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1. INTRODUCTION

The TCT -1000 Battery Capacity Analyzer has been designed to perform automatic capacity testing of 12 and 24 Volt lead-acid batteries. This unit is capable of accurately measuring the capacity of a fully charged battery with a rating between 10 and 59 amp-hours. It is self-contained and easy to operate.

The load tester will display, in percentage, the conformance to the battery's one hour rating.

2. SCOPE

This document provides instructions on how to calibrate and operate the TCT-1000 Battery Load Tester. The calibration instruction has been broken down into the following categories:

- Calibrate Cutoff at 20.0 Volts
- Calibrate Cutoff at 10.0 Volts
- Calibrate Frequency
- Calibrate 24 Volt 10 Amp Setting
- Calibrate 24 Volt 50 Amp Setting
- Calibrate 12 Volt 10 Amp Setting
- Calibrate 12 Volt 50 Amp Setting

3. OPERATION PROCEDURE

CAUTION
Wear **SAFETY GLASSES** whenever handling batteries

3.1. Set Up

- 3.1.1. Before starting the capacity test, the battery should be fully charged per manufacturer's instructions.
- 3.1.2. The load tester must be located in an atmosphere that is free of combustible material and gasses.
- 3.1.3. The POWER switch – see picture below, must be in the "OFF" position.

3.2. Operation

- 3.2.1. Connect the RED cable to the POSITIVE terminal and the BLACK cable to the NEGATIVE terminal.



- 3.2.2. Turn the POWER switch “ON”
- 3.2.3. Set the one hour capacity (see Tables 1 and 2) using the switches  located under the RATING display window.
- 3.2.4. Press the  button located on the right of the tester above the GILL logo.
- 3.2.5. After the battery has been discharged to the appropriate end voltage (10V for a 12V battery and 20V for a 24V battery), the unit will terminate the testing and the CAPACITY window will display the actual capacity in percentage of the one hour rating of the battery.
- 3.2.6. Turn the POWER switch “OFF” and disconnect the cables from the battery terminals.
- 3.2.7. The battery must meet the minimum requirements specified by the manufacturer.
- 3.2.8. Recharge the battery before placing it in service.



Table 1
VRLA Battery Capacity Ratings


Battery Type	Battery Voltage (V)	One Hour Rate (A)	30 Minute Rate (A)
G-242S	24	10	17
7025-20	12	20	32
7035-28	12	28	45
7243-14	24	14	22
7243-16	24	16	25
7243-16T	24	14	22
7641-20	24	20	35
7639-25	24	25	40
7639-27	24	27	45
7639-30LT	24	30	50
7639-34	24	34	55
7638-36	24	36	63
7638-38HT	24	38	63
7638-44/T	24	44	70
7638-48P	24	48	75
7638-53	24	53	80
7407-28	24	28	45

Table 2
Flooded Battery Capacity Ratings

Battery Type	Battery Voltage (V)	One Hour Rate (A)	30 Minute Rate (A)
G-25	12	18	30
G-35 and 35M	12	23	40
G-240*	24	8	13
G-241*	24	8	13
G-242	24	10	17
G-243	24	10	17
G-244	24	18	30
G-245	24	18	30
G-246	24	19	32
G-247	24	19	32
G-639E/C	24	24	40
G-641E	24	18	30
G-6381E/C	24	43	70
G-640C	24	14	25
GE-50E/C	24	31	55
GE-51E/C	24	22	35
GE-54E/C	24	10	16
G-88	12	65	108

*

Note: 30 minute rate must be used for these battery types.

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4. CALIBRATION

4.1. TEST EQUIPMENT

- 4.1.1. TCT-1000 Battery Capacity Analyzer Test Fixture: Kelly Aerospace P/N 20758 Test Fixture (Pictured at right)
- 4.1.2. Battery: 24 Volt, fully charged per Manufacturer's recommendation
- 4.1.3. Battery: 12 Volt, fully charged per manufacturers recommendation
- 4.1.4. DC Power Supply: Capable of at least 24 volts and 20 amps with course and fine voltage adjustments
- 4.1.5. Battery Chargers: 4.1.5 (a) or 4.1.5 (b)
 - a. (1) 12 Volt Charger & (1) 24 Volt Charger
 - b. (1) At least one DC Power Supply capable of 28 volts or any other means for charging batteries to manufacturer's recommendation.
- 4.1.6. Calibrated FLUKE 87 or Equivalent Multi-meter with DC volts & milli-volts ranges (DVM)
- 4.1.7. Stop watch
- 4.1.8. Small common screwdriver for adjusting P1 through P4 calibration pots
- 4.1.9. Miscellaneous hand tools for connecting Test Fixture to batteries and power supply.
- 4.1.10. Photocopy of Page 8 showing Records table with blank values in Measured Value, Pass & Fail columns



5 CALIBRATION PROCEDURE

5.1 Connections

- a. Connect 20758 test fixture to 24 volt 20 amp power supply by connecting the red lead to positive terminal of power supply and the black lead to the negative terminal of power supply.
- b. Plug the connector for the 20758 test fixture into the TCT-1000 connector.
- c. Connect the DVM leads to the power supply leads.
- d. Record the DVM calibration expiration date in the blank below the Records table.

5.2 20.0 Volt Cutoff

- a. It may be necessary to repeat procedure 5.2. & 5.3 until all values fall within range. When this is necessary there will be interim values that do not need to be recorded in the Records section. The "final" readings to be recorded are the readings in which no adjustment is required to complete Procedure 5.3.
- b. Set the DVM to DC-Volts and a range capable of measuring up to 22 volts.
- c. Turn **Power Switch** off.
- d. Adjust power supply until DVM reads 21.0 volts.

- e. Adjust the current limiting for the power supply to 20 amps or more.
- b. Turn **Power Switch** on.
- c. **24 VOLT** LED illuminates.
- d. **READY** LED illuminates.
- e. **RATING** display should be flashing at 10.
- f. Press **START** button (hold briefly for test to start, then release START button).
- g. **READY** LED extinguishes.
- h. **TESTING** LED illuminates.
- i. **RATING** LED should stop flashing and continue to read 10.
- j. Wait until **CAPACITY** display reads 001 or higher.
- k. Slowly decrease power supply voltage while monitoring the DVM.
- l. **TESTING** LED should extinguish and the **COMPLETE** LED illuminate between 19.80 volts & 20.20 volts (as indicated by the DVM).
- m. If that voltage falls below 19.80 volts turn P4 Clock-wise (CW), if that voltage is above 20.20 volts turn P4 Counter-clockwise (CCW).
- n. If P4 required adjustment repeat procedure 5.2 until no adjustment is required.
- o. Enter the final voltage reading in the "Measured Value" column in the "20.0 Volt Cutoff" row in the Records table.

5.3 10.0 Volt Cutoff

- a. Turn **Power Switch** off.
- b. Adjust power supply until DVM reads 11.0 volts.
- c. Turn **Power Switch** on.
- d. **12 VOLT** LED illuminates.
- e. **READY** LED illuminates.
- f. **RATING** display should be flashing at 10.
- g. Press **START** Button (hold briefly for test to start, then release START button).
- h. **READY** LED extinguishes.
- i. **TESTING** LED illuminates.
- j. **RATING** LED should stop flashing and continue to read 10.
- k. Wait until **CAPACITY** display reads 001 or higher.
- l. Slowly decrease power supply voltage while monitoring the DVM.
- m. **TESTING** LED should extinguish and the **COMPLETE** LED illuminate between 9.90 volts & 10.10.10 volts (as indicated by the DVM).
- n. If that voltage falls below the 9.90 volts turn P4 CW, if that voltage is above 10.10 volts turn P4 CCW.
- o. If P4 required adjustment repeat procedures 5.2. & 5.3 until no adjustment is required.
- p. Enter the final voltage reading in the "Measured Value" column in the "10.0 Volt Cutoff" row in the Records table.

5.4 Frequency

- a. It may be necessary to repeat procedure 5.4 until all values fall within range. When this is necessary there will be interim values that do not need to be recorded in the Records section. The “final” readings to be recorded are the readings in which no adjustment is required when calibration finishes Procedure 5.4.
- b. Turn **Power Switch** off.
- c. Adjust power supply to 24 Volts.
- d. Turn **Power Switch** on.
- e. **24 VOLT** LED illuminates.
- f. **READY** LED illuminates.
- g. **RATING** display should be flashing at 10.
- h. Press **START** button (hold briefly for test to start, then release START button).
- i. **READY** LED extinguishes.
- j. **TESTING** LED illuminates.
- k. **RATING** LED should stop flashing and continue to read 10.
- l. Wait until **CAPACITY** display reads 001 or higher.
- m. With a stopwatch, measure the time interval for the **CAPACITY** display to increase by 10 units. For example, measure the amount of time from the instant the display changes to 003 until the instant it changes to 013.
- n. The period of the interval should be 357 to 363 seconds.
- o. If that time falls below the 357 seconds turn **P1** CCW, if that time is above 363 seconds turn **P1** CW.
- p. If **P1** has been adjusted repeat procedure 5.4 until no adjustment is required.
- q. Enter the final time in the “Measured Value” column in the “Frequency” row in the Records table.
- r. Turn **Power Switch** off.

5.5 Connections

- a. Plug the DVM leads into the 20758 test fixture terminal jacks. The positive lead in the red jack and the negative lead in the black jack.
- b. Plug the connector for the 20758 test fixture into the TCT-1000 connector.

5.6 24 Volt 10 Amp Setting

- a. It may be necessary to repeat procedure 5.6, 5.7, 5.8 & 5.9 until all values fall within range. When this is necessary there will be interim values that do not need to be recorded in the Records section. The “final” readings to be recorded are the readings in which no adjustment is required when calibration finishes Procedure 5.9.
- b. Connect 20758 test fixture to a fully charged 24-volt battery by connecting the red lead to the positive terminal and the black lead to the negative terminal.
- c. Set the DVM to DC-Volts and a range capable of measuring up to 20 mV.
- d. Turn **Power Switch** on.

- e. **24 VOLT** LED illuminates.
- f. **READY** LED illuminates.
- g. **RATING** display should be flashing at 10.
- h. Press **START** button (hold briefly for test to start, then release START button).
- i. **READY** LED extinguishes.
- j. **TESTING** LED illuminates.
- k. **RATING** LED should stop flashing and continue to read 10.
- l. DVM should read 9.8 mV – 10.2 mV.
- m. If it reads within range, record the final value read in the “Measured Value” column in the “24 Volt 10 Amp Setting” row in the Records table.
- n. If the reading is below 9.8 mV turn P3 CW until it reads 10.0 mV, if that voltage is above 10.2 mV turn P3 CCW until it reads 10.0 mV.
- o. Turn **Power Switch** off.

5.7 24 Volt 50 Amp Setting

- a. Set the DVM to DC-Volts and a range capable of measuring up to 100 mV.
- b. Turn **Power Switch** on.
- c. **24 VOLT** LED illuminates.
- d. **READY** LED illuminates.
- e. **RATING** display should be flashing at 10.
- f. Using left ▲ to set 10’s digit, set **RATING** display to 50.
- g. Press **START** button (hold briefly for test to start, then release START button).
- h. **READY** LED extinguishes.
- i. **TESTING** LED illuminates.
- j. **RATING** LED should stop flashing and continue to read 50.
- k. DVM should read 49.6 mV – 50.4 mV.
- l. If it reads within range, record final value read in the “Measured Value” column in the “24 Volt 150 Amp Setting” row in the Records table.
- m. If the reading is below 9.8 mV turn P2 CW until it is within range, if that voltage is above 50.4 mV turn P2 CCW until it is within range.
- n. Turn **Power Switch** off.
- o. If P2 has been adjusted go back and repeat procedures 5.6 & 5.7 until no adjustment is required.

5.8 12 Volt 10 Amp Setting

- a. Connect 20758 test fixture to a fully charged 12 volt battery by connecting the red lead to the positive terminal and the black lead to the negative terminal.
- b. Set the DVM to DC-Volts and a range capable of measuring up to 20 mV.
- c. Turn **Power Switch** on.
- d. **12 VOLT** LED illuminates.
- e. **READY** LED illuminates.
- f. **RATING** display should be flashing at 10.
- g. Press **START** button (hold briefly for test to start, then release START button).


- h. **READY** LED turns off.
- i. **TESTING** LED extinguishes.
- j. **RATING** display should stop flashing & continue to read 10.
- k. DVM should read 9.8 mV – 10.2 mV.
- l. If it reads within range, record final value read in the “Measured Value” column in the “12 Volt 10 Amp Setting” row in the Records table.
- m. If the reading is below 9.8 mV turn P3 CW until it is within range, if that voltage is above 10.2 mV turn P3 CCW until it is within range.
- n. Turn **Power Switch** off.
- o. If P3 has been adjusted go back and repeat procedures 5.6, 5.7 & 5.8 until no adjustment is required.

5.9 12 Volt 50 Amp Setting

- a. Set the DVM to DC-Volts and a range capable of measuring up to 100 mV.
- b. Turn **Power Switch** on.
- c. **12 VOLT** LED illuminates.
- d. **READY** LED illuminates.
- e. **RATING** display should be flashing at 10.
- f. Using left ▲ to set 10’s digit, set **RATING** display to 50.
- g. Press **START** button (hold briefly for test to start, then release START button).
- h. **READY** LED turns off.
- i. **TESTING** LED extinguishes.
- j. **RATING** display should stop flashing & continue to read 50.
- k. DVM should read 49.6 mV – 50.4 mV.
- l. If it reads within range, record final value read in the “Measured Value” column in the “12 Volt 50 Amp Setting” row in the Records table.
- m. If the reading is below 49.6 mV turn P2 CW until it is within range, if that voltage is above 50.4 mV turn P2 CCW until it is within range.
- n. Turn **Power Switch** off.
- o. If P2 has been adjusted repeat procedures 5.6, 5.7, 5.8 & 5.9 until no adjustment is required.
- p. Disconnect unit from test fixture.
- q. Test is complete.

5.10 Records

- 5.10.1 If all values input into the records section are within range, check the corresponding space in the “Pass” column.
- 5.10.2 If any value cannot be brought within range, using this calibration procedure check the corresponding space in the “Fail” column.
- 5.10.3 If all value, are checked as “Pass”, check the space in the “Pass” column in the TCT-1000 Battery Capacity Analyzer.
- 5.10.4 Sign and date the bottom of the Records section.
- 5.10.5 Retain that sheet for your records.

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5.10.6 If any values are checked as “Fail”, check the space in the “Fail” column in the TCT-1000 Battery Capacity Analyzer.

5.10.7 Send the unit back to Teledyne Battery Products for repair or replacement.

6 RECORDS – P/N: TCT-1000; S/N: _____

TCT-1000 Battery Capacity Analyzer				
Record Name	Measured Value	Specification	Pass	Fail
20.0 Volt Cutoff		20.20 – 19.80 Volts		
10.0 Volt Cutoff		10.10 – 9.90 Volts		
Frequency (Period for 10 Unit Increase)		357 sec. – 363 sec.		
24 Volt 10 Amp Setting		9.8 – 10.2 mV		
24 Volt 50 Amp Setting		49.6 – 50.4 mV		
12 Volt 10 Amp Setting		9.8 – 10.2 mV		
12 Volt 50 Amp Setting		49.6 – 50.4 mV		

Multi-meter Calibration Expiration Date: _____

TCT-1000 Calibration performed as specified by _____; Date _____

NOTE: THE UNIT MUST BE CALIBRATED ANNUALLY.