CYANAMID

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file sampling strategy

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June 5, 1979

Dear Colleague:

Thank you for your interest in my poster presentation on Quality Control in Air Sampling Pumps which was given at the 1979 AIHA annual meeting.

Although there were several critical typographical errors, which will be corrected in an upcoming issue, the basis of this presentation was published in the March 1979 issue of the AIHA Journal. Rather than repeat the discussion in that article, I felt it would be more useful to you to present a step-by-step approach to setting up a quality control program for Sipin-type air sampling pumps (those which are calibrated by means of a stroke-volume calibration factor, based on the number of pump strokes required to draw a given volume of air).

Procedure - For each newly purchased or newly overhauled Sipin-type pump received, determine and record the calibration factor at least 10 times in succession at a given flow rate. More than 10 replications are to be preferred. This is done by counting the number of strokes required to draw a given volumn of air, and dividing the volume of air by the number of strokes to get the Kv factor, in mL. stroke. The average Kv value is computed, and this is used in determining the Standard Deviation, Coefficient of Variation and the 2 SD Warning Limits. These parameters can be very easily obtained by using readily available hand calculators. The actual equations are presented below:

1. Mean (Average) Kv value

$$\frac{Kv + Kv_2 + Kv_3 + \ldots + Kv_4}{n} = \bar{X}$$

2. Standard Deviation

$$\pm\sqrt{\frac{\Sigma (\bar{X} - X)^2}{n - 1}} = SD$$

$\bar{X}$ is the average Kv factor, and X is each of the individual Kv factors. Σ represents the sum of the quantity shown to its right.

3. Coefficient of Variation (CV)

$$\frac{\bar{X}}{SD} \times 100 = CV$$

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Once the Standard Deviation has been determined, the quality control chart can be filled out, using the 2 SD and 3 SD limits. Providing the CV is equal to or less than 5%, the pump is now ready to be put in service. Each time the pump is to be used, it is calibrated once before sampling, and then once again at the end of the sampling period. These individual calibration factors are plotted on the quality control chart. If any one Kv value exceeds the +2S or -2S levels, repeat the calibration to see if the second Kv value is within acceptable limits. This should happen about 5% of the time. I refer you to the March '79 AIHA Journal for a complete discussion of the significance of values lying outside, or approaching the acceptable limits.

I hope this summary is of help to you in setting up your quality control program. Should you have any questions, please call me at (201) 831-1234, ext. 2035, and I will be happy to chat with you.

Sincerely,

Henry P. Shotwell

Henry P. Shotwell

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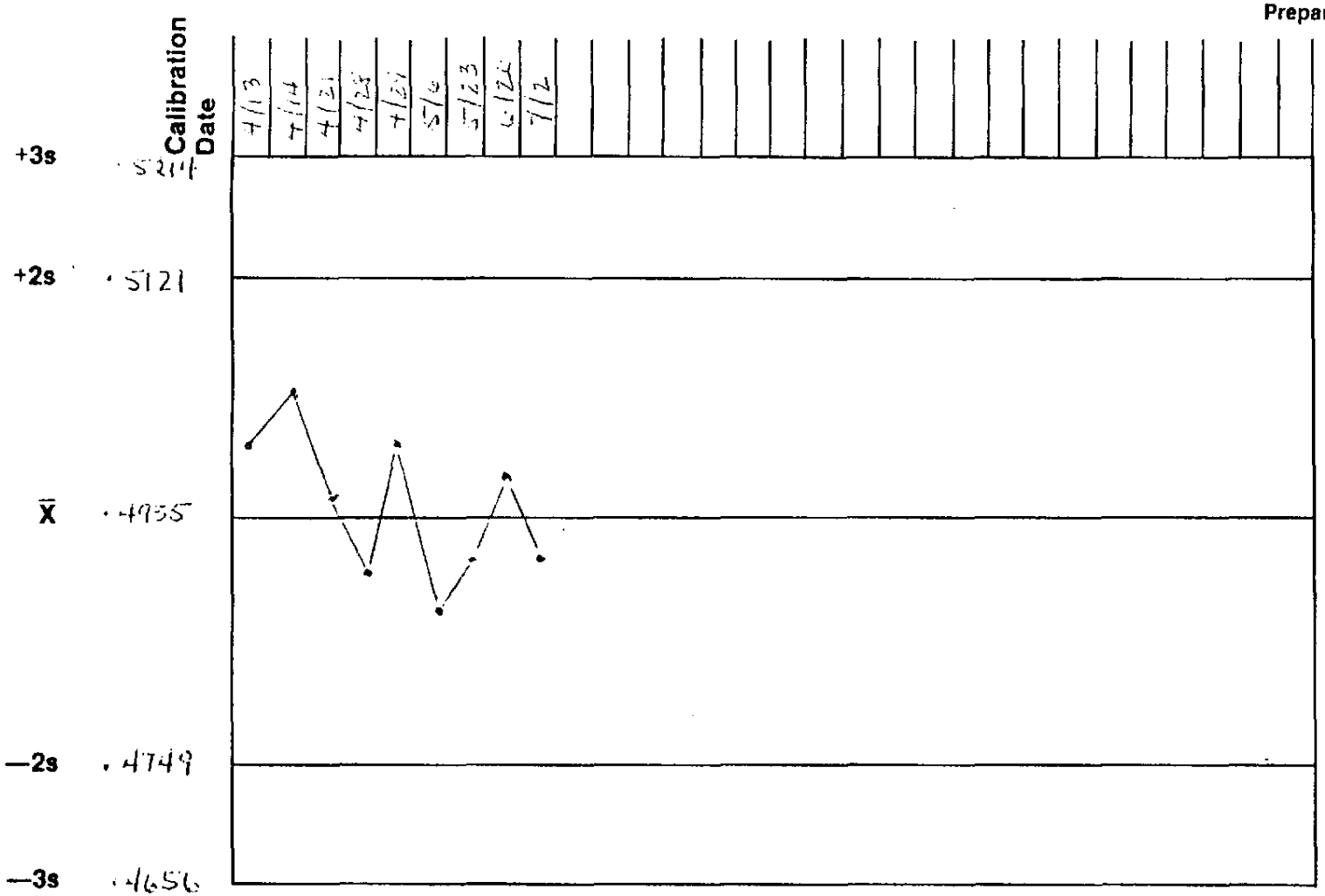
QUALITY CONTROL CHART

Pump No.

Date Prepared: 4/12

Prepared By:



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KEY

$\bar{X}$ =	Mean value of the Kv	
S =	Standard Deviation	
CV =	Coefficient of Variation (s ÷ $\bar{X}$)	
N =	Number of Kv Replicates	
SE =	Standard Error;	$\frac{s}{\sqrt{n}}$

Calibration Data

n = 12

$\bar{x}$ = .4935

S = .0073

CV = 1.9%

SE =

CALIBRATION WORK SHEET

Analyst:

Pump Setting:

Date:

Flow Rate:

Pump No.

RUN NO.	1	2	3	4	5
FINAL COUNT					
INITIAL COUNT					
TOTAL COUNTS					
AIR VOLUME					
Kv FACTOR (ml/count)					