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## Environmental Requirements

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**NOTE** Samples of this product have been type-tested in accordance with the Agilent Environmental Test Manual and verified to be robust against the environmental stresses of storage, transportation and end-use; those stresses include but are not limited to temperature, humidity, shock, vibration, altitude and power-line conditions. Test methods are aligned with IEC 60068-2 and levels are similar to MIL-PRF-28800F Class 3.

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**Table 2-1 Environmental Requirements**

Parameter	Limits
Temperature	
Operating <sup>a</sup>	+20 °C to +26 °C
Storage	-40 °C to +75 °C
Error-corrected range <sup>b</sup>	± 1 °C of measurement calibration temperature
Altitude	
Operating	< 4,500 meters (≈15,000 feet)
Storage	< 4,500 meters (≈15,000 feet)
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 shown in [Table 2-1](#).

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

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## Mechanical Characteristics

Mechanical characteristics such as center conductor protrusion and pin depth are *not* performance specifications. They are, however, important supplemental characteristics related to electrical performance. 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 center conductor protrusion or improper pin depth when the kit leaves the factory.

“Gaging Connectors” on page 3-7 explains how to use gages to determine if the kit devices have maintained their mechanical integrity. (Refer to Table 2-3 on page 2-4 for *typical* and *observed* pin depth limits).

**Table 2-2 Mechanical Characteristics**

Dimension	Typical Value
Inside diameter of outer conductor	7.0000 ±0.0076 mm
Outside diameter of center conductor	3.0404 ±0.0051 mm

### Pin Depth

Pin depth is the distance the center conductor mating plane differs from being flush with the outer conductor mating plane. See 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 redefining of pin depth with regard to protrusion and recession.

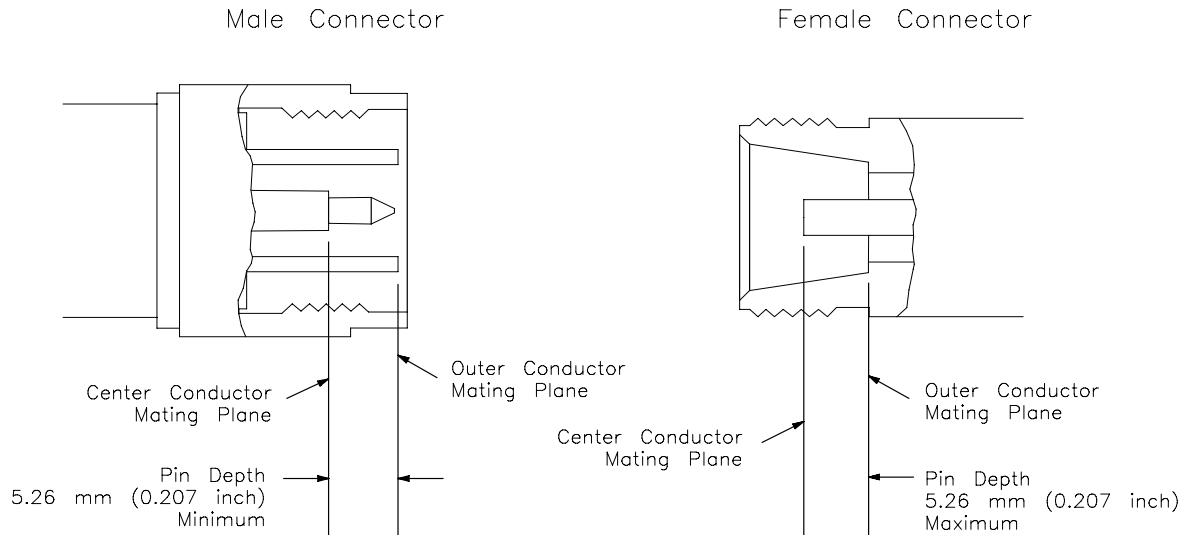
**Protrusion** refers to a male type-N connector center conductor having a pin depth value less than 5.26 mm (0.207 inch), or female type-N connector center conductor having a pin depth value greater than 5.26 (0.207 inch).

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

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 2-3 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 a visual representation of proper pin depth in type-N connectors.

**NOTE** The gages intended for measuring the type-N connectors compensate for the designed offset of 5.26 mm (0.207 inch). Therefore, protrusion and recession readings will be 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 2-3](#).

**Figure 2-1 Connector Pin Depth**



**Table 2-3 Pin Depth Limits**

Device	Typical Pin Depth	Measurement Uncertainty <sup>a</sup>	Observed Pin Depth Limits
Opens	0 to -0.0127 mm (0 to -0.0005 in)	+0.0038 to -0.0038 mm (+0.00015 to -0.00015 in)	+0.0038 to -0.0165 mm (+0.00015 to -0.00065 in)
Shorts	0 to -0.0127 mm (0 to -0.0005 in)	+0.0038 to -0.0038 mm (+0.00015 to -0.00015 in)	+0.0038 to -0.0165 mm (+0.00015 to -0.00065 in)
Fixed Loads	0 to -0.0508 mm (0 to -0.002 in)	+0.0038 to -0.0038 mm (+0.00015 to -0.00015 in)	+0.0038 to -0.0546 mm (+0.00015 to -0.00215 in)

a. Approximately +2 sigma to -2 sigma of gage uncertainty based on studies done at the factory using the 85054-60049 gages kit (same as kit gages) according to recommended procedures.

**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 2-3](#) to evaluate the condition of device connectors.

## Electrical Specifications

The electrical specifications in [Table 2-4](#) apply to the devices in your calibration kit when connected with an Agilent precision interface.

**Table 2-4 Electrical Specifications**

Device	Frequency (GHz)	Parameter	Specification
Broadband Loads (male and female)	DC to $\leq 2$	Return Loss	$\geq 48$ dB ( $\leq 0.00398\rho$ )
	$> 2$ to $\leq 3$	Return Loss	$\geq 45$ dB ( $\leq 0.00562\rho$ )
	$> 3$ to $\leq 6$	Return Loss	$\geq 40$ dB ( $\leq 0.010\rho$ )
	$> 6$ to $\leq 9$	Return Loss	$\geq 38$ dB ( $\leq 0.0126\rho$ )
Adapters <sup>a</sup>	DC to $\leq 9$	Return Loss	$\geq 34$ dB ( $\leq 0.01996\rho$ )
Offset Opens <sup>b</sup> (male and female)	DC to $\leq 3$	Deviation from Nominal	$\pm 0.65^\circ$
	$> 3$ to $\leq 9$	Phase	$\pm 1.00^\circ$
Offset Shorts <sup>b</sup> (male and female)	DC to $\leq 3$	Deviation from Nominal	$\pm 0.65^\circ$
	$> 3$ to $\leq 9$	Phase	$\pm 1.00^\circ$

a. Specifications apply to Options 100, 200, and 300 only.

b. The specifications for the opens and shorts are given as allowed deviation from the nominal model as defined in the standard definitions. Refer to the Appendix, [“Class Assignments and Standard Definitions Values are Available on the Web”](#).