SAMPLING PLANS

**Application of Sampling Plans Based
On An Average Requirement**

I. BACKGROUND.
    A. Due to the laws of chance, the average sample may not conform to contractual requirement even though the average of the lot from which the sample was drawn complies with the requirement. To minimize rejection of good lots due to chance, an allowance is made for such nonconformance, provided the contractor is eligible for such allowance. Unless otherwise specified, the allowance shall be determined by Sample Allowance (S-Allowance) for average results of individual units.
    B. The contractor shall be eligible for the allowance of nonconformance of average results <u>unless</u>:
        1. The lot was previously rejected for nonconformance to the requirement in question and was reworked or retested. Once the lot is reworked or retested, inspection results must be strictly in accordance with the specified requirements in order to be accepted.
        2. The two preceding inspected (Government Acceptance or Verification) lots indicated nonconformance for the characteristic concerned. This exception is effective even though the two previous lots complied through application of an allowance.
    C. If difference between the average and the requirement is equal to or less than the allowance, the lot is conforming. If the difference is greater than the allowance, the lot is nonconforming.

II. PURPOSE AND SCOPE. The purpose of this Subsection is to prescribe procedures for determining whether a lot average based on sampling information is statistically different from the lot average requirement in the DLA Troop Support contract/specification. These procedures are applicable to all inspection personnel required to make decisions on conformity to lot average requirements. Examples include, but are not limited to, net weight, thickness, percent of breading and fill of fluids.

III. POLICY. Any lot determined to be within the S-Allowance shall be considered conforming.

IV. PROCEDURES.

A. <u>Measurements</u>. When conducting examination for compliance with an average requirement, the Quality Assurance Representative (QAR) shall make the unit measurements to the next unit beyond the requirement. The average of the unit measurements shall be rounded off to the same increment of the requirement when comparing the average value to the average requirement. For example, the weight requirement is stated "the nearest one-half pound," but the available scales are marked with one-quarter pound increments. The QAR shall record each weight "to the nearest quarter pound," but round off the average weight "to the nearest half pound." For determining the S-Allowance, the calculation shall be rounded to the nearest hundredth or second decimal place.

> <u>NOTE</u>: Instruments that cannot measure to the required increment shall not be used; i.e., if the requirement calls for the weight "to the nearest one-half pound," the QAR shall not use scales whose smallest increments are whole pounds.

B. <u>Missing Marked Net Weights.</u> If the marked weight is missing from one or more sample units when examining for significant differences between actual and marked net weights, the average marked weight shall be determined only from the number of sample units that are marked. If the sample does not include every unit in the lot, the unmarked units in the sample may be replaced by randomly drawn units from the remainder of the lot before determining the average marked weight.

C. <u>Determining Conformance, Applying the S-Allowance for Average Results.</u> Method for Calculation and Application of the S-Allowance:

1. From the inspection results, calculate the sample range. This is the difference between the largest and smallest measured result (see paragraph IV.D. for more details).

2. Select the Sample Factor (S-Factor) from Table I which corresponds to the number of sample units measured. For example, if eight sample units were measured, the S-Factor would be 0.24.

TABLE I – S-FACTORS 1/

Sample Size	S-Factor	Sample Size	S-Factor
2	3.96	14	0.14
3	1.00	15	0.13
4	0.57	16-17	0.12
5	0.41	18-19	0.11
6	0.32	20-22	0.10
7	0.27	23-25	0.09
8	0.24	26-30	0.08
9	0.21	31-35	0.07
10	0.19	36-45	0.06
11	0.18	46-59	0.05
12	0.16	60-93	0.04
13	0.15	94-104	0.03

<u>1/</u> For sample sizes larger than 104, S-Factor is not applicable.

     3. Calculate the S-Allowance by multiplying the S-Factor by the range and round off to the nearest hundredth or second decimal place.

     4. Calculate the difference between the sample average and the specification requirement. For the determination of this difference, the sample average and the difference between the sample average and requirement shall be rounded to the second decimal place.

     5. If the difference between the sample average and the specification requirement is equal to or less than the S-Allowance, the lot is conforming. If the difference between the sample average and the specification requirement is greater than the S-Allowance, the lot is nonconforming.

     6. Application of the S-Allowance to temperature determinations:

       a. The S-Allowance shall be applied when the acceptance inspection Temperature requirement is expressed as an average of the individual sample unit.

       b. The S-Allowance shall not be used when the acceptance inspection temperature requirements are expressed as an Acceptable Quality Level (AQL), rather than as an average requirement.

       c. Once an inspection lot has been found to be nonconforming, the S-Allowance shall not be used in determining eligibility for reworking/retendering of the nonconforming lot.

       d. When there are both average and maximum individual sample unit temperature requirements, the S-Allowance shall not be used if the unit requirement has been exceeded.

  D. <u>Calculation of the Sample Range</u>.

     1. When one inspection result is obtained from each sample unit, the range is the calculated difference between the greatest and smallest result.

     2. When more than one observation is taken from each sample unit, the average of the results from each unit shall be calculated prior to calculating the sample range. The point is illustrated as follows:

     Three sample units comprise the sample and two measurements are made on each unit. The results are as follows:

     Unit A: 24.5, 24.9 (Average = 24.7).
     Unit B: 25.2, 25.4 (Average = 25.3).
     Unit C: 22.9, 23.7 (Average = 23.3).

For these results, the sample range is the difference between 23.3 and 25.3 or 2.0.

  E. The following examples illustrate application of the S-Allowances:

    1. <u>Example A</u>.

     a. Specification requirement (average) is 80 minimum.
     b. Inspection Level is S-2, ANSI/ASQCZ1.4
     c. Lot size is 2000 units.
     d. Sample size is 8.
     e. Inspection unit results: 79.0, 82.0, 80.0, 77.0, 84.0, 79.0, 76.0 and 75.0.
     f. Average is 79.0 or 79 when rounded.
     g. Determine conformance as follows:
      (1) Find sample range: 84.0 – 75.0 = 9.0.
      (2) Multiply sample range (9.0) by appropriate S-Factor (0.24, Table I) to obtain S-Allowance, in this case (2.16).

h. Conclusion: Sample average (79) differed from the requirement (80) by less than the S-Allowance 2.16. Lot is conforming. (Had the sample average been 77, the difference from the requirement would be 3, greater than the S-Allowance 2.16. Lot would be nonconforming.)

    2. <u>Example B</u>.

      a. Specification requirement (average) is 10% fat maximum.

      b. The test results using a sample size of S units are: 14, 14, 6, 12, 12, 6, 14 (%). Average value is 11.25% fat.

      c. The rounded average is 11% fat.

      d. Since the rounded average is greater than the requirement, the S-Allowance must be used to determine if the difference between the requirement and the average result is due to sample variation.

      e. The S-Factor for a sample size of eight is 0.24 (Table I). The sample range is 14-6 or 8. Therefore, the S-Allowance is 0.24 x 8 or 1.92. In that, the difference between the average of the sample unit results (11%) and the maximum average requirement (10%), which is less than 1%, is less than the S-Allowance (1.92), the lot is acceptable. Note that if the difference between the sample average and the maximum allowable average fat percent had exceeded the S-Allowance, the lot would have been rejected.