

User's and Service Guide

Agilent Technologies 85036B/E 75Ω Type-N Calibration Kits

This manual applies directly to Agilent 85036B calibration kits with serial number prefix 3514A, and Agilent 85036E calibration kits with serial number prefix 3142A. The calibration devices in this kit are individually serialized. Record the device serial numbers in the table provided in this manual. (See "Recording the Device Serial Numbers" in Chapter 1.)



Manufacturing Part Number: 85036-90016

Printed in USA

Print Date: June 2002

Supersedes: October 2001

© Copyright 1995, 2001, 2002 Agilent Technologies, Inc. All rights reserved.

Documentation Warranty

THE MATERIAL CONTAINED IN THIS DOCUMENT IS PROVIDED "AS IS," AND IS SUBJECT TO BEING CHANGED, WITHOUT NOTICE, IN FUTURE EDITIONS. FURTHER, TO THE MAXIMUM EXTENT PERMITTED BY APPLICABLE LAW, AGILENT DISCLAIMS ALL WARRANTIES, EITHER EXPRESS OR IMPLIED WITH REGARD TO THIS MANUAL AND ANY INFORMATION CONTAINED HEREIN, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. AGILENT SHALL NOT BE LIABLE FOR ERRORS OR FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES IN CONNECTION WITH THE FURNISHING, USE, OR PERFORMANCE OF THIS DOCUMENT OR ANY INFORMATION CONTAINED HEREIN. SHOULD AGILENT AND THE USER HAVE A SEPARATE WRITTEN AGREEMENT WITH WARRANTY TERMS COVERING THE MATERIAL IN THIS DOCUMENT THAT CONFLICT WITH THESE TERMS, THE WARRANTY TERMS IN THE SEPARATE AGREEMENT WILL CONTROL.

Assistance

Product maintenance agreements and other customer assistance agreements are available for Agilent products.

For any assistance, contact Agilent Technologies. Refer to [page 5-3](#).

1. General Information

Calibration Kit Overview	1-2
Kit Contents	1-2
Calibration Definitions	1-3
Equipment Required but Not Supplied	1-3
Incoming Inspection	1-4
Recording the Device Serial Numbers	1-6
Calibration Kits Documented in this Manual	1-7
Calibration Kit History	1-7
Clarifying the Sex of a Connector	1-8
Preventive Maintenance	1-8

2. Specifications

Environmental Requirements	2-2
Temperature—What to Watch Out For	2-2
Mechanical Specifications	2-3
Supplemental Mechanical Characteristics	2-3
Electrical Specifications	2-4
Certification	2-4

3. Use, Maintenance, and Care of the Devices

Electrostatic Discharge	3-2
Visual Inspection	3-3
Look for Obvious Defects and Damage First	3-3
Inspect the Mating Plane Surfaces	3-3
Inspect the Precision Slotless Connectors (female)	3-4
Cleaning Connectors	3-4
Connections	3-6
How to Make a Connection	3-6
How to Separate a Connection	3-9
Handling and Storage	3-10

4. Performance Verification

Introduction	4-2
How Agilent Verifies the Devices in This Kit	4-2
Recertification	4-3
Limited Recertification	4-3
How Often to Recertify	4-3
Where to Send a Kit for Recertification	4-3

5. Troubleshooting

Troubleshooting Process	5-2
Returning a Kit or Device to Agilent	5-3

Contents

6. Replaceable Parts

Introduction	6-2
--------------------	-----

A. Standard Definitions

Standard Class Assignments.....	A-2
Blank Form	A-3
Nominal Standard Definitions	A-4
Setting the System Impedance	A-4
Blank Form	A-6

1 General Information

Calibration Kit Overview

The Agilent 85036B and 85036E type-N calibration kits are used to calibrate Agilent network analyzers up to 3 GHz for measurements of components with 75 Ω type-N connectors.

Kit Contents

The 85036B calibration kit contains the following:

- one male and one female 75 Ω type-N open termination
- one male and one female 75 Ω type-N short termination
- one male and one female 75 Ω type-N load
- three 75 Ω type-N to 75 Ω type-N adapters

Refer to [Table 6-1](#) and [Figure 6-1](#) for a complete list of kit contents and their associated part numbers.

The 85036E calibration kit contains the following:

- one male combination open/short termination
- one male 75 Ω type-N load

Refer to [Table 6-2](#) and [Figure 6-2](#) for a complete list of kit contents and their associated part numbers.

Broadband Loads

The broadband loads are instrument-grade, 75 Ω terminations that have been optimized for performance up to 3 GHz. The rugged internal structure provides for highly repeatable connections. A distributed resistive element on sapphire provides excellent stability and return loss.

Opens and Shorts

The opens and shorts are built from parts that are machined to the current state-of-the-art precision machining.

The short's inner conductors have a one-piece construction, common with the shorting plane. This construction provides for extremely repeatable connections.

The female open has a separate-piece inner conductor that is made from a low-dielectric-constant plastic to minimize compensation values.

Both the opens and shorts are constructed so that the pin depth can be controlled very tightly, thereby minimizing phase errors. Some of the opens and shorts have offsets. The lengths of these offsets are designed so that the difference in phase of their reflection coefficients is approximately 180 degrees at all frequencies.

Adapters

Like the other devices in the kit, the adapters are built to very tight tolerances to provide good broadband performance. The adapters utilize a dual-beaded connector structure to ensure stable, repeatable connections. The beads are designed to minimize return loss and are separated far enough so that interaction between the beads is minimized.

The adapters are designed so that their nominal electrical lengths are the same, which allows them to be used in calibration procedures for non-insertable devices.

Calibration Definitions

The calibration kit must be selected and the calibration definitions for the devices in the kit installed in the network analyzer prior to performing a calibration. Refer to your network analyzer user's guide for instructions on selecting the calibration kit and performing a calibration.

The calibration definitions can be:

- resident within the analyzer
- entered from the front panel

Installation of the Calibration Definitions

The calibration definitions for the kit may be permanently installed in the internal memory or hard disk of the network analyzer.

If the calibration definitions for the kit are not permanently installed in the network analyzer, they must be manually entered. Refer to your network analyzer user's guide for instructions.

Equipment Required but Not Supplied

Gages, torque and open-end wrenches, ESD protective devices, and various connector cleaning supplies are *not* included in the calibration kit but are required to ensure successful operation of the calibration kit. Refer to [Table 6-3 on page 6-5](#) for ordering information

Incoming Inspection

Verify that the shipment is complete by referring to [Figure 1-1 on page 1-5](#).

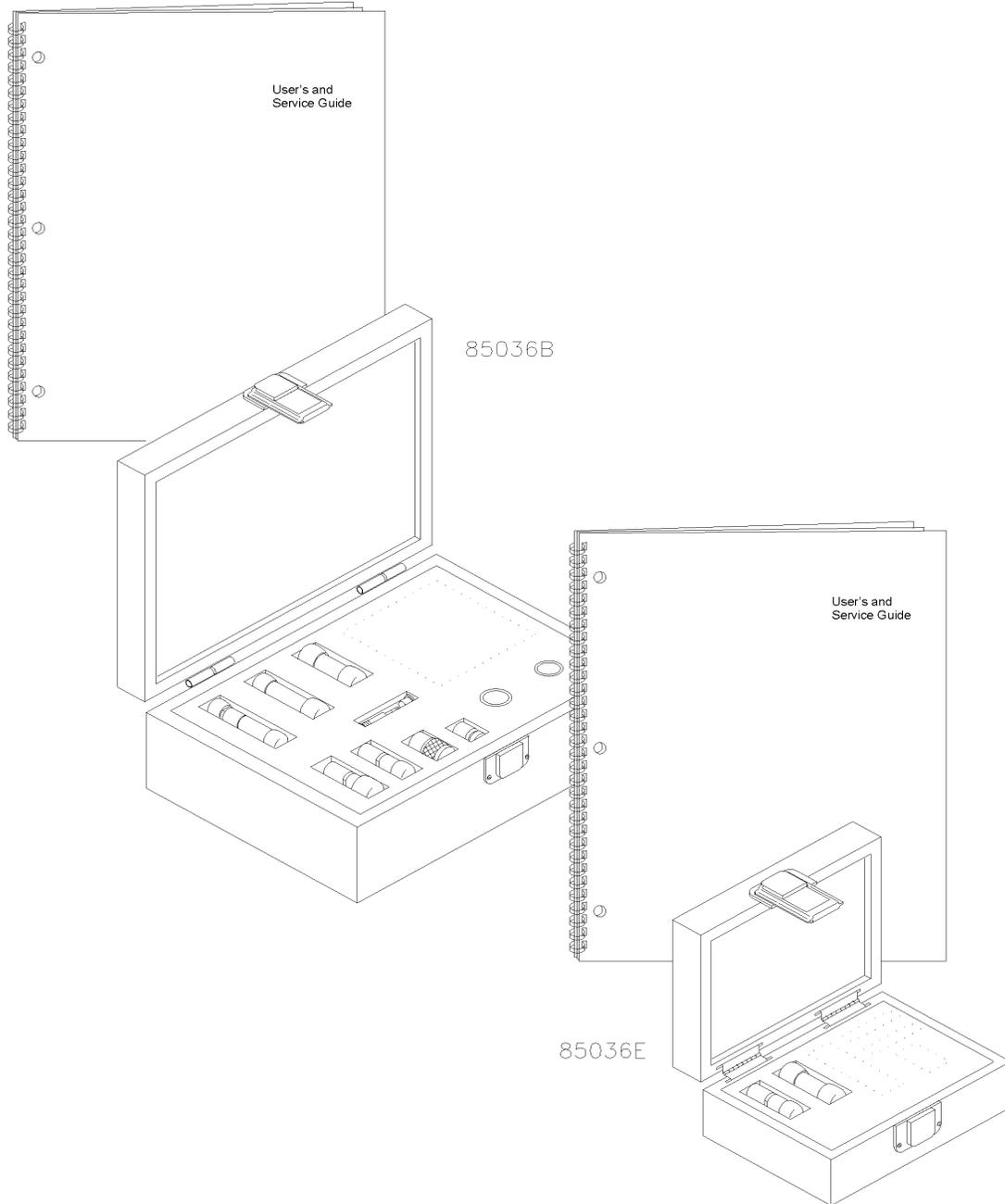
Check for damage. The foam-lined storage case provides protection during shipping.

If the case or any device appears damaged, or if the shipment is incomplete, contact Agilent. See [Table 5-1 on page 5-3](#). Agilent will arrange for repair or replacement of incomplete or damaged shipments without waiting for a settlement from the transportation company.

When you send the kit or device to Agilent, include a service tag (found near the end of this manual) with the following information:

- your company name and address
- the name of a technical contact person within your company, and the person's complete phone number
- the model number and serial number of the kit
- the part number and serial number of the device
- the type of service required
- a *detailed* description of the problem

Figure 1-1 Calibration Kit Contents



hj71be

Recording the Device Serial Numbers

In addition to the kit serial number, the devices in this kit are individually serialized (serial numbers are labeled onto the body of each device). Record these serial numbers in [Table 1-1](#) for the 85036B and [Table 1-2](#) for the 85036E. Recording the serial numbers will prevent confusing the devices in this kit with similar devices in other kits.

Table 1-1 Serial Number Record for 85036B

Device	Serial Number
Calibration kit	_____
Male broadband load	_____
Female broadband load	_____
Male open	_____
Female open body	_____
Male short	_____
Female short	_____
Type-N male to male adapter	_____
Type-N- female to female adapter	_____
Type-N- male to female adapter	_____

Table 1-2 Serial Number Record for 85036E

Device	Serial Number
Calibration kit	_____
Male broadband load	_____
Male combination open/short	_____

Calibration Kits Documented in this Manual

This manual applies to any 85036B or 85036E calibration kit whose serial prefix is listed on the title page. If your calibration kit has a different serial number prefix than the one listed on the title page, refer to [“Calibration Kit History”](#) below for information on how this manual applies.

Calibration Kit History

This section describes calibration kits with serial number prefixes different than those listed on the title page.

Agilent 85036B kits with serial prefix 3102A and below

- 75 ohm load specification: return loss \geq 45 db, dc to 2 GHz
- all other kit components unspecified

85036B calibration kits with serial number prefix 3102A and below should meet the specifications published in this manual. If you wish to have your kit recertified to current specifications, contact your nearest Agilent service center. For contact information, see [Table 5-1 on page 5-3](#).

Agilent 85036B kits with serial prefix 3103A and below

These calibration kits had a center conductor extender with a smaller body. Therefore, a different procedure was used for connecting the female open. If you're using one of the smaller extenders, replace steps 1 through 3 in [“Connecting and Disconnecting the Two-Piece Female Open \(85036B\)”](#) on page 3-9 of this manual with the steps below.

1. Mate the center conductor extender to the male pin of the test port.
2. Connect the open body to the test port by carefully guiding it over the extender.
3. To disconnect the open, carefully remove the open body first.

The part numbers in this manual are the recommended replacement parts for these kits (*including the center conductor extender*).

Clarifying the Sex of a Connector

In this manual, the sex of calibration devices and adapters are referred to in terms of their connector interface. For example, a male open has a male connector.

However, during a measurement calibration, the network analyzer softkey menus label a type-N calibration device with reference to the sex of the analyzer's test port connector—not the calibration device connector. For example, the label `SHORT(F)` on the analyzer's display refers to the short that is to be connected to the female test port. This will be a male short from the calibration kit.

Conversely, connector gages are referred to in terms of the connector that it measures. For instance, a male connector gage has a female connector on the gage so that it can measure male devices.

Preventive Maintenance

The best techniques for maintaining the integrity of the devices in this kit include:

- routine visual inspection
- cleaning
- proper gaging
- proper connection techniques

All of the above are described in [Chapter 3](#), “[Use, Maintenance, and Care of the Devices.](#)” Failure to detect and remove dirt or metallic particles on a mating plane surface can degrade repeatability and accuracy and can damage any connector mated to it. Improper connections, resulting from pin depth values being out of the limits (see [Table 2-3 on page 2-3](#)), or from bad connections, can also damage these devices.

2 Specifications

Environmental Requirements

Table 2-1 Environmental Requirements

Parameter	Limits
Operating temperature ^a	+18 °C to +28 °C (+64 °F to +82 °F)
Error-corrected temperature range ^b	±1 °C of measurement calibration temperature
Storage temperature	-40 °C to +75 °C (-40 °F to +167 °F)
Altitude	
Operation	< 4,500 meters (≈15,000 feet)
Storage	< 15,000 meters (≈50,000 feet)
Relative humidity	Always non-condensing
Operation	0 to 80% (26 °C maximum dry bulb)
Storage	0 to 95%

- 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 Specifications

The mechanical specifications in [Table 2-2](#) apply to the devices in the 85036B and the 85036E 75 Ω type-N calibration kits.

Table 2-2 Mechanical Specifications

Device	Specification
Type-N Male Open	Inside diameter of outer conductor: 6.985 to 7.010
Type-N Male Short	Inside diameter of outer conductor: 7 ± 0.015 mm Distance from reference plane to shorting plane: 5.29 ± 0.013 mm

Supplemental Mechanical Characteristics

Supplemental characteristics are values which are typically met by a majority of the calibration kit devices tested at Agilent. These supplemental characteristics are intended to provide information useful in calibration kit applications by giving typical, but non-warranted performance parameters. [Table 2-3](#) lists the typical characteristics of the devices in this kit.

Table 2-3 Mechanical Characteristics

Device	Characteristic
Type-N Male Short	Diameter of male pin: 0.897 ± 0.013 mm
All Type-N Male Connectors	Pin depth: 0.207 to 0.210 inch
All Type-N Female Connectors	Pin depth: 0.204 to 0.207 inch

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	Specification	Frequency (GHz)
Loads ^a	Return loss ≥ 46 dB ($\rho \leq 0.00501$)	DC to ≤ 2
	Return loss ≥ 40 dB ($\rho \leq 0.01000$)	> 2 to ≤ 3

a. $23^{\circ} + 5^{\circ}$ °C; typical resistance change: ± 300 ppm/°C

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.

3 Use, Maintenance, and Care of the Devices

Electrostatic Discharge

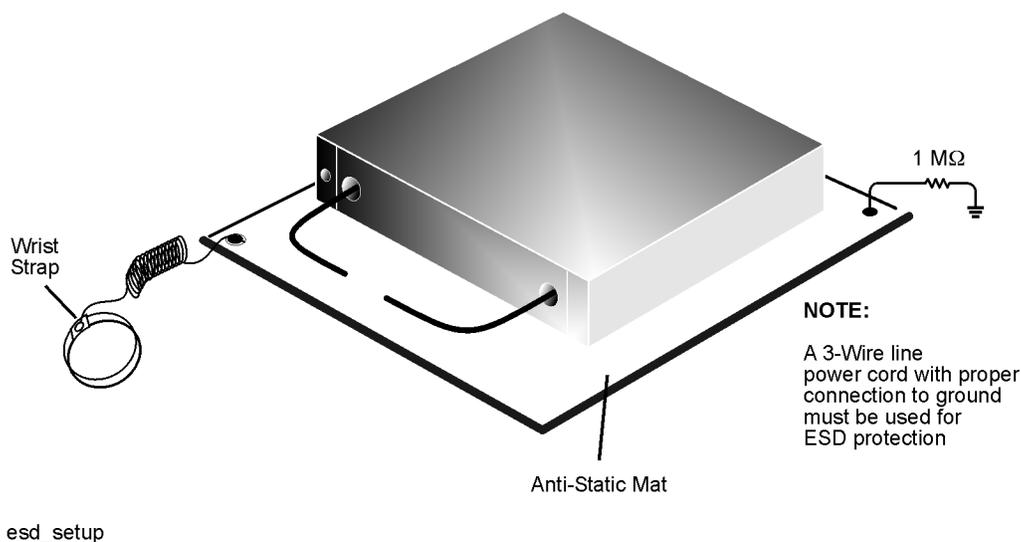
Protection against ESD (electrostatic discharge) is essential while connecting, inspecting, or cleaning connectors attached to a static-sensitive circuit (such as those found in test sets).

Static electricity can build up on your body and can easily damage sensitive internal circuit elements when discharged. Static discharges too small to be felt can cause permanent damage. Devices such as calibration components and devices under test (DUTs), can also carry an electrostatic charge. To prevent damage to the test set, components, and devices:

- *always* wear a grounded wrist strap having a 1 M Ω resistor in series with it when handling components and devices or when making connections to the test set.
- *always* use a grounded, conductive table mat while making connections.
- *always* wear a heel strap when working in an area with a conductive floor. If you are uncertain about the conductivity of your floor, wear a heel strap.
- *always* ground yourself before you clean, inspect, or make a connection to a static-sensitive device or test port. You can, for example, grasp the grounded outer shell of the test port or cable connector briefly.
- *always* ground the center conductor of a test cable before making a connection to the analyzer test port or other static-sensitive device. This can be done as follows:
 1. Connect a short (from your calibration kit) to one end of the cable to short the center conductor to the outer conductor.
 2. While wearing a grounded wrist strap, grasp the outer shell of the cable connector.
 3. Connect the other end of the cable to the test port.
 4. Remove the short from the cable.

Refer to [Chapter 6](#), “Replaceable Parts,” for part numbers and instructions for ordering ESD protective devices.

Figure 3-1 ESD Protection Setup



Visual Inspection

Visual inspection and, if necessary, cleaning should be done every time a connection is made. Metal particles from the connector threads may fall into the connector when it is disconnected. One connection made with a dirty or damaged connector can damage both connectors beyond repair.

In some cases, magnification is necessary to see damage on a connector; a magnifying device with a magnification of $\geq 10\times$ is recommended. However, not all defects that are visible only under magnification will affect the electrical performance of the connector. Use the following guidelines when evaluating the integrity of a connector.

Look for Obvious Defects and Damage First

Examine the connectors first for obvious defects and damage: badly worn plating on the connector interface, deformed threads, or bent, broken, or misaligned center conductors. Connector nuts should move smoothly and be free of burrs, loose metal particles, and rough spots.

What Causes Connector Wear?

Connector wear is caused by connecting and disconnecting the devices. The more use a connector gets, the faster it wears and degrades. The wear is greatly accelerated when connectors are not kept clean, or are connected incorrectly.

Connector wear eventually degrades performance of the device. Calibration devices should have a long life if their use is on the order of a few times per week. Replace devices with worn connectors.

The test port connectors on the network analyzer test set may have many connections each day, and are therefore more subject to wear. It is recommended that an adapter be used as a test port saver to minimize the wear on the test set's test port connectors.

Inspect the Mating Plane Surfaces

Flat contact between the connectors at all points on their mating plane surfaces is required for a good connection. Look especially for deep scratches or dents, and for dirt and metal particles on the connector mating plane surfaces. Also look for signs of damage due to excessive or uneven wear or misalignment.

Light burnishing of the mating plane surfaces is normal, and is evident as light scratches or shallow circular marks distributed more or less uniformly over the mating plane surface. Other small defects and cosmetic imperfections are also normal. None of these affect electrical or mechanical performance.

If a connector shows deep scratches or dents, particles clinging to the mating plane surfaces, or uneven wear, clean and inspect it again. Devices with damaged connectors should be discarded. Determine the cause of damage before connecting a new, undamaged connector in the same configuration.

Inspect the Precision Slotless Connectors (female)

Precision slotless female connectors are used to improve accuracy. The slotless contacts are not affected by the slight variations in male contact pin diameter. However, it is still advisable to inspect them regularly for damage.

NOTE Inspection is particularly important when mating nonprecision to precision devices.

Cleaning Connectors

Clean connectors are essential for ensuring the integrity of RF and microwave coaxial connections.

1. Use Compressed Air or Nitrogen

WARNING Always use protective eyewear when using compressed air or nitrogen.

Use compressed air (or nitrogen) to loosen particles on the connector mating plane surfaces.

You can use any source of clean, dry, low-pressure compressed air or nitrogen that has an effective oil-vapor filter and liquid condensation trap placed just before the outlet hose.

Ground the hose nozzle to prevent electrostatic discharge, and set the air pressure to less than 414 kPa (60 psi) to control the velocity of the air stream. High-velocity streams of compressed air can cause electrostatic effects when directed into a connector. These electrostatic effects can damage the device. Refer to [“Electrostatic Discharge”](#) earlier in this chapter for additional information.

2. Clean the Connector Threads

WARNING Keep isopropyl alcohol away from heat, sparks, and flame. Store in a tightly closed container. It is extremely flammable. In case of fire, use alcohol foam, dry chemical, or carbon dioxide; water may be ineffective.

Use isopropyl alcohol with adequate ventilation and avoid contact with eyes, skin, and clothing. It causes skin irritation, may cause eye damage, and is harmful if swallowed or inhaled. It may be harmful if absorbed through the skin. Wash thoroughly after handling.

In case of spill, soak up with sand or earth. Flush spill area with water.

Dispose of isopropyl alcohol in accordance with all applicable federal, state, and local environmental regulations.

Use a lint-free swab or cleaning cloth moistened with isopropyl alcohol to remove any dirt or stubborn contaminants on a connector that cannot be removed with compressed air or nitrogen. Refer to [Table 6-3 on page 6-5](#) for part numbers for isopropyl alcohol and cleaning swabs.

- a. Apply a small amount of isopropyl alcohol to a lint-free cleaning swab.
- b. Clean the connector threads.
- c. Let the alcohol evaporate, then blow the threads dry with a gentle stream of clean, low-pressure compressed air or nitrogen. Always completely dry a connector before you reassemble or use it.

3. Clean the Mating Plane Surfaces

- a. Apply a small amount of isopropyl alcohol to a lint-free cleaning swab.
- b. Clean the center and outer conductor mating plane surfaces. When cleaning a female connector, avoid snagging the swab on the center conductor contact fingers by using short strokes.
- c. Let the alcohol evaporate, then blow the connector dry with a gentle stream of clean, low-pressure compressed air or nitrogen. Always completely dry a connector before you reassemble or use it.

4. Reinspect

Inspect the connector again to make sure that no particles or residue are present.

Connections

Good connections require a skilled operator. *The most common cause of measurement error is bad connections.* The following procedures illustrate how to make good connections.

CAUTION Never mate a 50 ohm connector with a 75 ohm connector. The larger center pin of a male 50 ohm connector will destroy the contact fingers of a female 75 ohm connector.

How to Make a Connection

Preliminary Connection

1. Ground yourself and all devices. Wear a grounded wrist strap and work on a grounded, conductive table mat. Refer to [“Electrostatic Discharge” on page 3-2](#) for ESD precautions.
2. Visually inspect the connectors. Refer to [“Visual Inspection” on page 3-3](#).
3. If necessary, clean the connectors. Refer to [“Cleaning Connectors” on page 3-4](#).
4. Carefully align the connectors. The male connector center pin must slip concentrically into the contact finger of the female connector.
5. Push the connectors straight together.

CAUTION Do *not* turn the device body. Only turn the connector nut. Damage to the center conductor can occur if the device body is twisted.

Do *not* twist or screw the connectors together. As the center conductors mate, there is usually a slight resistance.

6. The preliminary connection is tight enough when the mating plane surfaces make uniform, light contact. Do not overtighten this connection.

A connection in which the outer conductors make gentle contact at all points on both mating surfaces is sufficient. Very light finger pressure is enough to accomplish this.

7. Make sure the connectors are properly supported. Relieve any side pressure on the connection from long or heavy devices or cables.

Final Connection Using a Torque Wrench

1. Use a torque wrench to make a final connection. [Table 3-1](#) provides information about the torque wrench recommended for use with this calibration kit. A torque wrench is *not* included in the calibration kit. Refer to [Chapter 6](#) for part number and ordering information.

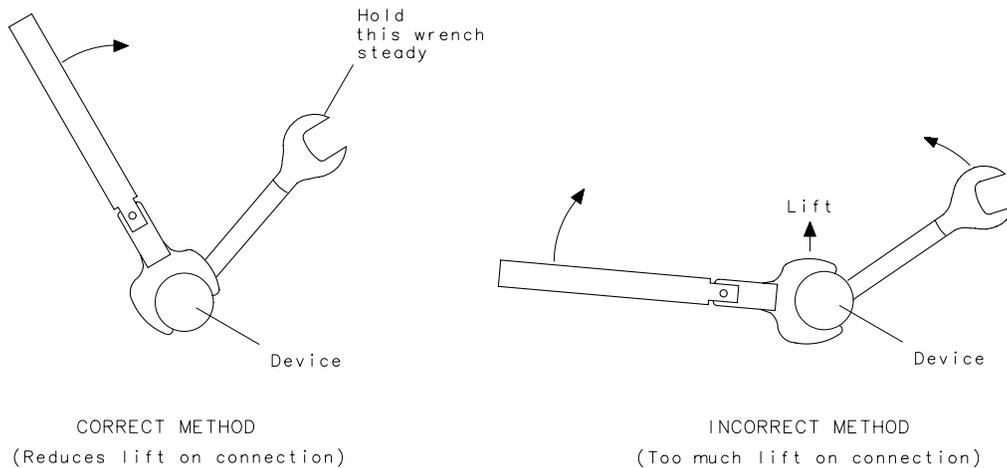
Table 3-1 Torque Wrench Information

Connector Type	Torque Setting	Torque Tolerance
Type-N	135 N-cm (12 in-lb)	± 13.5 N-cm (± 1.2 in-lb)

Using a torque wrench guarantees that the connection is not too tight, preventing possible connector damage. It also guarantees that all connections are equally tight each time.

- Prevent the rotation of anything other than the connector nut that you are tightening. It may be possible to do this by hand if one of the connectors is fixed (as on a test port). In all situations, however, it is recommended that you use an open-end wrench to keep the body of the device from turning. Refer to [Chapter 6 “Replaceable Parts”](#) for part number and ordering information.
- Position both wrenches within 90 degrees of each other before applying force. See [Figure 3-2](#). Wrenches opposing each other (greater than 90 degrees apart) will cause a lifting action which can misalign and stress the connections of the devices involved. This is especially true when several devices are connected together.

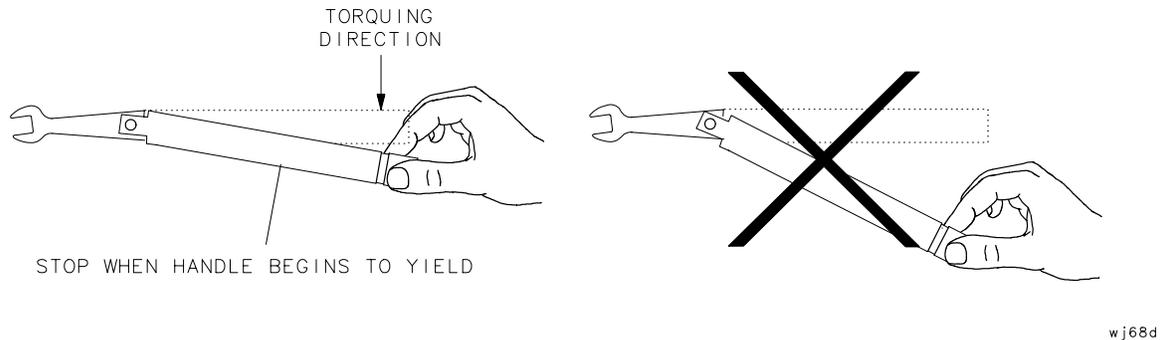
Figure 3-2 Wrench Positions



wj56f

4. Hold the torque wrench lightly, at the end of the handle only (beyond the groove). See [Figure 3-3](#).

Figure 3-3 Using the Torque Wrench



5. Apply downward force perpendicular to the wrench handle. See [Figure 3-3](#). This applies torque to the connection through the wrench.
Do not hold the wrench so tightly that you push the handle straight down along its length rather than pivoting it, otherwise you apply an unknown amount of torque.
6. Tighten the connection just to the torque wrench break point. The wrench handle gives way at its internal pivot point. See [Figure 3-3](#). Do not tighten the connection further.

CAUTION You don't have to fully break the handle of the torque wrench to reach the specified torque; doing so can cause the handle to kick back and loosen the connection. Any give at all in the handle is sufficient torque.

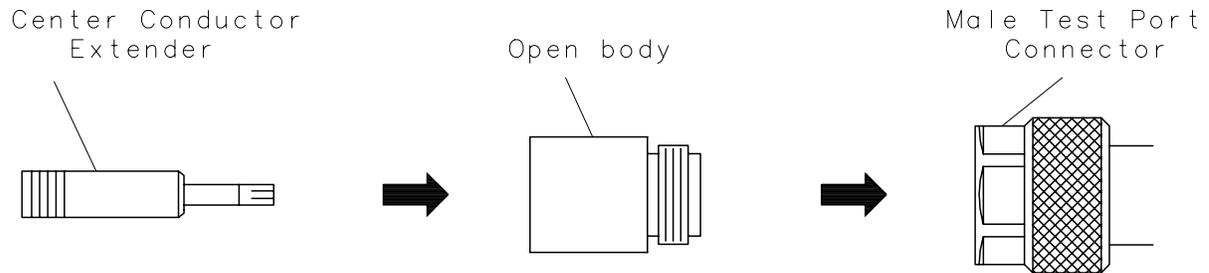
Do not pivot the wrench handle on your thumb or other fingers, otherwise you apply an unknown amount of torque to the connection when the wrench reaches its break point.

Do not twist the head of the wrench relative to the outer conductor mating plane. If you do, you apply more than the recommended torque.

Connecting and Disconnecting the Two-Piece Female Open (85036B)

The female open standard in the 85036B calibration kit is composed of two parts: the open body (outer conductor) and the center conductor extender. Refer to [Figure 3-4](#).

Figure 3-4 Connecting the Two-Piece Female Open



To connect the female open:

1. Connect the open body to the male test port.
2. Insert the center conductor extender into the hole at the end of the body and push gently until the center conductors mate.

To disconnect the female open:

1. Remove the center conductor extender by pulling gently outwards without twisting, rocking, or bending the extender or the body.
2. Disconnect the body from the test port.

How to Separate a Connection

To avoid lateral (bending) force on the connector mating plane surfaces, always support the devices and connections.

CAUTION Turn the connector nut, *not* the device body. Major damage to the center conductor can occur if the device body is twisted.

1. Use an open-end wrench to prevent the device body from turning.
2. Use another open-end wrench to loosen the connector nut.
3. Complete the separation by hand, turning only the connector nut.
4. Pull the connectors straight apart without twisting, rocking, or bending either of the connectors.

Handling and Storage

- Install the protective end caps and store the calibration devices in the foam-lined storage case when not in use.
- Never store connectors loose in a box, desk, or bench drawer. This is the most common cause of connector damage during storage.
- Keep connectors clean.
- Do not touch mating plane surfaces. Natural skin oils and microscopic particles of dirt are easily transferred to a connector interface and are very difficult to remove.
- Do not set connectors contact-end down on a hard surface. The plating and the mating plane surfaces can be damaged if the interface comes in contact with any hard surface.

4 Performance Verification

Introduction

The performance of your calibration kit can only be verified by returning the kit to Agilent Technologies for recertification. The equipment required to verify the specifications of the devices in the kit has been specially manufactured and is not commercially available.

How Agilent Verifies the Devices in This Kit

Agilent verifies the specifications of these devices as follows:

1. The residual microwave error terms of the test system are verified with precision airlines and shorts that are directly traced to NIST (National Institute of Standards and Technology). The airline and short characteristics are developed from mechanical measurements. The mechanical measurements and material properties are carefully modeled to give very accurate electrical representation. The mechanical measurements are then traced to NIST through various plug and ring gages and other mechanical measurements.
2. Each calibration device is electrically tested on this system. For the initial (before sale) testing of the calibration devices, Agilent includes the test measurement uncertainty as a guardband to guarantee each device meets the published specification. For recertifications (after sale), no guardband is used and the measured data is compared directly with the specification to determine the pass or fail status. The measurement uncertainty for each device is, however, recorded in the calibration report that accompanies recertified kits.

These two steps establish a traceable link to NIST for Agilent to the extent allowed by the institute's calibration facility. The specifications data provided for the devices in this kit is traceable to NIST through Agilent Technologies.

Recertification

The following will be provided with a recertified kit:

- a new calibration sticker affixed to the case
- a certificate of calibration
- a calibration report for each device in the kit listing measured values, specifications, and uncertainties

NOTE A list of NIST traceable numbers may be purchased upon request to be included in the calibration report.

Agilent Technologies offers a *Standard* calibration for the recertification of this kit. For more information, contact Agilent Technologies. See [Table 5-1 on page 5-3](#).

Limited Recertification

The 75 Ω loads in the calibration kit are specified for use up to 3 GHz. For many applications, the performance above 2 GHz is not utilized.

For a standard recertification, the devices in the calibration kit are tested and calibrated up to 3 GHz. However, a limited recertification can be requested. For this limited recertification, the devices are tested and calibrated up to 2 GHz.

To request a limited recertification, make sure the following is clearly written on the order: *Limited Calibration DC-2 GHz*.

All loads that receive a limited calibration are supplied with a limited calibration label applied to the device.

How Often to Recertify

The suggested initial interval for recertification is 12 months or sooner. The actual need for recertification depends on the use of the kit. After reviewing the results of the initial recertification, you may establish a different recertification interval that reflects the usage and wear of the kit.

NOTE The recertification interval should begin on the date the kit is *first used* after the recertification date.

Where to Send a Kit for Recertification

Contact Agilent Technologies for information on where to send your kit for recertification. See [Table 5-1 on page 5-3](#).

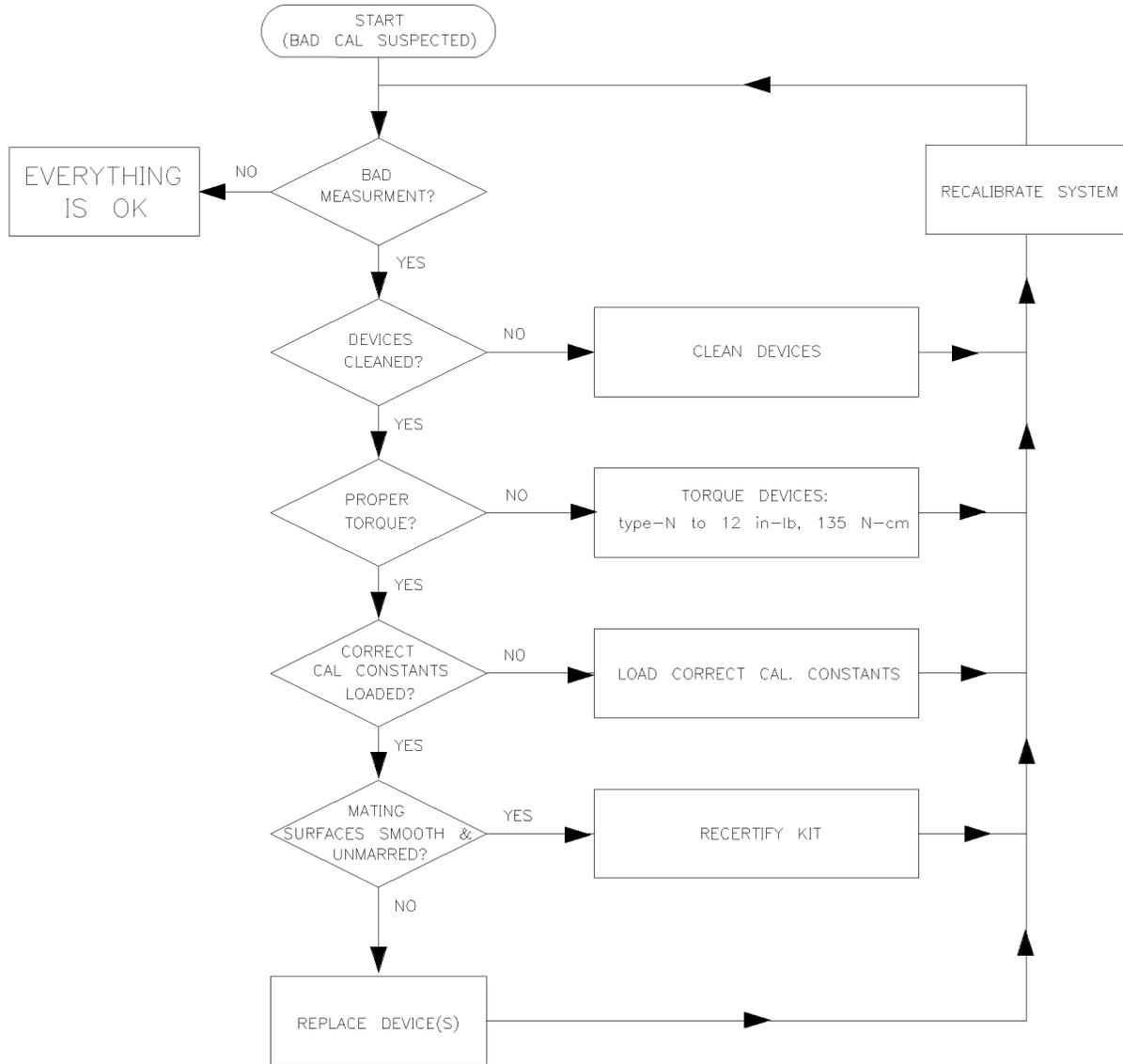
When you return the kit, complete and attach a service tag. Refer to [“Returning a Kit or Device to Agilent” on page 5-3](#) for details.

5 Troubleshooting

Troubleshooting Process

If you suspect a bad calibration, or if your network analyzer does not pass performance verification, follow the steps in [Figure 5-1](#).

Figure 5-1 Troubleshooting Flowchart



h j 75be

Returning a Kit or Device to Agilent

If your kit or device requires service, contact the Agilent Technologies office nearest you for information on where to send it. See [Table 5-1](#). Include a service tag (located near the end of this manual) on which you provide the following information:

- your company name and address
- a technical contact person within your company, and the person's complete phone number
- the model number and serial number of the kit
- the part number and serial number of each device
- the type of service required
- a *detailed* description of the problem and how the device was being used when the problem occurred (such as calibration or measurement)

Table 5-1 Contacting Agilent

Online assistance: www.agilent.com/find/assist

United States <i>(tel)</i> 1 800 452 4844	Latin America <i>(tel)</i> (305) 269 7500 <i>(fax)</i> (305) 269 7599	Canada <i>(tel)</i> 1 877 894 4414 <i>(fax)</i> (905) 282-6495	Europe <i>(tel)</i> (+31) 20 547 2323 <i>(fax)</i> (+31) 20 547 2390
New Zealand <i>(tel)</i> 0 800 738 378 <i>(fax)</i> (+64) 4 495 8950	Japan <i>(tel)</i> (+81) 426 56 7832 <i>(fax)</i> (+81) 426 56 7840	Australia <i>(tel)</i> 1 800 629 485 <i>(fax)</i> (+61) 3 9210 5947	Singapore <i>(tel)</i> 1 800 375 8100 <i>(fax)</i> (65) 836 0252
Malaysia <i>(tel)</i> 1 800 828 848 <i>(fax)</i> 1 800 801 664	Philippines <i>(tel)</i> (632) 8426802 <i>(tel)</i> (PLDT subscriber only): 1 800 16510170 <i>(fax)</i> (632) 8426809 <i>(fax)</i> (PLDT subscriber only): 1 800 16510288	Thailand <i>(tel)</i> outside Bangkok: (088) 226 008 <i>(tel)</i> within Bangkok: (662) 661 3999 <i>(fax)</i> (66) 1 661 3714	Hong Kong <i>(tel)</i> 800 930 871 <i>(fax)</i> (852) 2506 9233
Taiwan <i>(tel)</i> 0800-047-866 <i>(fax)</i> (886) 2 25456723	People's Republic of China <i>(tel)</i> (preferred): 800-810-0189 <i>(tel)</i> (alternate): 10800-650-0021 <i>(fax)</i> 10800-650-0121	India <i>(tel)</i> 1-600-11-2929 <i>(fax)</i> 000-800-650-1101	

6 Replaceable Parts

Introduction

Table 6-1 lists the replacement part numbers for items included in the 85036B calibration kit and Figure 6-1 illustrates each of these items.

Table 6-2 lists the replacement part numbers for items included in the 85036E calibration kit and Figure 6-2 illustrates each of these items.

Table 6-3 lists the replacement part numbers for items recommended or required for successful operation but not included in the calibration kit.

To order a listed part, note the description, the part number, and the quantity desired. Telephone or send your order to Agilent Technologies. See Table 5-1 on page 5-3.

Table 6-1 Replaceable Parts for the 85036B Calibration Kit

Description	Qty Per Kit	Agilent Part Number
Calibration Devices (75Ω Type-N)		
Male broadband load	1	00909-60019
Female broadband load	1	00909-60020
Male short	1	85036-60012
Female short	1	85036-60011
Male open	1	85032-60007
Female open body	1	85032-20001
Female open center conductor extender	1	85036-60019
Adapters		
Type-N-male to male	1	85036-60013
Type-N-female to female	1	85036-60014
Type-N-male to female	1	85036-60015
Calibration Kit Storage Case		
Box	1	85036-80001
Foam pad set	1	85036-80002
Miscellaneous Items		
User's and service guide	1	85036-90016
Male protective end caps	as required	1401-0214
Female protective end caps	as required	1401-0225
Tube package (for center conductor extender)	1	1540-1027

Figure 6-1 Replaceable Parts for the 85036B Calibration Kit

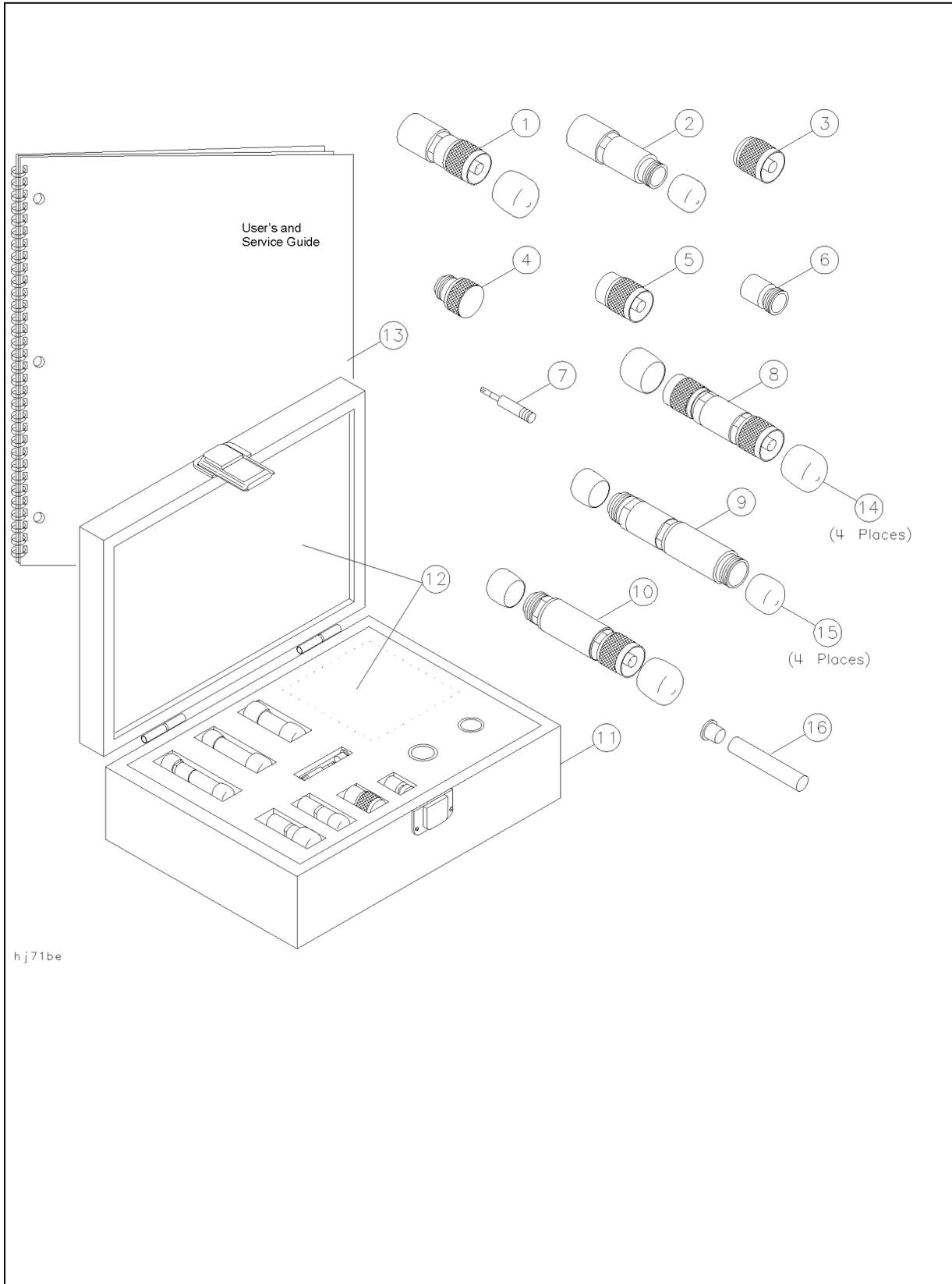


Table 6-2 Replaceable Parts for the 85036E Calibration Kit

Description	Qty Per Kit	Agilent Part Number
Calibration Devices (75Ω Type-N)		
Male broadband load	1	00909-60019
Male combination open/short	1	85036-60016
Calibration Kit Storage Case		
Box	1	9211-1582
Foam pad set	1	85023-80005
Miscellaneous Items		
User's and service guide	1	85036-90016
Male protective end cap	as required	1401-0214

Figure 6-2 Replaceable Parts for the 85036E Calibration Kit

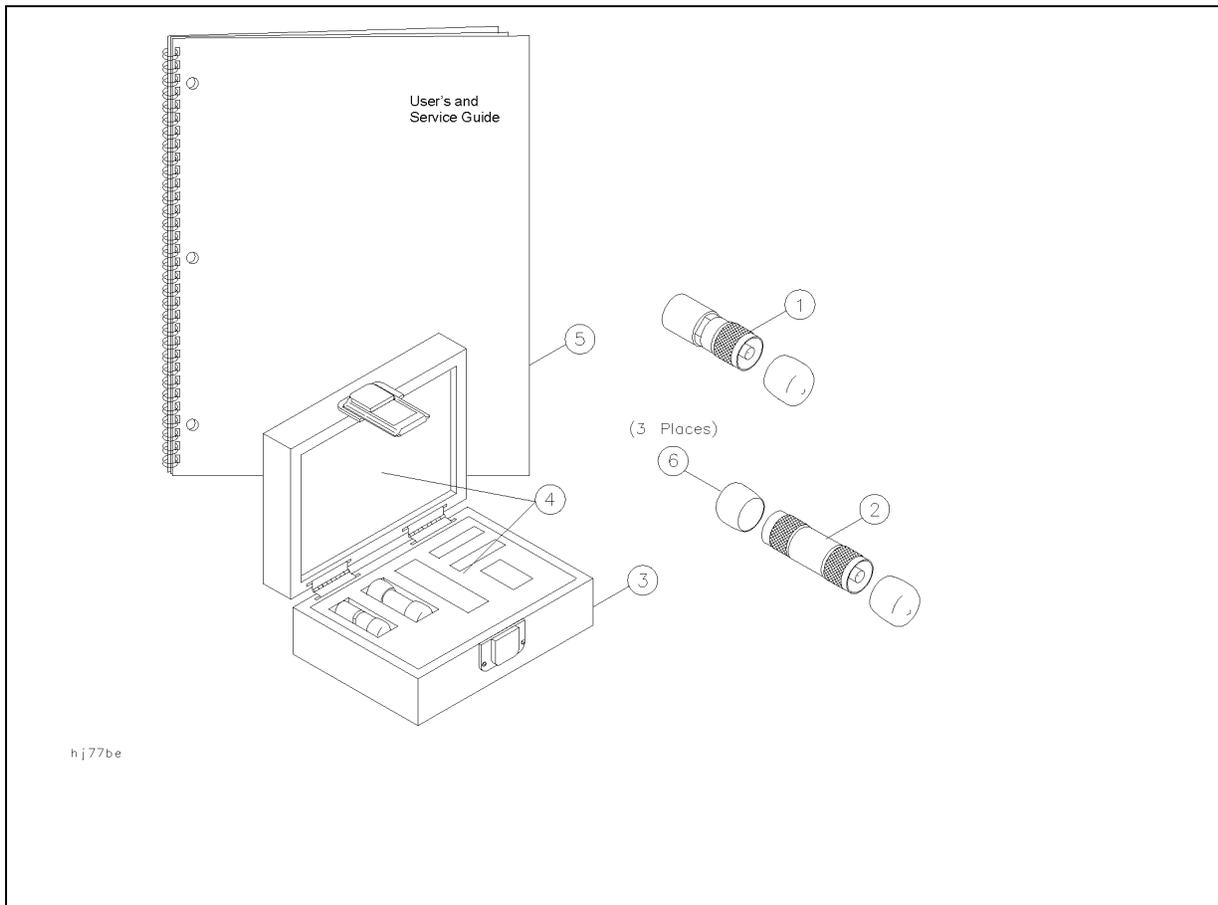


Table 6-3 Replaceable Parts—Items Not Included in the 85036B and 85036E Calibration Kits

Description	Qty	Agilent Part Number
Connector Gages (75Ω Type-N)		
Connector gage set	1	85036B K01
Wrenches		
3/4 in, 135 N-cm (12 in-lb) torque wrench	1	8710-1766
1/2 in and 9/16 in open-end wrench	1	8710-1770
3/4 in open-end wrench	1	8720-0011
ESD Protective Devices		
Grounding wrist strap	1	9300-1367
5 ft grounding cord for wrist strap	1	9300-0980
2 ft by 4 ft conductive table mat with 15 ft grounding wire	1	9300-0797
ESD heel strap	1	9300-1308
Connector Cleaning Supplies		
Isopropyl alcohol	30 ml	8500-5344
Foam tipped cleaning swabs	100	9301-1243
Miscellaneous Items		
Connector care - quick reference card	1	08510-90360

A Standard Definitions

Standard Class Assignments

Class assignment organizes calibration standards into a format compatible with the error models used in the measurement calibration. A class or group of classes corresponds to the systematic errors to be removed from the measured network analyzer response. [Table A-1](#) lists the classes of the devices in this calibration kit.

Table A-1 Standard Class Assignments

Calibration Kit Label: N 75 Ω								
Class	A	B	C	D	E	F	G	Standard Class Label
S ₁₁ A	2	8						Opens
S ₁₁ B	1	7						Shorts
S ₁₁ C	3							Load
S ₂₂ A	2	8						Opens
S ₂₂ B	1	7						Shorts
S ₂₂ C	3							Load
Forward Transmission	4							Thru
Reverse Transmission	4							Thru
Forward Match	4							Thru
Reverse Match	4							Thru
Response	1	7	2	8	4			Response
Response and Isolation	1	7	2	8	4			Response & Isolation

Blank Form

The standard class assignments listed in [Table A-1](#) may be changed to meet your specific requirements. [Table A-2](#) is provided to record the modified standard class assignments.

Table A-2 Standard Class Assignments Blank Form

Calibration Kit Label: _____								
Class	A	B	C	D	E	F	G	Standard Class Label
S ₁₁ A								
S ₁₁ B								
S ₁₁ C								
S ₂₂ A								
S ₂₂ B								
S ₂₂ C								
Forward Transmission								
Reverse Transmission								
Forward Match								
Reverse Match								
Response								
Response and Isolation								

Nominal Standard Definitions

Standard definitions provide the constants needed to mathematically model the electrical characteristics (delay, attenuation, and impedance) of each calibration standard. The nominal values of these constants are theoretically derived from the physical dimensions and material of each calibration standard, or from actual measured response. These values are used to determine the measurement uncertainties of the network analyzer. The standard definitions in [Table A-3](#) list typical calibration kit parameters used to specify the mathematical model of each device. This information must be loaded into the network analyzer to perform valid calibrations. Refer to your network analyzer's user's guide for instructions on loading calibration constants.

NOTE The values in the standard definitions table are valid *only* over the specified operating temperature range.

Setting the System Impedance

This kit contains only 75 ohm devices. Ensure the system impedance (Z_0) is set to 75 ohms. Refer to your network analyzer's user's guide for instructions on setting system impedance.

Table A-3 Standard Definitions

System $Z_0^a = 75 \Omega$		Calibration Kit Label: N 75 Ω											
Standard ^b		$C0 \times 10^{-15} \text{ F}$	$C1 \times 10^{-27} \text{ F/Hz}$	$C2 \times 10^{-36} \text{ F/Hz}^2$	$C3 \times 10^{-45} \text{ F/Hz}^3$	Fixed or Sliding ^c	Offset			Freq (GHz)		Coax or Waveguide	Standard Label ^d
Number	Type						Delay (ps)	$Z_0 \Omega$	Loss (Ω/s)	Min	Max		
1	Short						0	75	1.13G	0	999	Coax	Short (m) ^d
2	Open	63.5	84	56	0		0	75	1.13G	0	999	Coax	Open (m) ^d
3	Load					Fixed	0	75	1.13G	0	999	Coax	Broad-band
4	Delay/Thru						0	75	1.13G	0	999	Coax	Thru
5													
6													
7	Short						17.544	75	1.13G	0	999	Coax	Short (f) ^d
8	Open	41 ^e	40	5	0		17.544	75	1.13G	0	999	Coax	Open (f) ^d

- a. Ensure system impedance (Z_0) of network analyzer is set to this value.
- b. Open, short, load, delay/thru, or arbitrary impedance.
- c. Load or arbitrary impedance only.
- d. Standard labels that specify sex, (m) or (f), refer to the sex of the analyzer's test port connector.
- e. If your instrument is an Agilent 8752B or 8711 Option 1EC, and you are calibrating at the test port, this number is 33. For all other instruments and applications, including calibrating at a point other than the test port (such as the end of a cable), 41 is the correct number. This is because the 8752B and 8711 Option 1EC have special female test ports with longer, more rugged fingers.

Blank Form

The standard definitions listed in [Table A-3](#) may be changed to meet your specific requirements. [Table A-4](#) is provided to record the modified standard definitions.

Table A-4 Standard Definitions Blank Form

System $Z_0^a =$ _____ Calibration Kit Label: _____													
Standard ^b		$C0 \times 10^{-15} F$	$C1 \times 10^{-27} F/Hz$	$C2 \times 10^{-36} F/Hz^2$	$C3 \times 10^{-45} F/Hz^3$	Fixed or Sliding ^c	Offset			Freq (GHz)		Coax or Waveguide	Standard Label ^d
Number	Type						Delay (ps)	$Z_0 \Omega$	Loss (GΩ/s)	Min	Max		
1													
2													
3													
4													
5													
6													
7													
8													

- a. Ensure system Z_0 of network analyzer is set to this value.
- b. Open, short, load, delay/thru, or arbitrary impedance.
- c. Load or arbitrary impedance only.
- d. Standard labels that specify sex, (m) or (f), refer to the sex of the analyzer's test port connector.

A

adapters, 1-3
part numbers, 6-5
alcohol
isopropyl
as cleaning solvent, 3-4
altitude, 2-2

B

blank form
standard class assignments, A-3
standard definitions, A-6
broadband loads, 1-2

C

cal kit
contents, 1-2
overview, 1-2
return to Agilent, 5-3
serial number, 1-6
calibration
bad, 5-2
certificate of, 4-2
constants, 1-3
permanently stored, 1-3
limited, 4-3
standards, 2-4
temperature, 2-2
calibration constants
entering, 1-3
permanently stored, 1-3
calibration definitions, 1-3
calibration kit
contents, 1-2
overview, 1-2
return to Agilent, 5-3
serial number, 1-6
calibration kit history, 1-7
calibration label
part number, 6-5
calibration report, 4-2
calibration sticker, 4-3
certificate of calibration, 4-2
certification
specifications, 2-4
class assignment
standard, A-2
class assignments
blank form, A-3
cleaning connectors, 3-4
cleaning supplies, 1-3
ordering, 6-5
part numbers, 6-5
compressed air or nitrogen, 3-4
connecting the two-piece female open, 3-9
connections, 3-2, 3-6, 3-9
cautions in making, 3-6
disconnecting, 3-9
ESD concerns, 3-6
final, 3-6

how to make, 3-6
preliminary, 3-6
two-piece female open, 3-9
undoing, 3-9
using a torque wrench, 3-6
connector
cleaning, 3-4
cleaning supplies, 6-5
damage, 3-3
female, 3-4
life, 3-3
mating plane, 3-5
precision slotless (female), 3-4
sex, 1-8
threads, 3-4
visual inspection, 3-3
wear, 3-3
constants
calibration, 1-3
entering, 1-3
permanently stored, 1-3
contacting Agilent Technologies, 5-3
contents
kit, 1-2

D

damage
shipment, 1-4
to connectors, 3-3
damaged connectors, 3-3
data, recertification, 4-2
defective connectors, 3-3
definitions
standard, A-4
device
connecting, 3-6
disconnecting, 3-9
handling, 3-10
maintenance, 1-8
part numbers, 6-5
return to Agilent, 5-3
storage, 3-10
temperature, 2-2
visual inspection, 3-3
devices
how Agilent verifies, 4-2
serial numbers, 1-6
disconnecting the two-piece female open, 3-9
disconnection
two-piece female open, 3-9
disconnections, 3-9
distance from ref plane to shorting plane,
specifications, 2-3
documentation warranty, ii

E

electrical specifications, 2-4
electrostatic discharge, 3-2
supplies
part numbers, 6-5

Index

- when making connections, 3-6
- environmental requirements, 2-2
- equipment
 - required, 1-3
 - but not supplied, 1-3, 6-2, 6-5
 - supplied, 1-2, 6-2, 6-4
- ESD, 3-2
 - precautions, 3-2, 3-4
 - supplies
 - part numbers, 6-5
 - when making connections, 3-6

F

- female open, 3-9
 - connecting, 3-9
 - disconnecting, 3-9
- frequency
 - specifications, 2-4
- frequency range, 2-4, 4-3

G

- gage
 - connector
 - master, 6-5
- gage master
 - part numbers, 6-5
- gages, 1-3

H

- handling, 3-10
- history, calibration kit, 1-7
- humidity, 2-2

I

- impedance
 - system, A-4
- incoming inspection, 1-4
- inside diameter of outer conductor, specifications, 2-3
- inspection
 - damage, 3-3
 - defects, 3-3
 - incoming, 1-4
 - mating plane, 3-3
 - visual, 3-3
- isopropyl alcohol
 - as cleaning solvent, 3-4

K

- kit
 - contents, 1-2
 - overview, 1-2
 - return to Agilent, 5-3
 - serial number, 1-6

L

- label
 - calibration, 4-3
 - part number, 6-5

- limited calibration, 4-3
- limited calibration
 - requesting, 4-3
- loads
 - broadband, 1-2

M

- maintenance, 3-2
 - preventive, 1-8
- maintenance of devices, 1-8
- making connections, 3-6
- manual
 - part number, 6-5
- mating plane
 - connector, 3-5
- mating plane inspection, 3-3
- mating plane surfaces, 3-5
- mechanical specifications, 2-3

N

- nitrogen, 3-4
- nominal standard definitions, A-4
- numbers
 - serial, 1-6
 - recording, 1-6

O

- offices
 - sales and service, 5-3
- open-end wrench, 1-3, 3-9
 - part number, 6-5
- opens, 1-2
- opens and shorts, 1-2
- ordering parts, 6-2

P

- part numbers, 6-2
- parts
 - ordering, 6-2
 - replaceable, 6-2
 - required but not supplied, 6-2
- performance verification, 4-2
 - fail, 5-2
- permanently stored calibration definitions, 1-3
- pin depth
 - typical values, 2-3
- precision slotless connectors, 3-4
- preventive maintenance, 1-8

R

- recertification, 4-3
 - how often?, 4-3
 - interval, 4-3
 - limited, 4-3
 - what's included, 4-3
 - where to send your kit, 4-3
- regulations
 - environmental, 3-5
- replaceable parts, 6-2

requirements
 environmental, 2-2
return loss
 specifications, 2-4
return, kit or device, 5-3

S

sales
 and service offices, 5-3
sales and service offices, 5-3
serial numbers, 1-6
 devices, 1-6
 recording, 1-6
service, 5-2
 and sales offices, 5-3
service tag, 1-4, 4-3, 5-3
sex
 connector, 1-8
shipment
 damage, 1-4
 verifying complete, 1-4
shorts, 1-2
specifications, 2-2
 altitude, 2-2
 certification, 2-4
 distance from ref plane to shorting plane, 2-3
 electrical, 2-4
 environmental, 2-2
 frequency, 2-4
 humidity, 2-2
 inside diameter of outer conductor, 2-3
 mechanical, 2-3
 return loss, 2-4
 temperature, 2-2
 verifying, 4-2
standard class assignments, A-2
 blank form, A-3
standard definitions, A-4, A-6
 blank form, A-6
 nominal, A-4
standards
 calibration, 2-4
 NIST, 2-4, 4-3
static discharge, 3-2
sticker
 calibration, 4-3
storage, 3-10
 altitude, 2-2
 humidity, 2-2
 temperature, 2-2
supplies
 cleaning, 1-3
system impedance
 setting, A-4

T

tag
 service, 1-4, 4-3, 5-3
temperature
 calibration, 2-2

device, 2-2
error-corrected temperature range, 2-2
measurement, 2-2
operating range, 2-2
verification and measurement, 2-2
test data, 4-2
threads
 connector, 3-4
torque wrench, 1-3, 3-6
 part number, 6-5
 specifications, 3-6
traceability, 4-2
troubleshooting, 5-2
two-piece female open, 3-9

V

verification
 performance, 4-2
 temperature, 2-2
visual inspection, 3-3

W

warranty, documentation, ii
wrench
 open-end, 1-3, 3-9
 part number, 6-5
 undoing connections, 3-9
torque, 1-3
 part number, 6-5
wrenches
 part numbers, 6-5