The Engineering Society For Advancing Mobility Land Sea Air and Space®
INTERNATIONAL
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AEROSPACE RECOMMENDED PRACTICE

ARP4992

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PERIODIC TEST PLAN FOR PROCESSING SOLUTIONS

1. SCOPE

1.1 Scope:

This SAE Aerospace Recommended Practice (ARP) describes a method for classifying the frequencies of analysis of solutions used in the processing of metals, such as electroplating, anodizing, and conversion coating and associated processes but usage is not limited to such applications.

1.2 Intent:

This document is intended to establish a periodic test plan that may be used by processors to satisfy the requirement of an Aerospace Material Specification (AMS) for a chemical processing solution periodic test plan as a control factor.

1.3 Limitation:

This document does not fulfill the criteria for a formal statistical process control program.

2. APPLICABLE DOCUMENTS:

This section is not applicable to this document.

3. TECHNICAL REQUIREMENTS:

3.1 The analysis of process solution constituents shall be performed at such a frequency as to ensure that the solution is not operated beyond the concentration limits authorized by the applicable specification or work instruction.

3.2 Classes of test frequency used herein.

TABLE 1

Class	Frequency of Analysis
Y	Annually
2Y	Semiannually
4Y	Quarterly
6Y	Bimonthly
M	Monthly
2M	Biweekly
W	Weekly
2W	Semiweekly
3W	Three times each week
D	Daily
SH	Once each working shift
BP	Before processing each production load

3.3 Definitions:

3.3.1 Specification Range: The concentration range of a constituent in a solution required by the applicable process specification or work instruction.

3.3.2 Process Control Range: A concentration range that is 75% of the Specification Range. It is a tool used to aid in the establishment of a frequency of process control testing.

3.4 Calculation of Process Control Range:

3.4.1 Subtract the lower permissible concentration limit to the Specification Range (A) for each constituent from the higher permissible concentration limit to the Specification Range (B) and multiply by 0.25.

3.4.1.1 For those processes where a constituent's concentration decreases with use, add this value to the lower permissible limit. The upper limit value remains as specified by the process specification or work instruction (B). Lower limit to Process Control Range = [A + (B-A) x 0.25].

3.4.1.2 For those processes where a constituent's concentration increases with use, subtract this value from the higher permissible limit. The lower limit value remains as specified by the process specification or work instruction (A). Upper limit to Process Control Range = [B - (B-A) x 0.25].

3.4.2 When there is no lower limit to the Specification Range, only a maximum limit, multiply this number by 0.75. Upper limit to Process Control Range = 0.75 x B.

3.4.3 When there is no upper limit to the Specification Range, only a minimum limit, multiply this number by 1.33. Lower limit to Process Control Range = 1.33 x A.

3.5 Example Calculations:

The following example applies to AMS 2649, Etch Inspection of High Strength Steels. All these concentrations or values normally decrease with use.

TABLE 2

Constituent	Specification Range	Process Control Range
Nitric Acid	3 to 5% by volume	3.5 to 5% by volume
Ammonium Persulfate	pH decreases 0.1 from original	pH decreases 0.075 from original
Sodium Hydroxide	4 to 6% by weight	4.5 to 6% by weight
Sodium Phosphate	0.5 to 1.0 oz/gal	0.625 to 1.0 oz/gal

3.6 Adjustments to the concentration of any constituent shall be made whenever its concentration is found to be outside the Process Control Range in order to bring the concentration to within the Process Control Range. It is preferable to adjust the concentration to the opposite extreme of the Process Control Range (A or B).

3.7 Determination of Class:

3.7.1 Initial Frequency Class: Sampling frequency rate for a solution for which there is no history-of-use should be analyzed at a frequency selected by the processor unless specified by the cognizant engineering or quality organization.

3.7.2 Adjustment of Frequency: If three analyses for any individual constituent of a process solution out of the previous ten consecutive analyses show that constituent to be outside of the Process Control Range, the frequency of analysis for that constituent shall be increased by progressing to the next more frequent analysis class stated in 3.2. If ten consecutive analyses show the constituent has been within the Process Control Range, the frequency of analysis may be decreased by selecting an adjacent (next less frequent analysis) class stated in 3.2.

3.7.2.1 Infrequently Used Solutions: If a solution is not used regularly or has not been used since the last analysis, periodic testing may be suspended. However, this solution must be analyzed and shall be within the Specification Range prior to use.

3.8 Unspecified Concentrations:

When there is no Specification Range for any constituent contained in the applicable process specification or work instruction, or there is no requirement that an acceptable range must be established by the processor, the process solution need not be analyzed. The solution should be discarded and replaced on a periodic basis or subjected to periodic analysis. The frequency of replacement shall be selected by the processor unless specified by the cognizant quality organization.