OPERATOR SKILL in making good connections is essential. The mechanical tolerances for the connectors used in the calibration kit, and the resultant electrical performance, are much better than most other precision 7mm connectors. Therefore, slight errors in operator technique that would go unnoticed with regular connectors often appear when the calibration connectors are used. Lack of repeatability is the major symptom of incorrect operator technique. Study the connection techniques that are explained in this manual, and practice them until your calibration measurements are satisfactory. A recommended practice procedure is described later in this manual.

TEMPERATURE of the calibration devices is critical, because the dimensions of the devices (and hence their electrical characteristics) change with temperature. Figure 4 shows the allowable environmental conditions for using the HP 85050A calibration kit. Notice especially that the temperature during calibration must be between 20°C (68°F) and 26°C (79°F). Afterwards, the operating temperature must be within ±1°C (1.8°F) of the calibration temperature for the network analyzer to meet all specifications. Thus, for example, if the calibration was done at 22°C (71.6°F) then the operating temperature must be 21-23°C (69.8-73.4°F).

The temperature of the devices must be stable before use. Typically, devices kept with the network analyzer are at a stable temperature and are ready for use immediately. Devices that have been shipped from one location to another might require several hours to reach thermal stability. Also, remember that your fingers are a heat source (37°C or 98.6°F) and avoid unnecessary handling of the devices during calibration. Some devices have a plastic jacket over the connector body to provide thermal insulation during handling.

Barometric pressure and relative humidity also affect device performance, although to a lesser extent than temperature. Air exists between the inner and outer conductors of these devices (hence their name, air-dielectric devices), and the dielectric constant of air depends on pressure and humidity.

WEAR of the connectors will eventually degrade their performance. The calibration components, which are typically used only a few times each day, should have a very long life. A network analyzer's connectors, however, might undergo a hundred or more connections each day, and are subject to rapid wear. Therefore, it is essential that the connectors be examined regularly both visually (with a magnifying glass), and mechanically (with a connector gage), and replaced as necessary. Procedures for visual and mechanical examination are given later in this manual. For test sets used in high-volume work, place an adapter on the input and output ports. It is much faster, and less expensive, to replace a worn adapter than it is to replace a worn test set connector.

DEVICE CHARACTERISTICS

Table 2a lists the device characteristics for these calibration components, and it is to be used with the calibration procedure described in Section II (Operating and Programming) of the

Table 1. Specifications

Device	Frequency Range	Specification
30cm Airline 1250 – 1877	45 MHz – 18 GHz	≥54 dB Return Loss
Sliding Load 1250 – 1890	2 GHz – 18 GHz	≥ 52 dB Return Loss
Fixed Load Termination 85050-60001 (HP 909C)	dc – 2GHz	≥ 52 dB Return Loss

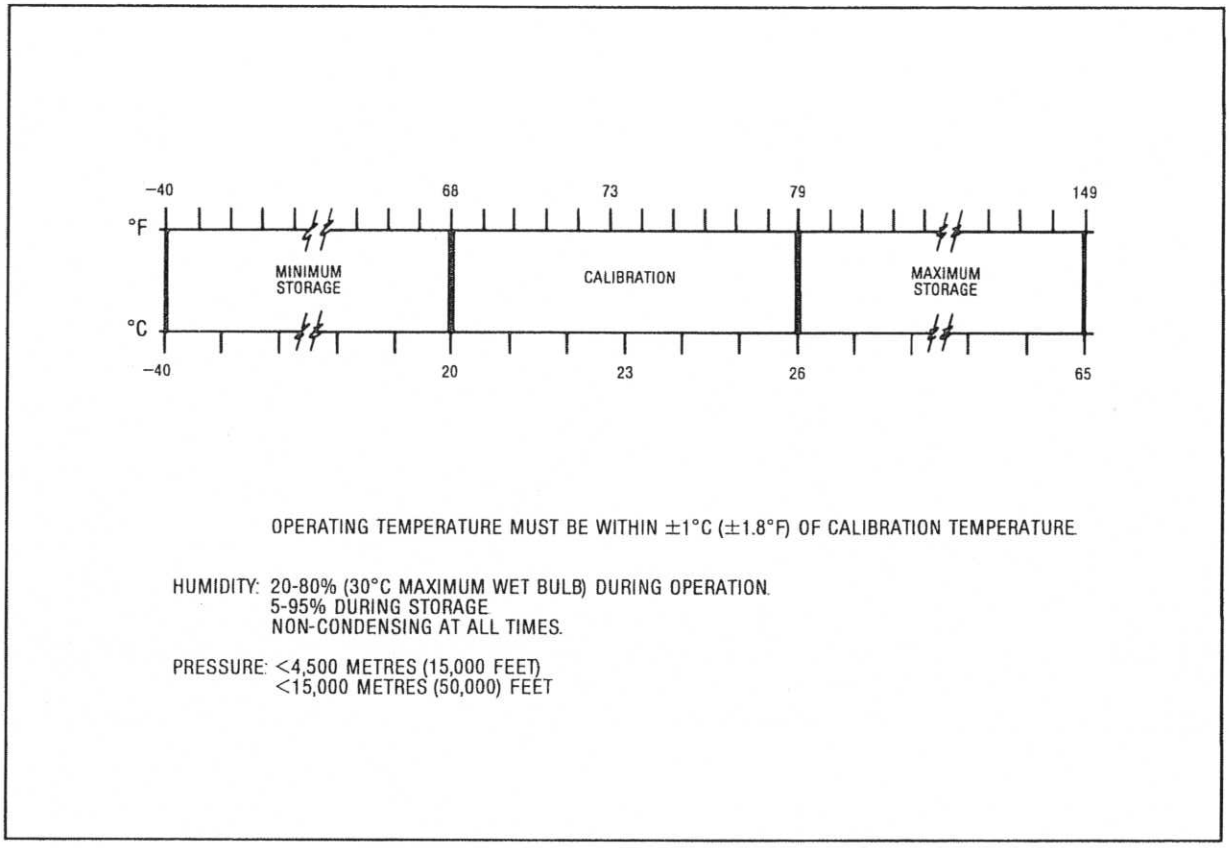

Figure 4. Allowable Temperature, Humidity, and Pressure

HP 8510 manual. The use of Table 2b, a blank version of Table 2a, is also described in Section III. Hewlett-Packard has released the copyright to this blank table, so you may copy it as needed.

VERIFYING THE SPECIFICATIONS

Two fundamental methods are used to verify the specifications of these calibration components: (1) electrically comparing the HP 85050A components with components of significantly higher quality; and (2) precisely measuring the physical dimensions of these components, then theoretically determining their expected performance.

The electrical comparison method is more difficult to perform than the physical measurement, for two principal reasons. First, it is difficult to obtain calibration components that are **significantly** better than the HP 85050A components ("significant" enough that the measurement uncertainties between the standard and test devices can be resolved). The second, and most severe limitation of the electrical comparison method is the difficulty of making a repeatable port connection. The errors caused by even a slightly imperfect mating of connectors tends to obscure the intended measurement. Consequently, Hewlett-Packard recommends that direct electrical comparison be used only as a secondary method of confirming the HP 8505A's specifications.

MECHANICAL DIMENSIONS: STANDARDS LAB TRACEABILITY

The best method for validating the specifications of a calibration component is to measure the device physically, using non-contact measuring tools. If these tools have been calibrated with United States National Bureau of Standards (NBS) certified gage blocks, a traceable link between the components and NBS is established. Hewlett-Packard measures outside diameters with a laser micrometer, inside diameters with an air gage, and length with an interferometric micrometer.