

## AMS 2750F System Accuracy Testing & Temperature Uniformity Surveys

**AMS 2750F** is a comprehensive directive that standardize the pyrometric requirements of thermal processing equipment used in heat treatment. The [54 pages of Rev F of June 2020](#) cover among many other related topics:

1. Temperature sensors
2. Instrumentation
3. System Accuracy Test (SAT)
4. Temperature Uniformity Survey (TUS)

AMS 2750F serves as a guideline to classify furnaces according to their instrumentation and thermal consistency and is referenced by many AMS process specifications. The standard serves to ensure that parts or raw materials are heat treated in accordance with the applicable specification(s).

AMS 2750F section 3.1.7.3 also addressed the considerable drift of the “K”-type thermocouples and defined its limitations. Table 7 (instruments and instrument calibration) requires now the recording instrument to display one tenth of a degree.

### **SAT**-System Accuracy Testing. (also referred to as a “Probe Test”)

It is important to note that this test is essentially a comparison of readings and data of two separate systems that monitor the same furnace. The system to be evaluated is the resident system of the furnace, which may include instruments, lead wires, recorders, and sensors. The second system is the control system or reference system, which consists of instruments, lead wires, recorders and sensors that have been calibrated and serve as a baseline for comparison. The control system is introduced into the furnace for testing purposes.

The SAT is performed by monitoring and recording data during a typical heating cycle while comparing the readings generated from both systems. The purpose of the test is to detect and quantify any deviation in furnace instrumentation accuracy and determine if the deviations are within acceptable limits.

### **TUS**-Temperature Uniformity Survey

The TUS is a controlled set of temperature measurements within the load chamber of a furnace. The purpose of the temperature uniformity survey is to determine the variations in temperature present at different locations in the load chamber during a normal firing cycle. The measurements are carried out prior to and after thermal stabilization of the furnace temperature control zones. Unlike the SAT which evaluates the accuracy of system hardware, the TUS is an actual survey of a furnaces thermal consistency. When performing a TUS specially designed fixtures or racks may be employed to strategically position thermocouples in different areas within the furnace load chamber.

The temperature uniformity within the furnace must be regularly surveyed. The frequency of surveying is dependent on the type of equipment and process employed according to AMS 2750F. Precision heat treat furnaces are qualified through an initial comprehensive temperature uniformity survey. Uniformity surveys should also be performed after any major repair to the furnace. Indications of temperature inconsistencies or variations are a reason to conduct a temperature uniformity survey.

### **SAT-System Accuracy Testing & TUS-Temperature Uniformity Survey Tips**

1. Conduct a first TUS survey without the load then conduct a second survey with the load.
2. Use certified new thermocouples that have not been degraded.
3. Ensure the insulation on the thermocouples is not damaged and avoid contact of the wires with bare metal.
4. The tip or junction of the thermocouples should be welded and not twisted together.
5. Avoid running thermocouples through the door-seal where they can cause leakage points into the load chamber.
6. Try to keep the entry point where the thermocouples enter the oven/furnace constant. Shifts in the hot to cold transition points along the wire length can cause errors in readings.
7. Keep the tips of the thermocouple at least 3 inches (76mm) away from any surface
8. Avoid any sharp bends in the thermal thermocouple. Mechanical stress can cause an error in the calibration of the thermocouple.
9. Keep the recorder away from the oven to keep it at a consistent temperature to avoid any cold junction errors.
10. Make sure the recorder or any other electrical instrument used in conducting the survey is properly grounded. Measure the quality of the ground if necessary.
11. Be aware of any high energy / high frequency electrical equipment in the proximity of the survey (welding equipment, plasma cutters, EDM machines etc.); this type of equipment can be the source of EMF noise that may cause interference with the survey readings.

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Source: <https://www.sae.org/standards/content/ams2750f/>