Environmental Requirements

Table 2-1 Environmental Requirements

Parameter	Limits
Temperature	
Operating[a]	+20 °C to +26 °C
Storage	–40 °C to +75 °C
Error-corrected range[b]	± 1 °C of measurement calibration temperature
Relative humidity	Type tested, 0% to 95% at 40 °C, non-condensing

a. The temperature range over which the calibration standards maintain conformance to their specifications.
b. The allowable network analyzer ambient temperature drift during measurement calibration and during measurements when the network analyzer error correction is turned on. Also, the range over which the network analyzer maintains its specified performance while correction is turned on.

Temperature—What to Watch Out For

Changes in temperature can affect electrical characteristics. Therefore, the operating temperature is a critical factor in performance. During a measurement calibration, the temperature of the calibration devices must be stable and within the range specified in Table 2-1.

IMPORTANT Avoid unnecessary handling of the devices during calibration because your fingers are a heat source.

Mechanical Characteristics

Mechanical characteristics such as center conductor protrusion and pin depth are *not* performance specifications. They are, however, important supplemental characteristics related to the electrical performance of devices. Agilent Technologies verifies the mechanical characteristics of the devices in this kit with special gaging processes and electrical testing. This ensures that the device connectors do not exhibit any excess center conductor protrusion or improper pin depth when the kit leaves the factory.

"Gaging Connectors" on page 3-6 explains how to use gages to determine if the kit devices have maintained their mechanical integrity. (Refer to Table 2-2 on page 2-4 for typical and observed pin depth limits.)

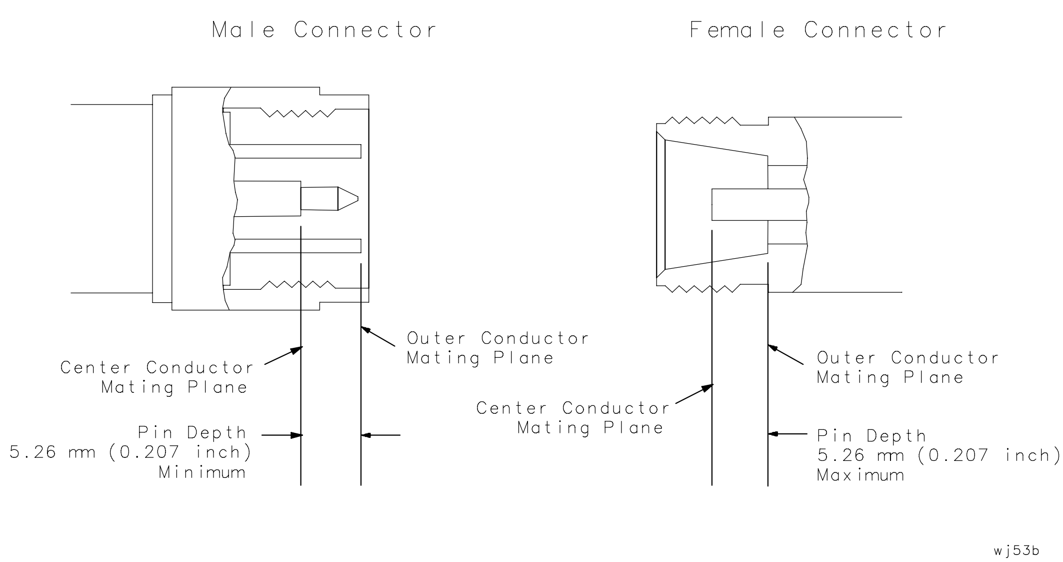
Pin Depth

Pin depth is the distance the center conductor mating plane differs from being flush with the outer conductor mating plane. Refer to Figure 2-1. Some coaxial connectors, such as 2.4 mm and 3.5 mm, are designed to have these planes nearly flush. Type-N connectors, however, are designed with a pin depth offset of approximately 5.26 mm (0.207 inch), not permitting these planes to be flush. The male center conductors are recessed by the offset value while the female center conductors compensate by protruding the same amount. This offset necessitates the redefining of pin depth with regard to protrusion and recession.

Protrusion refers to a male type-N connector center conductor having a pin depth value less than 5.26 mm (0.207 inch), or a female type-N connector center conductor having a pin depth value greater than 5.26 mm (0.207 inch).

Recession refers to a male type-N connector center conductor having a pin depth value greater than 5.26 mm (0.207 in), or a female type-N connector center conductor having a pin depth value less than 5.26 mm (0.207 inch).

Figure 2-1 Connector Pin Depth



NOTE The gages for measuring type-N connectors compensate for the designed offset of 5.26 mm (0.207 inch), therefore, protrusion and recession readings are in relation to a *zero* reference plane (as if the inner and outer conductor planes were intended to be flush). Gage readings can be directly compared with the *observed* values listed in Table 2-2.

The pin depth value of each calibration device in this kit is not specified, but is an important mechanical parameter. The electrical performance of the device depends, to some extent, on its pin depth. The electrical specifications for each device in this kit take into account the effect of pin depth on the device's performance. Table 2-2 lists the typical pin depths and measurement uncertainties, and provides observed pin depth limits for the devices in the kit. If the pin depth of a device does not measure within the *observed* pin depth limits, it may be an indication that the device fails to meet electrical specifications. Refer to Figure 2-1 for an illustration of pin depth in type-N connectors.

Table 2-2 Pin Depth Limits

Device	Typical Pin Depth micrometers (10^{-4} inches)	Measurement Uncertainty[a] micrometers (10^{-4} inches)	Observed Pin Depth Limits[b] micrometers (10^{-4} inches)
Opens	0 to –12.7 (0 to –5.0)	+3.8 to –3.8 (+ 1.5 to –1.5)	+3.8 to –16.5 (+ 1.5 to –6.5)
Shorts	0 to –12.7 (0 to –5.0)	+3.8 to –3.8 (+ 1.5 to –1.5)	+3.8 to –16.5 (+ 1.5 to –6.5)
Lowband loads	0 to –50.8 (0 to –20.0)	+3.8 to –3.8 (+ 1.5 to –1.5)	+3.8 to –54.6 (+ 1.5 to –21.5)
Sliding loads	0 to –7.6 (0 to –3.0)	+3.8 to –3.8 (+ 1.5 to –1.5)	+3.8 to –11.4 (+ 1.5 to –4.5)
Adapters (7 mm end)	0 to –50.8 (0 to –20.0)	+3.8 to –3.8 (+ 1.5 to –1.5)	+3.8 to –54.6 (+ 1.5 to –21.5)
Adapters (type-N end)	0 to –12.7 (0 to –5.0)	+3.8 to –3.8 (+ 1.5 to –1.5)	+3.8 to –16.5 (+ 1.5 to –6.5)

a. Approximately +2 sigma to –2 sigma of gage uncertainty based on studies done at the factory according to recommended procedures.
b. Observed pin depth limits are the range of observation limits seen on the gage reading due to measurement uncertainty. The depth could still be within specifications.

NOTE When measuring pin depth, the measured value (resultant average of three or more measurements) is *not* the true value. Always compare the measured value with the observed pin depth limits in Table 2-2 to evaluate the condition of device connectors.

Electrical Specifications

The electrical specifications in Table 2-3 apply to the devices in your calibration kit when connected with an Agilent precision interface.

Table 2-3 Electrical Specifications

Device	Frequency (GHz)	Parameter	Specification
Lowband loads	DC to ≤ 2	Return Loss	≥ 48 dB (≤0.00398ρ)
Sliding loads[a]	> 2 to ≤ 18	Return Loss	≥ 42dB (≤0.00794ρ)
Adapters (both styles)	DC to ≤ 8 > 8 to ≤ 18	Return Loss Return Loss	≥ 34 dB (≤ 0.0200ρ) ≥ 28 dB (≤0.0398ρ)
Offset Opens[b]	at 18	Deviation from Nominal Phase	±1.5°
Offset Shorts[b]	at 18	Deviation from Nominal Phase	±1.0°

a. Assuming proper usage, the specifications for the residual return loss after calibration for the sliding load termination include:
- the quality of the airline portions within the sliding load, combined with
- the effective stability of the sliding element.

Proper usage includes the following practices:
- Connector mating surfaces are clean.
- The changes in slide positioning are NOT done in equal steps since this results in very poor calibration for some portions of the frequency range.
- The center conductor of test port connectors are nominally set back from the outer conductor.

Sliding loads are designed to allow the center conductor to be moved. The position of the sliding load center conductor should be set by a reference block and not positioned flush against the center conductor of the test port.

b. The specifications for the opens and shorts are given as allowed deviation from the nominal model as defined in the standard definitions (see "Class Assignments and Standard Definitions Values are Available on the Web" on page A-2).

Certification

Agilent Technologies certifies that this product met its published specifications at the time of shipment from the factory. Agilent further certifies that its calibration measurements are traceable to the United States National Institute of Standards and Technology (NIST) to the extent allowed by the institute's calibration facility, and to the calibration facilities of other International Standards Organization members. See "How Agilent Verifies the Devices in This Kit" on page 4-2 for more information.