Keysight 16453A Dielectric Material Test Fixture

Specification and Service Manual

KEYSIGHT TECHNOLOGIES

Notices

Trademark Acknowledgments

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CAUTION

A **CAUTION** notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a CAUTION notice until the indicated conditions are fully understood and met.

WARNING

A **WARNING** notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in personal injury or death. Do not proceed beyond a WARNING notice until the indicated conditions are fully understood and met.

Table of Contents

1 General Information

Introduction

This manual contains the following information:

- The specifications of the 16453A (in this chapter).
- Initial inspection of the 16453A (see Chapter 2).
- Ordering replaceable parts for the 16453A (see Chapter 3).
  For measurement procedures using the 16453A, see the applicable impedance analyzer manual/help.

Product Description

The 16453A is a fixture for measuring the permittivity of dielectric materials.

Applicable Instrument

The 16453A has been designed to operate specifically with the Impedance analyzer with 7mm terminal.

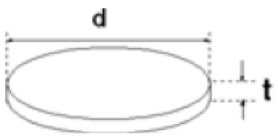
Specifications

This section lists the complete 16453A specifications.These specifications are the performance standards and limits against which the 16453A is tested. When shipped from the factory, the 16453A meets the following listed specifications. For the specifications when used with an applicable impedance analyzer, see the data sheet of impedance analyzer.

Specifications describe the instrument's warranted performance over the temperature range of 0˚C to 55˚C (except as noted). Supplemental characteristics are intended to provide information that is useful in applying the instrument by giving non warranted performance parameters. These are denoted as typical, typically, nominal or approximate.

Applicable MUT (Material Under Test) Size	See Table 1-1
Maximum DC Bias Voltage	±40V
Frequency Range	1MHz to 1.0GHz typically
Relative Permittivity of Load	ε'_r = 2.1 typically ε''_r = 0 typically
Operating Temperature	-55˚C to +200˚C
Operating Humidity (@wet bulb temperature <40˚C)	Up to 95% RH
Non-operating Temperature	-55˚C to +200˚C
Non-operating Humidity (@wet bulb temperature <65˚C)	Up to 90% RH
Weight	600g typically
Dimension	130mm H x 50mm W x60mm D typically

Table 1-1 Applicable Dielectric Material Size Using with 16453A



0.3mm ≤ **t** ≤ 3mm

d ≥ ϕ15mm

2 Initial Inspection

Introduction

This chapter contains the following information:

- Initial inspection
- Repackaging the test fixture for shipment

Initial Inspection

The dielectric material test fixture has been carefully inspected before being shipped from the factory. It should be in perfect physical condition, no scratches, dents or the like. It should also be in perfect electrical condition. Verify this by carefully performing an incoming inspection to check the dielectric material test fixture set for signs of physical damage and missing contents.If any discrepancy is found, notify the carrier and Keysight Technologies. Your Keysight Technologies sales office will arrange for repair and replacement without waiting for the claim to be settled.

- Inspect the shipping container for damage. Keep the shipping materials until the inspection is completed.
- Verify that the shipping container contains everything listed in Table 2-1.
- Inspect the exterior of the 16453A for any signs of damage.

Initial Inspection

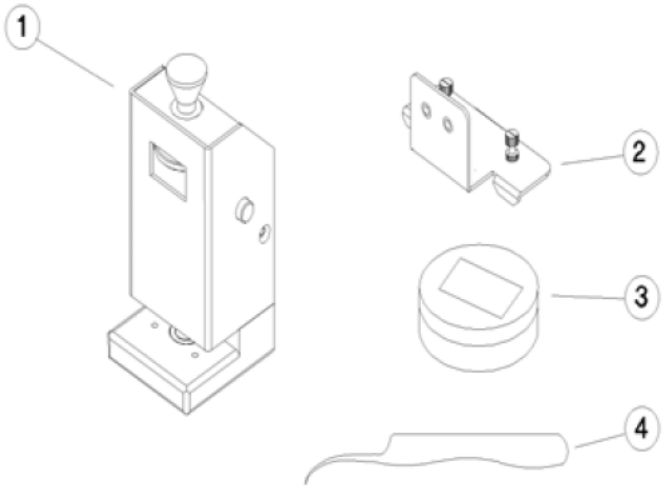


Table 2-1 16453A Contents

Reference Designator	Description	Keysight Part Number	Qty
1	Main Assembly	Not assigned	1
2	Fixture Holder	16453-01213	1
3	Load[1]	16453-60021	1
4	Tweezers	8710-2081	1
	Carrying Case[2]	16453-60011	1
	Specification and Service Manual (Option ABA)[2]	16453-90010	1

1. Consists of load plate, case, and thickness label.
2. These parts are not shown in the figure.

NOTE The load thickness value is written on the case of the load. This value is required to perform impedance analyzer load compensation.

Repackaging the Test Fixture For Shipment

If shipment to a Keysight Technologies service center is required, each test fixture should be repackaged using the original factory packaging materials.

If this material is not available, comparable packaging materials may be used. Wrap the dielectric material test fixture in heavy paper and pack in anti-static plastic packing material. Use sufficient shock absorbing material on all sides of the 16453A to provide a thick, firm cushion and to prevent movement. Seal the shipping container securely and mark it FRAGILE.

3 Service

Introduction

This chapter provides service information for the 16453A Dielectric Material Test Fixture.

Serial Number for Non-RoHS 16453A:
“MY43100001 - MY43199999”

Serial Number for RoHS 16453A:
“MY43200001 & above”

Replaceable Parts

Table 3-1,Table 3-2, and Table 3-3 identify the supported parts and their respective RoHS compliant replacement support part. RoHS conversion involves with design and dimension change which result in the RoHS support part backward incompatible with non-RoHS 16453A Dielectric Material Test Fixture. Special handling is needed while using the RoHS replacement part on non-RoHS 16453A. The original support part number is replaced by the respective “RoHS Compliant Replacement Part”. The parts listed in these tables can be ordered from your nearest Keysight Technologies office. Ordering information should include the Keysight Part number and the quantity required.

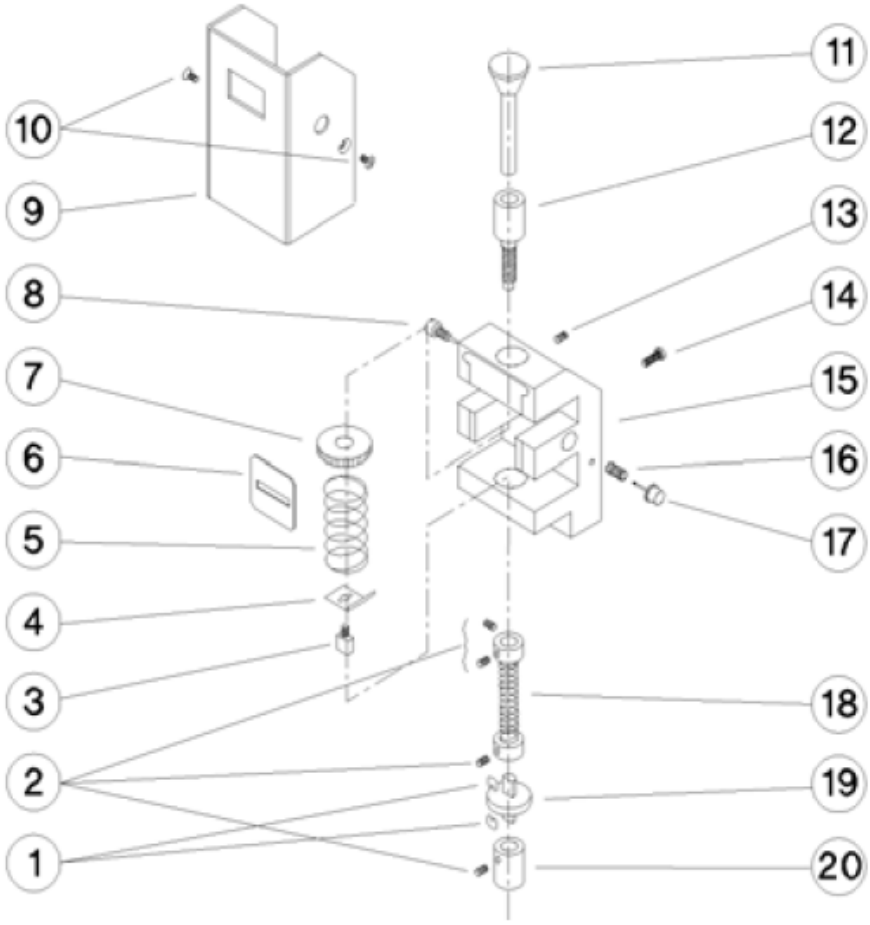


Table 3-1 Replaceable Parts List (Upper Part)

Ref/ D	Part Number	Description	Qty	RoHS Compliant Replacememt Part	Description	Qty
1	16190-09001	Plate	2	16190-09001	Plate	2
2	3030-0007	Screw SET4-40	4	[1]Set Change: 0515-4942	Screw Metric M3x0.5	4
3	16453-23004	Screw	1	16453-23004	Screw	1
4	16453-01215	Latch Plate	1	16453-01215	Latch Plate	1
5	1460-2384	Spring	1	5012-8767	Spring	1
6	16453-01211	Plate	1	16453-01211	Plate	1
7	16453-23003	Dial	1	16453-23003	Dial	1

Table 3-1 Replaceable Parts List (Upper Part)

Ref/ D	Part Number	Description	Qty	RoHS Compliant Replacememt Part	Description	Qty
8	16453-24003	Screw	1	16453-24003	Screw	1
9	16453-04001	Cover	1	16453-04001	Cover	1
10	0515-0914	Screw M3 L6	2	0515-1227	Screw M3 L6	2
11	16453-23001	Knob Shaft	1	16453-23001	Knob Shaft	1
12	16453-23002	Sleeve	1	16453-23002	Sleeve	1
13	3030-0285	Screw SET6-32	1	[2]Set Change: 0515-5199	Screw Metric M4x0.7	1
14	0515-1551	Screw M3 L10	1	0515-0373 & 2190-0584	Screw M3 L10	1
15	16453-20011 (16453-20021)	Deck	1	[2]Set Change: 16453-20621	Deck	1
16	1460-2385	Spring	1	16453-08602	Spring	1
17	16453-24004	Latch Button	1	16453-24004	Latch Button	1
18	16453-29001 (16453-29011)	Spring	1	[1]Set Change: 16453-29611	Spring	1
19	16453-25001	Insulator	1	16453-25001	Insulator	1
20	16453-24015	Electrode	1	[1]Set Change: 16453-24615	Electrode	1

1. Replace all associated parts marked with [1] as they are mutually dependent.
2. Replace all associated parts marked with [2] as they are mutually dependent.

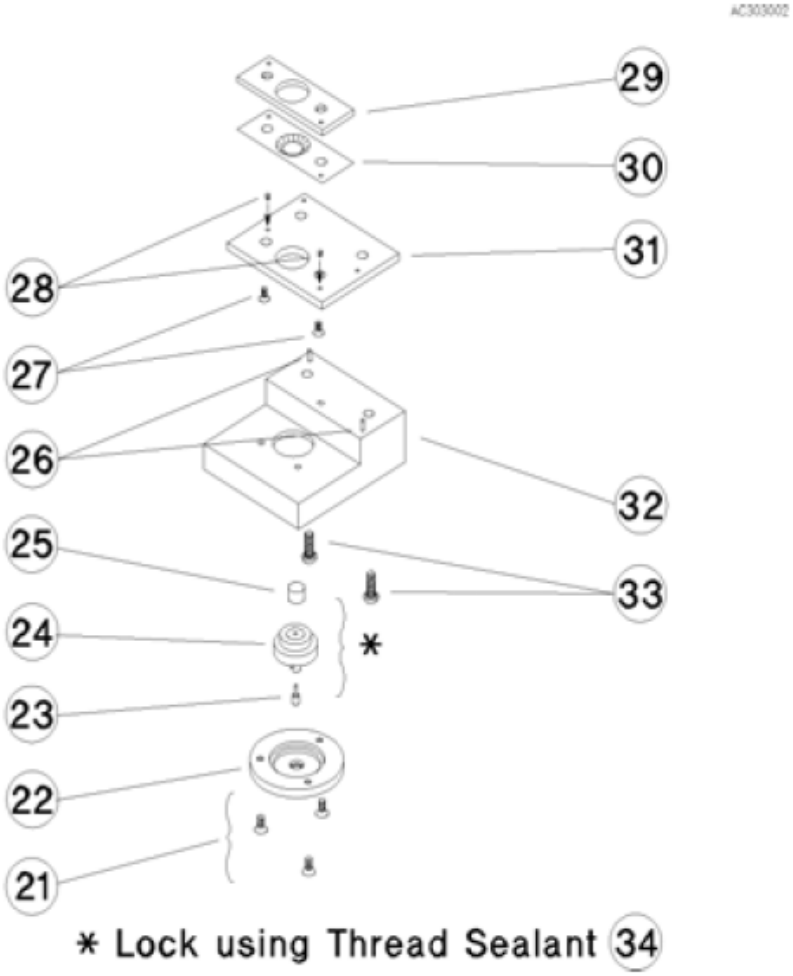


Table 3-2 Replaceable Parts List (Lower Part)

Ref/ D	Part Number	Description	Qty	RoHS Compliant Replacement Part	Description	Qty
21	0515-0914	Screw M3 L6	3	0515-1227	Screw M3 L6	3
22	16453-24011	Flange	1	16453-24011	Flange	1
23	1250-0816	Contact	1	1250-0816	Contact	1
24	16453-60001	Bead Assembly	1	16453-60001	Bead Assembly	1
25	16453-24018	Electrode	1	16453-24018	Electrode	1
26	1480-0739	Spring Pin	2	1480-0739	Spring Pin	2

Table 3-2 Replaceable Parts List (Lower Part)

Ref/ D	Part Number	Description	Qty	RoHS Compliant Replacement Part	Description	Qty
27	0515-0914	Screw M3 L6	2	0515-1227	Screw M3 L6; Washer	2
28	16092-21010	Pin	2	16092-21010	Pin	2
29	16453-01212	Plate	1	16453-01212	Plate	1
30	16453-08001	Spring	1	16453-08001	Spring	1
31	16453-01214	Plate	1	16453-01214	Plate	1
32	16453-20012	Base	1	16453-20012	Base	1
33	0515-0868	Screw M4 L16	2	0515-1143 & 2190-0586	Screw M4 L16; Washer	2
34	0470-0013	Thread Sealant	1	0470-0013	Thread Sealant	1

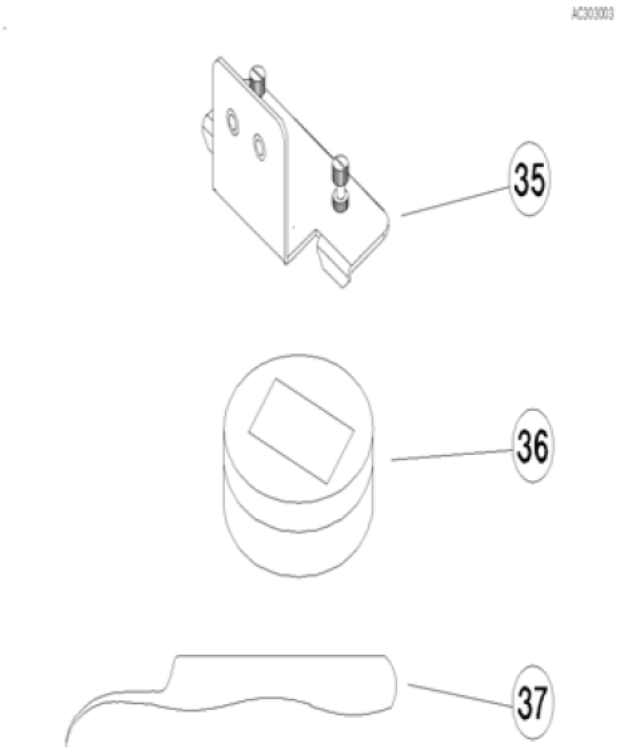


Table 3-3 Replaceable Parts List (Misc.)

Ref/ D	Part Number	Description	Qty	RoHS Compliant Replacement Part	Description	Qty
35	16453-01213	Angle Plate	1	16453-01213	Angle Plate	1
36	16453-60021	Load[1]	1	16453-60021	Load1[1]	1
37	8710-2081	Tweezers	1	8710-2081	Tweezers	1
	16453-60011	Carrying Case[2]	1	16453-60011	Carrying Case[2]	1

1. Consists of load plate, case and thickness label.
2. These parts are not shown in this figure.

Parts Replacement Procedures

This section provides removal and replacement procedures for the 16453A.

NOTE In this section, numbers quoted by " " correspond to Reference Designators in the Replaceable Parts Lists (Table 3-1, Table 3-2 and Table 3-3).

Removal Procedure

Cover Removal

1. Release latch button “17” by pulling up knob “11” if it is latched.
2. Remove two screws “10” on the sides of cover “9”.
3. Loosen screw “14” on the back of the main assembly until the button can be pushed into the cover.
4. Remove cover “9” carefully while preventing the button from popping out.
5. Remove plate “6”.
6. Remove button “17” and spring “16”.
7. Detach the lower part from the upper part by removing the two “33” screws from the bottom of the assembly.

Lower Part Disassembly

8. Remove plate “31”.
9. Remove plate “29” and spring “30” by removing the two “27” screws from plate “31”.
10. Remove flange “22” by removing the three “21” screws from base “32”.
11. Unscrew electrode “25” using pliers because contact “23” and electrode “25” are locked with thread sealant.

NOTE Contact “23” and electrode “25” are not reusable after disassembly.

Upper Part Disassembly

12. Disassemble spring “18”, insulator “19”, and electrode “20” by loosing the four “2” hex screws.
13. Unscrew “3” using a slot screwdriver and remove latch plate “4” and spring “5”.
14. Remove dial “7”.
15. Detach knob shaft “11” by removing screw “8”.

16. Detach sleeve “12” by loosing hex screw “13”.

Replacement Procedure

Reverse the “Removal Procedure”.

NOTE Contact “23” and electrode “25” should be locked with a drop of thread sealant “34” when assembling them.

Functional Test

This section provides the functional test procedure to check the 16453A's performance. The functional test can be used for post repair function verification.

Fixture Impedance Check

1. Perform the calibration of impedance analyzer with the High Impedance Test Head. (Refer to the applicable impedance analyzer's manual/help)
2. Place the fixture on the calibrated APC-7® terminal of the impedance analyzer.
3. Set the Analyzer Point Average to 10 by pressing Bw/Avg, POINT AVG FACTOR, 1, 0, x1, POINT AVG on OFF (then the label changes to POINT AVG ON off).
4. Set sub markers to each frequency point in Table 3-4.
5. Press the latch button while pulling up the knob so that the knob is latched.
6. Read Cp and G values for each frequency by marker list function. Verify they meet the open guidelines in Table 3-4.
7. Pull up the knob and release the latch button. Press down on the knob so that the upper and the lower electrodes are making contact.
8. Read Ls and Rs values for each frequency by marker list function. Verify they meet the short guidelines in Table 3-4.

Table 3-4 Fixture Impedance Check Guideline

Frequency	Open		Short	
	Cp	|G|	Ls	|Rs|
10MHz	3±1pF	|G|≤5.1μS	7±3nH	|Rs|≤2.0Ω
100MHz	3±1pF	|G|≤15μS	7±3nH	|Rs|≤6.3Ω
200MHz	3±1pF	|G|≤45μS	7±3nH	|Rs|≤8.9Ω
300MHz	3±1pF	|G|≤95μS	7±3nH	|Rs|≤11Ω
500MHz	3±1pF	|G|≤250μS	7±3nH	|Rs|≤14Ω
800MHz	3±1pF	|G|≤640μS	7±3nH	|Rs|≤18Ω
1GHz	3±1pF	|G|≤1000μS	7±3nH	|Rs|≤20Ω

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