tests, you need not attach too much significance to a single low rating, or pair of ratings, from this one series. A continuing tendency to get low ratings on several pairs of samples should lead a laboratory to consider the types of error, systematic and random, contribute to ratings that are low. Systematic error, which is indicated by low ratings with the same signs on each pair of samples, means a consistent error is occurring in equipment and/or test procedures. One indication of random error is low ratings on both samples with different signs. Since systematic error occurs with more regularity, its cause is generally easier to find than the cause of random error.

Summary of Results

Usually, averages, standard deviations, and coefficients of variation are given with all results reported, and then with one or more outlying results omitted. Sometimes, two or more recalculations with laboratories omitted, have been done for the same test. In these cases, all of the laboratories omitted in previous recalculations are also omitted in subsequent ones. Results omitted are values that are more than three standard deviations from the mean of one or both samples. Often, elimination of these outlying results has little effect on the average, but may have a more pronounced effect on the standard deviation and coefficient of variation.

Scatter Diagrams

General scatter diagrams are supplied with this report. Crandall and Blaine describe the manner of preparing scatter diagrams, and their interpretation, in the paper published in the 1959 ASTM Proceedings. Each laboratory will receive a complete set of diagrams according to their subscription to the given program.

Using the results received from each laboratory, a scatter diagram is generated for each test method by plotting the value for the odd numbered samples on the *X*, or horizontal axis, against the value for the even numbered samples on the *Y*, or vertical axis. To find your point, just plot as you would when plotting any scatter diagram. Vertical and horizontal dashed lines, which divide the diagrams into four sections or quadrants, place the average values for the odd and even numbered samples, respectively. The first line of print under the diagram includes the test number, as given on the data sheet, the test title, and the number of data points on the diagrams. The number of plotted points may not agree with the total number of data pairs included in the analysis because a few points may be off the diagram, and some points may represent several data pairs, which are identical. Laboratories whose points are off the diagram will have a rating of ±1 for that particular test. As described in Crandall and Blaine, a tight circular pattern of points around the intersection of the median lines is the ideal situation. Stretching out of the pattern into the first (upper right) and third (lower left) quadrants, suggests some kind of bias, or tendency for laboratories to get high or low results on both samples. Examination of the scatter diagrams indicates strong evidence of bias on many tests.

CCRL PROFICIENCY SAMPLE PROGRAM
Portland Cement Proficiency Samples No. 167 and No. 168
Final Report - Primary Chemical Results
March 28, 2008

SUMMARY OF RESULTS

			Sample No. 167			Sample No. 168		
Test		#Labs	Average	S.D.	C.V.	Average	S.D.	C.V.
Silicon Dioxide	prcnt	250	19.30	0.30	1.57	19.91	0.33	1.64
Silicon Dioxide	prcnt	* 237	19.29	0.22	1.144	19.91	0.18	0.934
Aluminum Oxide	prcnt	248	5.92	0.36	6.09	5.11	0.25	4.91
Aluminum Oxide	prcnt	* 235	5.92	0.13	2.25	5.11	0.10	1.96
Ferric Oxide	prcnt	252	2.44	0.063	2.57	2.15	0.093	4.35
Ferric Oxide	prcnt	* 242	2.44	0.049	2.01	2.14	0.046	2.17
Calcium Oxide	prcnt	249	61.65	0.49	0.794	62.27	0.56	0.905
Calcium Oxide	prcnt	* 242	61.64	0.42	0.676	62.28	0.47	0.752
Magnesium Oxide	prcnt	252	3.11	0.10	3.31	3.87	0.14	3.76
Magnesium Oxide	prcnt	* 247	3.11	0.093	2.98	3.88	0.106	2.72
Sulfur Trioxide	prcnt	257	4.38	0.21	4.86	3.49	0.15	4.44
Sulfur Trioxide	prcnt	* 243	4.39	0.134	3.05	3.48	0.093	2.66
Loss on Ignition	prcnt	254	0.86	0.14	16.6	0.89	0.22	25.5
Loss on Ignition	prcnt	* 243	0.84	0.076	9.08	0.86	0.076	8.77
Sodium Oxide	prcnt	238	0.351	0.063	17.9	0.225	0.056	24.8
Sodium Oxide	prcnt	* 228	0.355	0.050	14.0	0.226	0.043	19.0

CONTINUED ON NEXT PAGE

* ELIMINATED LABS: Data over three S.D. from the mean

Silicon Dioxide	24 39 51 206 932 2463 18 52 222 691 2437 3124 3125
Aluminum Oxide	30 201 222 24 208 247 690 694 768 975 1644 2463 3297
Ferric Oxide	2 222 3059 143 768 1936 2466 3057 3125 3250
Calcium Oxide	24 30 39 42 504 1251 2621
Magnesium Oxide	201 222 492 694 2463
Sulfur Trioxide	95 161 167 1196 1940 73 159 222 305 1483 2437 2464 3009 3297
Loss on Ignition	95 125 137 1524 92 121 221 2305 3125 3235 3297
Sodium Oxide	30 2463 2464 289 504 2466 3125 3235 3249 3279

CCRL PROFICIENCY SAMPLE PROGRAM
Portland Cement Proficiency Samples No. 167 and No. 168
Final Report - Primary Chemical Results
March 21, 2008

SUMMARY OF RESULTS

			Sample No. 167			Sample No. 168		
Test		#Labs	Average	S.D.	C.V.	Average	S.D.	C.V.
Potassium Oxide	prcnt	241	1.070	0.046	4.29	1.220	0.083	6.79
Potassium Oxide	prcnt	* 231	1.068	0.030	2.80	1.227	0.034	2.77
Titanium Dioxide	prcnt	191	0.24	0.024	10.1	0.20	0.024	11.9
Titanium Dioxide	prcnt	* 179	0.24	0.0092	3.85	0.20	0.0090	4.46
Phosphorous Pent	prcnt	177	0.24	0.046	18.9	0.20	0.088	43.5
Phosphorous Pent	prcnt	* 160	0.24	0.0119	4.94	0.19	0.0096	5.01
Zinc Oxide	prcnt	78	0.014	0.0107	75.5	0.015	0.0097	65.7
Zinc Oxide	prcnt	* 75	0.013	0.0034	26.2	0.014	0.0031	23.0
Manganic Oxide	prcnt	132	0.096	0.018	18.5	0.089	0.014	15.7
Manganic Oxide	prcnt	* 124	0.098	0.0043	4.40	0.089	0.0036	4.03
Chloride	prcnt	101	0.007	0.0053	76.7	0.005	0.0046	101.9
Chloride	prcnt	* 96	0.006	0.0036	57.9	0.004	0.0035	84.0
Insoluble Residue	prcnt	240	0.29	0.14	50.0	0.36	0.21	58.3
Insoluble Residue	prcnt	* 228	0.27	0.084	31.6	0.33	0.096	29.3
Free Calcium Oxid	prcnt	199	0.43	0.24	56.2	0.71	0.27	38.2
Free Calcium Oxid	prcnt	* 197	0.43	0.23	54.3	0.70	0.24	34.3

CONTINUED ON NEXT PAGE

* ELIMINATED LABS: Data over three S.D. from the mean

Potassium Oxide	94 222 1940 3009 3233 95 1025 1196 3234 3297
Titan Dioxide	492 504 1644 2251 18 56 129 176 696 2305 2477 2621
Phosphorous Pentoxide	504 2295 2305 2463 166 684 2465 2483 2484 2490 125 181 201 493 883 1053 3279
Zinc Oxide	30 38 2491
Manganic Oxide	38 696 2484 697 2462 2463 2491 2522
Chloride	166 246 208 289 1466
Insoluble Residue	143 1196 1379 2491 36 127 221 694 1251 1956 2477 3297
Free Calcium Oxide	3235 3297

CCRL PROFICIENCY SAMPLE PROGRAM
Portland Cement Proficiency Samples No. 167 and No. 168
Final Report - Primary Chemical Results
March 21, 2008

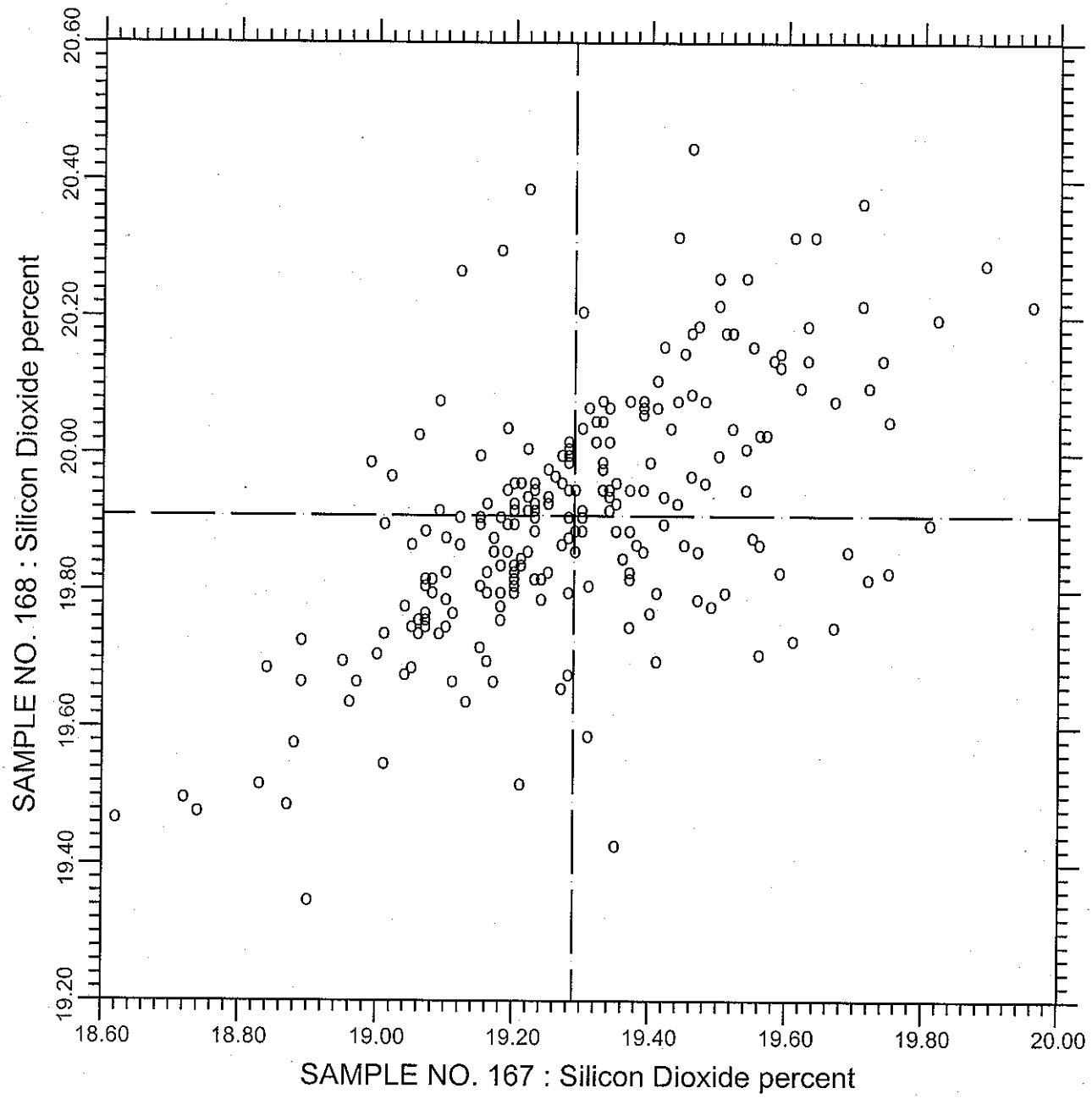
SUMMARY OF RESULTS

			Sample No. 167			Sample No. 168		
Test		#Labs	Average	S.D.	C.V.	Average	S.D.	C.V.
Carbon Dioxide	Not Determined for these Samples - Cements did Not Contain Limestone Additions							
Limestone	Not Determined for these Samples - Cements did Not Contain Limestone Additions							
Chromium Oxide	prcnt	84	0.012	0.0060	47.8	0.012	0.0053	45.9
Chromium Oxide	prcnt *	80	0.012	0.0040	34.4	0.011	0.0036	34.3
Tricalcium Silicate	prcnt	211	48.8	4.0	8.22	54.7	3.9	7.21
Tricalcium Silicate	prcnt *	205	48.7	3.1	6.32	54.8	3.2	5.90
Dicalcium Silicate	prcnt	211	18.5	3.6	19.4	15.8	3.4	21.4
Dicalcium Silicate	prcnt *	199	18.6	2.6	14.2	15.8	2.4	15.4
Tricalc Aluminate	prcnt	215	11.5	1.00	8.66	9.9	0.69	6.93
Tricalc Aluminate	prcnt *	207	11.5	0.40	3.48	9.9	0.31	3.16
Tetracalc Alumino	prcnt	213	7.4	0.19	2.58	6.5	0.28	4.29
Tetracalc Alumino	prcnt *	208	7.4	0.16	2.18	6.5	0.16	2.50

* ELIMINATED LABS: Data over three S.D. from the mean

Chromium Oxide	36 408 870 2295
Tricalcium Silicate	30 206 1054 1196 2305 2477
Dicalcium Silicate	24 30 206 1196 8 42 407 694 1053 1054 1483 2463
Tricalcium Aluminate	30 201 208 694 883 1644 2295 2463
Tetracalcium Aluminoferite	96 125 883 2466 3125

CCRL PROFICIENCY SAMPLE PROGRAM
Silicon Dioxide
PORTLAND CEMENT SAMPLES NO. 167 & NO. 168



TEST NO.10 Silicon Dioxide 236 POINTS

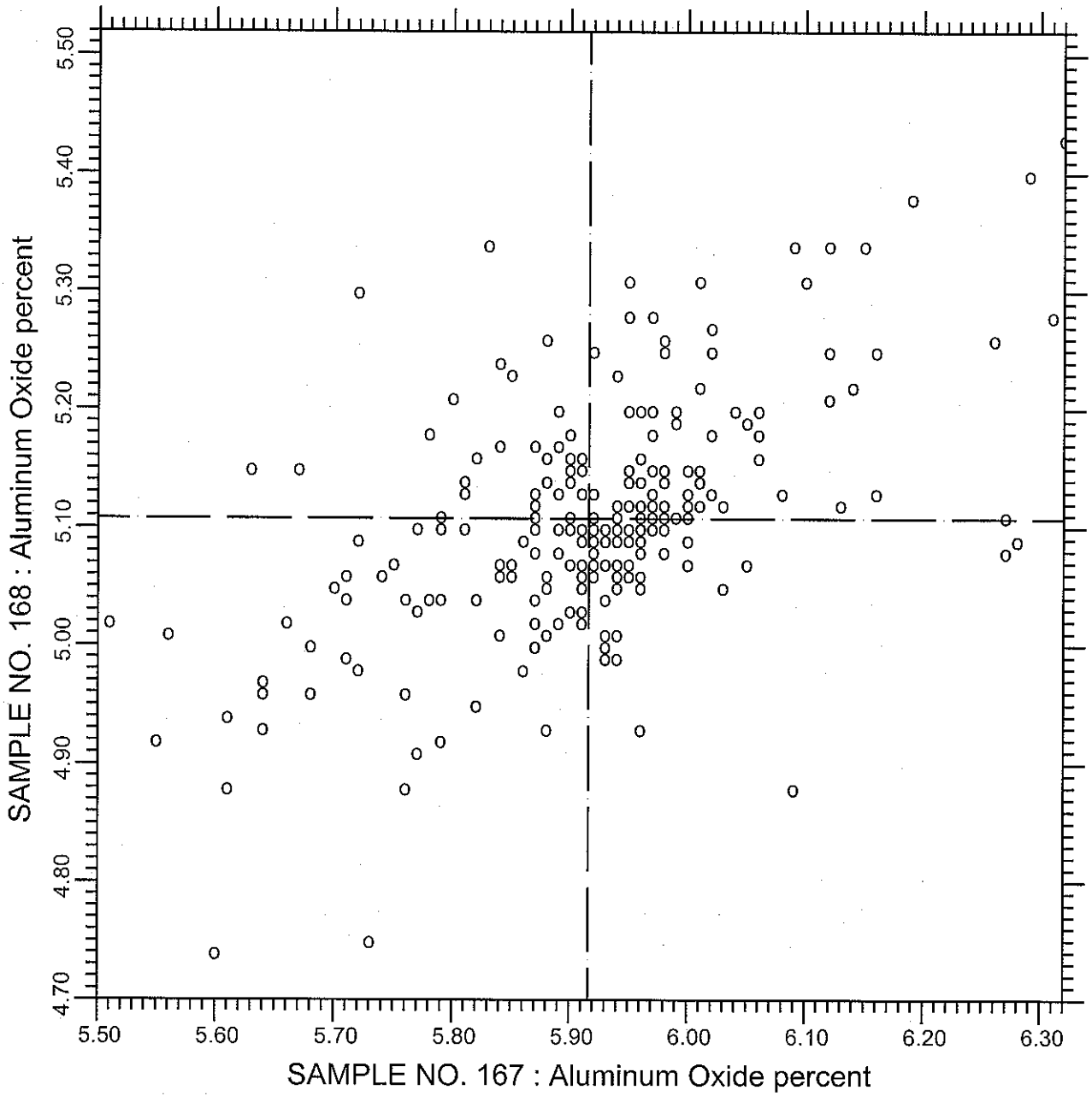
SAMPLE NO. 167 AVE 19.289 S.D. 0.22 C.V. 1.144

SAMPLE NO. 168 AVE 19.909 S.D. 0.18 C.V. 0.934

LABS ELIMINATED 24 39 51 206 932 2463 18 52 222 691 2437 3124 3125

LABS OFF DIAGRAM 2253

CCRL PROFICIENCY SAMPLE PROGRAM
Aluminum Oxide
PORTLAND CEMENT SAMPLES NO. 167 & NO. 168



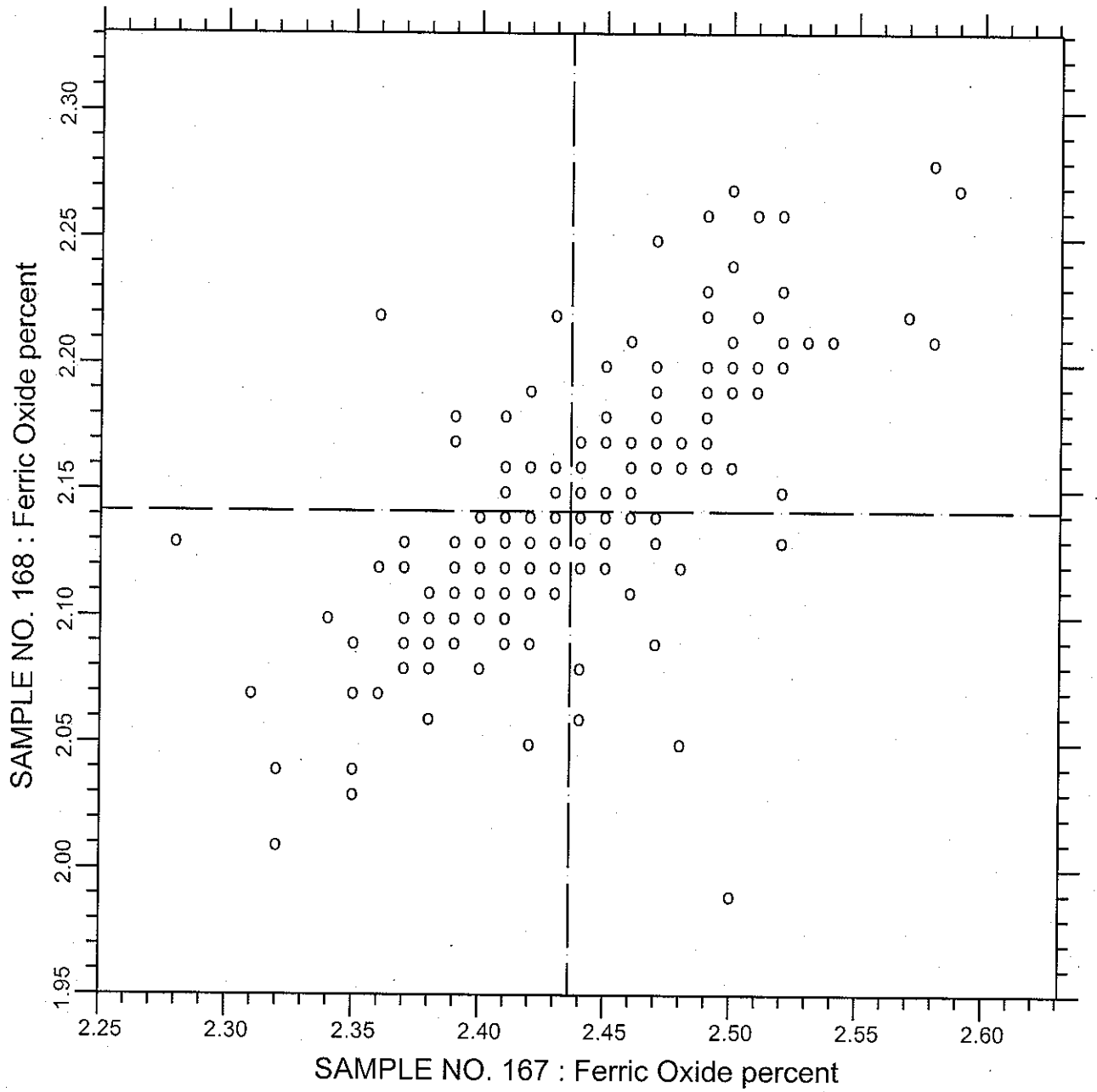
TEST NO.21 Aluminum Oxide 235 POINTS

SAMPLE NO. 167 AVE 5.9162 S.D. 0.13 C.V. 2.25

SAMPLE NO. 168 AVE 5.1075 S.D. 0.10 C.V. 1.96

LABS ELIMINATED 30 201 222 24 208 247 690 694 768 975 1644 2463 3297

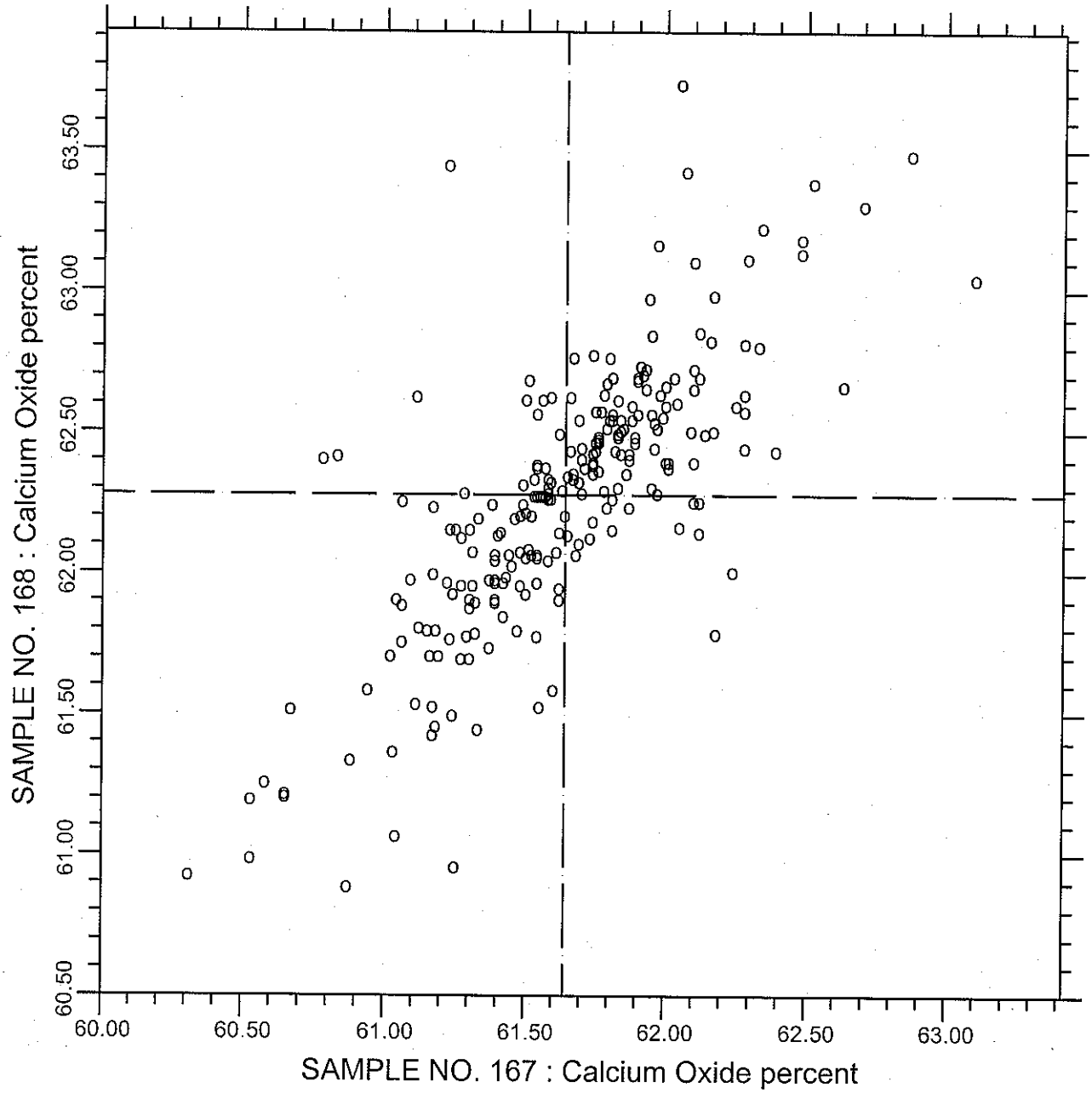
CCRL PROFICIENCY SAMPLE PROGRAM
Ferric Oxide
PORTLAND CEMENT SAMPLES NO. 167 & NO. 168



TEST NO.30 Ferric Oxide 242 POINTS

SAMPLE NO. 167 AVE 2.4363 S.D. 0.049 C.V. 2.01
SAMPLE NO. 168 AVE 2.1416 S.D. 0.046 C.V. 2.17
LABS ELIMINATED 2 222 3059 143 768 1936 2466 3057 3125 3250

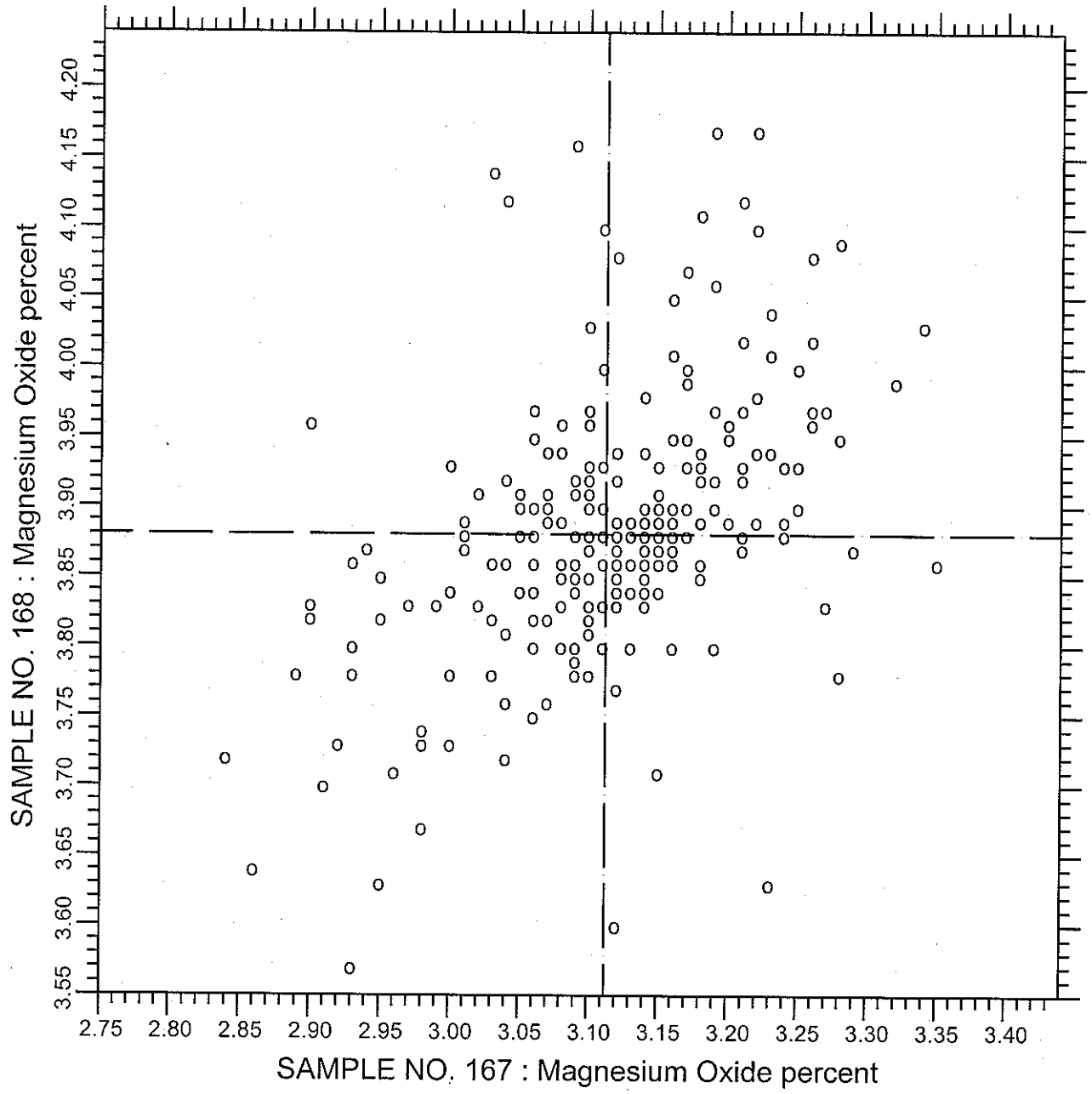
CCRL PROFICIENCY SAMPLE PROGRAM
Calcium Oxide
PORTLAND CEMENT SAMPLES NO. 167 & NO. 168



TEST NO.40 Calcium Oxide 242 POINTS

SAMPLE NO. 167 AVE 61.643 S.D. 0.42 C.V. 0.676
SAMPLE NO. 168 AVE 62.279 S.D. 0.47 C.V. 0.752
LABS ELIMINATED 24 30 39 42 504 1251 2621

CCRL PROFICIENCY SAMPLE PROGRAM
Magnesium Oxide
PORTLAND CEMENT SAMPLES NO. 167 & NO. 168



TEST NO.50 Magnesium Oxide 243 POINTS

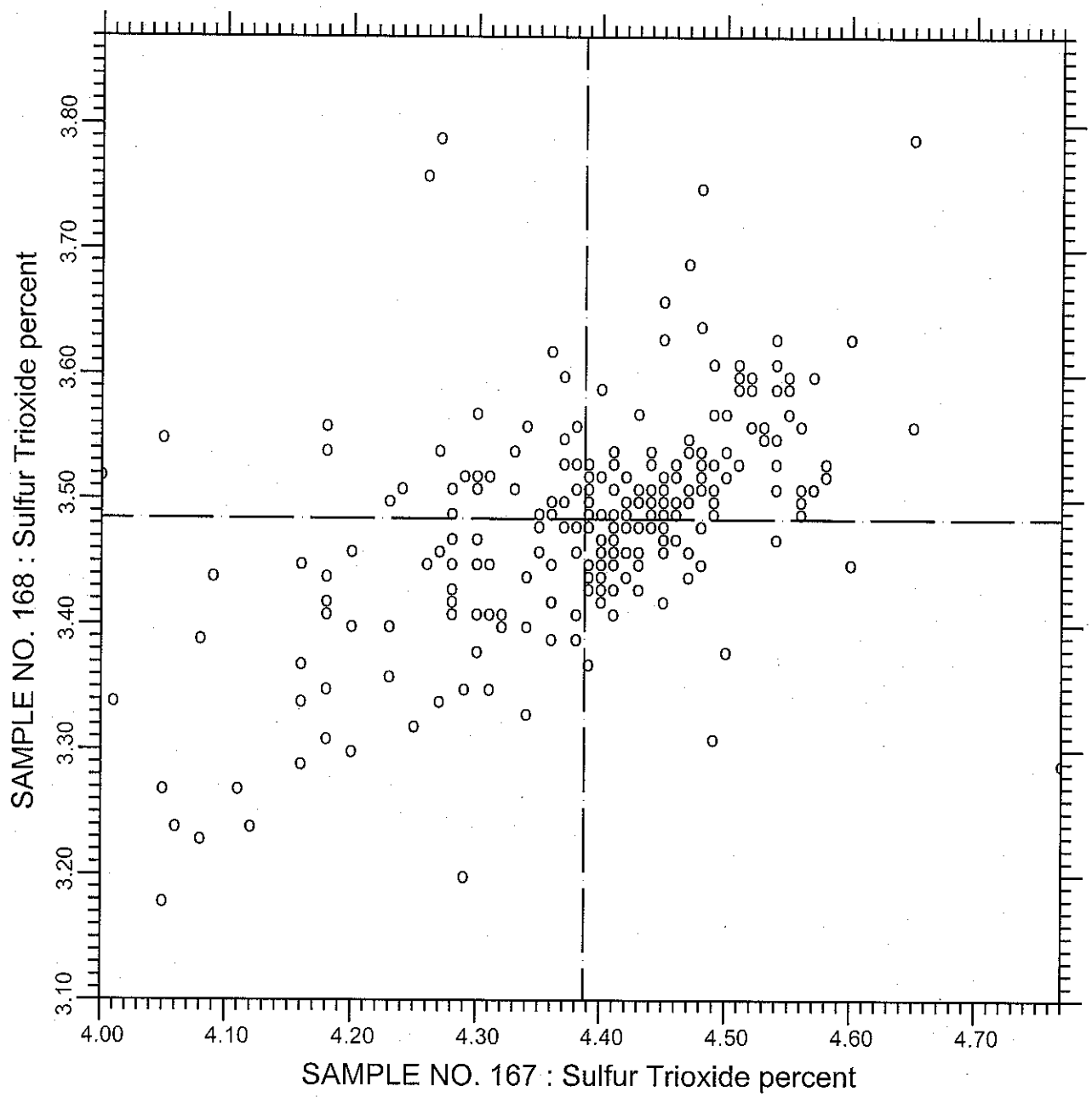
SAMPLE NO. 167 AVE 3.1125 S.D. 0.093 C.V. 2.98

SAMPLE NO. 168 AVE 3.8802 S.D. 0.106 C.V. 2.72

LABS ELIMINATED 201 222 492 694 2463

LABS OFF DIAGRAM 206 305 918 2491

CCRL PROFICIENCY SAMPLE PROGRAM
Sulfur Trioxide
PORTLAND CEMENT SAMPLES NO. 167 & NO. 168



TEST NO.60 Sulfur Trioxide 240 POINTS

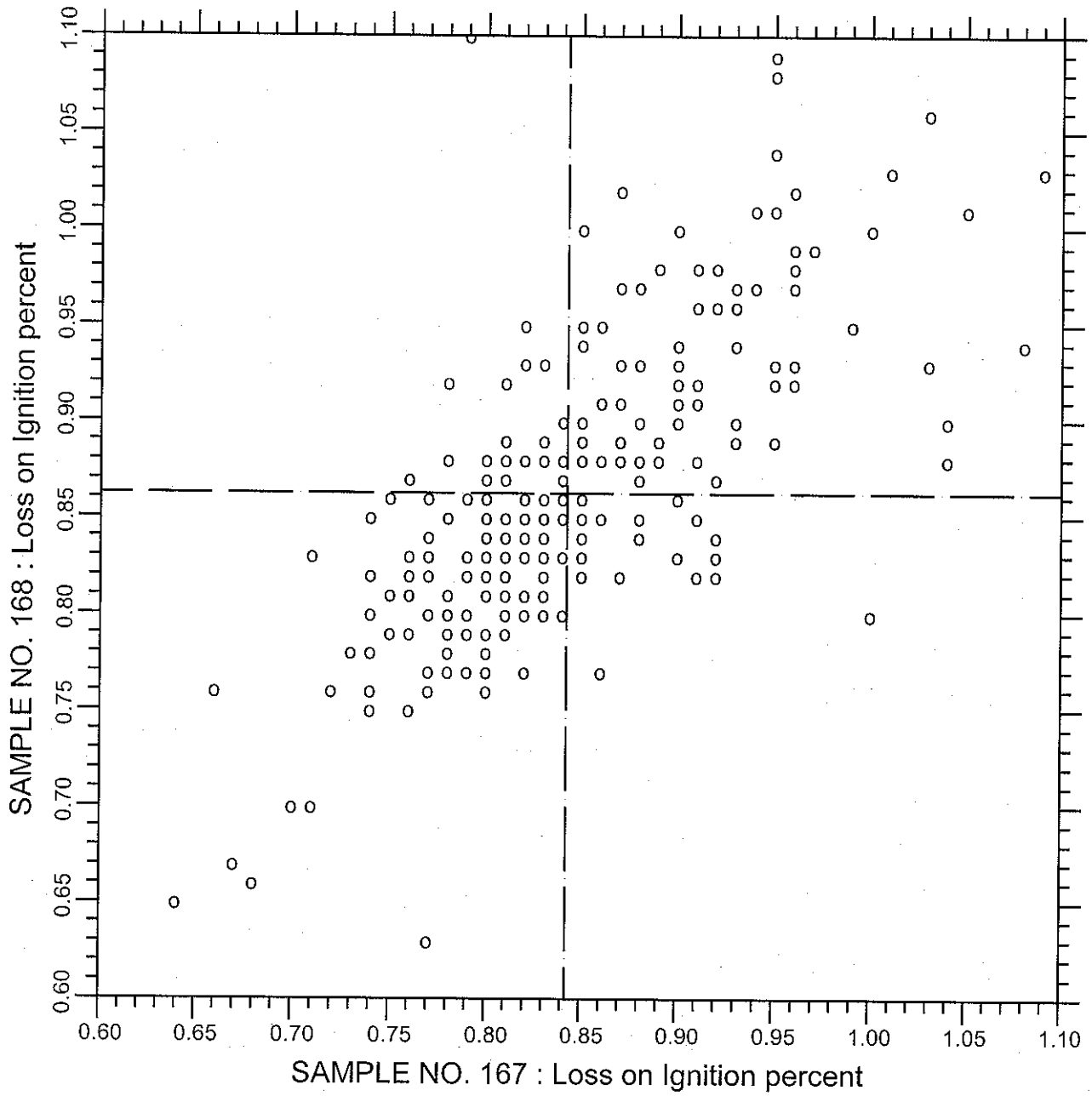
SAMPLE NO. 167 AVE 4.3872 S.D. 0.134 C.V. 3.05

SAMPLE NO. 168 AVE 3.4847 S.D. 0.093 C.V. 2.66

LABS ELIMINATED 95 161 167 1196 1940 73 159 222 305 1483 2437 2464 3009 3297

LABS OFF DIAGRAM 36 492 2491

CCRL PROFICIENCY SAMPLE PROGRAM
Loss on Ignition
PORTLAND CEMENT SAMPLES NO. 167 & NO. 168



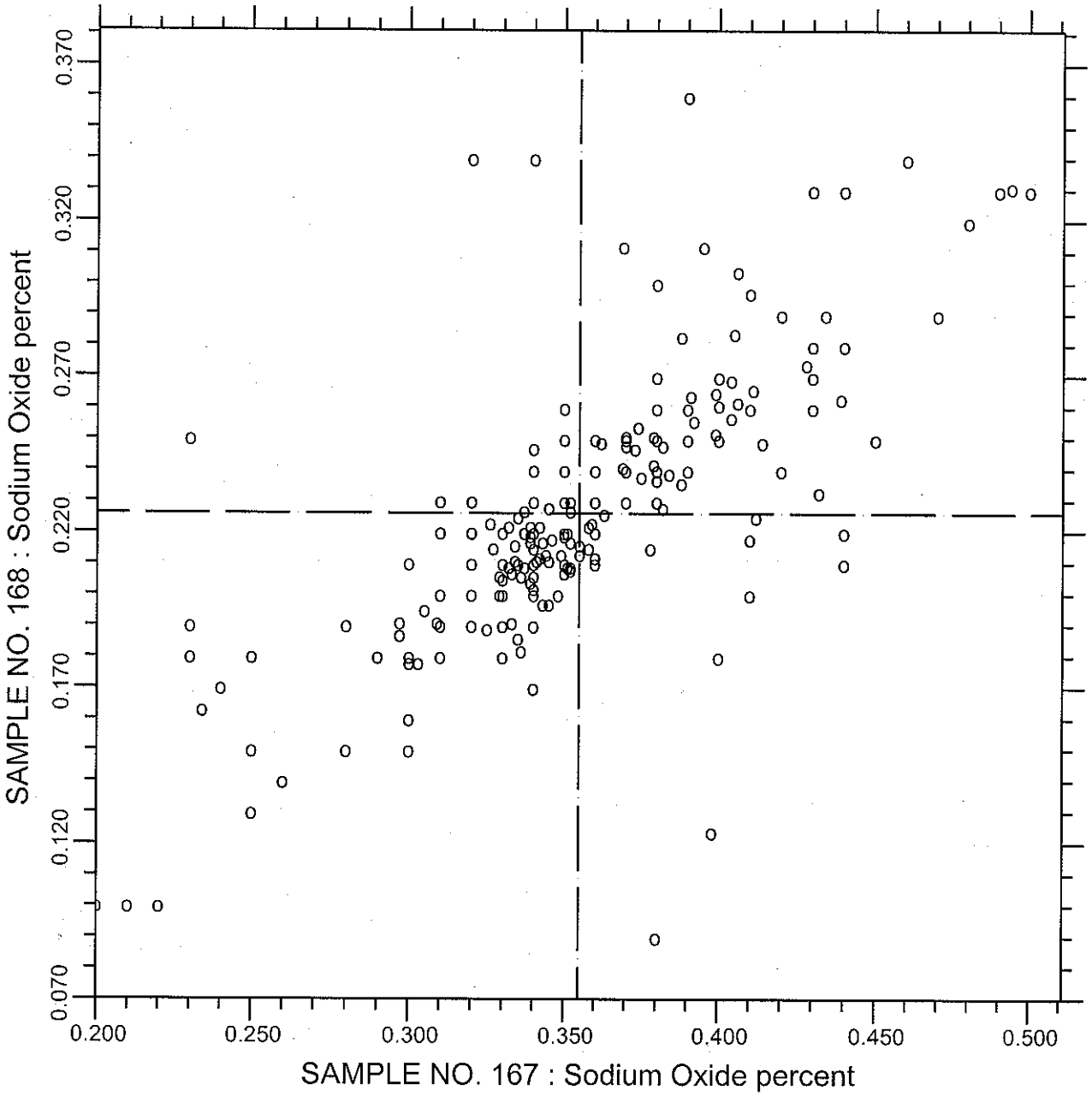
TEST NO.70 Loss on Ignition 243 POINTS

SAMPLE NO. 167 AVE 0.8425 S.D. 0.076 C.V. 9.08

SAMPLE NO. 168 AVE 0.8623 S.D. 0.076 C.V. 8.77

LABS ELIMINATED 95 125 137 1524 92 121 221 2305 3125 3235 3297

CCRL PROFICIENCY SAMPLE PROGRAM
Sodium Oxide
PORTLAND CEMENT SAMPLES NO. 167 & NO. 168

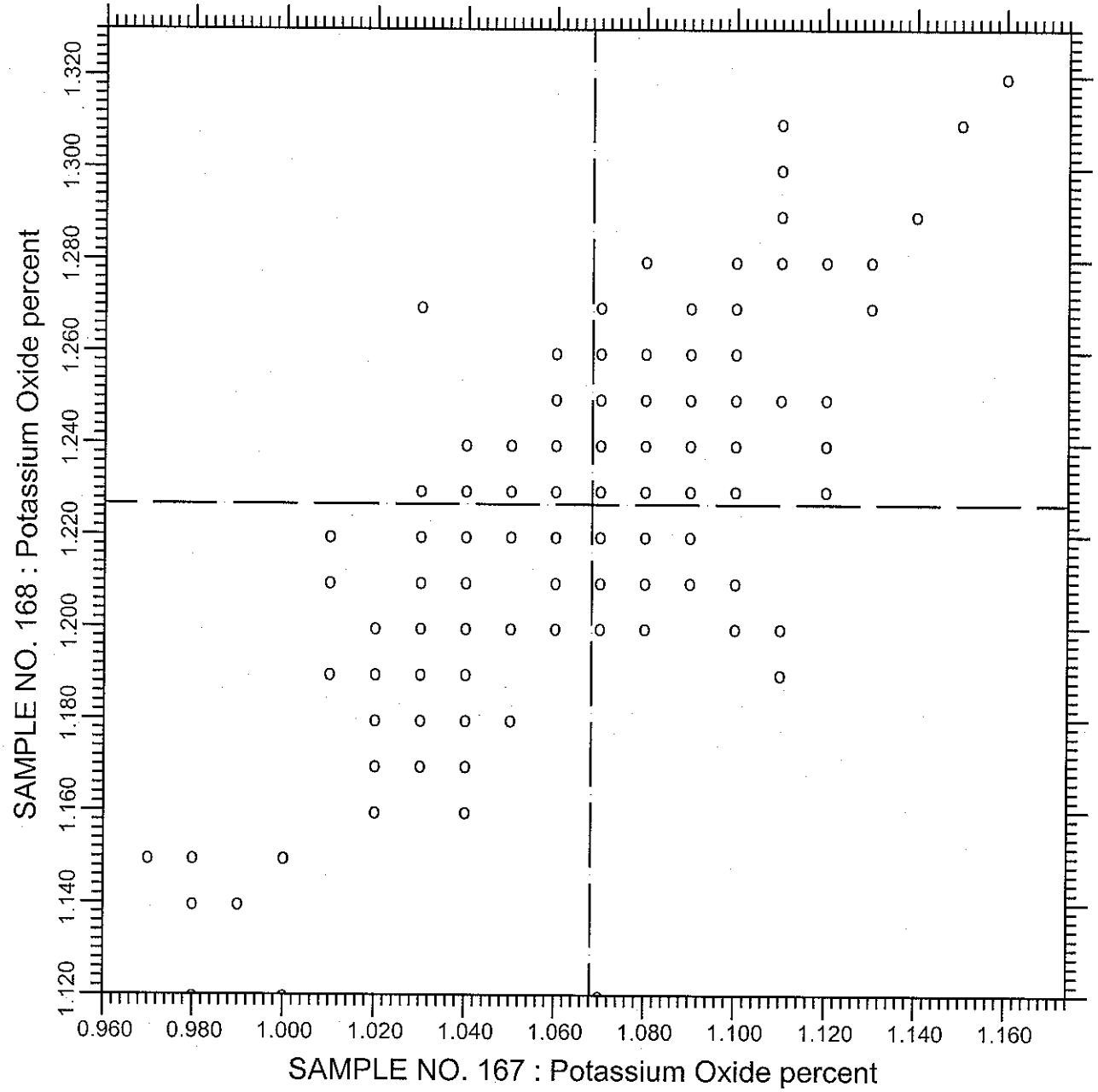


TEST NO.90 Sodium Oxide 228 POINTS

SAMPLE NO. 167	AVE	0.3549	S.D.	0.050	C.V. 14.0
SAMPLE NO. 168	AVE	0.2260	S.D.	0.043	C.V. 19.0

LABS ELIMINATED 30 2463 2464 289 504 2466 3125 3235 3249 3279

CCRL PROFICIENCY SAMPLE PROGRAM
Potassium Oxide
PORTLAND CEMENT SAMPLES NO. 167 & NO. 168



TEST NO.100 Potassium Oxide 229 POINTS

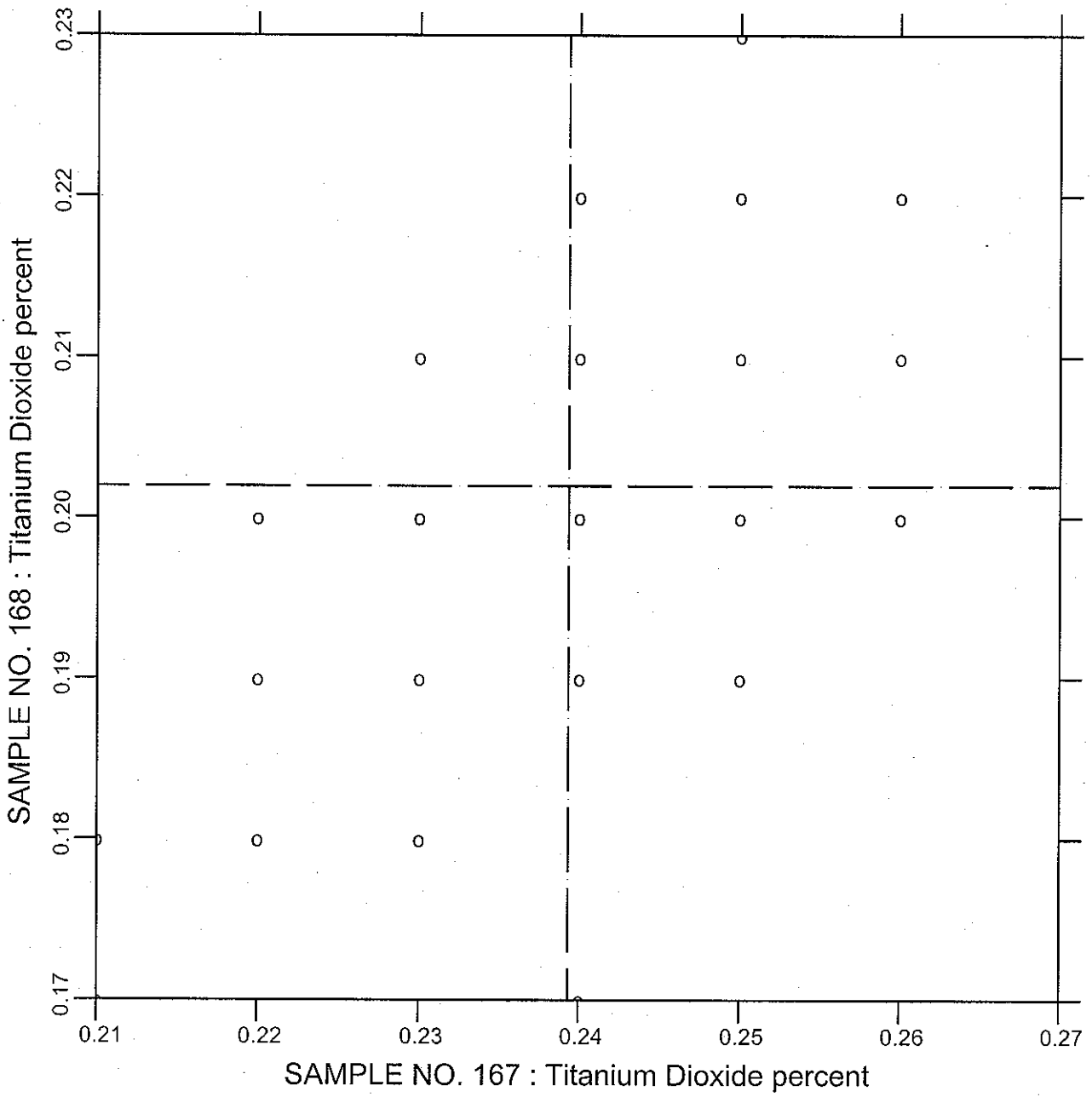
SAMPLE NO. 167 AVE 1.0682 S.D. 0.030 C.V. 2.80

SAMPLE NO. 168 AVE 1.2268 S.D. 0.034 C.V. 2.77

LABS ELIMINATED 94 222 1940 3009 3233 95 1025 1196 3234 3297

LABS OFF DIAGRAM 207 2934

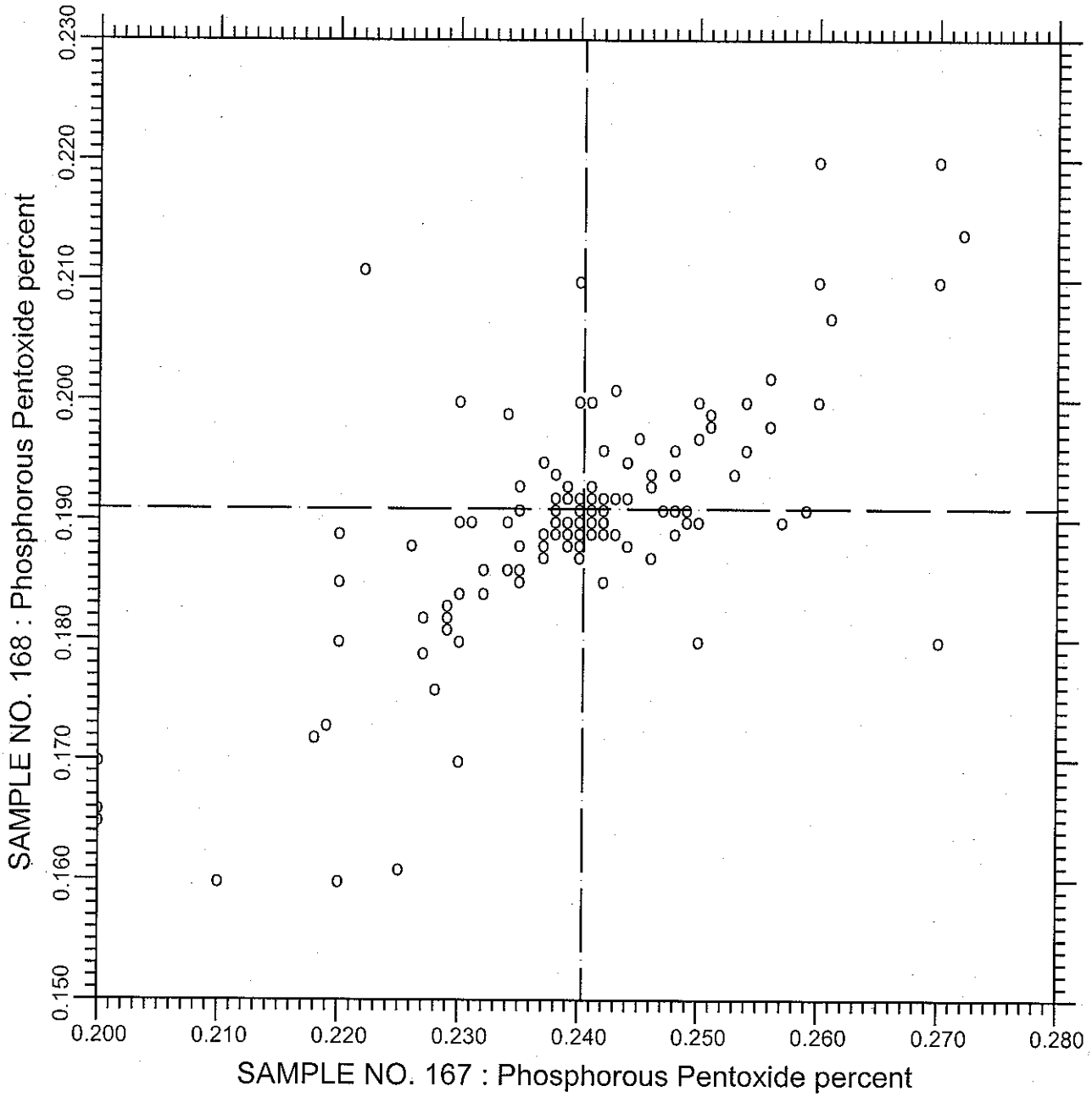
CCRL PROFICIENCY SAMPLE PROGRAM
Titanium Dioxide
PORTLAND CEMENT SAMPLES NO. 167 & NO. 168



TEST NO.103 Titanium Dioxide 179 POINTS

SAMPLE NO. 167 AVE 0.23933 S.D. 0.0092 C.V. 3.85
SAMPLE NO. 168 AVE 0.20196 S.D. 0.0090 C.V. 4.46
LABS ELIMINATED 492 504 1644 2251 18 56 129 176 696 2305 2477 2621

CCRL PROFICIENCY SAMPLE PROGRAM
Phosphorus Pentoxide
PORTLAND CEMENT SAMPLES NO. 167 & NO. 168



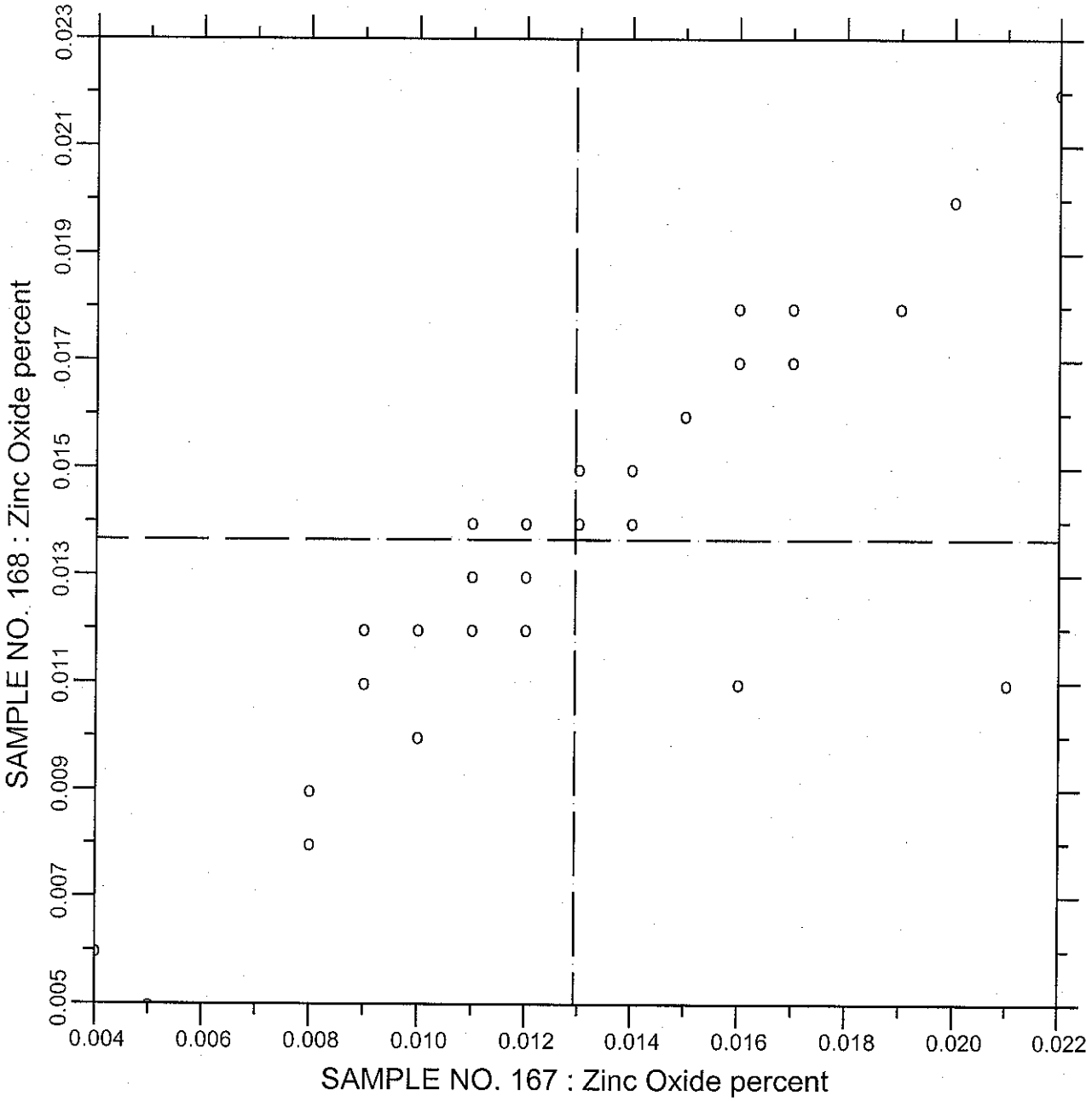
TEST NO.102 Phosphorous Pentoxide 160 POINTS

SAMPLE NO. 167 AVE 0.24039 S.D. 0.0119 C.V. 4.94

SAMPLE NO. 168 AVE 0.19096 S.D. 0.0096 C.V. 5.01

LABS ELIMINATED 504 2295 2305 2463 166 684 2465 2483 2484 2490 125 181 201 493 883 1053 3279

CCRL PROFICIENCY SAMPLE PROGRAM
Zinc Oxide
PORTLAND CEMENT SAMPLES NO. 167 & NO. 168



TEST NO.99 Zinc Oxide 74 POINTS

SAMPLE NO. 167	AVE	0.01293	S.D.	0.0034	C.V.	26.2
SAMPLE NO. 168	AVE	0.01367	S.D.	0.0031	C.V.	23.0

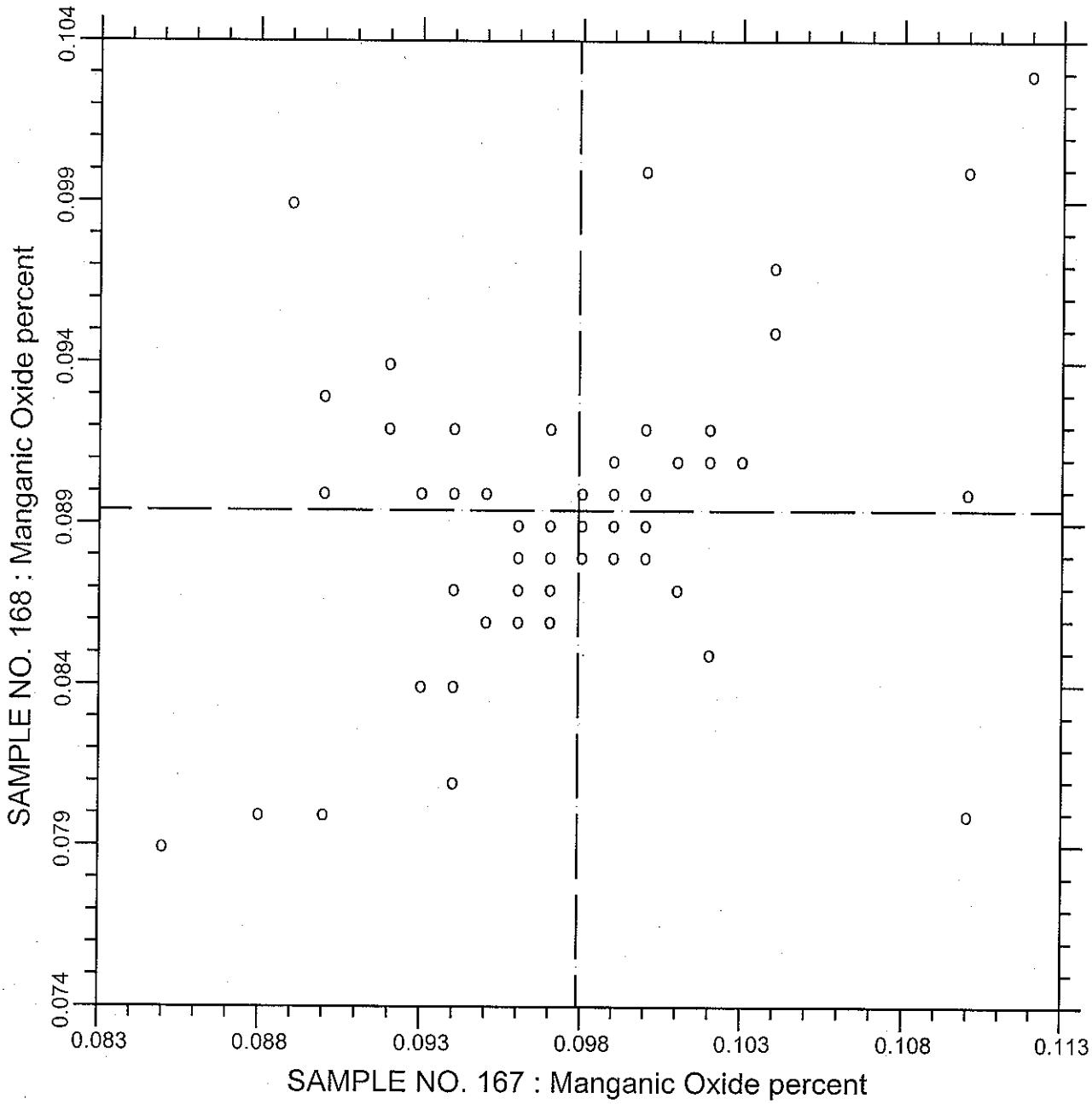
LABS ELIMINATED 30 38 2491

LABS OFF DIAGRAM 3057

CCRL PROFICIENCY SAMPLE PROGRAM

Manganic Oxide

PORTLAND CEMENT SAMPLES NO. 167 & NO. 168



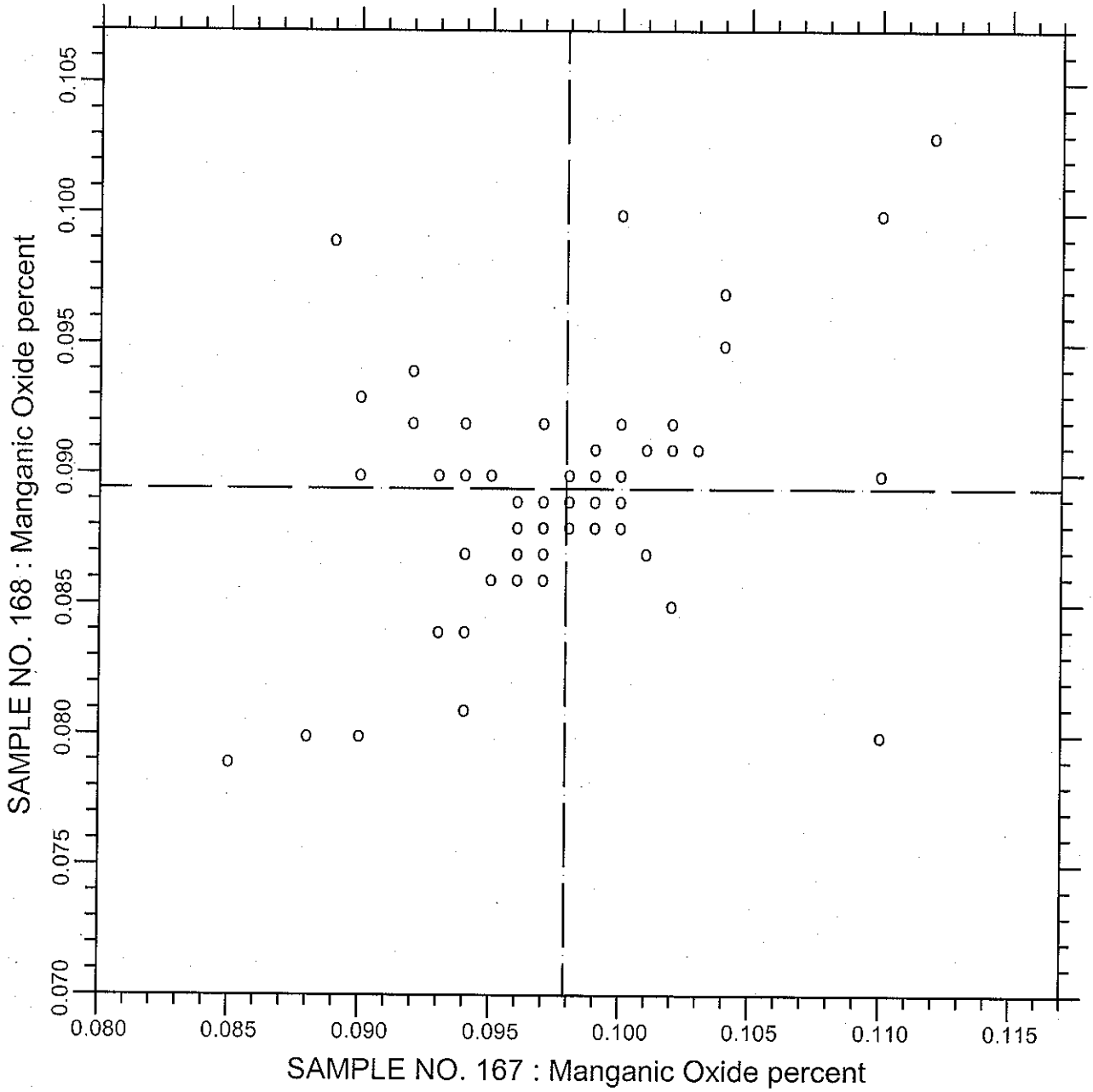
TEST NO.101 Manganic Oxide 124 POINTS

SAMPLE NO. 167 AVE 0.09790 S.D. 0.0043 C.V. 4.40

SAMPLE NO. 168 AVE 0.08942 S.D. 0.0036 C.V. 4.03

LABS ELIMINATED 38 696 2484 697 2462 2463 2491 2522

CCRL PROFICIENCY SAMPLE PROGRAM
Manganic Oxide
PORTLAND CEMENT SAMPLES NO. 167 & NO. 168

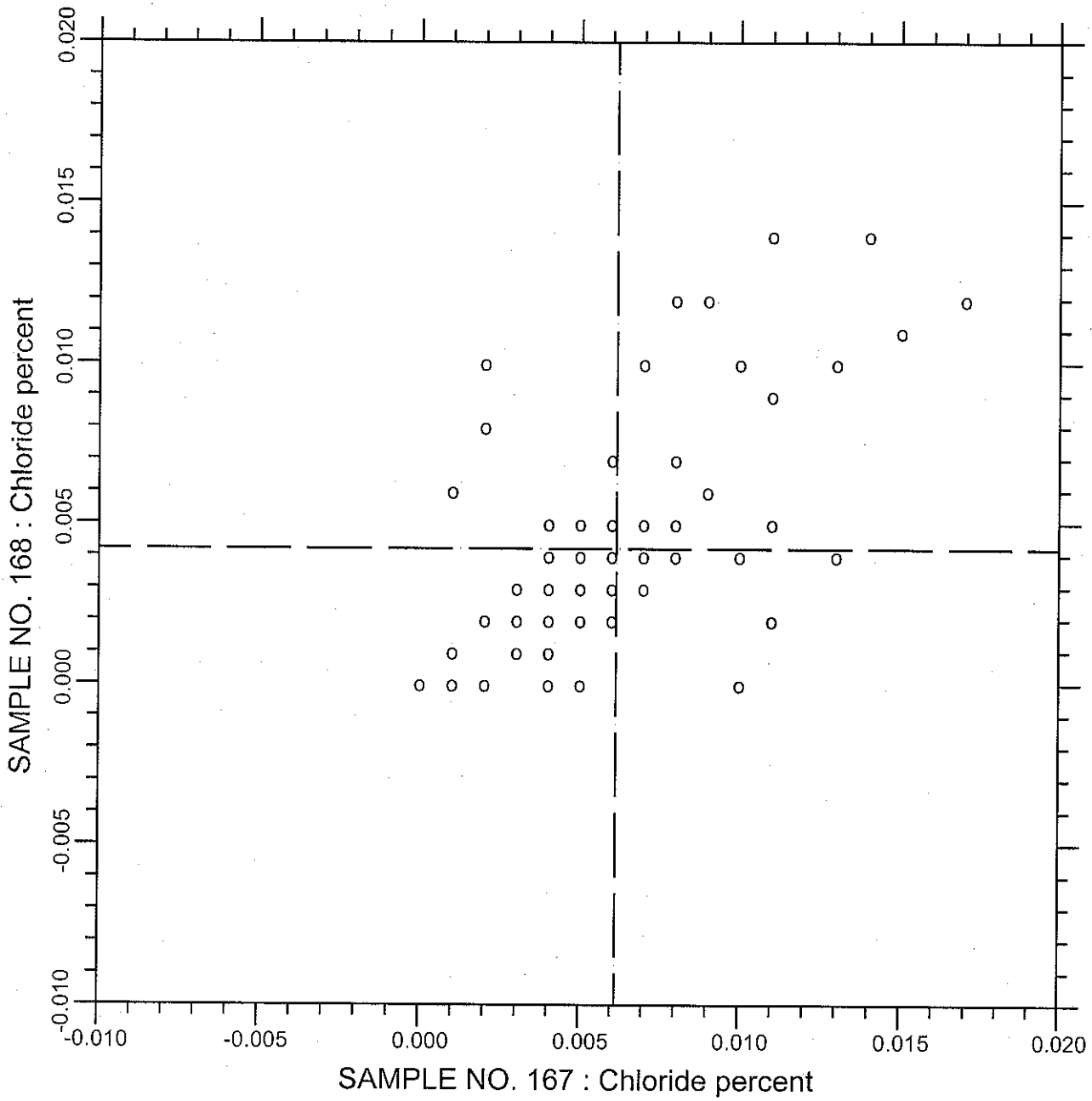


TEST NO.101 Manganic Oxide 124 POINTS

SAMPLE NO. 167	AVE 0.09790	S.D. 0.0043	C.V. 4.40
SAMPLE NO. 168	AVE 0.08942	S.D. 0.0036	C.V. 4.03

LABS ELIMINATED 38 696 2484 697 2462 2463 2491 2522

CCRL PROFICIENCY SAMPLE PROGRAM
Chloride
PORTLAND CEMENT SAMPLES NO. 167 & NO. 168

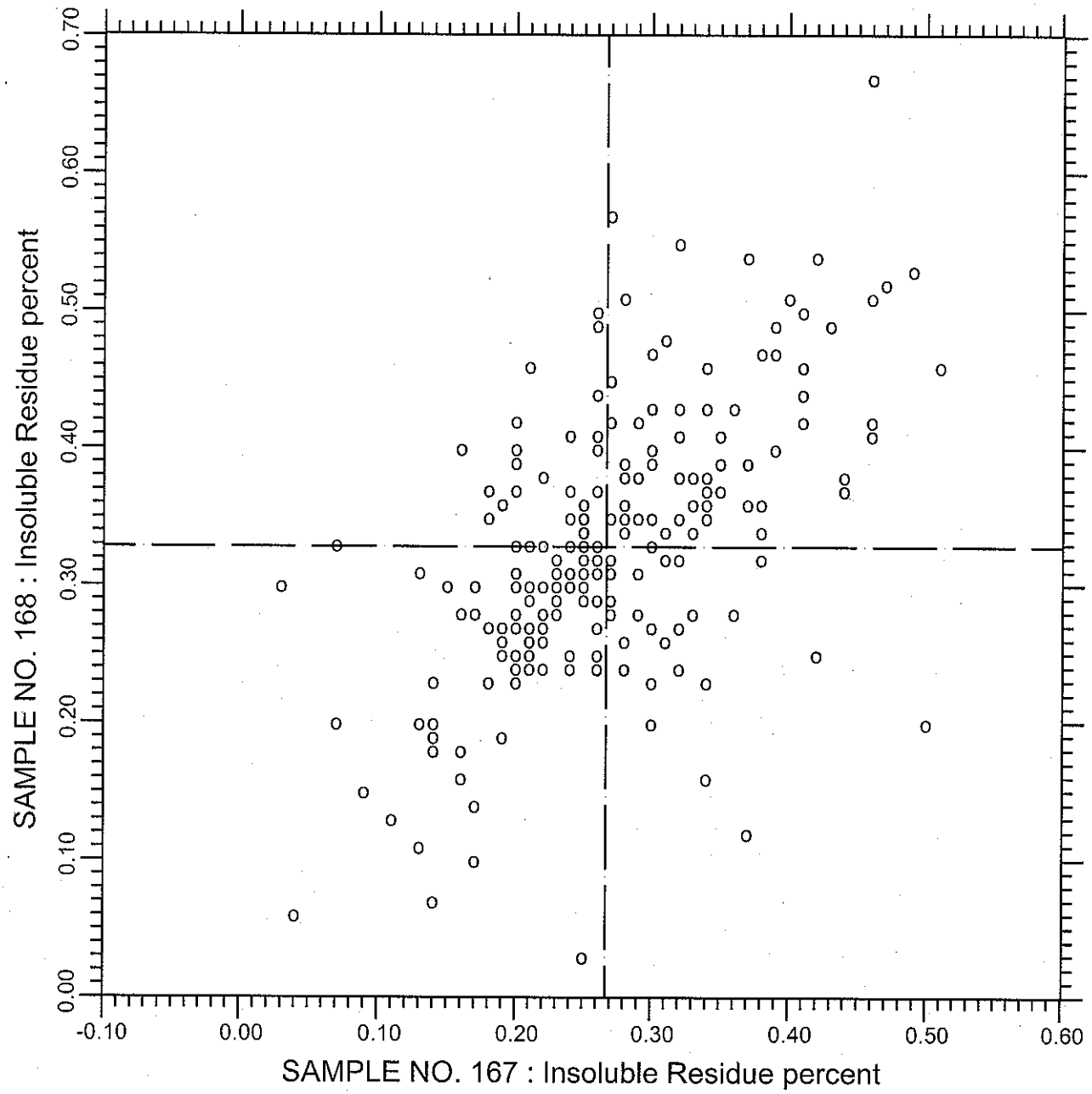


TEST NO.104 Chloride 96 POINTS

SAMPLE NO. 167	AVE	0.00614	S.D.	0.0036	C.V.	57.9
SAMPLE NO. 168	AVE	0.00421	S.D.	0.0035	C.V.	84.0

LABS ELIMINATED 166 246 208 289 1466

CCRL PROFICIENCY SAMPLE PROGRAM
Insoluble Residue
PORTLAND CEMENT SAMPLES NO. 167 & NO. 168



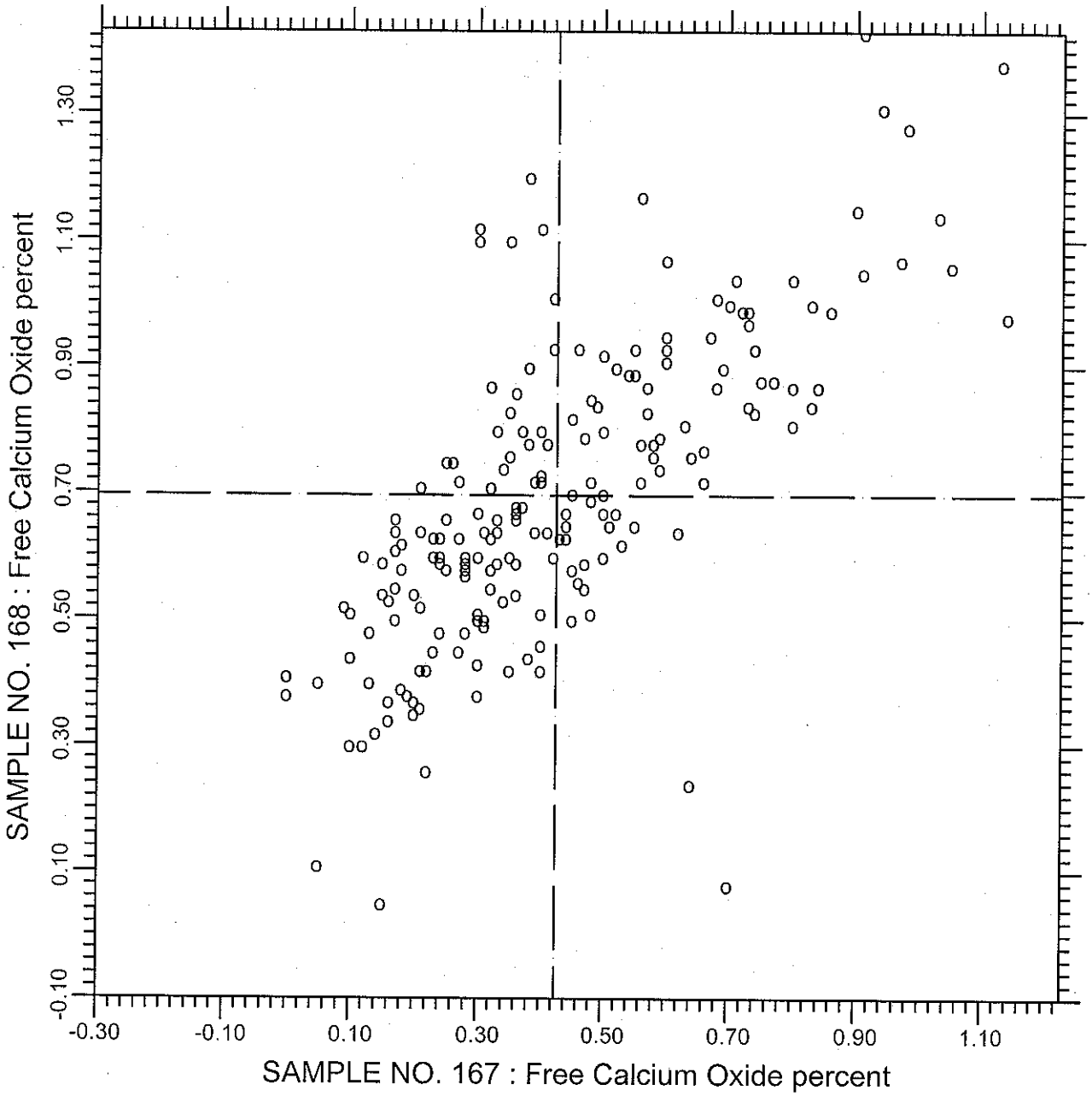
TEST NO.80 Insoluble Residue 228 POINTS

SAMPLE NO. 167 AVE 0.2671 S.D. 0.084 C.V. 31.6

SAMPLE NO. 168 AVE 0.3285 S.D. 0.096 C.V. 29.3

LABS ELIMINATED 143 1196 1379 2491 36 127 221 694 1251 1956 2477 3297

CCRL PROFICIENCY SAMPLE PROGRAM
Free Calcium Oxide
PORTLAND CEMENT SAMPLES NO. 167 & NO. 168

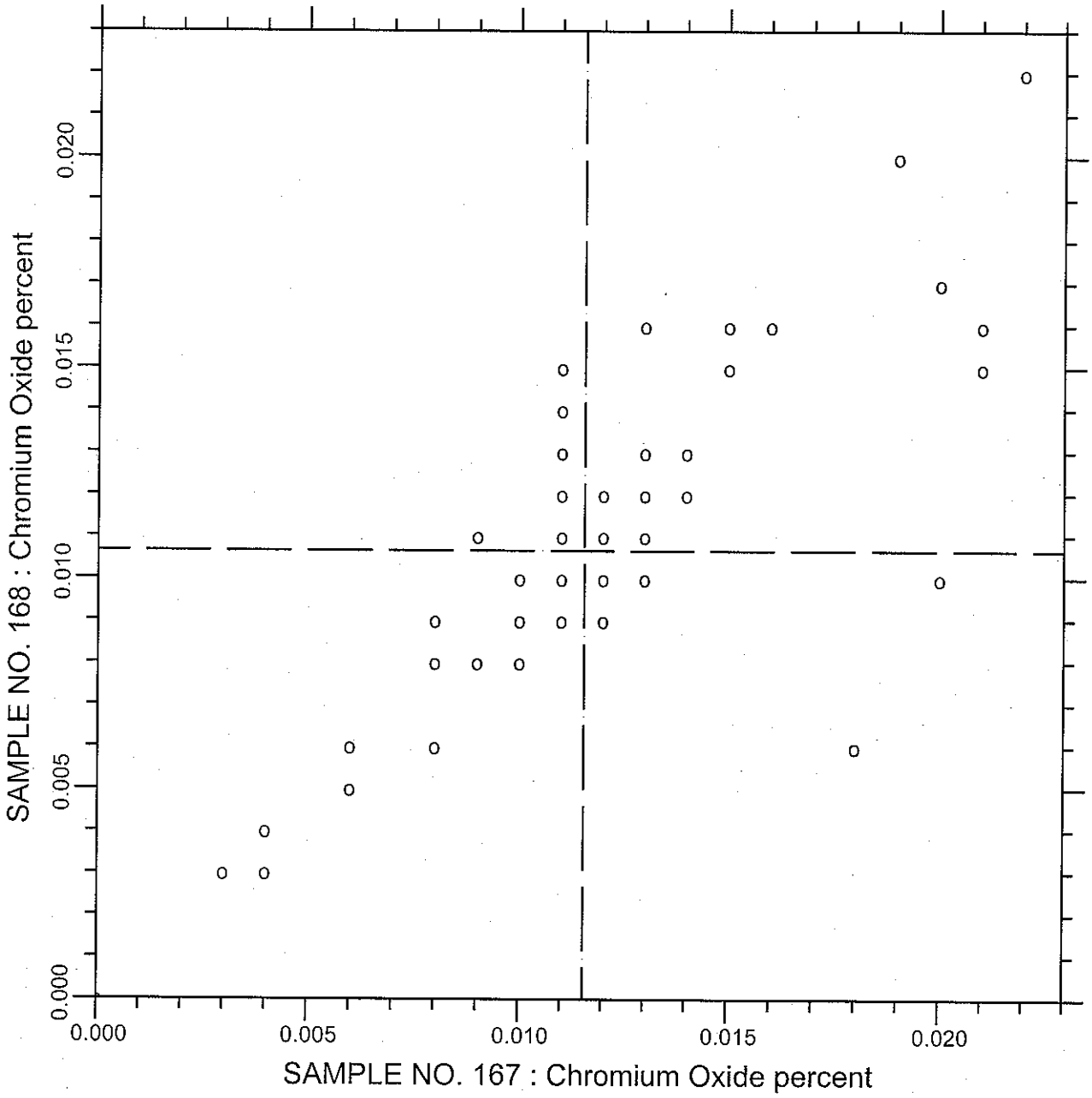


TEST NO.41 Free Calcium Oxide 197 POINTS

SAMPLE NO. 167	AVE	0.426	S.D.	0.23	C.V. 54.3
SAMPLE NO. 168	AVE	0.696	S.D.	0.24	C.V. 34.3

LABS ELIMINATED 3235 3297

CCRL PROFICIENCY SAMPLE PROGRAM
Chromium Oxide
PORTLAND CEMENT SAMPLES NO. 167 & NO. 168

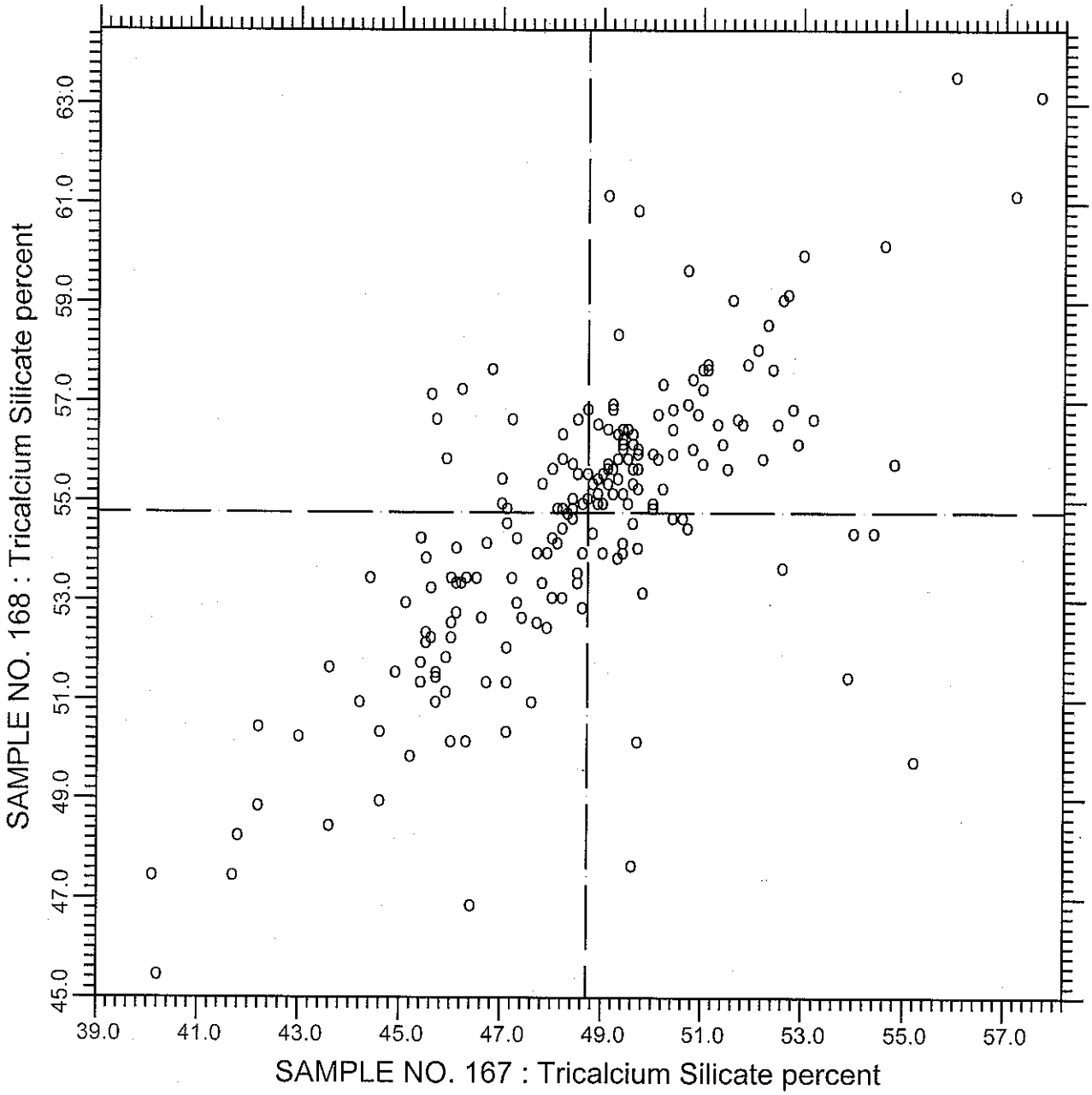


TEST NO.105 Chromium Oxide 80 POINTS

SAMPLE NO. 167	AVE	0.01155	S.D.	0.0040	C.V.	34.4
SAMPLE NO. 168	AVE	0.01065	S.D.	0.0036	C.V.	34.3

LABS ELIMINATED 36 408 870 2295

CCRL PROFICIENCY SAMPLE PROGRAM
Tricalcium Silicate
PORTLAND CEMENT SAMPLES NO. 167 & NO. 168



TEST NO.106 Tricalcium Silicate 200 POINTS

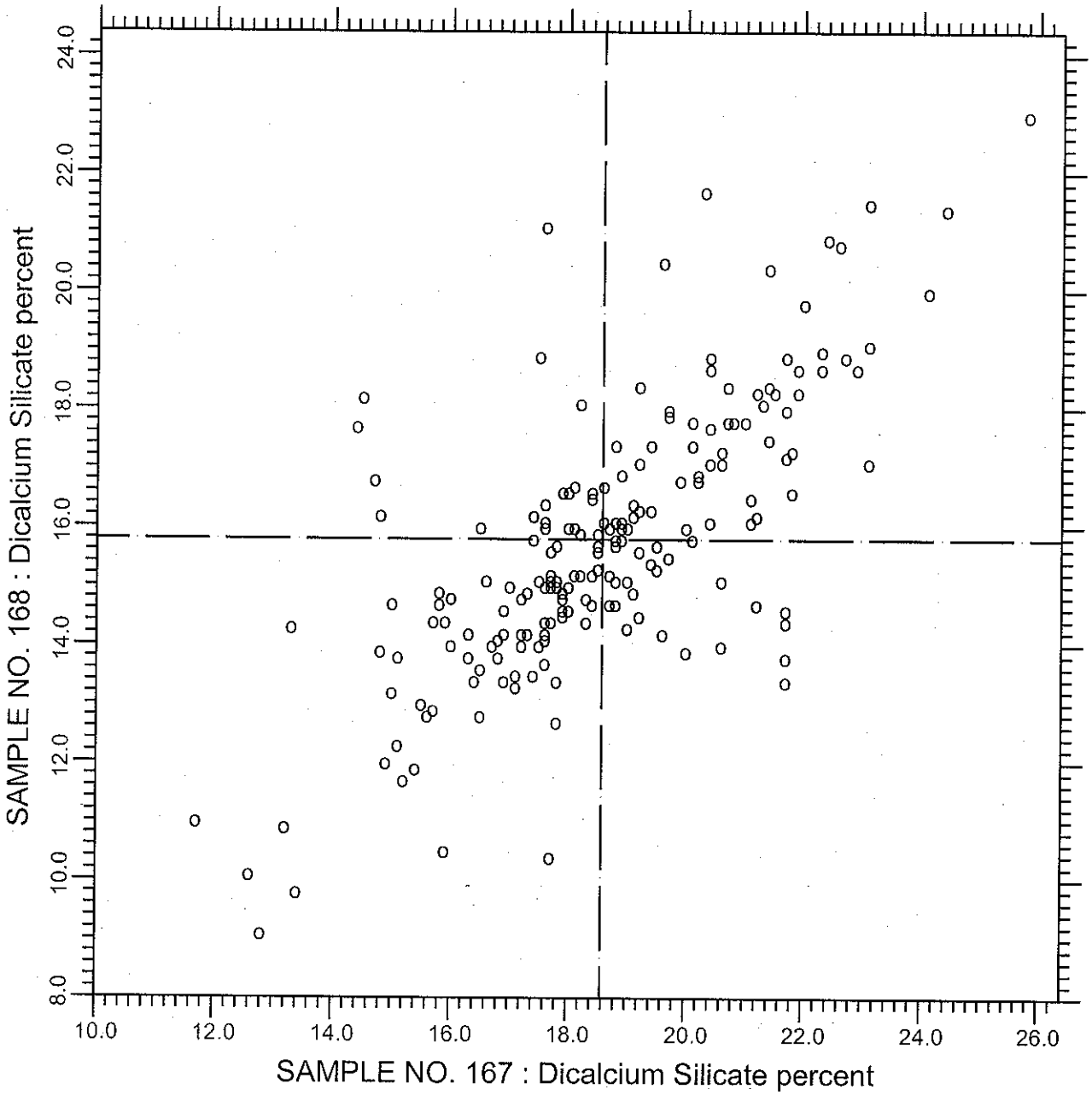
SAMPLE NO. 167 AVE 48.71 S.D. 3.1 C.V. 6.32

SAMPLE NO. 168 AVE 54.78 S.D. 3.2 C.V. 5.90

LABS ELIMINATED 30 206 1054 1196 2305 2477

LABS OFF DIAGRAM 24 42 694 1483 2463

CCRL PROFICIENCY SAMPLE PROGRAM
Dicalcium Silicate
PORTLAND CEMENT SAMPLES NO. 167 & NO. 168



TEST NO.107 Dicalcium Silicate 195 POINTS

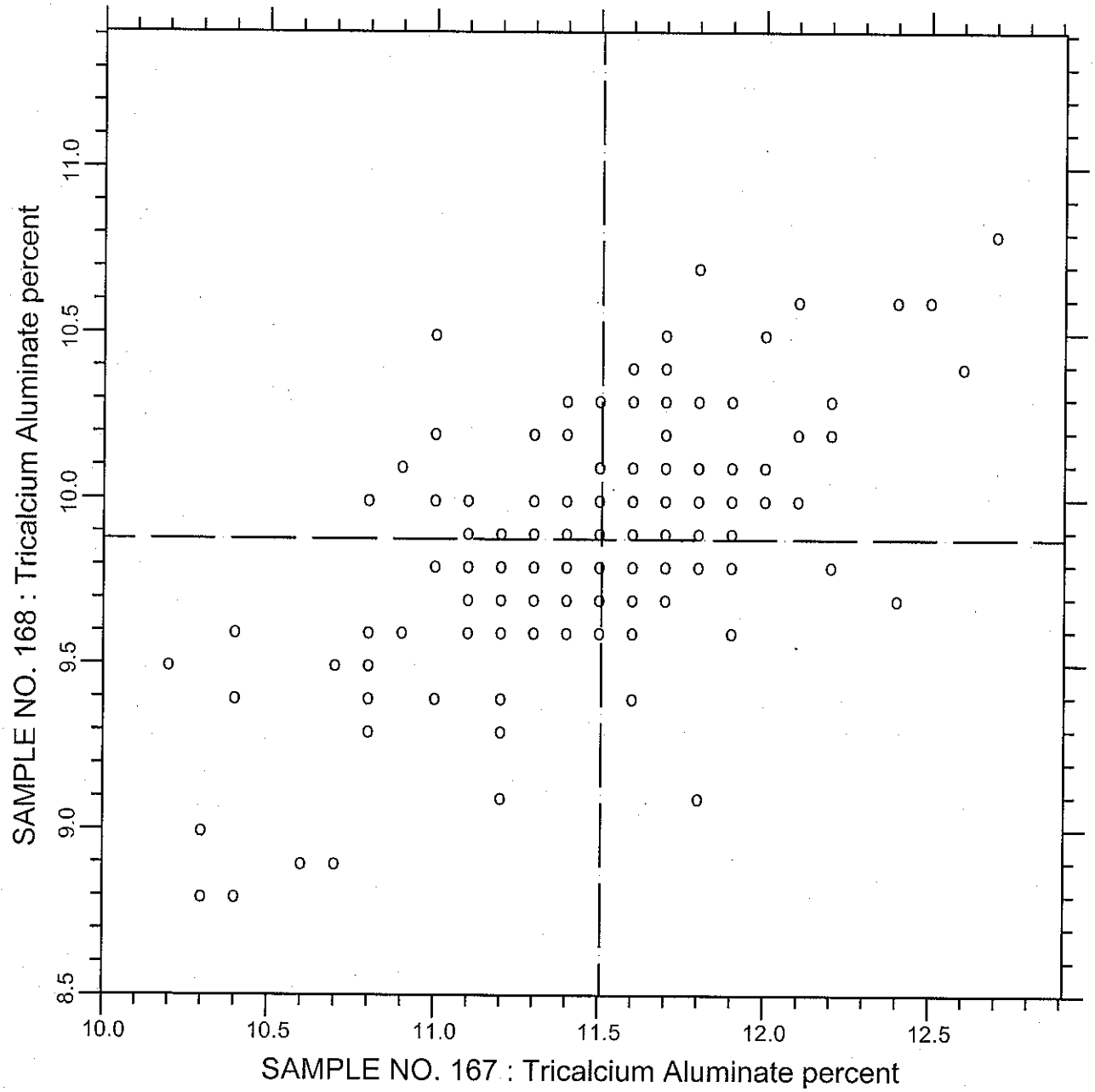
SAMPLE NO. 167 AVE 18.58 S.D. 2.6 C.V. 14.2

SAMPLE NO. 168 AVE 15.78 S.D. 2.4 C.V. 15.4

LABS ELIMINATED 24 30 206 1196 8 42 407 694 1053 1054 1483 2463

LABS OFF DIAGRAM 695 2477 3124 3125

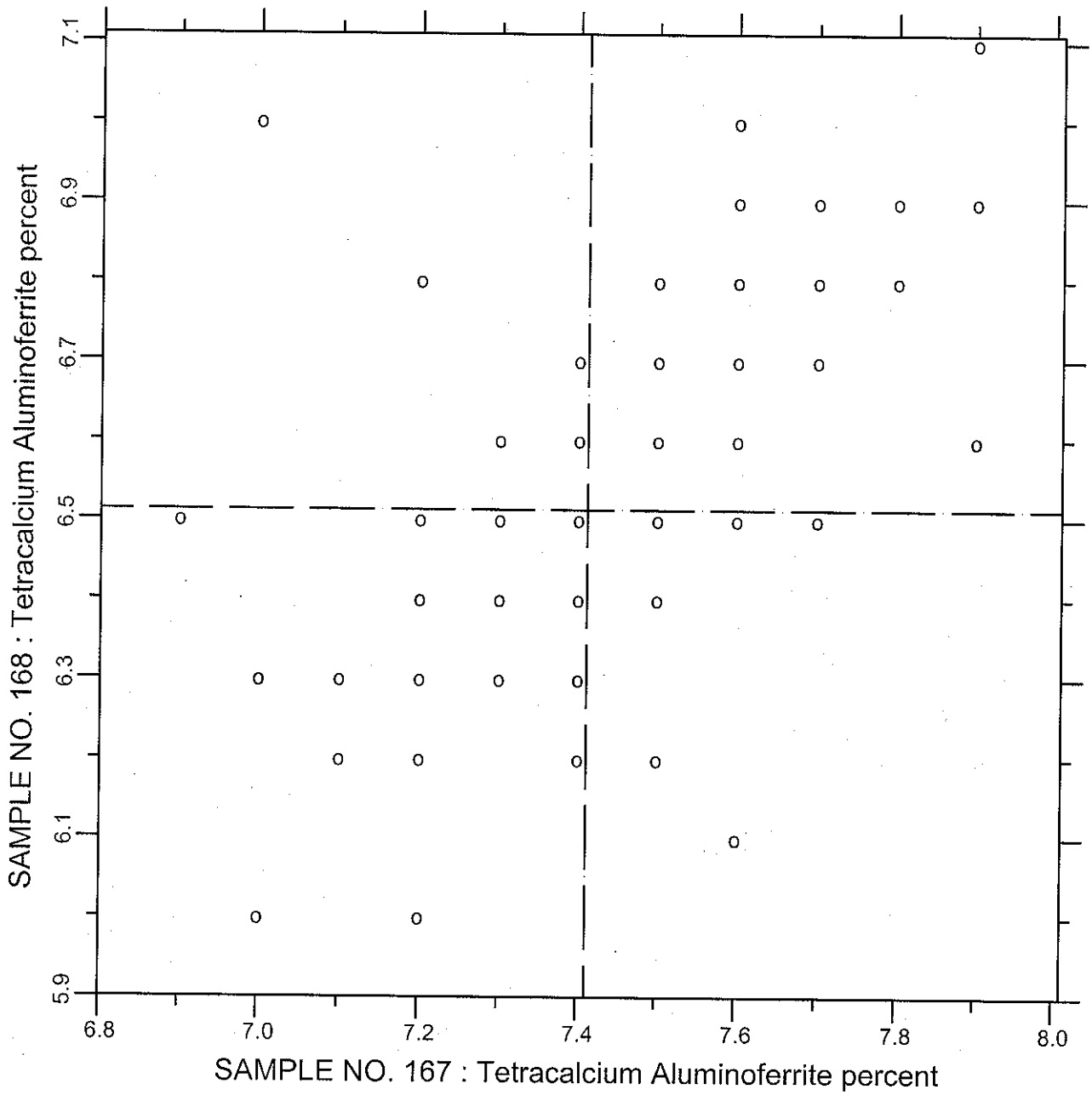
CCRL PROFICIENCY SAMPLE PROGRAM
Tricalcium Aluminate
PORTLAND CEMENT SAMPLES NO. 167 & NO. 168



TEST NO.108 Tricalcium Aluminate 207 POINTS

SAMPLE NO. 167 AVE 11.507 S.D. 0.40 C.V. 3.48
SAMPLE NO. 168 AVE 9.878 S.D. 0.31 C.V. 3.16
LABS ELIMINATED 30 201 208 694 883 1644 2295 2463

CCRL PROFICIENCY SAMPLE PROGRAM
Tetracalcium Aluminoferrite
PORTLAND CEMENT SAMPLES NO. 167 & NO. 168



TEST NO.109 Tetracalcium Aluminoferrite 208 POINTS

SAMPLE NO. 167 AVE 7.412 S.D. 0.16 C.V. 2.18
SAMPLE NO. 168 AVE 6.512 S.D. 0.16 C.V. 2.50
LABS ELIMINATED 96 125 883 2466 3125

CCRL PROFICIENCY SAMPLE PROGRAM
Portland Cement Proficiency Samples No. 167 and No. 168
Final Report - Physical Results
March 28, 2008

SUMMARY OF RESULTS

			Sample No. 167			Sample No. 168		
Test		#Labs	Average	S.D.	C.V.	Average	S.D.	C.V.
N.C. Water	prcnt	270	31.5	1.9	6.13	27.9	1.4	4.92
N.C. Water	prcnt	* 257	31.6	0.98	3.10	27.9	0.54	1.95
Vicat TS Initial	min	265	142	20.2	14.2	129	18.8	14.6
Vicat TS Initial	min	* 257	142	17.5	12.4	128	13.4	10.5
Vicat TS Final	min	255	257	44.4	17.3	240	40.5	16.9
Vicat TS Final	min	* 251	257	39.2	15.3	241	36.9	15.3
Gillmore TS Initial	min	169	181	28.3	15.6	169	23.4	13.8
Gillmore TS Final	min	168	297	42.4	14.3	280	39.2	14.0
Gillmore TS Final	min	* 164	298	38.5	12.9	280	36.3	13.0
False Set	prcnt	203	66	15.5	23.4	78	13.0	16.7
False Set	prcnt	* 198	67	14.1	21.0	78	11.3	14.5
Autoclave Expan	prcnt	251	0.10	0.071	71.0	0.18	0.090	48.5
Autoclave Expan	prcnt	* 242	0.10	0.038	38.9	0.19	0.068	35.3

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* ELIMINATED LABS: Data over three S.D. from the mean

Normal Consistency	180 768 2477 3250 10 21 127 551 2292 2295 2412 3236 3276
Vicat TS Initial	2 3 47 207 360 768 1483 2466
Vicat TS Final	2 165 252 2466
Gillmore TS Final	45 176 2295 2982
False Set Paste Method	90 152 360 1483 1715
Autoclave Expansion	26 252 823 2477 870 2295 3234 3276 3297

CCRL PROFICIENCY SAMPLE PROGRAM
Portland Cement Proficiency Samples No. 167 and No. 168
Final Report - Physical Results
March 21, 2008

SUMMARY OF RESULTS

			Sample No. 167			Sample No. 168		
Test		#Labs	Average	S.D.	C.V.	Average	S.D.	C.V.
Air Content	prcnt	240	7.4	1.6	21.3	7.1	1.6	22.5
Air Content	prcnt	* 235	7.3	0.99	13.6	7.1	1.14	16.1
AC Mix Water	prcnt	236	73.0	4.8	6.58	71.1	4.9	6.84
AC Mix Water	prcnt	* 226	73.4	2.4	3.35	71.6	2.4	3.34
AC Flow	prcnt	237	85	3.9	4.61	86	3.9	4.55
AC Flow	prcnt	* 232	85	3.6	4.18	86	3.3	3.88
Comp Str, 3 day	psi	275	5068	431.5	8.51	4160	358.1	8.61
Comp Str, 3 day	psi	* 266	5109	335.1	6.56	4189	276.2	6.59
Comp Str, 7 day	psi	270	5788	439.2	7.59	4891	369.7	7.56
Comp Str, 7 day	psi	* 262	5812	375.2	6.46	4906	294.1	5.99
Comp Str, 28 day	psi	242	6618	487.3	7.36	5737	406.9	7.09
Comp Str, 28 day	psi	* 239	6642	441.2	6.64	5751	390.9	6.80
Comp Str, Flow	prcnt	230	89	11.4	12.9	98	11.7	12.0

CONTINUED ON NEXT PAGE

* ELIMINATED LABS: Data over three S.D. from the mean

Air Content	768 47 1435 2491 3279
Air Content Mix Water	75 178 1379 2295 17 95 768 918 2491 3279
Air Content Flow	1379 3126 95 3279 96
Comp Strength, 3 day	10 30 95 2 5 46 48 2330 3059
Comp Strength, 7 day	30 48 51 691 10 1525 2330 3059
Comp Strength, 28 day	23 30 2330

CCRL PROFICIENCY SAMPLE PROGRAM
Portland Cement Proficiency Samples No. 167 and No. 168
Final Report - Physical Results
March 21, 2008

SUMMARY OF RESULTS

			Sample No. 167			Sample No. 168		
Test		#Labs	Average	S.D.	C.V.	Average	S.D.	C.V.
Fineness								
Air Permeability	cm^2/g	268	5201	374.0	7.19	4076	199.9	4.90
Air Permeability	cm^2/g	* 248	5237	192.1	3.67	4083	96.6	2.37
Wagner Turbidim	cm^2/g	15	2691	174.7	6.49	2175	119.6	5.50
45µm Sieve	prcnt	248	97.07	1.3	1.30	93.55	1.5	1.64
45µm Sieve	prcnt	* 234	97.22	0.56	0.578	93.61	1.04	1.114
C1038 Mortar Bar Expansion								
Mortar Expansion	prcnt	147	0.010	0.035	338	0.012	0.036	309
Mortar Expansion	prcnt	* 129	0.007	0.0039	55.8	0.007	0.0036	50.8
Mortar Water	prcnt	141	260	17.8	6.84	254	20.8	8.16
Mortar Water	prcnt	* 137	258	9.0	3.47	251	8.4	3.34
Mortar Flow	prcnt	137	108	6.2	5.82	109	4.4	4.02
Mortar Flow	prcnt	* 128	109	2.8	2.53	109	2.6	2.35

* ELIMINATED LABS: Data over three S.D. from the mean

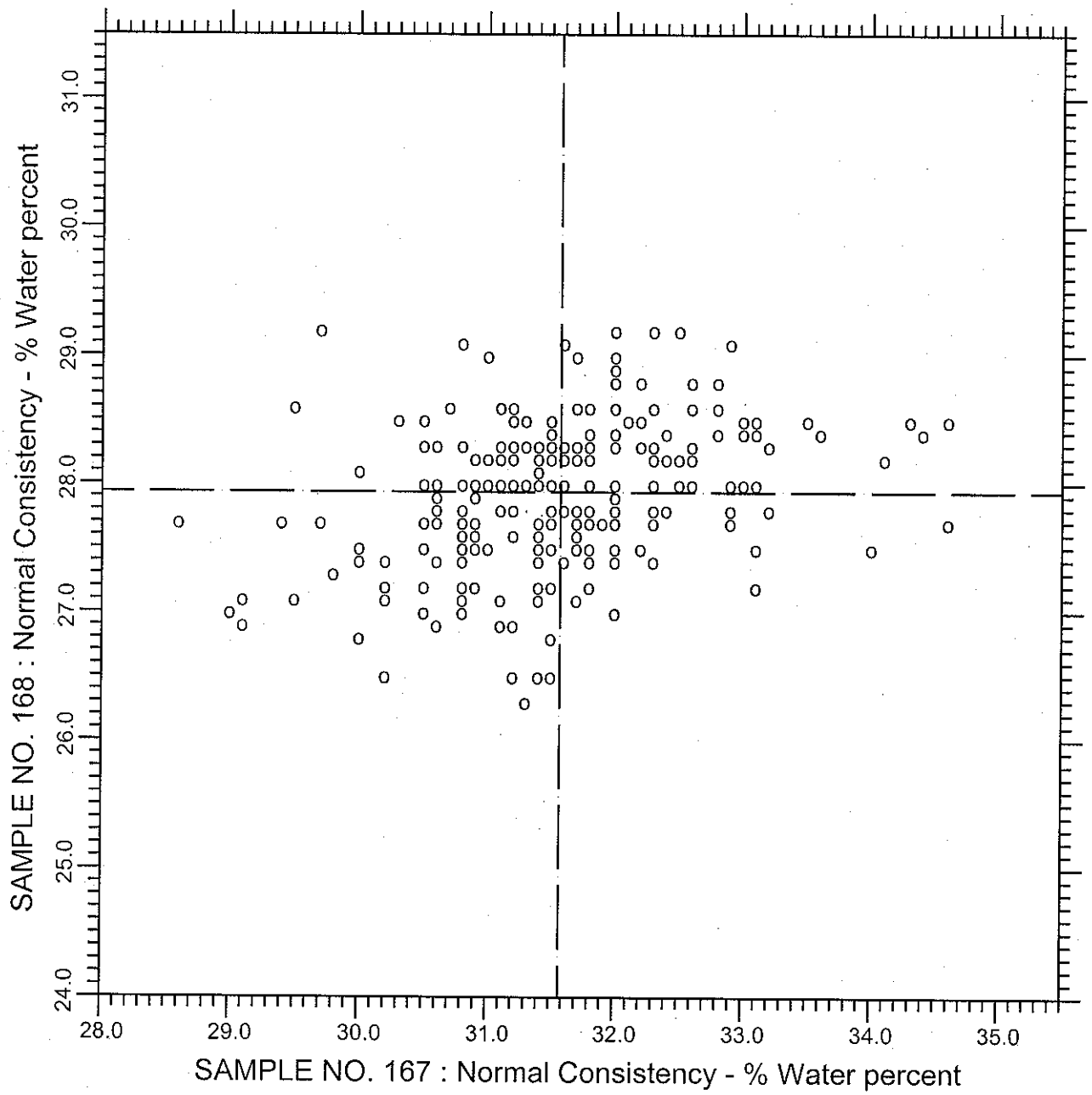
Fineness

Air Permeability	2 10 21 42 47 51 157 169 3235 36 48 49 92 221 416 687 698 1379 1799 3276
45µm Sieve	47 52 169 413 779 1644 1726 40 130 175 246 698 1053 2491

C1038 Expansion

C1038 Mortar Bar Exp	246 73 90 493 1466 2296 3059 15 121 125 139 181 1054 1251 2462 36 1190 3234
C1038 Mortar - Water	440 2363 3059 3126
C1038 Mortar - Flow	243 416 611 3126 8 3250 90 208 996 1936

CCRL PROFICIENCY SAMPLE PROGRAM
Normal Consistency - % Water
PORTLAND CEMENT SAMPLES NO. 167 & NO. 168



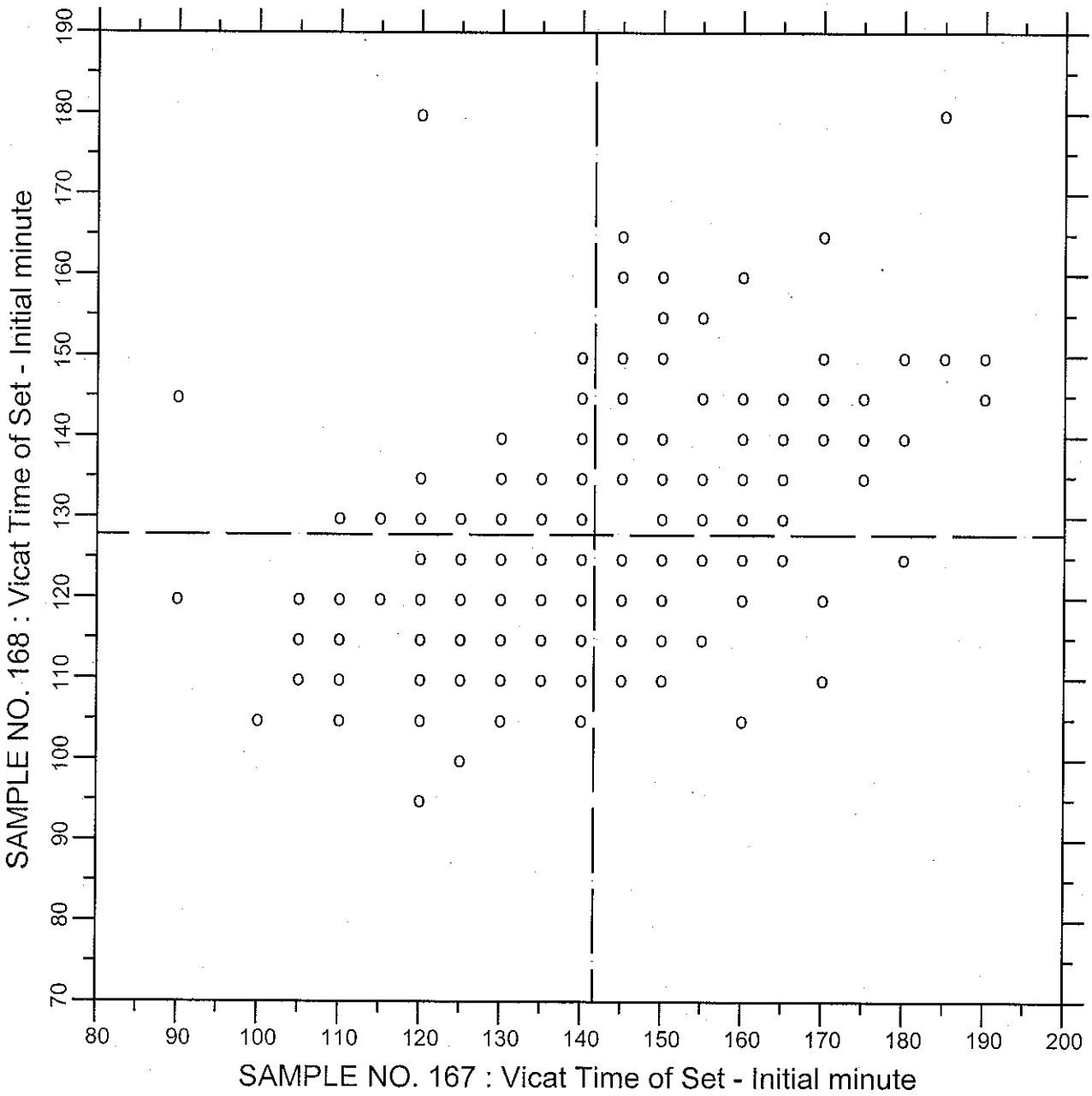
TEST NO.110 Normal Consistency - % Water 257 POINTS

SAMPLE NO. 167 AVE 31.575 S.D. 0.98 C.V. 3.10

SAMPLE NO. 168 AVE 27.935 S.D. 0.54 C.V. 1.95

LABS ELIMINATED 180 768 2477 3250 10 21 127 551 2292 2295 2412 3236 3276

CCRL PROFICIENCY SAMPLE PROGRAM
Vicat Time of Set - Initial
PORTLAND CEMENT SAMPLES NO. 167 & NO. 168



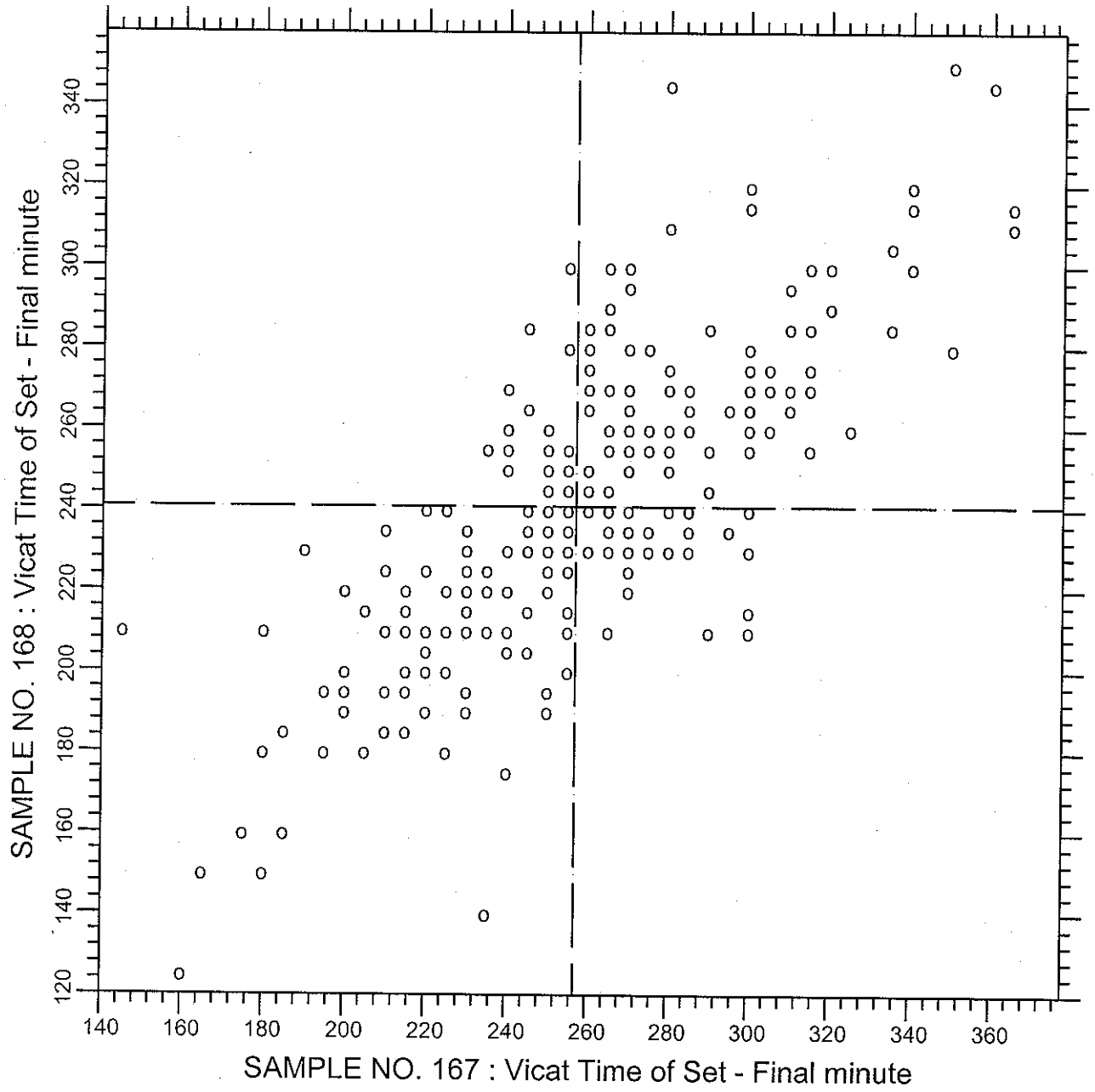
TEST NO.120 Vicat Time of Set - Initial 257 POINTS

SAMPLE NO. 167 AVE 141.61 S.D. 17.5 C.V. 12.4

SAMPLE NO. 168 AVE 127.80 S.D. 13.4 C.V. 10.5

LABS ELIMINATED 2 3 47 207 360 768 1483 2466

CCRL PROFICIENCY SAMPLE PROGRAM
Vicat Time of Set - Final
PORTLAND CEMENT SAMPLES NO. 167 & NO. 168



TEST NO.121 Vicat Time of Set - Final 250 POINTS

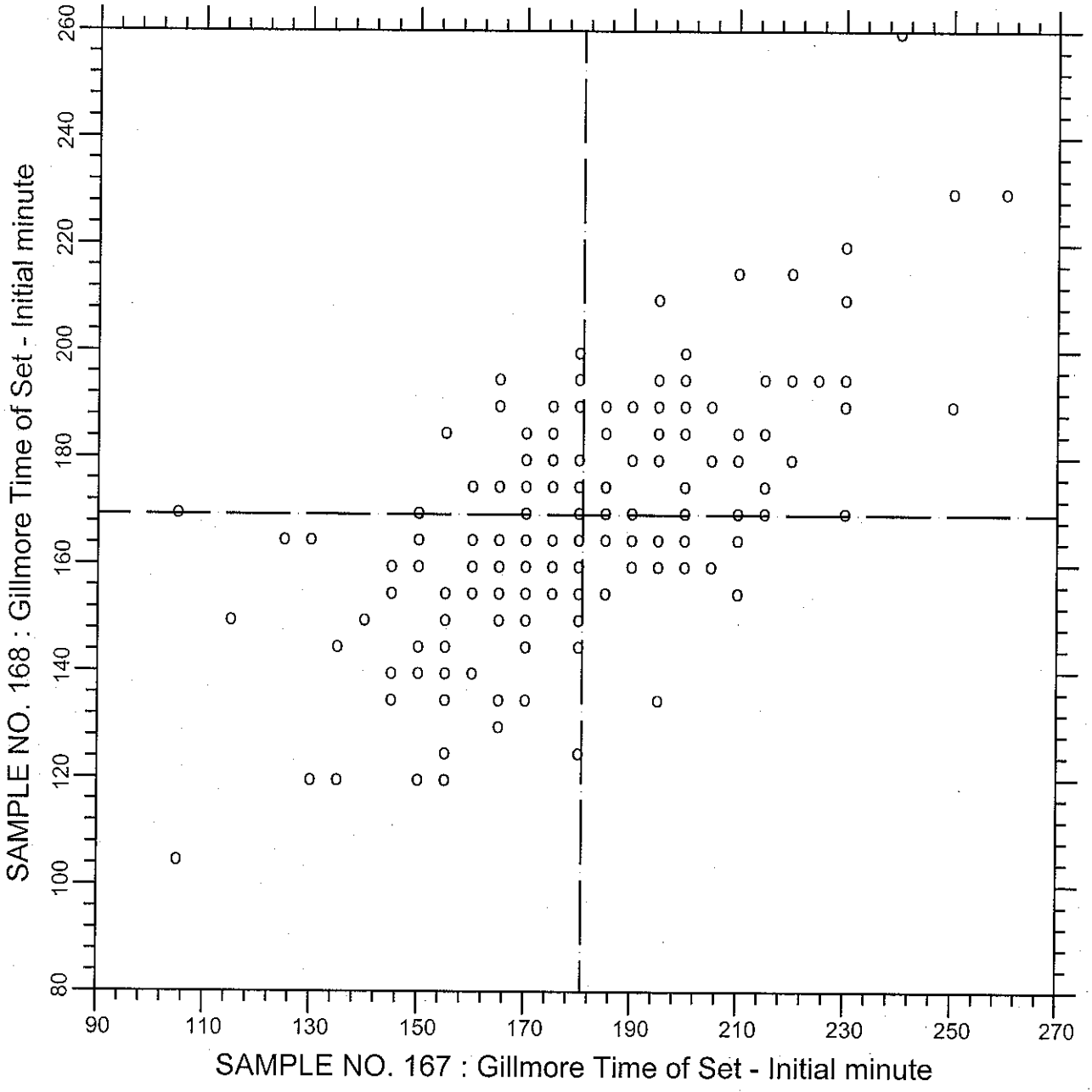
SAMPLE NO. 167 AVE 257.0 S.D. 39.2 C.V. 15.3

SAMPLE NO. 168 AVE 240.8 S.D. 36.9 C.V. 15.3

LABS ELIMINATED 2 165 252 2466

LABS OFF DIAGRAM 207

CCRL PROFICIENCY SAMPLE PROGRAM
Gillmore Time of Set - Initial
PORTLAND CEMENT SAMPLES NO. 167 & NO. 168



TEST NO.130 Gillmore Time of Set - Initial 168 POINTS

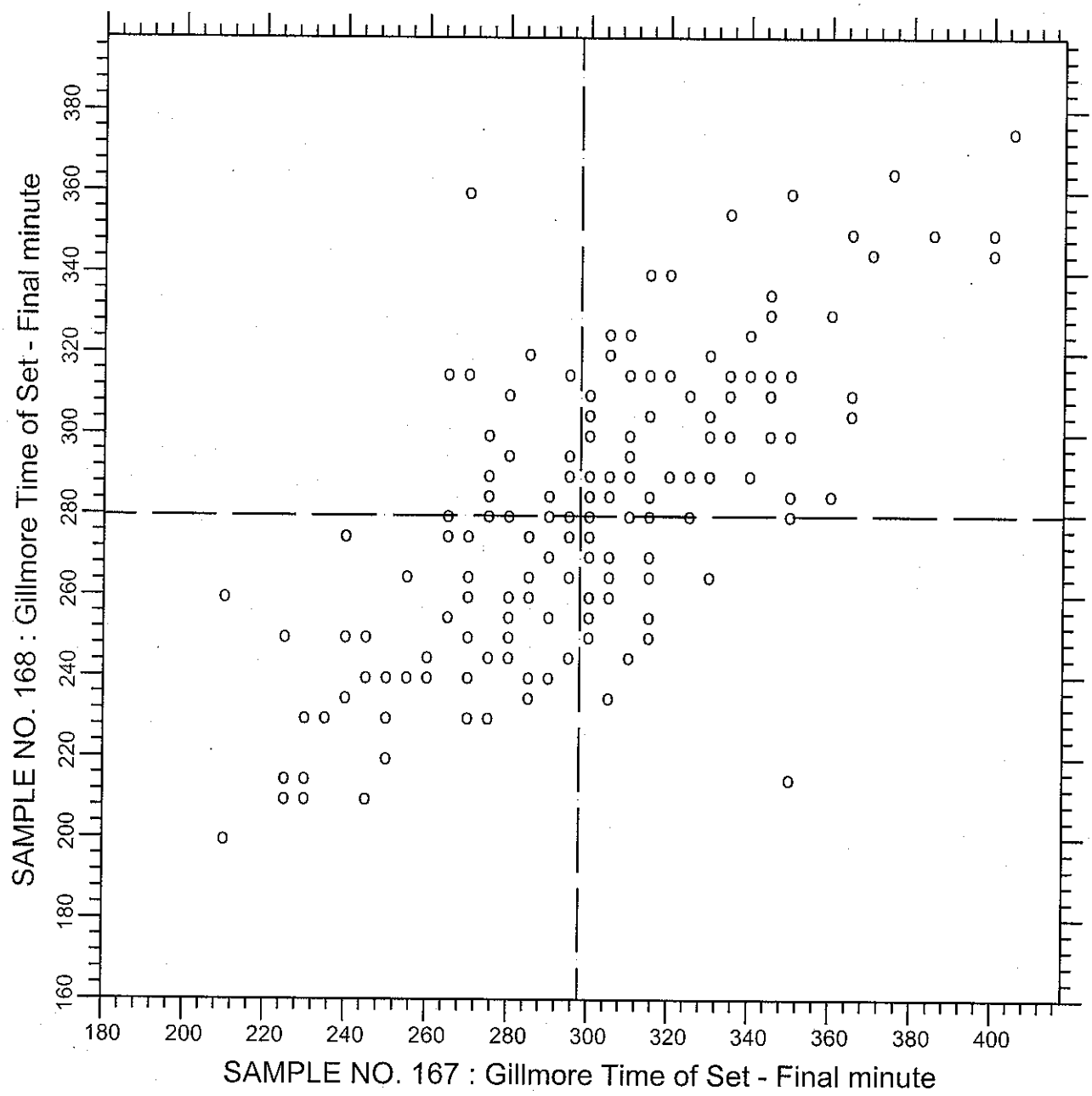
SAMPLE NO. 167	AVE	180.8	S.D.	28.3	C.V.	15.6
SAMPLE NO. 168	AVE	169.3	S.D.	23.4	C.V.	13.8

LABS OFF DIAGRAM 64

CCRL PROFICIENCY SAMPLE PROGRAM

Gillmore Time of Set - Final

PORTLAND CEMENT SAMPLES NO. 167 & NO. 168



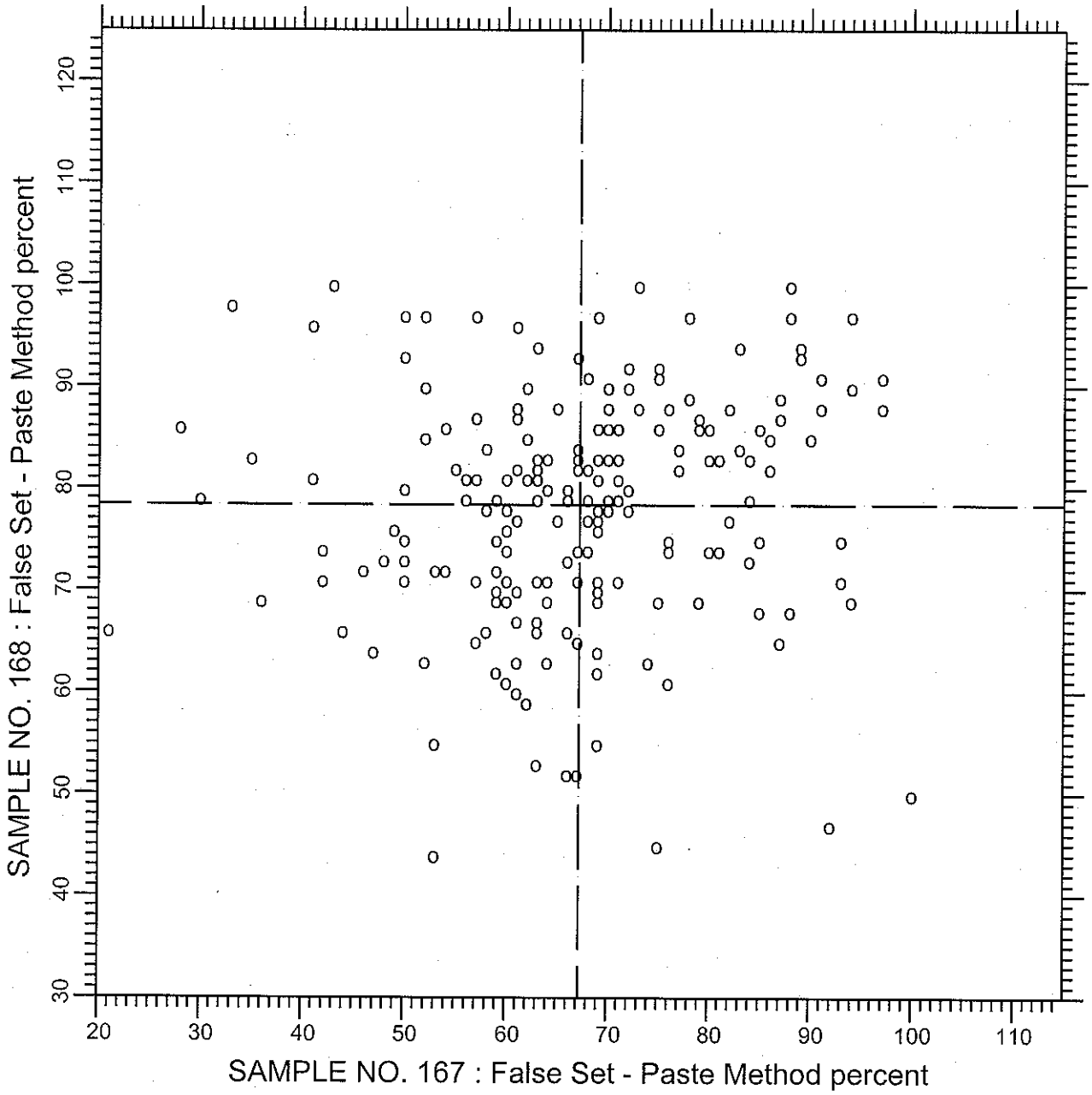
TEST NO.140 Gillmore Time of Set - Final 164 POINTS

SAMPLE NO. 167 AVE 297.9 S.D. 38.5 C.V. 12.9

SAMPLE NO. 168 AVE 279.7 S.D. 36.3 C.V. 13.0

LABS ELIMINATED 45 176 2295 2982

CCRL PROFICIENCY SAMPLE PROGRAM
False Set - Paste Method
PORTLAND CEMENT SAMPLES NO. 167 & NO. 168

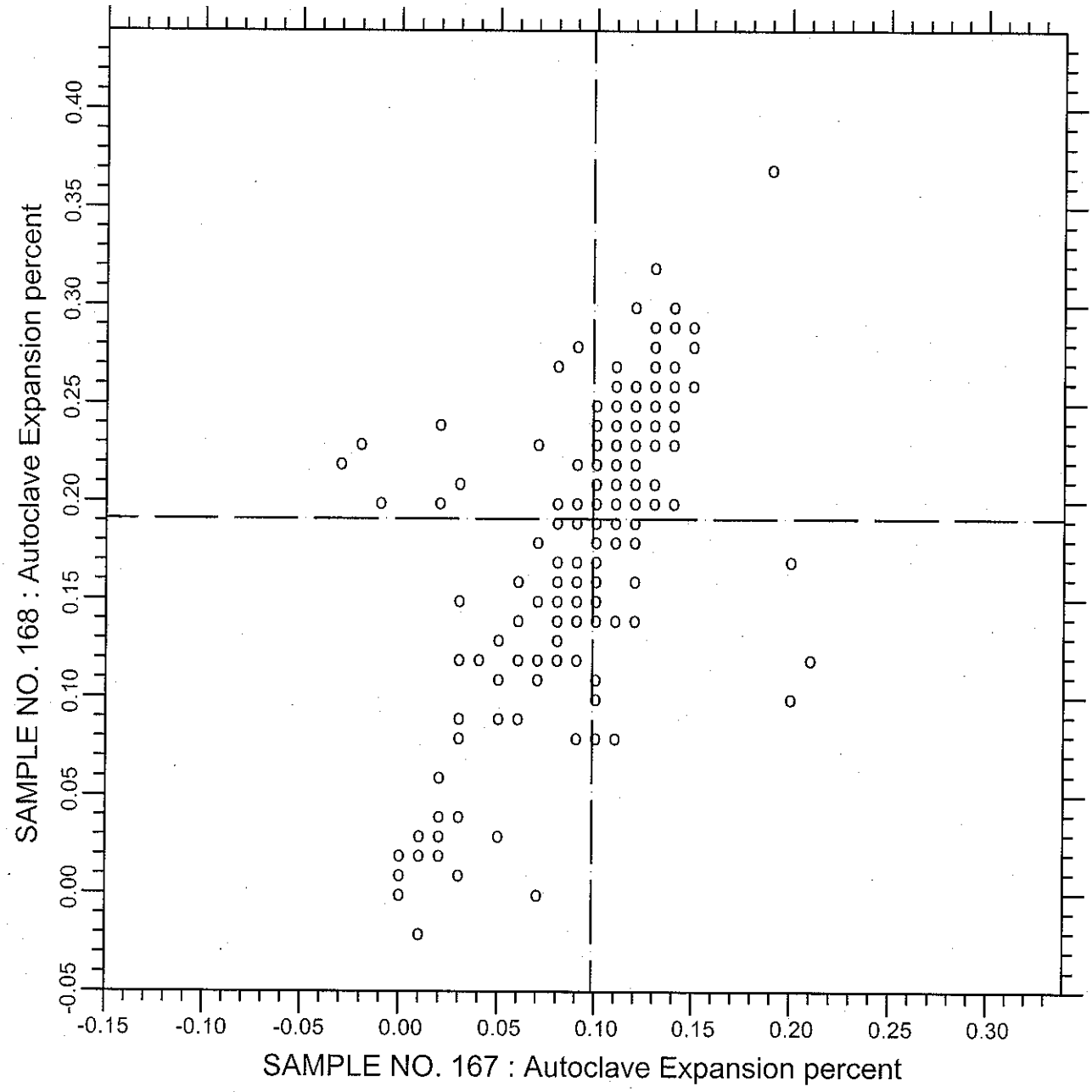


TEST NO.150 False Set - Paste Method 198 POINTS

SAMPLE NO. 167	AVE	67.22	S.D.	14.1	C.V. 21.0
SAMPLE NO. 168	AVE	78.39	S.D.	11.3	C.V. 14.5

LABS ELIMINATED 90 152 360 1483 1715

CCRL PROFICIENCY SAMPLE PROGRAM
Autoclave Expansion
PORTLAND CEMENT SAMPLES NO. 167 & NO. 168

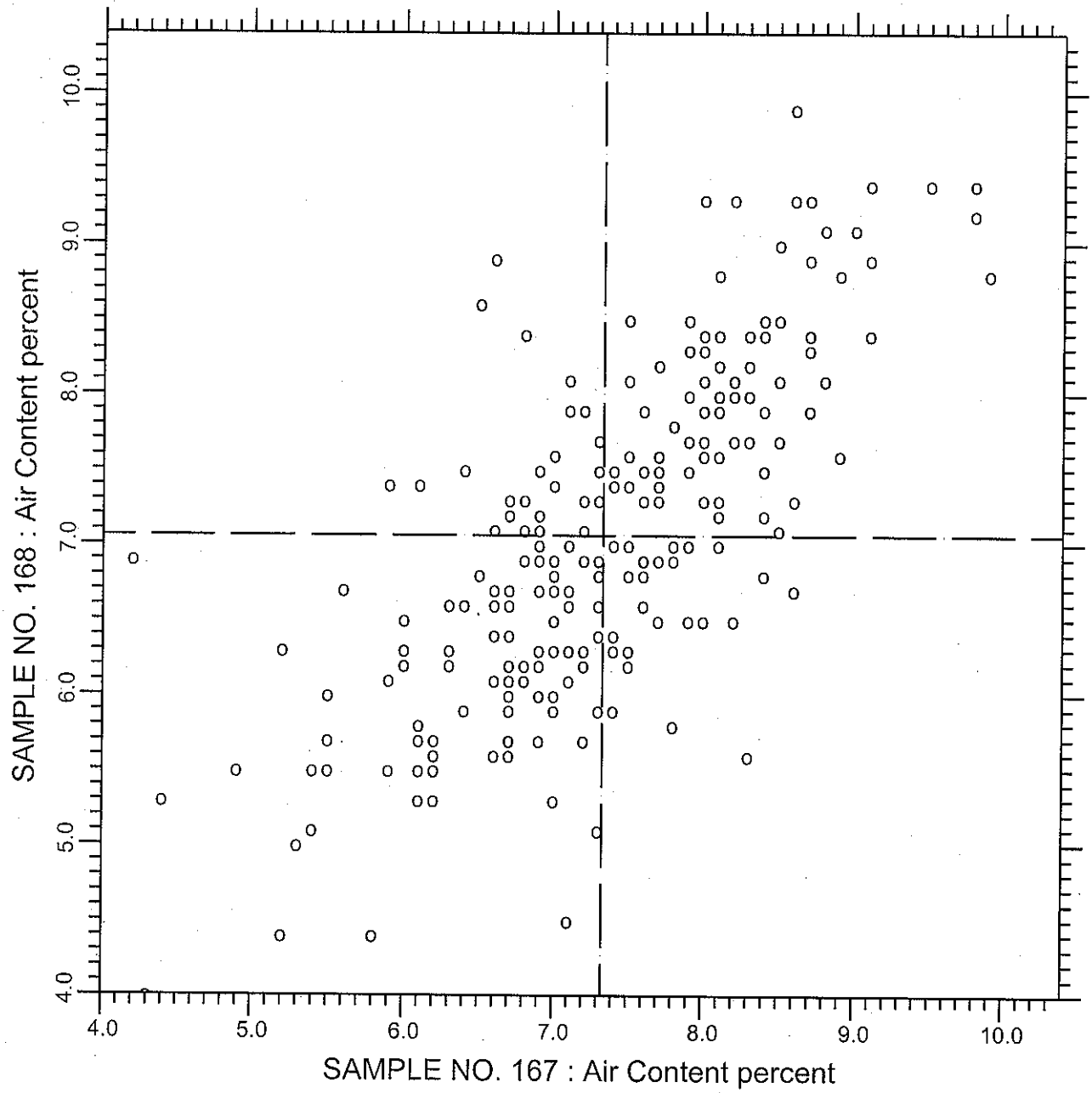


TEST NO.160 Autoclave Expansion 242 POINTS

SAMPLE NO. 167	AVE	0.0984	S.D.	0.038	C.V.	38.9
SAMPLE NO. 168	AVE	0.1912	S.D.	0.068	C.V.	35.3

LABS ELIMINATED 26 252 823 2477 870 2295 3234 3276 3297

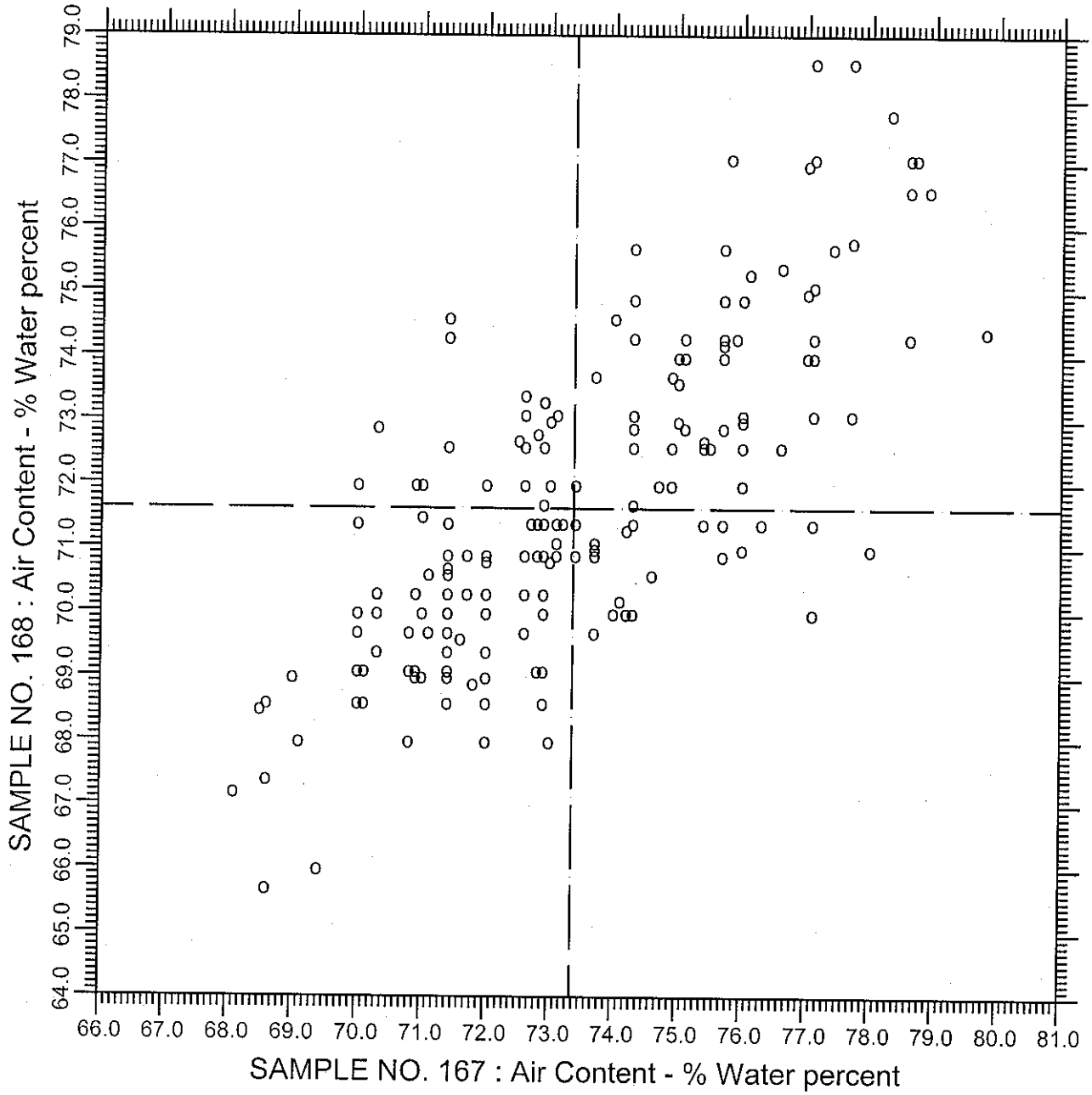
CCRL PROFICIENCY SAMPLE PROGRAM
Air Content
PORTLAND CEMENT SAMPLES NO. 167 & NO. 168



TEST NO.170 Air Content 233 POINTS

SAMPLE NO. 167 AVE 7.331 S.D. 0.99 C.V. 13.6
SAMPLE NO. 168 AVE 7.058 S.D. 1.14 C.V. 16.1
LABS ELIMINATED 768 47 1435 2491 3279
LABS OFF DIAGRAM 17 1956

CCRL PROFICIENCY SAMPLE PROGRAM
Air Content - % Water
PORTLAND CEMENT SAMPLES NO. 167 & NO. 168



TEST NO.180 Air Content - % Water 224 POINTS

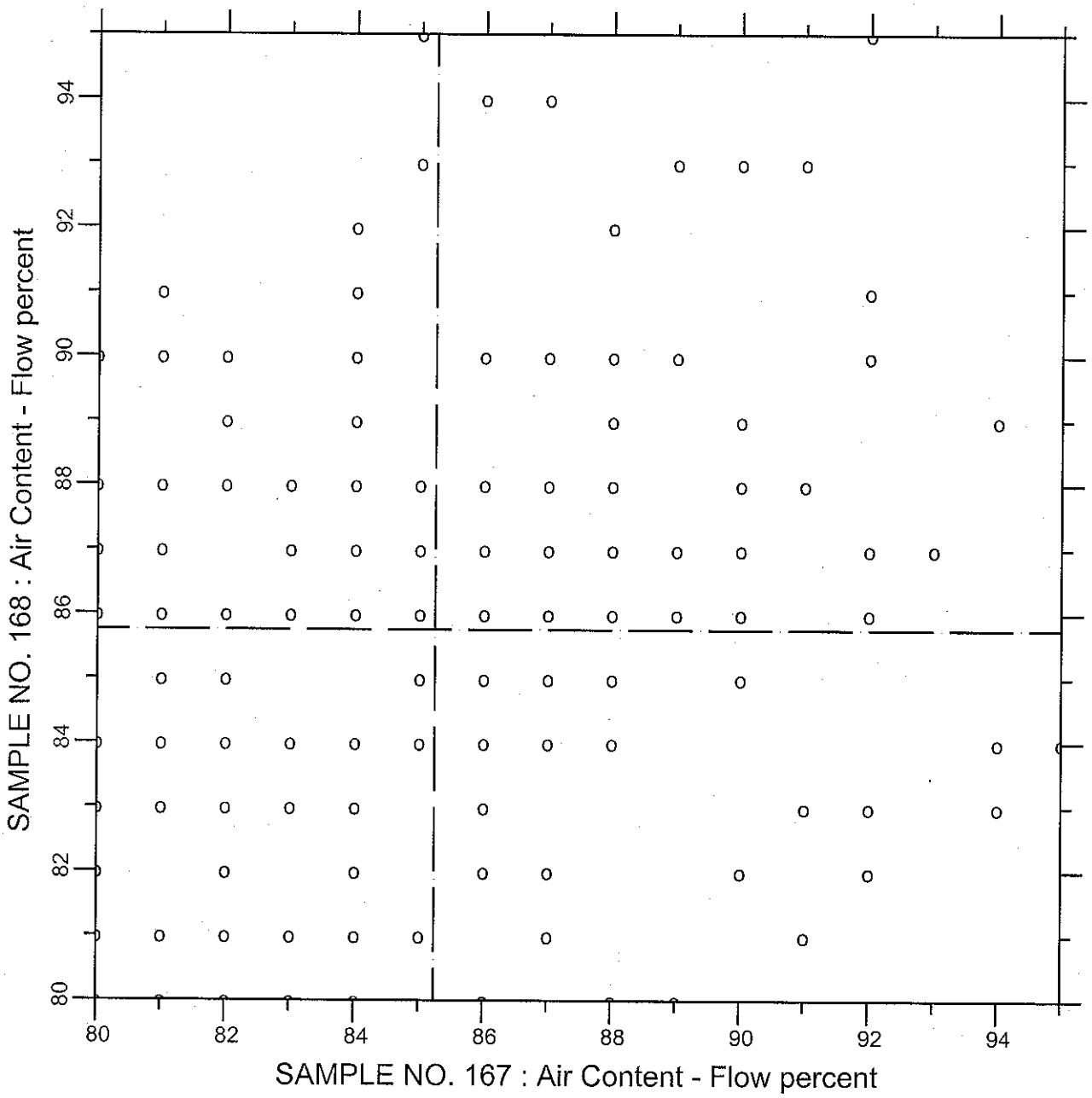
SAMPLE NO. 167 AVE 73.37 S.D. 2.4 C.V. 3.35

SAMPLE NO. 168 AVE 71.62 S.D. 2.4 C.V. 3.34

LABS ELIMINATED 75 178 1379 2295 17 95 768 918 2491 3279

LABS OFF DIAGRAM 1251 1956

CCRL PROFICIENCY SAMPLE PROGRAM
Air Content - Flow
PORTLAND CEMENT SAMPLES NO. 167 & NO. 168

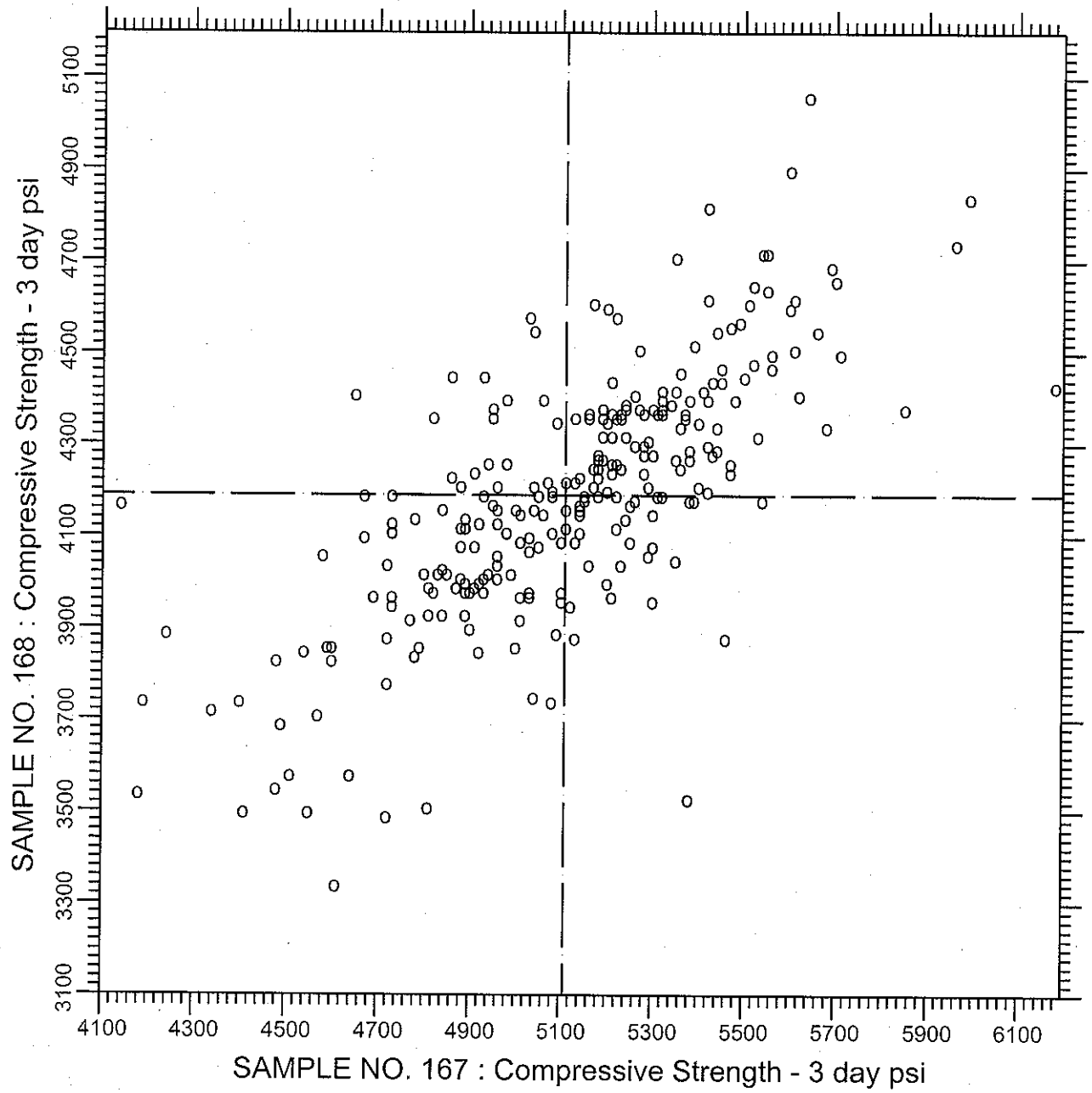


TEST NO.190 Air Content - Flow 232 POINTS

SAMPLE NO. 167	AVE	85.24	S.D.	3.6	C.V. 4.18
SAMPLE NO. 168	AVE	85.75	S.D.	3.3	C.V. 3.88

LABS ELIMINATED 1379 3126 95 3279 96

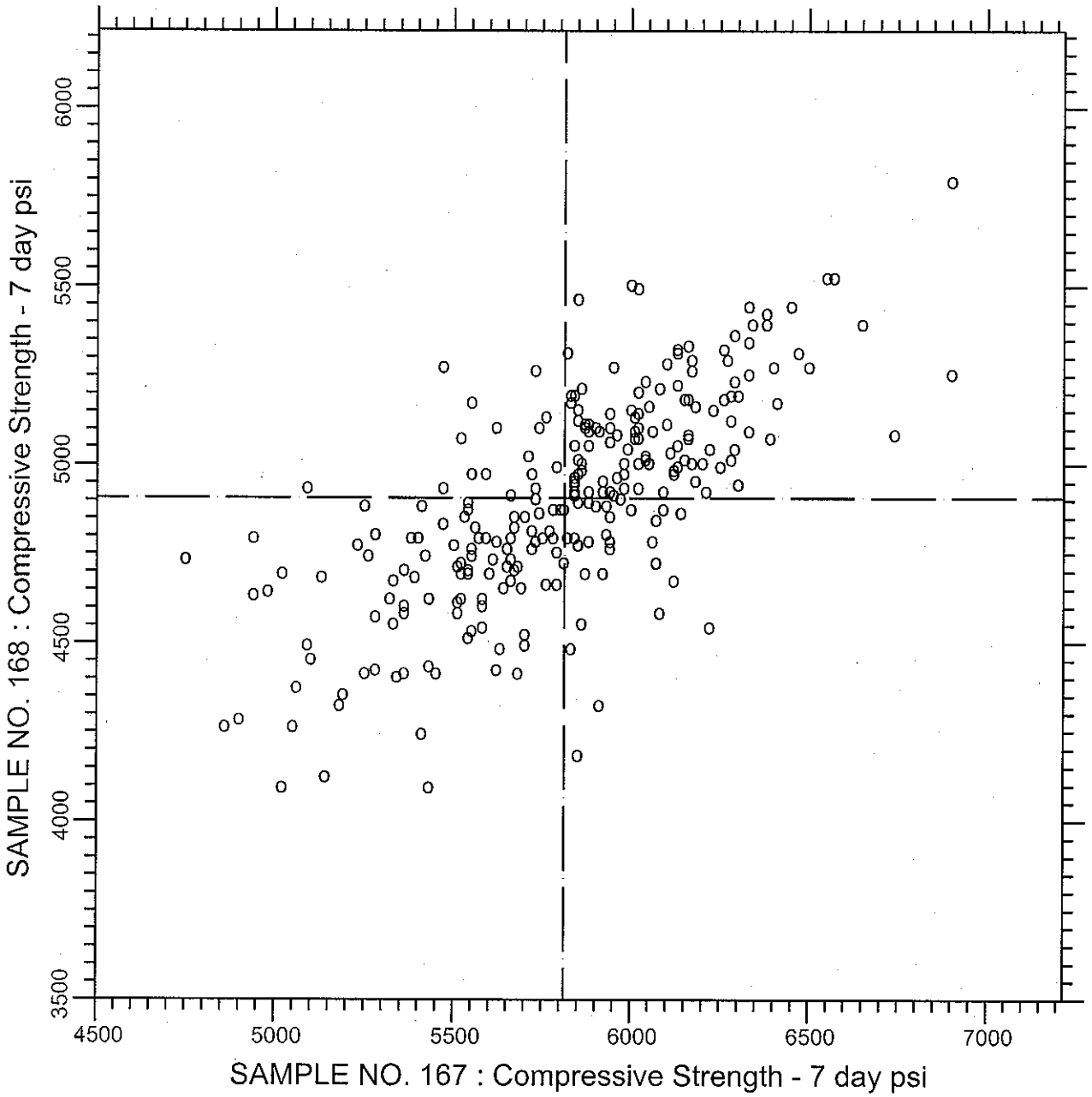
CCRL PROFICIENCY SAMPLE PROGRAM
Compressive Strength - 3 day
PORTLAND CEMENT SAMPLES NO. 167 & NO. 168



TEST NO.200 Compressive Strength - 3 day 264 POINTS

SAMPLE NO. 167 AVE 5109.0 S.D. 335.1 C.V. 6.56
SAMPLE NO. 168 AVE 4188.9 S.D. 276.2 C.V. 6.59
LABS ELIMINATED 10 30 95 2 5 46 48 2330 3059
LABS OFF DIAGRAM 1525 3287

CCRL PROFICIENCY SAMPLE PROGRAM
Compressive Strength - 7 day
PORTLAND CEMENT SAMPLES NO. 167 & NO. 168

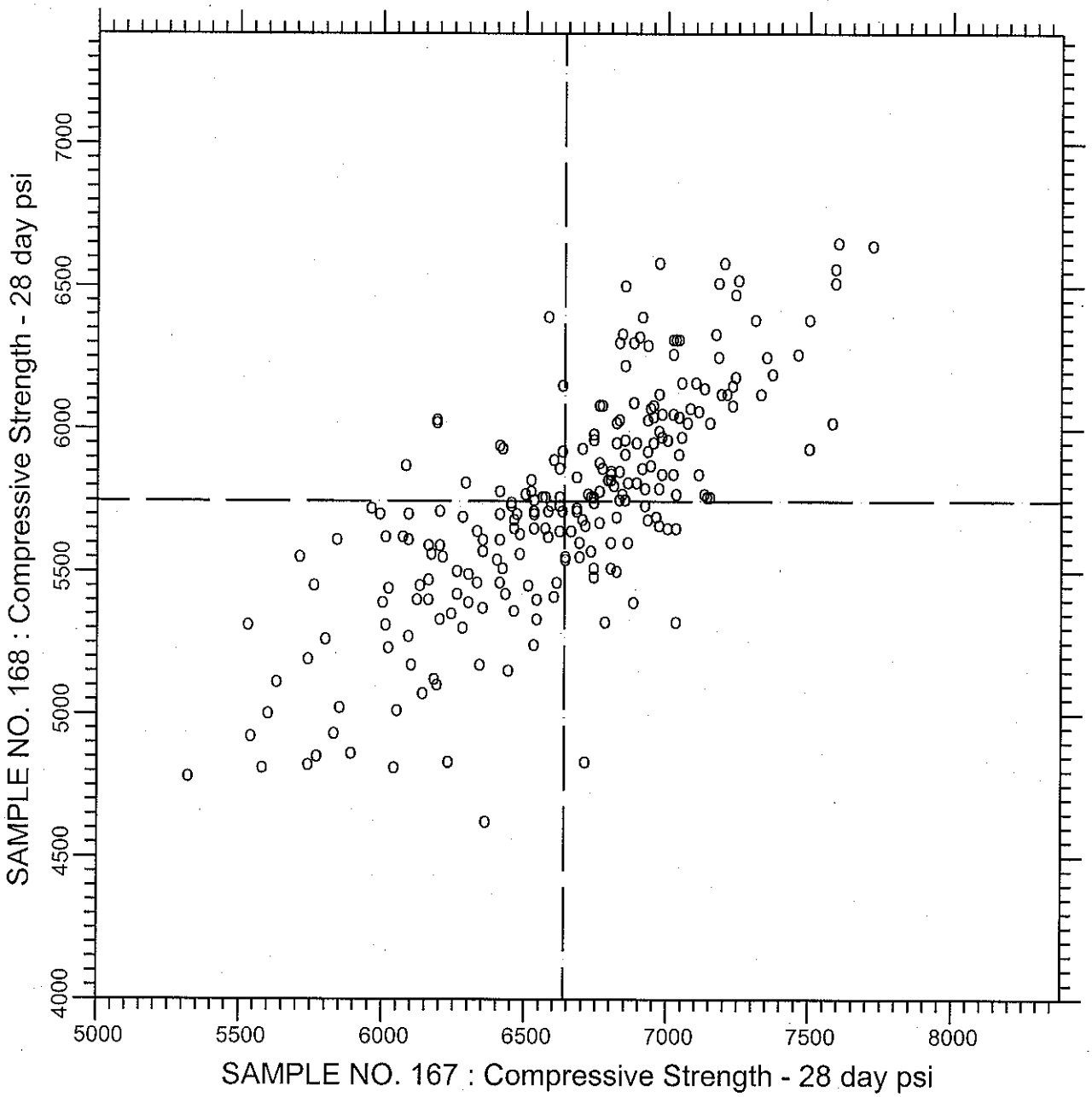


TEST NO.210 Compressive Strength - 7 day 262 POINTS

SAMPLE NO. 167	AVE	5812.4	S.D.	375.2	C.V.	6.46
SAMPLE NO. 168	AVE	4906.4	S.D.	294.1	C.V.	5.99

LABS ELIMINATED 30 48 51 691 10 1525 2330 3059

CCRL PROFICIENCY SAMPLE PROGRAM
Compressive Strength - 28 day
PORTLAND CEMENT SAMPLES NO. 167 & NO. 168



TEST NO.211 Compressive Strength - 28 day 240 POINTS

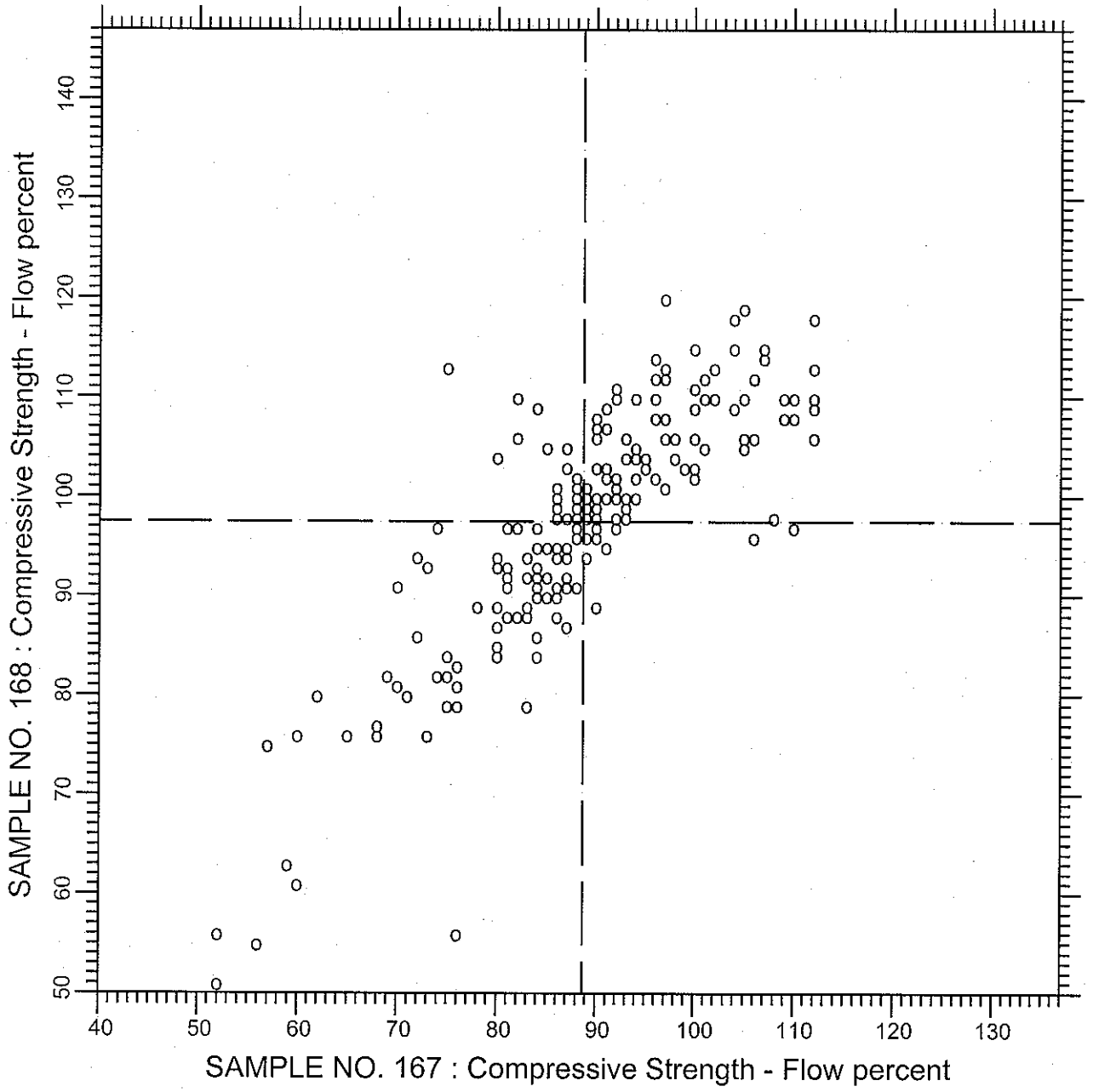
SAMPLE NO. 167	AVE	6638.2	S.D.	443.3	C.V.	6.68
SAMPLE NO. 168	AVE	5747.8	S.D.	392.8	C.V.	6.83

LABS ELIMINATED 23 30 2330

CCRL PROFICIENCY SAMPLE PROGRAM

Compressive Strength - Flow

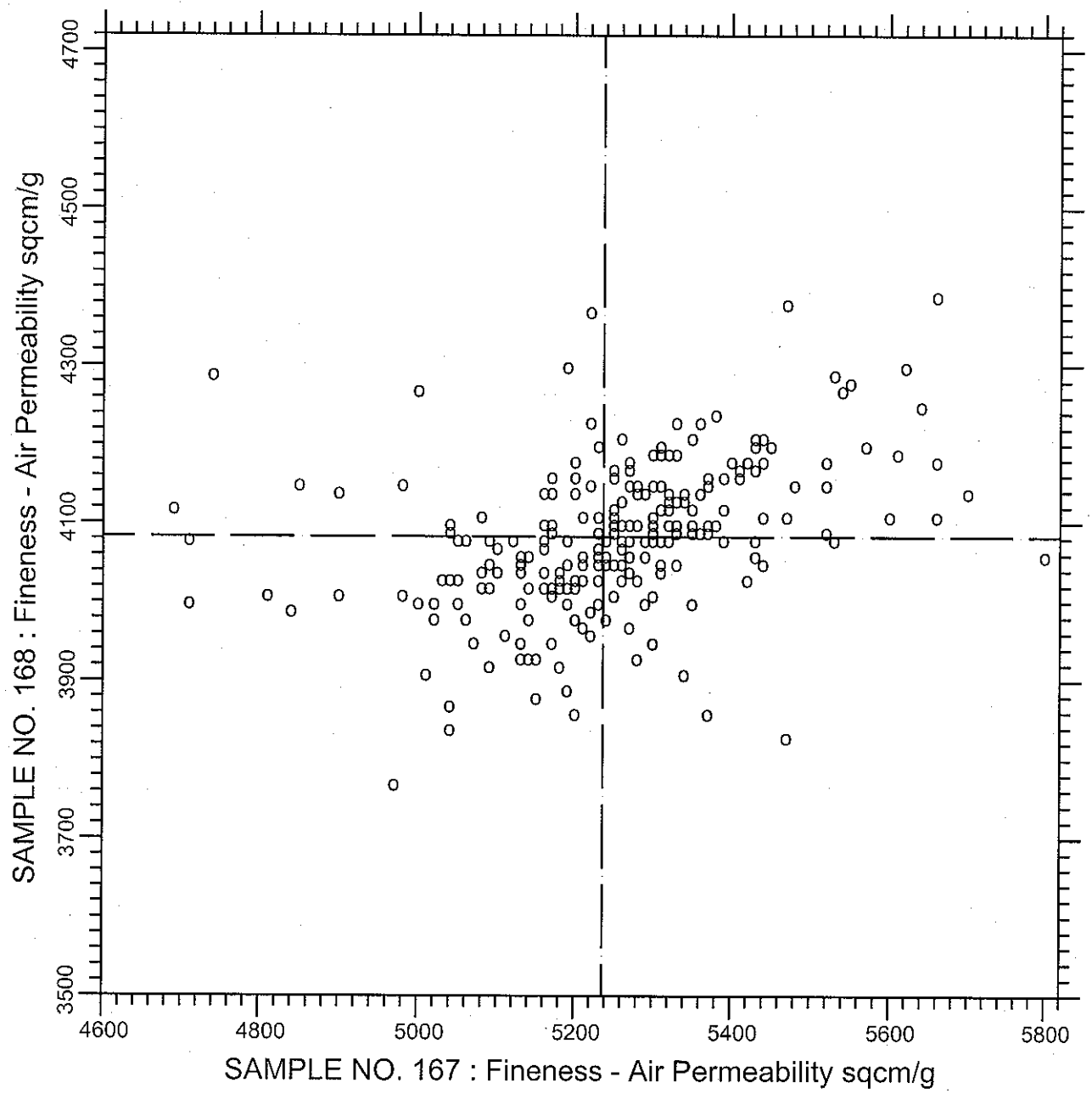
PORTLAND CEMENT SAMPLES NO. 167 & NO. 168



TEST NO.230 Compressive Strength - Flow 230 POINTS

SAMPLE NO. 167	AVE	88.71	S.D.	11.4	C.V.	12.9
SAMPLE NO. 168	AVE	97.53	S.D.	11.7	C.V.	12.0

CCRL PROFICIENCY SAMPLE PROGRAM
Fineness - Air Permeability
PORTLAND CEMENT SAMPLES NO. 167 & NO. 168



TEST NO.270 Fineness - Air Permeability 244 POINTS

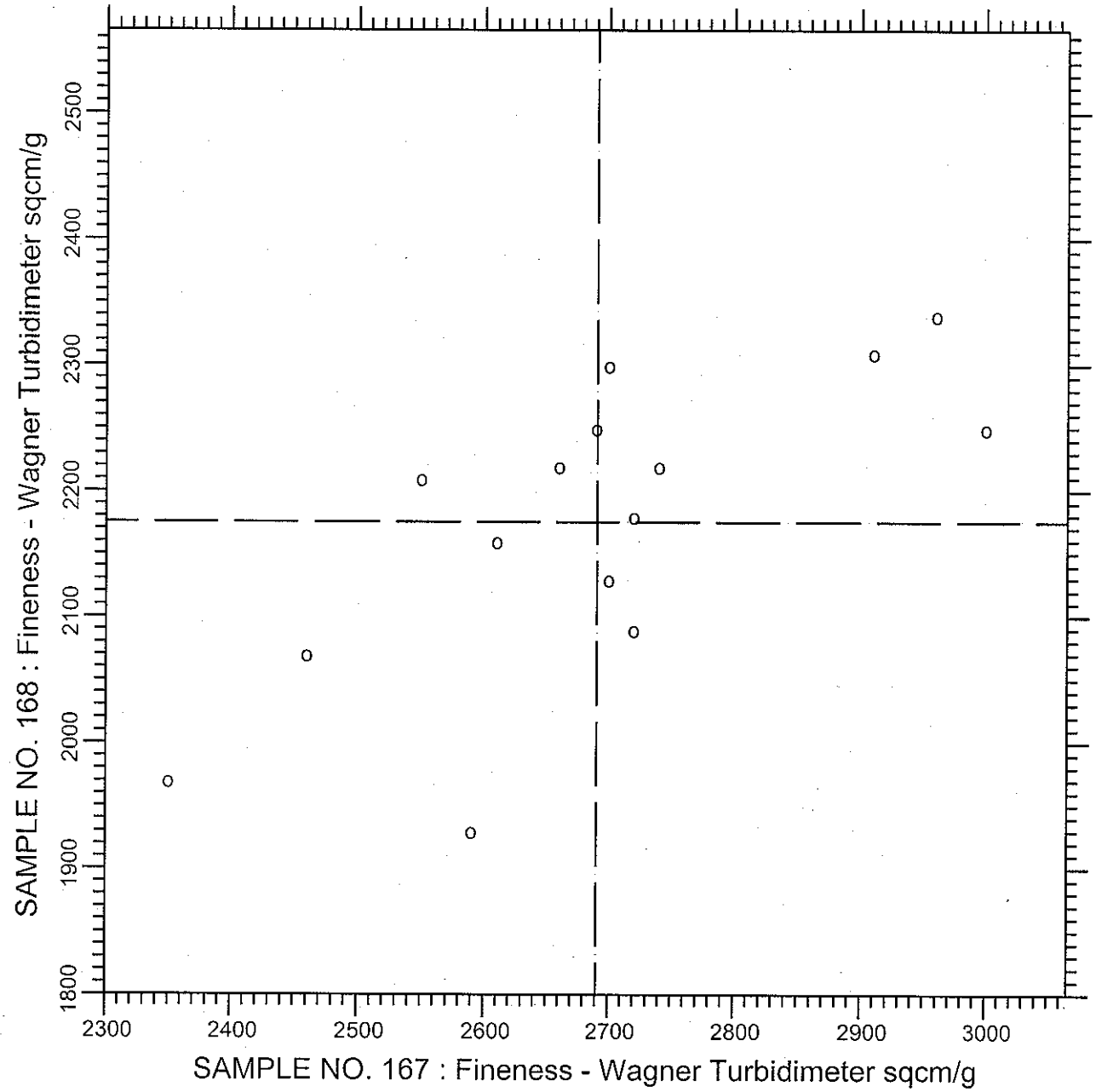
SAMPLE NO. 167 AVE 5236.8 S.D. 192.1 C.V. 3.67

SAMPLE NO. 168 AVE 4082.7 S.D. 96.6 C.V. 2.37

LABS ELIMINATED 2 10 21 42 47 51 157 169 3235 36 48 49 92 221 416 687 698 1379 1799 3276

LABS OFF DIAGRAM 14 41 50 2938

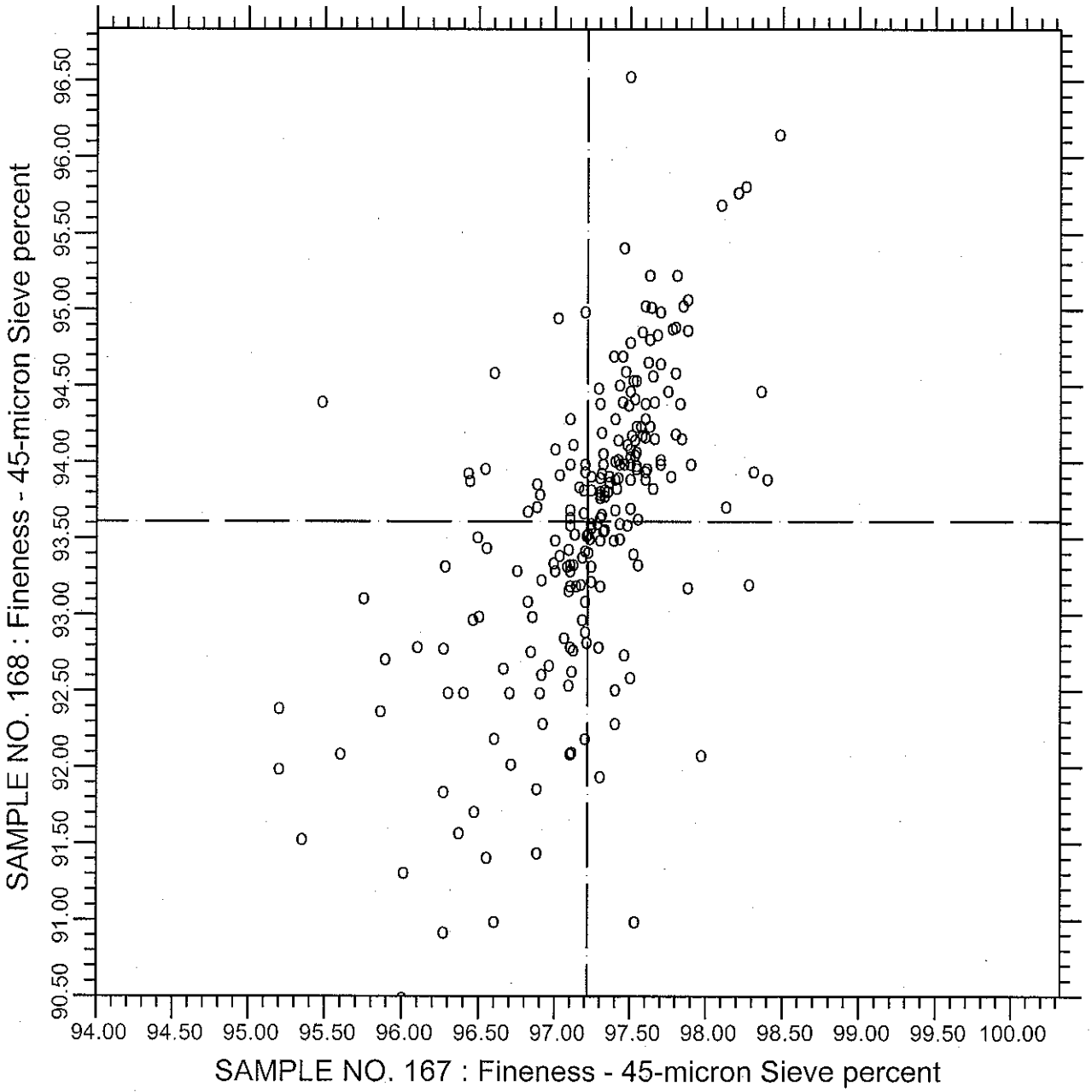
CCRL PROFICIENCY SAMPLE PROGRAM
Fineness - Wagner Turbidimeter
PORTLAND CEMENT SAMPLES NO. 167 & NO. 168



TEST NO.280 Fineness - Wagner Turbidimeter 15 POINTS

SAMPLE NO. 167	AVE	2690.7	S.D.	174.7	C.V.	6.49
SAMPLE NO. 168	AVE	2175.3	S.D.	119.6	C.V.	5.50

CCRL PROFICIENCY SAMPLE PROGRAM
Fineness - 45-micron Sieve
PORTLAND CEMENT SAMPLES NO. 167 & NO. 168



TEST NO.281 Fineness - 45-micron Sieve 230 POINTS

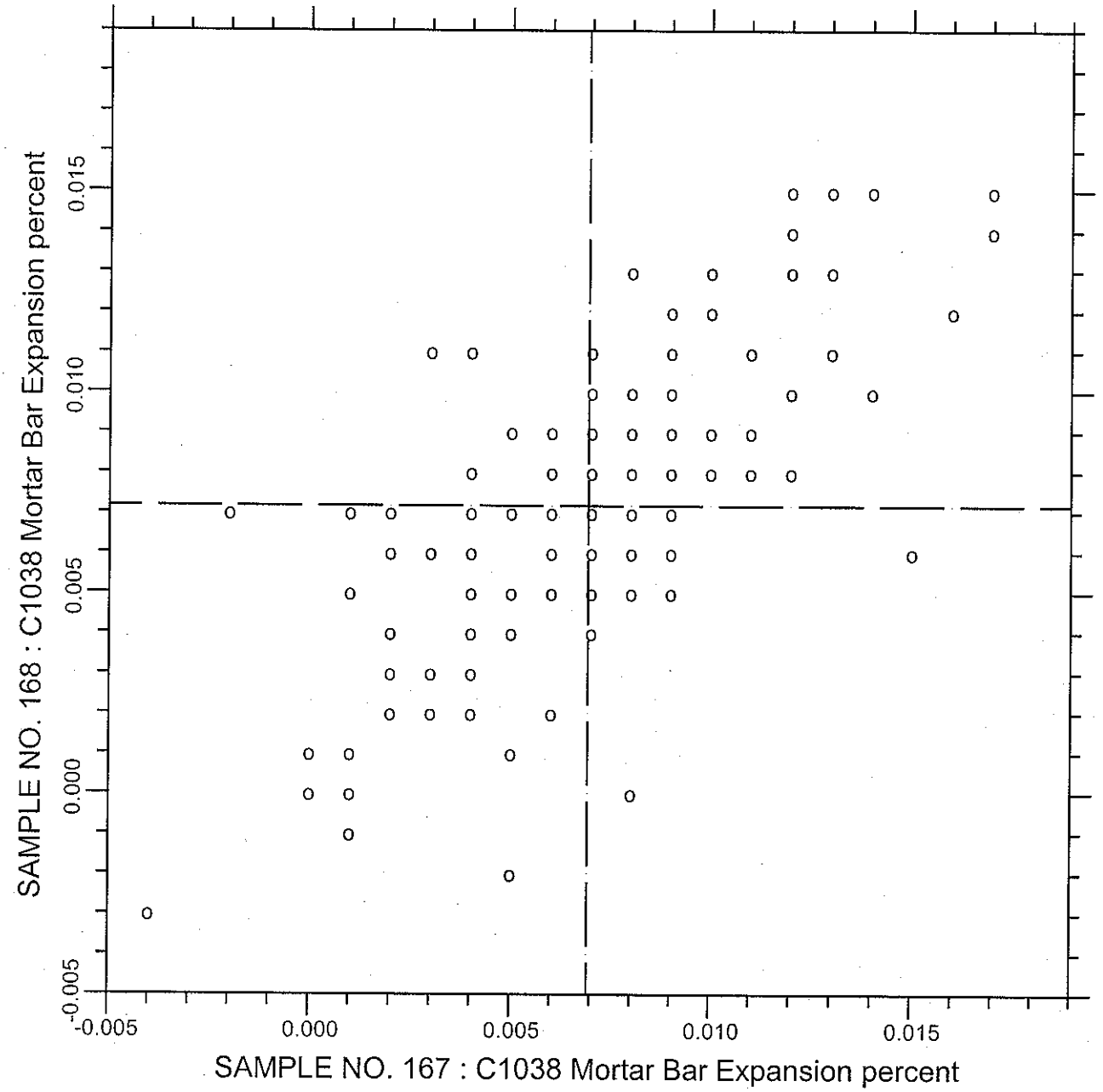
SAMPLE NO. 167 AVE 97.218 S.D. 0.56 C.V. 0.578

SAMPLE NO. 168 AVE 93.611 S.D. 1.04 C.V. 1.114

LABS ELIMINATED 47 52 169 413 779 1644 1726 40 130 175 246 698 1053 2491

LABS OFF DIAGRAM 49 125 206 2295

CCRL PROFICIENCY SAMPLE PROGRAM
C1038 Mortar Bar Expansion
PORTLAND CEMENT SAMPLES NO. 167 & NO. 168



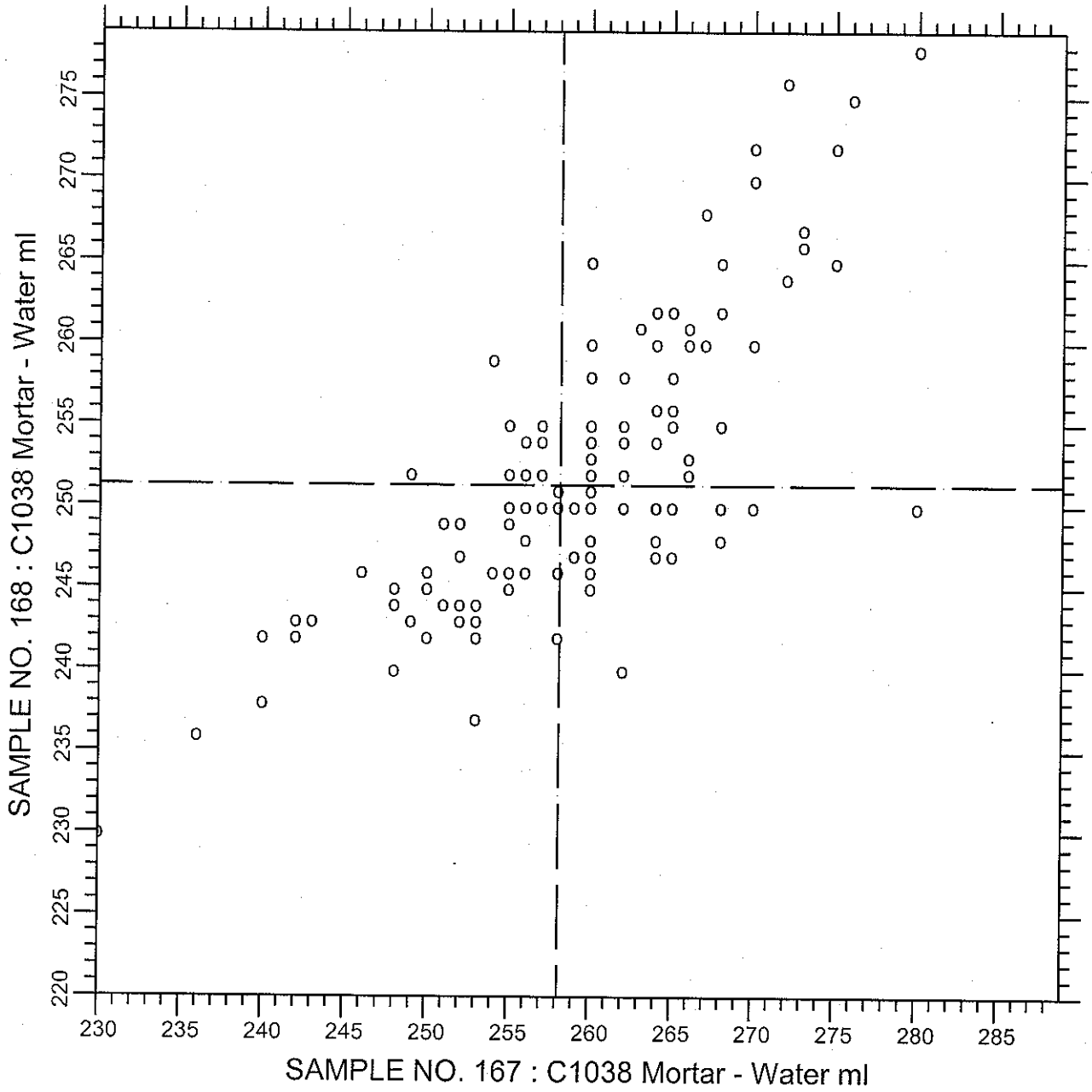
TEST NO.400 C1038 Mortar Bar Expansion 129 POINTS

SAMPLE NO. 167 AVE 0.00692 S.D. 0.0039 C.V. 55.8

SAMPLE NO. 168 AVE 0.00716 S.D. 0.0036 C.V. 50.8

LABS ELIMINATED 246 73 90 493 1466 2296 3059 15 121 125 139 181 1054 1251 2462 36 1190 3234

CCRL PROFICIENCY SAMPLE PROGRAM
C1038 Mortar - Water
PORTLAND CEMENT SAMPLES NO. 167 & NO. 168



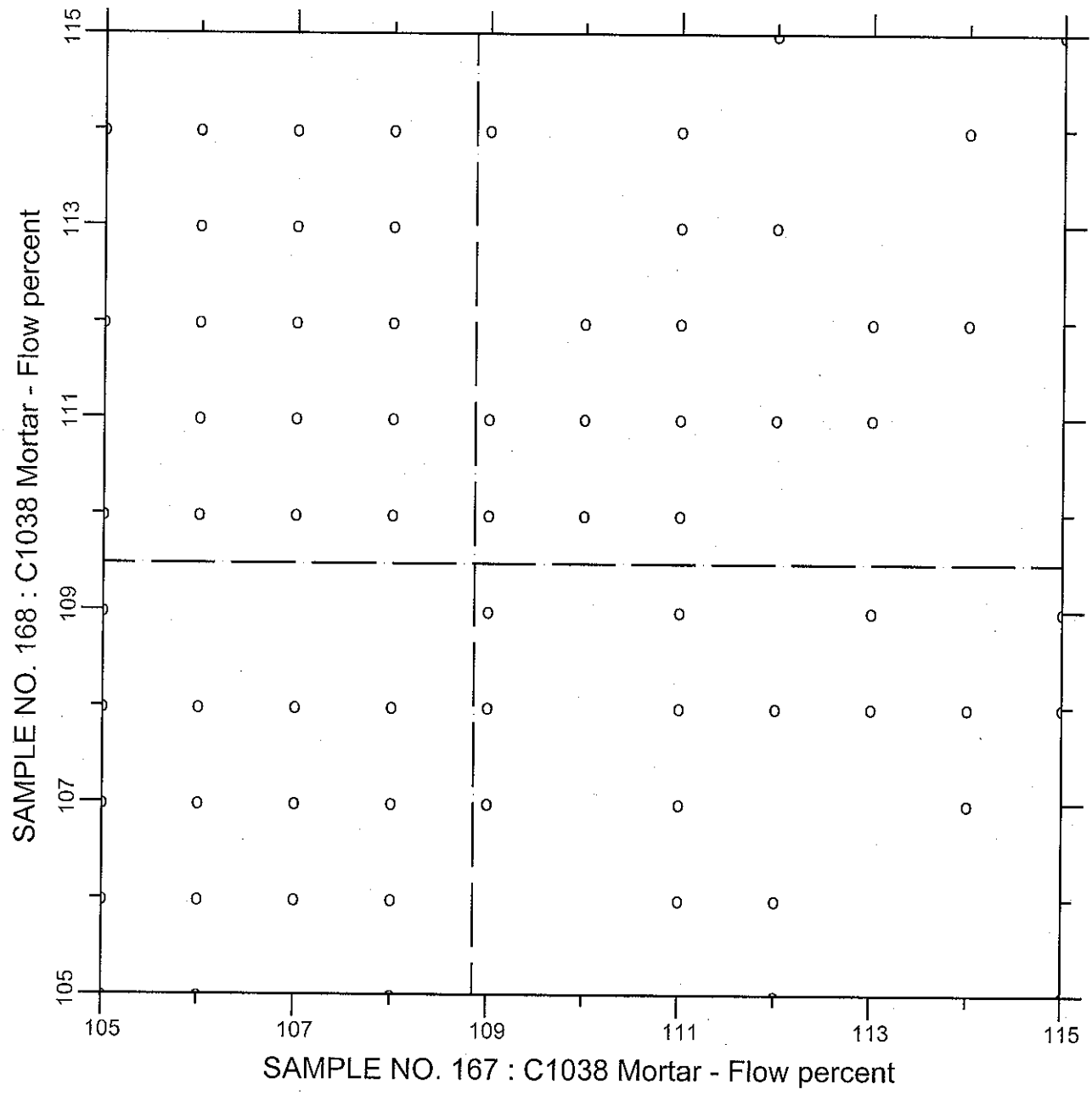
TEST NO.401 C1038 Mortar - Water 137 POINTS

SAMPLE NO. 167 AVE 258.15 S.D. 9.0 C.V. 3.47

SAMPLE NO. 168 AVE 251.26 S.D. 8.4 C.V. 3.34

LABS ELIMINATED 440 2363 3059 3126

CCRL PROFICIENCY SAMPLE PROGRAM
C1038 Mortar - Flow
PORTLAND CEMENT SAMPLES NO. 167 & NO. 168



TEST NO.402 C1038 Mortar - Flow 128 POINTS

SAMPLE NO. 167 AVE 108.86 S.D. 2.8 C.V. 2.53
SAMPLE NO. 168 AVE 109.48 S.D. 2.6 C.V. 2.35
LABS ELIMINATED 243 416 611 3126 8 3250 90 208 996 1936

CCRL PROFICIENCY SAMPLE PROGRAM
Portland Cement Proficiency Samples No. 167 and No. 166
Final Report - Heat of Hydration Results
March 28, 2008

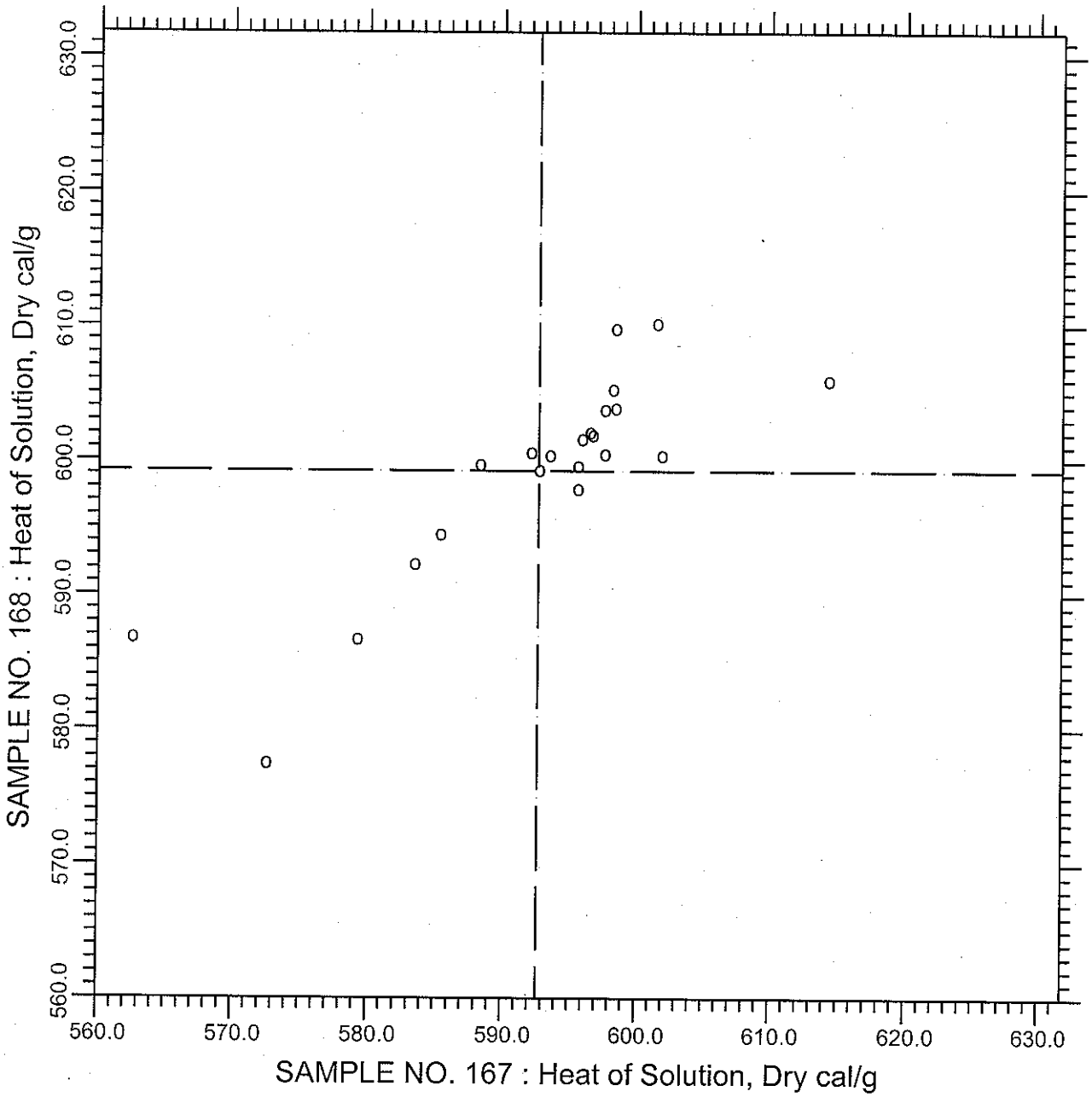
SUMMARY OF RESULTS

			Sample No. 167			Sample No. 168		
Test		#Labs	Average	S.D.	C.V.	Average	S.D.	C.V.
Heat Solution, Dry	cal/g	24	593.0	12.4	2.10	597.8	21.5	3.60
Heat Solution, Dry	cal/g	* 22	592.6	10.9	1.83	599.2	7.7	1.28
Heat Sol, 7 day	cal/g	24	511.0	15.3	3.00	518.5	21.5	4.14
Heat Sol, 7 day	cal/g	* 21	507.2	7.4	1.46	520.6	11.2	2.15
Heat Sol, 28 day	cal/g	17	503.1	17.0	3.38	514.0	14.2	2.76
Heat Sol, 28 day	cal/g	* 16	500.1	11.9	2.38	511.2	8.5	1.66
Heat Hyd, 7 day	cal/g	25	82.4	9.3	11.34	79.9	7.6	9.58
Heat Hyd, 7 day	cal/g	* 23	83.7	7.4	8.80	80.9	5.5	6.82
Heat Hyd, 28 day	cal/g	18	92.6	8.6	9.28	89.0	4.5	5.08

* ELIMINATED LABS: Data over three S.D. from the mean

Heat of Solution, Dry	1644 3057
Heat of Solution, 7 day	1644 2254 3057
Heat of Solution, 28 day	3057
Heat of Hydration, 7 day	176 2254

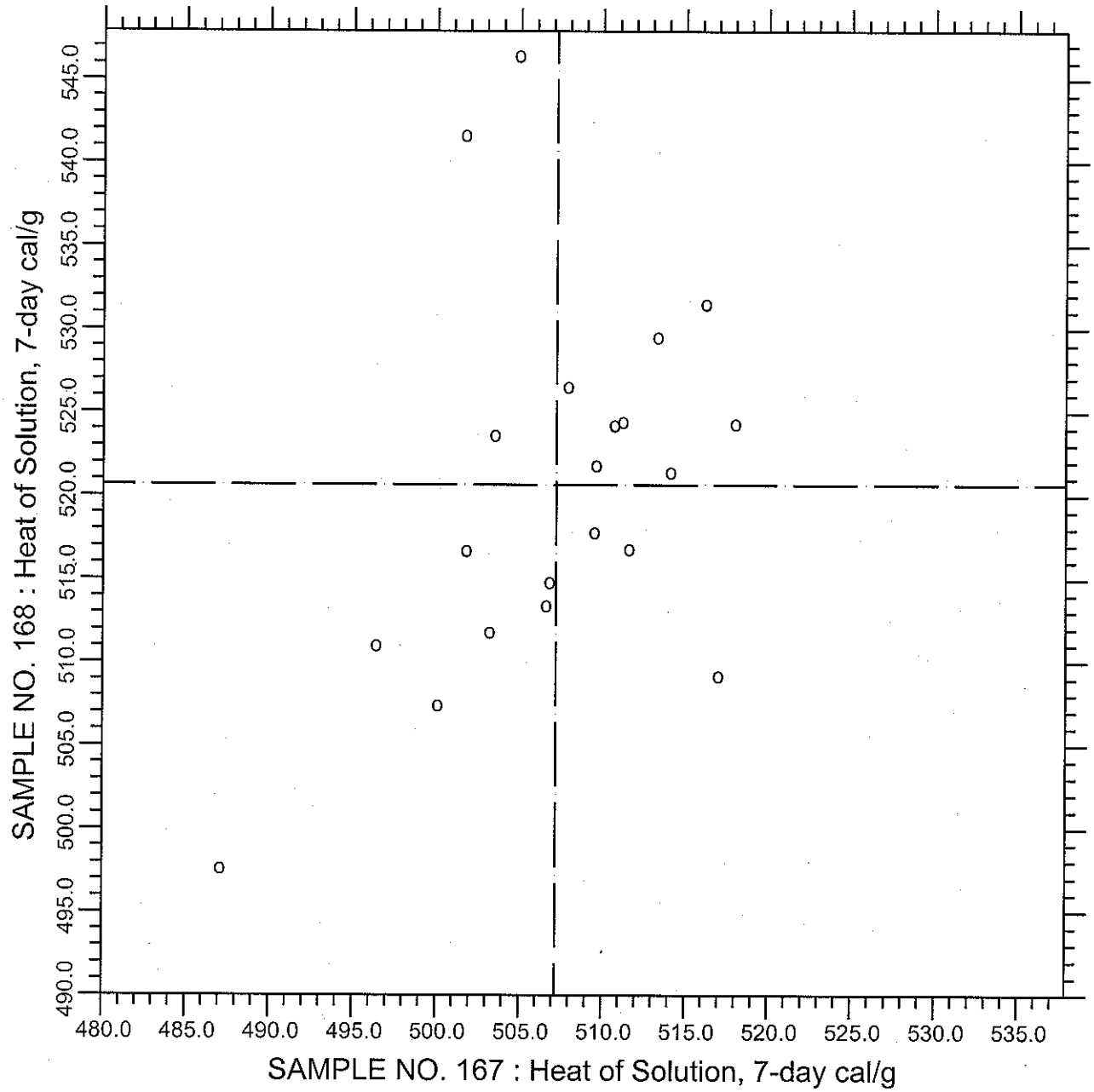
CCRL PROFICIENCY SAMPLE PROGRAM
Heat of Solution - Dry Cement
PORTLAND CEMENT SAMPLES NO. 167 & NO. 168



TEST NO.291 Heat of Solution, Dry 22 POINTS

SAMPLE NO. 167 AVE 592.6 S.D. 10.9 C.V. 1.83
SAMPLE NO. 168 AVE 599.2 S.D. 7.7 C.V. 1.28
LABS ELIMINATED 1644 3057

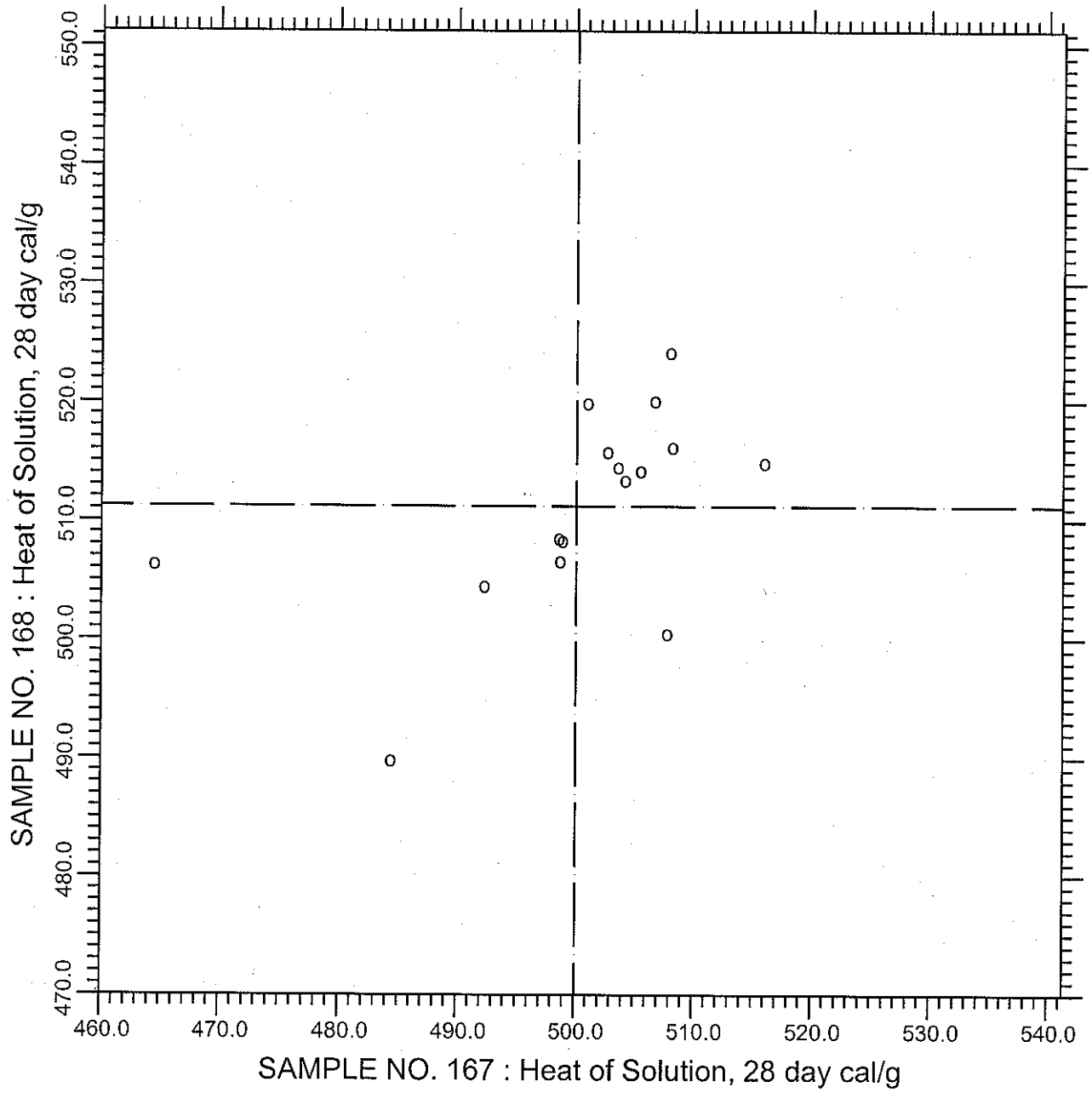
CCRL PROFICIENCY SAMPLE PROGRAM
Heat of Solution - 7-day
PORTLAND CEMENT SAMPLES NO. 167 & NO. 168



TEST NO.292 Heat of Solution, 7-day 21 POINTS

SAMPLE NO. 167 AVE 507.2 S.D. 7.4 C.V. 1.46
SAMPLE NO. 168 AVE 520.6 S.D. 11.2 C.V. 2.15
LABS ELIMINATED 1644 2254 3057

CCRL PROFICIENCY SAMPLE PROGRAM
Heat of Solution - 28-day
PORTLAND CEMENT SAMPLES NO. 167 & NO. 168



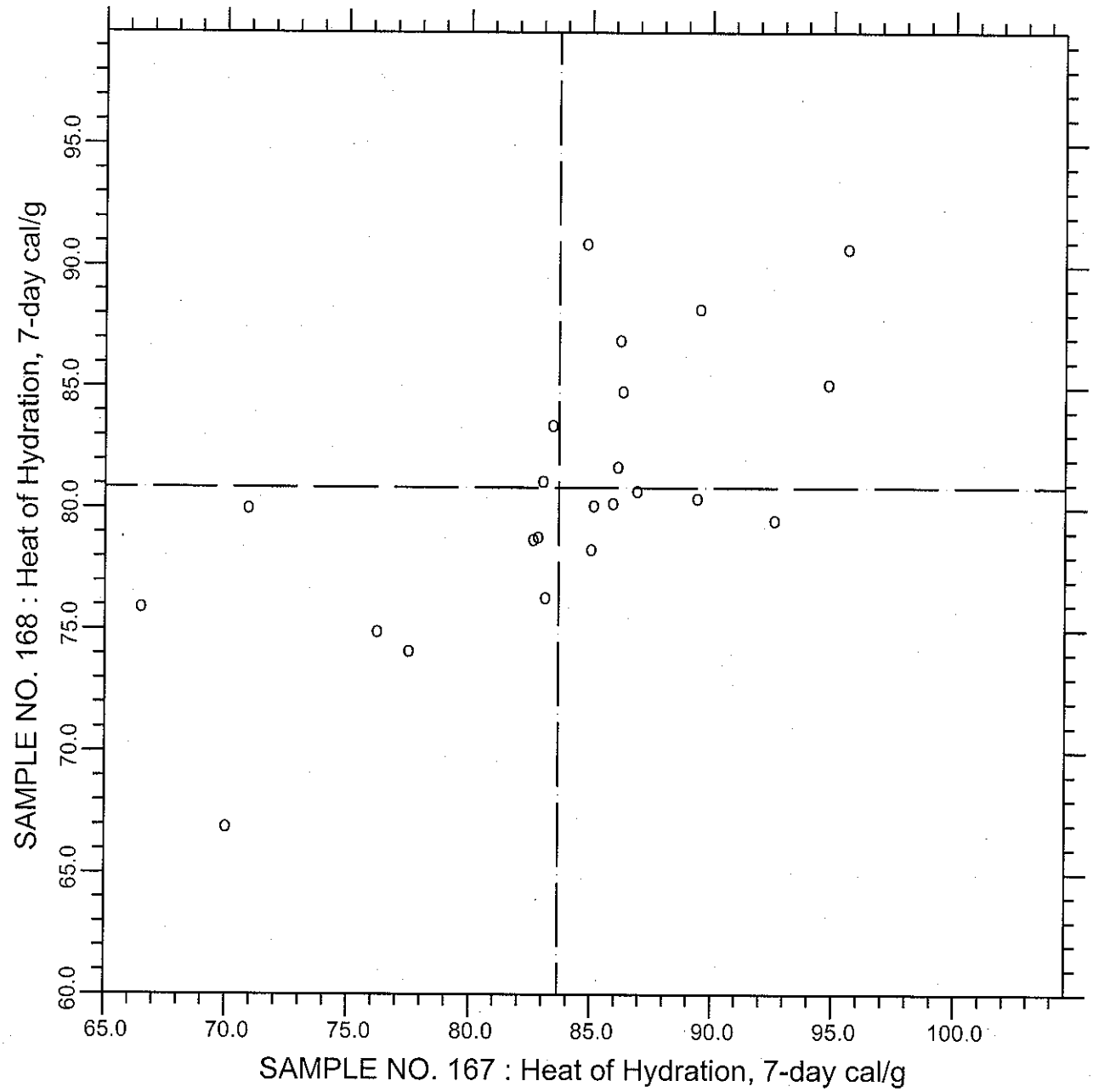
TEST NO.301 Heat of Solution, 28 day 16 POINTS

SAMPLE NO. 167 AVE 500.1 S.D. 11.9 C.V. 2.38
SAMPLE NO. 168 AVE 511.2 S.D. 8.5 C.V. 1.66
LABS ELIMINATED 3057

CCRL PROFICIENCY SAMPLE PROGRAM

Heat of Hydration - 7-day

PORTLAND CEMENT SAMPLES NO. 167 & NO. 168

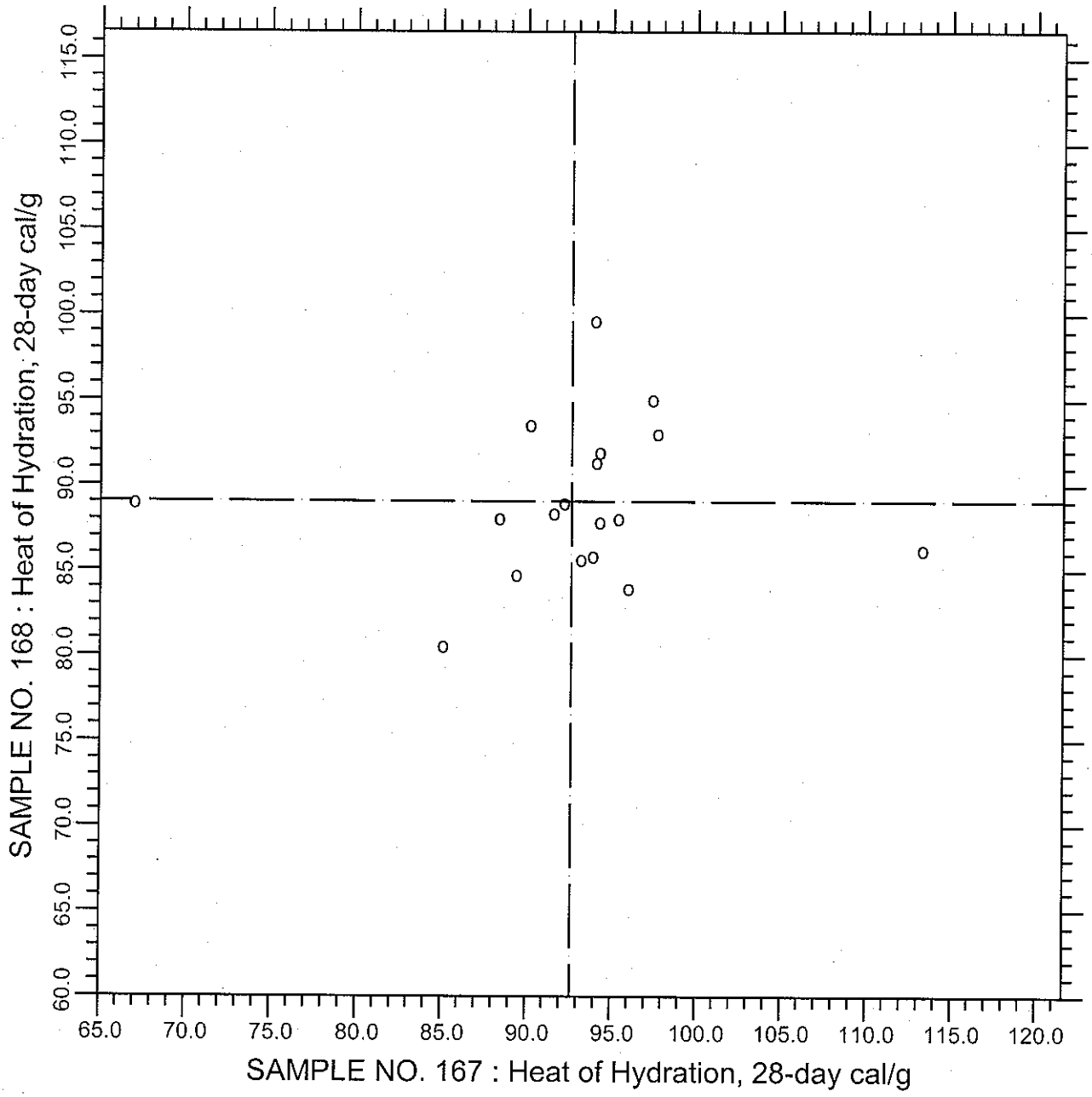


TEST NO.290 Heat of Hydration, 7-day 23 POINTS

SAMPLE NO. 167	AVE	83.7	S.D.	7.4	C.V. 8.80
SAMPLE NO. 168	AVE	80.9	S.D.	5.5	C.V. 6.82

LABS ELIMINATED 176 2254

CCRL PROFICIENCY SAMPLE PROGRAM
Heat of Hydration - 28-day
PORTLAND CEMENT SAMPLES NO. 167 & NO. 168



TEST NO.300 Heat of Hydration, 28-day 18 POINTS

SAMPLE NO. 167	AVE	92.6	S.D.	8.6	C.V.	9.28
SAMPLE NO. 168	AVE	89.0	S.D.	4.5	C.V.	5.08