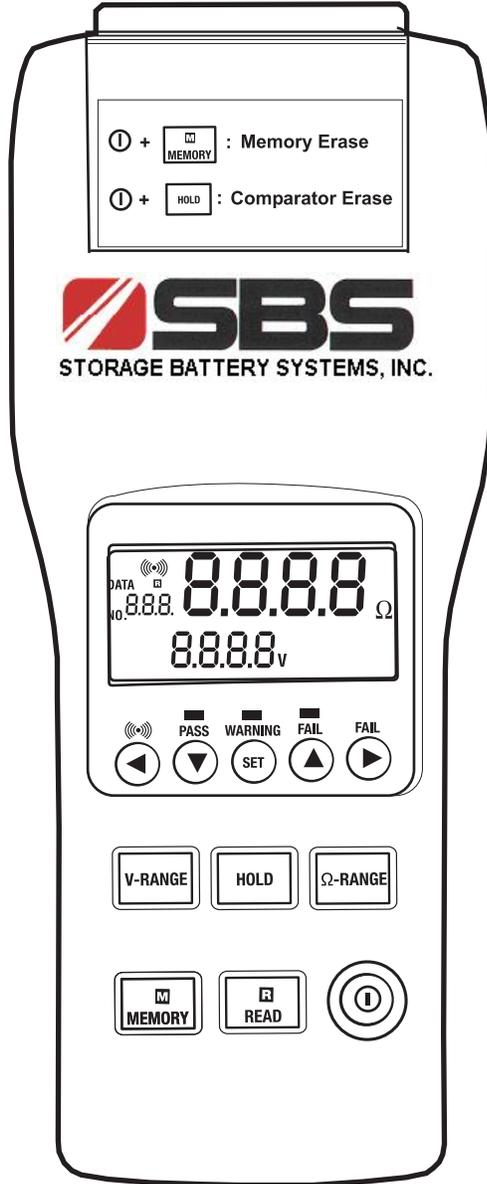


User's Guide



Battery Capacity Tester

Model RT100



Introduction

The Battery Tester is designed for measuring the internal resistance and output voltage of batteries including lead storage cell, nickel-cadmium battery, lithium-ion battery and nickel-metal hydride battery.

- AC four-terminal method to eliminates lead resistances and contact resistances and yield the most accurate results.
- 1kHz test current with up to 10 $\mu\Omega$ resistance resolution.
- Dual display simultaneously indicates the internal resistance and voltage of the battery.
- Comparator function with storage of up to 99 sets of resistance and voltage values for battery deterioration characterization.
- Pin type and alligator type 4-terminal Kelvin leads for quick and accurate resistance measurements.
- Memory capacity to store up to 999 manually stored data points or up to 9600 points stored using interval datalogging.
- RS232 PC port and Windows compatible software.

Warranty

Storage Battery Systems, Inc. warrants the basic instrument to be free of defects in parts and workmanship for one year from date of shipment (a six month limited warranty applies on sensors and cables). If it should become necessary to return the instrument for service during or beyond the warranty period, contact the Customer Service Department at (800) 554-2243. **A Return Authorization (RA) number must be issued before any product is returned to SBS, Inc.** The sender is responsible for shipping charges, freight, insurance and proper packaging to prevent damage in transit. This warranty does not apply to defects resulting from action of the user such as misuse, improper wiring, operation outside of specification, improper maintenance or repair, or unauthorized modification. SBS, Inc. specifically disclaims any implied warranties or merchantability or fitness for a specific purpose and will not be liable for any direct, indirect, incidental or consequential damages. SBS's total liability is limited to repair or replacement of the product. The warranty set forth above is inclusive and no other warranty, whether written or oral, is expressed or implied.

Specifications

Measuring method:	Resistance (AC four-terminal method).
A/D conversion:	Dual slope method.
Display:	Dual display LCD and LEDs (comparator output).
Sampling rate:	1 set (resistance & voltage measurements)/second.
Open-Circuit terminal voltage:	3.5Vpp max.
Input over range:	"OL" display.
Low battery detection:	BT display.
Test current fault detection:	"- - -" display.
Auto power off:	After approximately 30 minutes.
Zero (Relative) function:	Circuit offset voltage is displayed as 0V.
Hold function:	Display is held.
Beeper function:	Audible output for warning and fail results (can be turned on and off).
Comparator settings:	Resistance High and Low limits and voltage threshold point.
Number of comparator settings:	99 sets.
Comparator output:	LEDs for pass (green), warning (yellow) and fail (red) results, audible tone for warning and fail.

Resistance	Lo	IN	Hi
Voltage	Lo	IN	Hi
Lo	Warning	Warning	Fail
Hi	PASS	Warning	Fail

Manual Data logging:	999 sets.
Continuous Data logging:	9600 sets.
Operating environment:	32 to 104°F (0° to 40°C) 80%RH (non-condensing)
Storage environment:	14 to 122°F (-10° to 50°C) 80%RH (non-condensing)
Power source:	Six AA size 1.5V batteries. (AC adaptor (output 9VDC) is optional)
Maximum power consumption:	1.0VA
Continuous operating time:	7 hours approx.
Maximum altitude value usable:	2000m or less.
Size:	9.8x3.9x1.7" (250x100x45mm)
Weight:	1.1 lbs (500g) approx. (including batteries)
Accessories:	Test Leads, Instruction Manual, Batteries.
Option:	AC adaptor (9V DC output).

Electrical Specifications

Conditions to guarantee accuracy:

Temperature: 23°C ± 5°
 Humidity: 80%RH or less (non-condensing).
 Zero adjustment: After zero adjustment for each range.

Resistance measurement

Temperature coefficient: (±0.1% rdg ± 0.5digits)/°C
 Measuring current frequency: 1KHz ± 10%
 Measuring burden voltage: 1.5mVAC

Range	Resolution	Measurement current	Accuracy
40mΩ	10μΩ	37.5mA approx.	±(1% reading ± 10digits)
400mΩ	100μΩ	3.75mA approx.	
4Ω	1mΩ	375μA approx.	
40Ω	10mΩ	37.5μA approx.	

Voltage Measurement

Temperature coefficient (±0.1%rdg±0.5digits)/ °C

Range	Resolution	Accuracy
4V	1mV	±(0.1% reading ± 6digits)
40V	10mV	

Maximum Input Voltage: 50VDC maximum, No AC voltage input, , 60VDC and AC maximum between input terminals and ground.

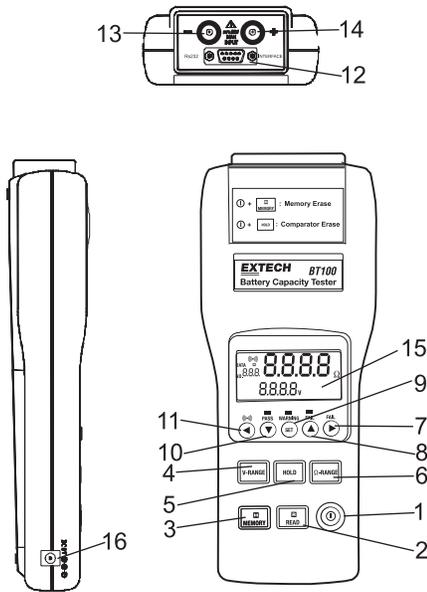


DANGER

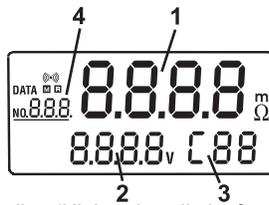
Do not exceed the maximum permissible input voltage to the measurement terminal. This could result in injury or damage to the unit.

Meter Description

1. **Ⓜ** Power button: Power on /off
2. **R** READ button:
 - ① Press **R** button to show the manual logged readings.
 - ② Press **R** READ button again to stop reading.
3. **M** MEMORY button:
 - ① Under the manual logging mode, the tester stores each single set of logged reading to the memory by pressing **M** MEMORY button.
 - ② Press and hold **M** MEMORY button for 2 seconds to enter continuous logging mode. Press again to stop logging.
4. **V-RANGE** button: Select the voltage range. (4V, 40V)
5. **HOLD** button:
 - ① Press HOLD button to freeze or unfreeze the displayed reading.
 - ② Press and hold HOLD button for 2 seconds to enter the interval time setting mode for continuous data logging.
6. **Ω - RANGE** button: Select the resistance range. (40mΩ, 400mΩ, 4Ω, 40Ω)
7. **▶ REL** button:
 - ① Press **▶** button to move the cursor to the right.
 - ② Press REL (Relative) button to zero the reading.
8. **▲** button : Press **▲** button to increase the displayed value.
9. **SET** button:
 - ① Press **SET** button to switch the comparator mode on or off.
 - ② Press and hold the SET button for 2 seconds to enter the comparator-setting mode. Press again to store the setting in memory.
10. **▼** button: Press **▼** button to decrease the displayed value.
11. **◀ 🔔** Button:
 - ① Press **◀** button to move the cursor to the left.
 - ② Press **🔔** button to turn the beeper on or off.
12. **RS-232 connector**: PC interface connector.
13. **- Input jack**: For connecting with the black test lead plug.
14. **+ Input jack**: For connecting with the red test lead plug.
15. **LCD display**
16. **AC adaptor input**



Display Description



1. Measured resistance reading (High or Low limit of resistance on the comparator settings)
2. Measured voltage reading (High or Low limit of voltage on the comparator settings).
3. The assigned number of comparator: 99 sets
4. The location for the manual logged data.
5. Symbols:

mΩ: Milliohm (resistance).

V: Voltage.

HOLD: Hold function.

COMP: Comparator function enabled.

BT: Low-Battery

•••: Beeper enabled

DATA **R**: Manual datalogging enabled.

M: Continuous datalogging enabled (Flashes when data is stored).

INTV: Interval time settings of continuous datalogging function. (1~255 seconds).

COMP.SET: Comparator settings.

HIGH: High limit setting of the comparator resistance & voltage.

LOW: Low limit setting of the comparator resistance.

LED Display Indicators

PASS (green LED): Battery complies with the high limit of comparator.

WARNING (yellow LED) Battery is beginning to deteriorate.

FAIL (red LED): Battery has failed.

These indications will appear when the High and Low comparator limits for internal resistance and the comparator threshold value for voltage are all set.

Basic Operation

Preparation

The following safety information must be observed to ensure maximum personal safety during the operation of this tester.

- To avoid electric shock when replacing the batteries first disconnect the leads from the object to be measured.
- Check the battery polarity carefully when inserting the batteries.
- Be sure to dispose of used batteries properly.
 1. Remove the battery cover.
 2. Insert the batteries into the battery compartment.

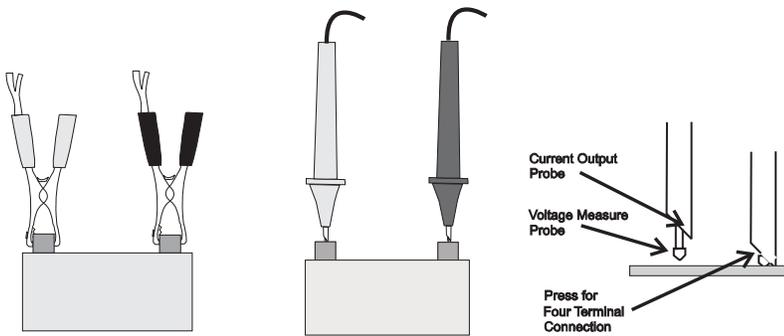


WARNING

- Do not attempt to measure DC voltage exceeding 50V. Do not attempt to measure AC voltages. This could result in injury or damage to the unit.
- Do not attempt to measure the voltage of a generator. This would result in an AC voltage being applied to the voltage generating output terminals, which is dangerous.
- After measuring a high voltage battery, before continuing to measure a low voltage battery first short the measurement leads together. This will discharge the DC-elimination capacitor which is connected across the leads. Otherwise an excess voltage may be applied to the low voltage battery, which is dangerous.

Test Leads

Two sets of test leads are supplied with the meter. Both sets provide 4 terminal Kelvin connections which eliminates lead resistance and probe contact resistance from the measurement. Use of either the alligator or press-probe is determined by the measurement application.



Operation

Connect the red test lead to the "+" jack and the black test lead to the "-" jack.

1. Press Power  button to turn on the tester.
2. Connect the red test probe to the positive battery terminal, and the black test probe to the negative battery terminal.
3. Use the V-RANGE and Ω -RANGE buttons to select the desired voltage and resistance ranges.
4. Read the battery internal resistance and DC voltage directly from the display.

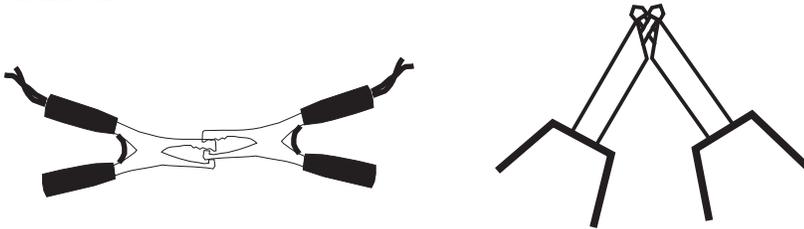
Note : When the measured DC voltage or battery internal resistance value is over range, "OL" is displayed.

When the AC test current faults, "- - -" will be displayed.

REL Zero Adjust

The **REL** function zeros the selected range of resistance and voltage. The reading displayed when the REL button is pressed will be taken as zero and will be used to calibrate subsequent measurements.

1. Short the 4 tips of red and black test leads probe terminals.
2. Press **REL** button. The display shows , then the resistance and voltage value is zero, connect the test leads probe to the battery to be tested.
3. The zero adjustment is valid only for the currently selected range, as long as the power remains on.



Comparator (99 sets)

The comparator function compares the measured values with preset High and Low limit values for internal resistance and voltage level, and determines the range that the measurement should fall into. Then, according to the following conditions, lights the corresponding LED, and sounds a beeper under the WARNING and FAIL cases.

Comparator Settings

1. Press and hold the "SET" button for 2 seconds, the display will show **COMP.SET** indicating the comparator mode is enabled.
2. Use the ▲ or ▼ button to change the comparator number from 01 up to 99.
3. Use the **V-RANGE** or **Ω-RANGE** button to set the desired voltage and resistance measured range.
4. Press ▶ button one time, **LOW** and the left two digits of the low limit resistance will be flashing. (Use the ▲ & ▼ buttons to select the desired value.)
5. Press ▶ button one time, the right two digits of the low limit resistance will be flashing. (Use the ▲ and ▼ buttons to select the desired value.)
6. Press ▶ button one time, **HIGH** and the left two digits of the high limit resistance will be flashing. (Use the ▲ and ▼ buttons to select the desired value.)
7. Press ▶ button one time, the right two digits of the high limit resistance will be flashing. (Use the ▲ and ▼ buttons to select the desired value.)
8. Press ▶ button one time, the left two digits of the threshold voltage will be flashing. (Use the ▲ and ▼ buttons to select the desired value.)
9. Press ▶ button one time, the right two digits of the threshold voltage will be flashing. (Use the ▲ and ▼ buttons to select the desired value.)
10. Repeat step 2 to step 9 to set the next comparator number.
11. Press SET button again to exit from comparator setting mode.

Comparator Tables

Resistance		Low limit resistance		High limit resistance	
		Lo	Middle	Hi	Hi
Voltage	Lo	WARNING Beeper	WARNING Beeper	FAIL Beeper	
Comparison	→				
Value	Hi	Pass	WARNING Beeper	FAIL Beeper	

Comparator Start / Stop Controls

1. Press **SET** button to start comparator function, the **COMP** indication will appear on the display, and the comparator will be operating once the measurements are taken.
2. Press ▲ and ▼ buttons to select the desired comparator number. The selected comparator number remains in memory even when the power is turned off.
3. Press **•••** button to set the beeper on, the **•••** indication will appear on the display, and the beeper will sound with a WARNING or FAIL result. Press **•••** button again to disable the beeper.
4. Press SET button again to disable the comparator function.

Datalogging

Manual Data Logging (999 sets)

1. Log the reading one by one to the memory by pressing the **M MEMORY** button. "DATA M NO XXX" will appear on the LCD for one sec. to indicate the memorized location.
2. Press **R READ** button to review the logged readings. The display will show "DATA R NO XXX".
3. Press The **▲** and **▼** buttons to scroll through the logged readings.
4. Press **R READ** button again to stop viewing logged readings.

Continuous Data Logging

1. Press **HOLD** button for 2 seconds, the display will show **INTV**.
2. Using **▲** or **▼** button, select the desired interval time from 1 second to 255 seconds.
3. Press **SET** button to exit interval time setting.
4. Press **M MEMORY** button for 2 seconds to enter continuous logging mode, the display will show **M**.
5. The **M** will flash every time a reading is stored.
6. Press **M MEMORY** button again to exit continuous logging mode.
7. Data stored using continuous datalogging can not be read directly on the tester's display, it must be downloaded to a PC using the supplied software.

Erasing Memory

When memory is full, "Full" symbol will appear on the display and logging will stop.

1. Press **ⓘ** button to turn off the tester.
2. Press and hold the **MEMORY** button, then press the **ⓘ** button. The display will indicate "CLR" and all datalogged readings will be cleared from memory.

Software

The supplied software can download and display real time readings and also download and display readings stored in memory.

PC Requirements

- 486-33 IBM compatible PC or better
- One CD-ROM drive
- Available serial port.
- Windows 95, 98, 2000, NT, ME, XP Operating System

Installing the Windows Application Program

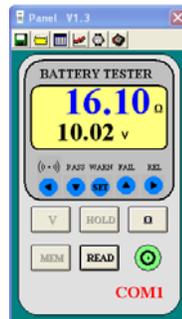
1. Connect the RT100 to the serial PC port (COM1 or COM2) using the 9-pin female connector to the 9-pin male serial PC port cable supplied.
2. Place the supplied software CD in the PC CD-ROM drive
3. Wait for "Autorun" to start and follow the on-screen instructions
4. If "Autorun" does not start, click on "Start" then "Run". Type the drive letter of the CD-ROM and :\\B\\Disk1\\Setup.exe and click OK (To install the LabVIEW version, type the drive letter and :\\LV\\installer\\Setup.exe and click OK).
5. Change the path if necessary or choose install the program to its default location.
6. Launch the program by double clicking the program file in the location where it was saved during installation.
7. Remember not to run the supplied software until the meter is properly connected to the PC.

Software Operation

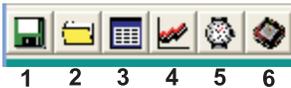
Click "Start" on the Start menu, click "Programs" and then click on "BatTester" to launch the program. The COM Port screen will appear. Select COM1 or COM2 then click OK



The Battery Tester main screen will appear. On the lower right of the screen, "COM1" or "COM2" will appear if a connection has been accomplished. "No COM" will appear if there is no connection.



The function of the Main screen icons are:



1. Opens the "Save As" dialog box to save data.
2. Opens the "Open" dialog box to open a saved file.
3. Opens the "Real Time List" display box
4. Opens the "Real Time Graph" of the voltage and resistance.
5. Opens the "Real Time Sampling Rate" dialog box
6. Opens the "Data Logger" box and downloads the data.
7. Opens the "Manual Records" box and downloads the data.

Real Time Displays

Data can be downloaded from the meter in “real time” and displayed as a List, a Voltage graph or a Resistance graph.

No.	Date	Time	400hm	4Voltage
10	2004/09/30	10:16:54	15.43	9.95
11	2004/09/30	10:16:56	15.42	9.95
12	2004/09/30	10:16:58	15.46	9.95
13	2004/09/30	10:17:00	15.42	9.95
14	2004/09/30	10:17:02	15.41	9.95
15	2004/09/30	10:17:04	15.45	9.95
16	2004/09/30	10:17:06	15.42	9.95
17	2004/09/30	10:17:08	15.42	9.95
18	2004/09/30	10:17:10	15.42	9.95
19	2004/09/30	10:17:12	15.43	9.95
20	2004/09/30	10:17:14	15.43	9.95
21	2004/09/30	10:17:16	15.42	9.95
22	2004/09/30	10:17:18	15.43	9.95
23	2004/09/30	10:17:20	15.42	9.95
24	2004/09/30	10:17:22	15.42	9.95
25	2004/09/30	10:17:24	15.43	9.95
26	2004/09/30	10:17:26	15.44	9.95
27	2004/09/30	10:17:28	15.41	9.95
28	2004/09/30	10:17:30	15.42	9.95



Real Time Sampling Rate

The sampling rate for real time data acquisition can be set from 1 sample per second to 1 sample every 86400 seconds (1 sample every 24 hours).

Note: This sampling rate is for downloading data directly to the pc. The sample rate for the meter's internal memory is set using the front panel controls.

Input Sampling Time

Enter the SAMPLING TIME in seconds
(1 <= t <= 86400)

2

OK Cancel

Data Logger

The internal memory stores data in files. Each file is created when a datalogging session is started and then stopped using the MEMORY button. The Data Logger screen lists each file (1, 2, 3, ...) with the ohms range, voltage range, sampling time and the number of records stored in the file.

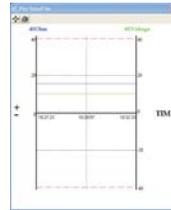
Click on one of the numbered files and the “Input Starting Time” box appears. The meter does not have a real time clock so this is an opportunity to enter the time when recording was started. If no time is entered, the pc's current clock data will be applied to the data.

Memory Size: 48.0 K Remained: 46.2K 100.0% Completed

No.	Ohm Range	V Range	Sampling	Records
1	400hm	4Voltage	2	6
2	40hm	4Voltage	2	4
3	400hm	40Voltage	2	156
4	400hm	40Voltage	2	3

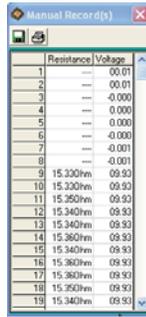
The recalled data can be listed, graphed and saved as file

No.	Date	Time	400hm	4Voltage
1	2004/09/30	10:27:22	15.46	9.95
2	2004/09/30	10:27:25	15.43	9.96
3	2004/09/30	10:27:27	15.49	9.96
4	2004/09/30	10:27:29	15.48	9.96
5	2004/09/30	10:27:31	15.47	9.96
6	2004/09/30	10:27:33	15.48	9.97
7	2004/09/30	10:27:36	15.50	9.96
8	2004/09/30	10:27:37	15.42	9.96
9	2004/09/30	10:27:38	15.48	9.96
10	2004/09/30	10:27:41	15.50	9.96
11	2004/09/30	10:27:43	15.45	9.96
12	2004/09/30	10:27:46	15.48	9.96
13	2004/09/30	10:27:47	15.43	9.96
14	2004/09/30	10:27:49	15.50	9.97
15	2004/09/30	10:27:51	15.43	9.97
16	2004/09/30	10:27:53	15.50	9.97
17	2004/09/30	10:27:55	15.47	9.96
18	2004/09/30	10:27:57	15.45	9.97
19	2004/09/30	10:27:58	15.48	9.96



READ Button

Data stored manually (single press of the MEMORY button) can be downloaded by clicking on the READ button. The data can be viewed as a list, saved in a file or printed.



The screenshot shows a window titled "Manual Record(s)" with a table containing 19 rows of data. The table has two columns: "Resistance" and "Voltage". The data is as follows:

	Resistance	Voltage
1	---	00.01
2	---	00.01
3	---	-0.000
4	---	0.000
5	---	0.000
6	---	-0.000
7	---	-0.001
8	---	-0.001
9	15.320hm	09.93
10	15.320hm	09.93
11	15.350hm	09.93
12	15.340hm	09.93
13	15.340hm	09.93
14	15.360hm	09.93
15	15.340hm	09.93
16	15.380hm	09.93
17	15.380hm	09.93
18	15.350hm	09.93
19	15.340hm	09.93

Excel spreadsheet import

Saved files may be imported into Excel. In the Excel import wizard select "Delimited", "TAB" and ("") as the text qualifier.

Maintenance

Cleaning

1. Repairs or servicing not covered in this manual should only be performed by qualified personnel.
2. Periodically wipe the case with a dry cloth. Do not use abrasives or solvents on this instrument.

Do not use abrasives or solvents on this instrument.

Battery Check & Replacement

1. The **BT** symbol will be displayed when the batteries need replacement.
2.
 - a). Disconnect the test leads.
 - b). Turning off the tester.
 - c). Open the battery cover with a screw driver.
 - d). Replace the batteries
 - e). Replace and secure the battery cover.

Calibration and Repair Services

SBS, Inc. offers complete repair and calibration services for all of the products we sell. For periodic calibration, certification on most products or repair of any SBS, Inc. product, call customer service for details on services available. SBS, Inc. recommends that calibration be performed on an annual basis to ensure calibration integrity.



Support line (800) 554-2243

Product specifications subject to change without notice

For the latest version of this User's Guide, Software updates, and other up-to-the-minute product information, visit our website: www.sbsbattery.com

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