Designation: G 121 – 98

Standard Practice for Preparation of Contaminated Test Coupons for the Evaluation of Cleaning Agents[1]

This standard is issued under the fixed designation G 121; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This practice describes the procedure for the preparation of single- and double-sided contaminated metallic test coupons for the evaluation of cleaning agents. It is applicable for the evaluation of cleaning agents proposed for the cleaning of oxygen-enriched systems and components. It also is applicable to other systems where contamination is a concern.

1.2 Several classes of contaminants most likely to be found in oxygen-enriched systems and components are identified. However, if the user of this practice has identified contaminants not included in these classes, such identified contaminants may be substituted for the preparation of the test coupons.

1.3 Preparation of nonmetallic substrates is not addressed, although similar methodology may be used. Solvent and cleaning agent compatibility with the nonmetallic substrate should be verified prior to the preparation of the test coupons. Typical nonmetallic materials utilized in oxygen systems are contained in Guide G 63.

1.4 *This practice may involve hazardous materials, operations, and equipment. This practice does not purport to address all of the safety concerns associated with its use. It is the responsibility of whomever uses this practice to consult and establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*

D 1193 Specification for Reagent Water[2]

E 1235 Test Method for Gravimetric Determination of Nonvolatile Residue (NVR) in Environmentally Controlled Areas for Spacecraft[3]

F 303 Practice for Sampling Aerospace Fluids and Components[4]

F 312 Methods for Microscopal Sizing and Counting Particles from Aerospace Fluids on Membrane Filters[5]

F 324 Test Method for Nonvolatile Residue of Volatile Cleaning Solvents Using the Solvent Purity Meter[4]

F 331 Test Method for Nonvolatile Residue of Halogenated Solvent Extract from Aerospace Components (Using Rotary Flash Evaporator)[4]

G 63 Guide for Evaluating Nonmetallic Materials for Oxygen Service[5]

G 94 Guide for Evaluating Metals for Oxygen Service[5]

2.2 *ANSI:*

B46.1 Surface Texture (Surface Roughness, Waviness, and Lay)

3. Terminology

3.1 *Definitions:*

3.1.1 *contaminant*, *n*—unwanted molecular and particulate matter that could affect or degrade the performance of the components upon which they reside.

3.1.2 *contamination*, *n*—a process of contaminating.

3.1.3 *surface roughness, R_a*, *n*—the arithmetic average deviation of the surface profile from the centerline, normally reported in micrometres.

3.1.4 *nonvolatile residue (NVR)*, *n*—residual molecular and particulate matter remaining following the filtration of a solvent containing contaminants and evaporation of the solvent at a specified temperature.

3.1.5 *particle (particulate contaminant)*, *n*—a piece of matter in a solid state with observable length, width, and thickness.

3.1.5.1 *Discussion*—The size of a particle is usually defined by its great dimension and is specified in micrometres.

3.1.6 *molecular contaminant (nonparticulate contamination)*, *n*—the molecular contaminant may be in a gaseous, liquid, or solid state.

3.1.6.1 *Discussion*—It may be uniformly or nonuniformly distributed, or be in the form of droplets. Molecular contaminants account for most of the NVR.

3.1.7 *blank*, *n*—the contamination level of the fluid when the test coupon is omitted.

3.1.7.1 *Discussion*—Sometimes referred to as "background" level.

[1] This practice is under the jurisdiction of ASTM Committee G-4 on Compatibility and Sensitivity of Materials in Oxygen Enriched Atmospheres and is the direct responsibility of Subcommittee G04.02 on Recommended Practices.

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[2] *Annual Book of ASTM Standards,* Vol 11.01.

[3] *Annual Book of ASTM Standards,* Vol 15.03.

[4] *Annual Book of ASTM Standards,* Vol 10.05.

[5] *Annual Book of ASTM Standards,* Vol 14.04.

3.1.8 *control coupon (witness coupon)*, *n*—a coupon made from the same material as the test coupons, but in this test method is not coated with the contaminant.

4. Summary of Practice

4.1 A solution of the contaminant is applied to either one side or both sides of the precleaned test coupons and dried under standard conditions. The amount of contaminant on the test coupons is determined. Nonmetallic material test coupons used as inserts, seats, seals, etc. may also be prepared by this procedure and are evaluated in the as-used condition.

4.2 Three methods of coupon preparation are provided:

Method A, NVR sample, single side
Method B, NVR sample, double side
Method C, NVR and particulate sample

5. Significance and Use

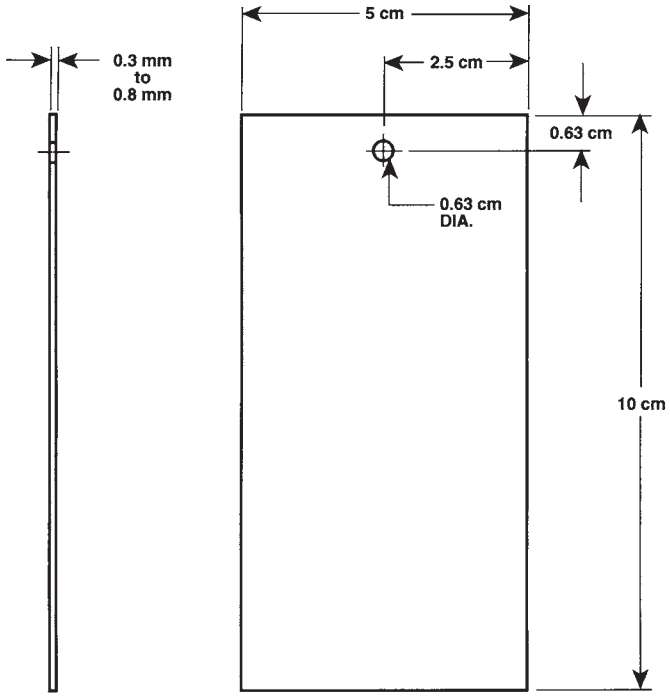
5.1 This practice will be suitable to direct the preparation of test coupons with a known amount of contaminant on the surface. A standard test coupon is described and a list of contaminants that have typically been found in oxygen-enriched systems and components is provided.

5.2 These coupons shall be used in the evaluation of cleaning agents for oxygen-enriched systems and components. This will permit direct comparison within and between test facilities.

5.3 Materials used in other fluid handling systems such as nitrogen, helium, hydrogen, gasoline, etc. may also be prepared for evaluation by this practice.

6. Apparatus

6.1 *Test Coupon*—Metal panels of the same material as the component part to be cleaned. Other alloys that may be used if the specific alloy is unknown are included in Guide G 94. The coupon configuration is shown in Fig. 1.



NOTE: ALL SHARP EDGES SHOULD BE BROKEN AND DEBURRED.

FIG. 1 Standard Test Coupon

NOTE 1—The surface finish of the test coupon should be the same as the part to be cleaned.

6.2 *Balance-Range* to a minimum of 50 g with an 0.1-mg accuracy capable of weighing to ±0.1 mg.

6.3 *Oven-Convection,* capable of maintaining 50°C ± 5°C.

6.4 *Spray Applicator*—Capable to apply an even coat of contaminant; i.e., an artist's airbrush, perfume atomizer, or a spray device such as that used with window or tile cleaners has been found to apply an even coating of the contaminant in a controlled manner.

6.5 Other standard equipment such as a vacuum filtration system, solvent resistant filters, gloves, laboratory glassware, syringes, pipettes, desiccator, laboratory tongs, tweezers, and wire.

7. Reagents

7.1 Contaminant materials-general classes of materials that have typically been found in oxygen-enriched systems and components as a result of the manufacturing, assembly, fabrication, and construction processes include:

silicone oils and greases,
fluorinated aerospace fluids and greases,
petroleum based oils and greases,
ester based oils and greases,
phosphate esters,
waxes,
chlorotrifluoroethylene based oils and greases,
inks,
cutting oils, and
dye penetrants.

7.2 Solvent-reagent grade used to prepare standard solutions of contaminants which may include the following: 2-propanol, 2-butanone, hexane, Type II reagent water, or better, in accordance with D 1193, and perfluorinated carbon fluids.

NOTE 2—**Warning:** Solvents such as 2-propanol hexane and 2-butanone are highly flammable. The reader should refer to appropriate safe handling procedures.

7.3 Desiccant—e.g., silica gel.

7.4 Particulate contaminant—fine (0- to 80-μm), or coarse (0- to 200-μm) dusts[6] available commercially.

8. Procedure

8.1 *Coupon Preparation*

8.1.1 The test coupons shall be numbered and precleaned prior to use; record the number. Determine the surface roughness, R_a, of representative coupons of each alloy being evaluated per ANSI B 46.1 and record. Determine the surface area to be contaminated (S) of each of the test coupons and record. Attach a handling wire through the hole at the top of each of the test coupons. The preclean procedure shall be performed in an ultrasonic cleaner with the coupons immersed

[6] Dusts of varying particle sizes are available from the AC Spark Plug Division of General Motors, 1300-T N. Dort Hwy., Flint, MI 48556.