



AEROSPACE RECOMMENDED PRACTICE	ARP1153	REV. A
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Method for Determining Relative Specific Gravity Polytetrafluoroethylene Tubing		

RATIONALE

AIR1153A has been reaffirmed to comply with the SAE five-year review policy.

1. SCOPE:

This document describes a method for determining the specific gravity of tubing, fabricated from polytetrafluoroethylene, after a controlled heating and cooling cycle. The specific gravity obtained by this method is a measure of relative molecular weight of the resin. The measure, termed relative specific gravity (RSG), increases with decreasing molecular weight (see 2.3).

2. REFERENCES:

- 2.1 ASTM D 4895-89 Standard Specification for Polytetrafluoroethylene (PTFE) Produced from Dispersion
- 2.2 ASTM D 1505-85 Standard Method of Test for Density of Plastics by the Density-Gradient Technique
- 2.3 Advances in Polymer Science - Fluorine Containing Polymers II Polytetrafluoroethylene, Pages 465-495, 1961, by C. A. Sperati and H. W. Starkweather.

3. THE METHOD:

3.1 The Sample:

The sample shall be a representative cross section of the size, thickness, and construction of the tubing under test. The size and shape of the sample is not critical, but shall be large enough to provide sufficient specimen material for specific gravity measurements in a density gradient tube (see 2.2).

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3.2 Heating and Cooling Cycle:

The air circulating oven is to be preheated at $716\text{ }^{\circ}\text{F} \pm 5$. The specimen shall be placed in the oven and held at $716\text{ }^{\circ}\text{F} \pm 5$ for $30 +5/-0$ min. The oven air temperature shall reach $716\text{ }^{\circ}\text{F}$ within 5 min after insertion of the sample.

The sample is then cooled in the oven at an average rate of $2.2\text{ }^{\circ}\text{F} \pm 0.1$ per minute to $572\text{ }^{\circ}\text{F} +0/-10$ with a minimum cooling time of 63 min and maximum time of 68 min. Deviations in oven temperature should not exceed $\pm 5\text{ }^{\circ}\text{F}$ from the average temperature indicated on a plot of temperature versus time for the cooling rate actually achieved as shown in Figure 1. The sample is then removed from the oven and allowed to cool to room temperature.

3.3 Measuring Relative Specific Gravity:

The method is described in detail in Reference 2.2. It involves determining the level a specimen sinks in a vertical tube in which a continuous gradient has been established by partially mixing liquids of different densities. A diagram of the equipment is shown in Figure 2.

Glass floats of calibrated specific gravity are employed to determine the liquid gradient produced in relation to their positions on a linear scale adjacent to the vertical tube. The sample is introduced to the tube and sinks to an equilibrium position equivalent to its own specific gravity. The position of the sample along the linear scale is read at its estimated center of gravity.

3.3.1 Liquids: Suggested liquids for use in preparing the gradient tubes are listed below:

Tetrachloroethylene, density 1.62 g/ml - tribromomethane, density 2.89 g/ml
Bromobenzene, density 1.50 g/ml - tribromomethane, density 2.89 g/ml
Chlorobenzene, density 1.11 g/ml - tribromomethane, density 2.89 g/ml
1,3 Dibromopropane, density 1.98 g/ml - Bromoform, density 2.88 g/ml

3.3.2 Specimen Size: The specimens of fabricated polytetrafluoroethylene resins should be quite small, a perimeter of $3/8$ to $5/8$ in being adequate. In order to differentiate between specimens, they may be cut in a variety of simple geometric shapes. Holes or cracks in the specimens will entrap air and cause bubbles. This will influence the specific gravity and should be avoided. Also, the specimens should be cut with a sharp knife or razor to prevent ragged edges.

3.3.3 Testing Procedure: The temperature of the tube should be maintained at $73.5\text{ }^{\circ}\text{F} \pm 0.5$. The specimen should be placed in the liquid with long tweezers and should be agitated slightly to eliminate any air bubbles that may cause erroneous readings. When the specimen is bubble-free, it should be released and allowed to sink to an equilibrium position. If the specimen clings to the walls of the tube or lodges on a float, gentle tapping on the side of the tube will dislodge it.

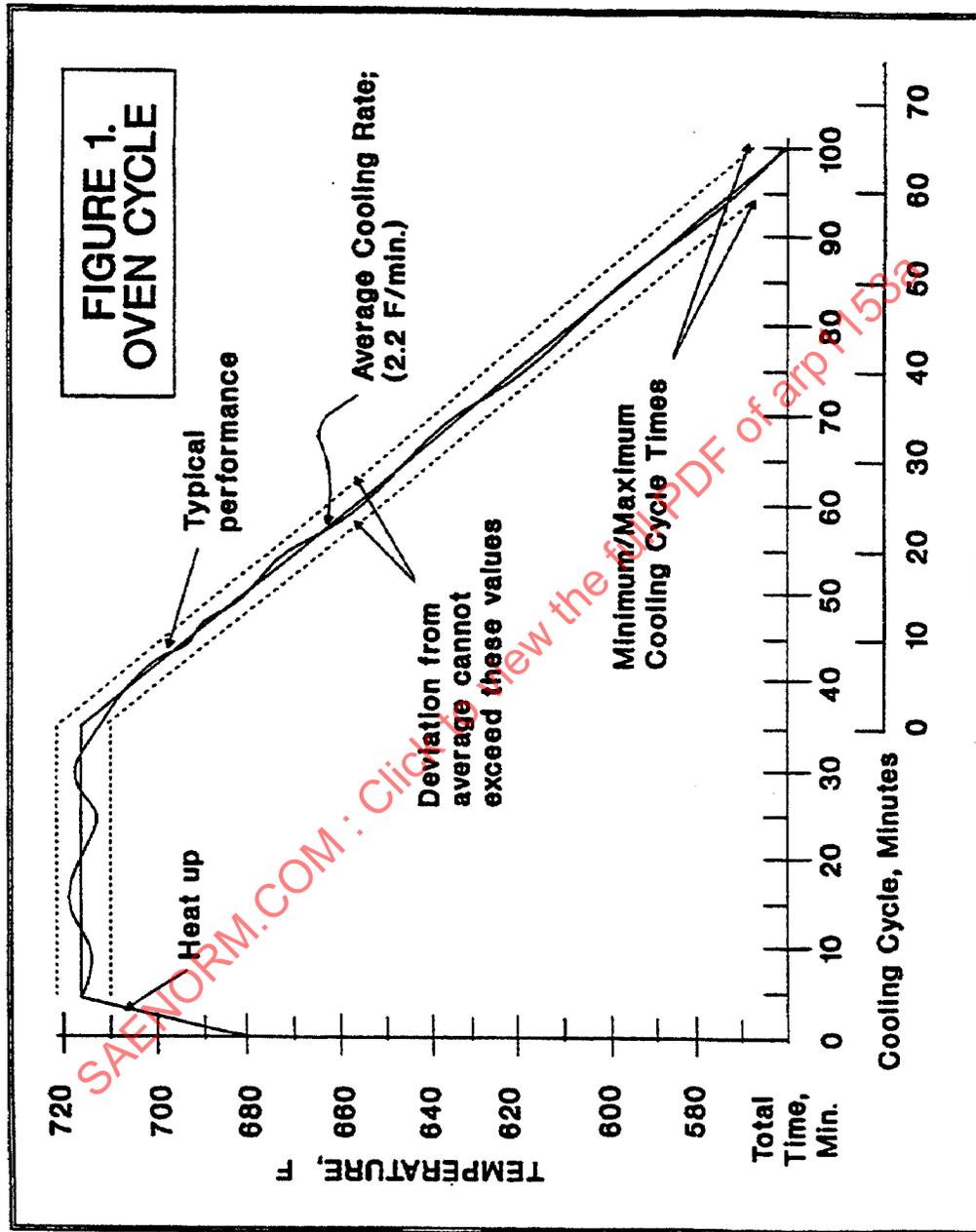


FIGURE 1 - Oven Cycle