

 AEROSPACE RECOMMENDED PRACTICE	SAE ARP4992		REV. B
	Issued	1996-08	
	Revised	2012-01	
Superseding ARP4992A			
Periodic Test for Processing Solutions			

RATIONALE

ARP4992B results from a Five Year Review and update of this document.

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.

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3.2 Classes of test frequency used herein.

TABLE 1 – CLASSES OF TEST FREQUENCY

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.
- 3.3.3 Work Instruction: A document that provides detailed processing or solution control instructions for fulfilling specified requirements.

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 = $[A + (B-A) \times 0.25]$.
- 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 = $[B - (B-A) \times 0.25]$.
- 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 = $0.75 \times B$.
- 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 = $1.33 \times A$.

3.5 Example Calculations

The following example applies to AMS2649, Etch Inspection of High Strength Steels. All these concentrations or values normally decrease with use.

TABLE 2 – EXAMPLES OF PROCESS CONTROL RANGE ESTABLISHED FROM A SPECIFICATION RANGE

Constituent	Specification Range	Process Control Range
Nitric Acid	3 to 5% by volume	3.5 to 5% by volume
Sodium Hydroxide	2 to 6% by weight	3 to 6% by weight
Sodium Phosphate	0.5 to 1.0 oz/gal (3.7 to 7.5 g/L)	0.625 to 1.0 oz/gal (4.7 to 7.5 g/L)

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 Table 1. 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 Table 1.

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 engineering organization.

3.9 A freshly mixed solution shall be analyzed and all constituent concentrations shall be within the applicable Specification Range prior to using the solution to process production parts.

3.10 Sampling Technique

Prior to the removal of any aliquot (test sample) from a process tank: (1) the level of the solution in the tank should be brought to normal operating level, (2) the solution temperature shall be adjusted as necessary to ensure all constituents are dissolved in the solution and (3) if the tank level needs to be adjusted by addition of water (or other diluent), the solution shall be mixed thoroughly.

3.11 When the concentration of any constituent is not within the Process Control Range yet is still within the Specification Range, the solution remains usable and parts processed through such a solution are fully acceptable (with respect to processing solutions) and equivalent to those processed in a solution which is within the Process Control Range. No solution shall be used to process parts if any constituent concentration is not within the applicable Specification Range unless otherwise authorized by the cognizant engineering organization.