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INSTRUCTION MANUAL for S.T.C. Model 612 6/12v Dynamic Battery Analyzer

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CONCEPT AND DESCRIPTION OF OPERATION

The Model 612 is a microcomputer controlled intelligent instrument designed to dynamically test 6 and 12 volt sealed, lead acid batteries, with capacities ranging from 2 to 24 amp-hours. While the instrument is connected to a battery, it is continually measuring the battery terminal voltage and reporting acceptable voltage ranges for various conditions. The microcomputer also controls time intervals and current levels during the dynamic load phase of the test. Throughout the remainder of this manual, all values enclosed in parentheses () refer to 6 volt mode operational values.

A battery test is accomplished in two phases:

#1. Observe the Static Test Indications

Connect the Model 612 to a battery to start the Pre-Load Static Test phase. To test the battery charging circuit, leave the charging leads connected to the battery during the first phase of this test. Once the analyzer has displayed the status of the charging circuit, a charge lead should be removed to continue testing the battery alone.

The analyzer draws its standby operating current, approximately 24 ma. (23 ma.), from the battery under test. If the battery does not have sufficient power to operate the tester, it is definitely not serviceable! During this phase of the test one of the green leds on the "OK TO TEST" bar will light indicating whether the analyzer is running in 6 or 12 volt mode. One of the four indicators beneath the "PRE-LOAD STATIC TESTING" label will also light corresponding to one of the following voltage ranges:



Yellow

CHARGE TOO HIGH/OPEN BATTERY

This indicator lights when the battery charging circuit is delivering a voltage which will damage the battery, or the battery may have an "open" cell, thereby not providing a suitable load for the charger. In either case, **this must be addressed before proceeding.**



Green

NORMAL CHARGING VOLTAGE

The indicator lights when the battery voltage is within an acceptable range of voltage for a charged battery while connected to a properly functioning charging circuit. This indicator may remain on for a short period of time after the charge circuit is disconnected as the battery voltage gradually decays to its non-charging level. **This is the normal display for a battery connected to the charging circuit.**

Some batteries will show normal voltage when checked with a voltmeter, but will not supply a significant amount of current. These batteries may display a number of unexpected results when connected to, or tested by, this Analyzer.

Listed here are some of these indications- ALL OF WHICH SHOW THAT THE BATTERY IS DEFECTIVE!

- A voltmeter reads voltage in the normal range, but no lights come on when Analyzer is connected, or one or more lights flash momentarily and then go out.
- A voltmeter reads voltage in the normal range, but the red "BAD" light shows when the Analyzer is connected.
- The static test shows "NORMAL CHARGED BATTERY", but all lights go out completely when dynamic test is initiated.
- The static test shows "NORMAL CHARGED BATTERY", but lights flicker briefly when dynamic load test is initiated, then return to the static test condition. This indicates that the Analyzer is not performing the dynamic test, but in reality the battery voltage is dropping so low under load that it resets the Analyzer to the static test mode.

The time required for any particular battery to charge from "GOOD" to "MARGINAL", and then possibly to "BAD- DO NOT USE", gives some indication of the battery's ability (or inability) to supply energy. If a battery starts the load test as "GOOD" and switches to "MARGINAL" near the end of the test (about 45-60 sec.), it is just approaching the end of its useful service life. A battery that indicates "MARGINAL" immediately upon the start of the load test is definitely suspect. Remember, this Analyzer uses only 2% of the battery's rated capacity during a single test. A fully charged, nearly new battery will indicate "GOOD" for at least 10 to 20 load cycles.

In situations where it is difficult or impractical to disconnect the battery from the charging circuit, load testing the battery while it still connected to the panel should be o.k., except where poor design of the panel or power supply allows the high load of the dynamic test to overload the charging circuit and blow a fuse. If a fuse blows during testing, disconnect the battery before testing the battery again on this panel and all other panels of identical model.

The 612 contains a high-temperature shut down circuit. When the internal temperature exceeds 140 deg. F, the Analyzer will reduce the heat producing current load and extend the test time to still draw the same total load from the battery. This extended test time can approach 15 minutes at the higher A.H settings.

During the discharge period, batteries which are beginning to fail due to high internal resistance, or which have cells which are beginning to go open, will not be able to maintain a level of voltage sufficient to keep the “GOOD” indicator on and the “MARGINAL” indicator may light, sometimes immediately upon beginning of the Dynamic Load Test and sometimes after the test has been in progress for a period of time. As a general rule, the more quickly this indicator comes on, the poorer the condition of the battery due to high internal resistance. If this indicator remains flashing throughout the test interval, some charge has been retained by the battery, but the battery should not be left in service due to high internal voltage drop.

Batteries which consistently test “MARGINAL” without dropping to “BAD” during repeated Dynamic Load Tests may be serviceable in some light load applications. The continued use of a battery which tests “MARGINAL” is definitely not recommended. The “MARGINAL” indication is a sign of an impending failure.

***The “BAD” indicator will flash during the discharge period if the battery voltage is less than 11.1 volts (5.5). After this indicator has flashed for 5 seconds, the analyzer will stop discharging the battery and begin flashing this indicator rapidly to show that the battery is not serviceable. Replace the battery.

This indicator generally comes on if the battery is unable to accept or hold a charge, or if it has open cells, or a very high internal resistance. **Under no circumstances should a battery be returned to service which is thought to be charged and tests “BAD”.**

SIGNIFICANT INSIGHTS

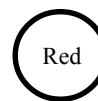
USE ONLY THE SUPPLIED TEST LEADS. The voltage drop across the test leads is calibrated and is part of the parameters used to perform the test. Do not use any other test leads!

Batteries with ratings larger than 12 Amp Hours can be checked by sequentially performing 2 or more load tests by using additive testing where the total of the tests equals or slightly exceeds the battery’s rating. For example, to check a 24 Amp Hour battery, perform two 12 A/H tests. If the Analyzer becomes too warm to hold during the testing, wait a few minutes between tests to allow the unit to cool. If you can still hold it, it is OK to proceed.



NORMAL CHARGED BATTERY

This indicator lights when the battery voltage is within the acceptable range for a charged battery, disconnected from the charger, and supplying a small load. If this indicator is on while the charging circuit is connected, it may be an indication that the charging circuit cannot supply sufficient voltage to fully charge the battery. **This is the normal indication for just the battery connected to the Model 612.**



NO CHARGING/TOO LOW TO USE

This indicator lights when the battery voltage is less than acceptable signifying that the battery is not charged or could not hold or accept a charge. If the charging circuit is connected to the battery while giving this indication, then that circuit may not be functioning or the battery may have one or more shorted cells. **This indicates a significant problem that must be addressed.**

The specific meaning of each of these indications is further explained under General Comments in the “Results and Interpretations” section.

#2 Perform Dynamic Load Test

After observing the indications during the Pre-Load Static Test phase, the technician may initiate the Dynamic Load Test phase by depressing one of the blue keys located below the “BATTERY SIZE A/H” label. Depressing one of these keys causes the Model 612 to draw a significant load current depending on the battery’s ampere-hour rating for a time interval calculated to drain a percentage of the battery’s storage capacity. The specific discharge rate and time are determined by the microcomputer, based on the ampere-hour rating. **Choose a value equal to the battery’s amp-hour rating (round up to the next value as needed).**

During this phase of the test, the green “OK TO TEST” light will go out and one of the bottom three indicators beneath the “TEST RESULT - DYNAMIC LOAD” label will begin to flash displaying the voltage range of the battery while under load. When the specified test interval ends, the indicator corresponding to the analyzer’s final determination of battery condition will flash rapidly. The voltage ranges for these indicators are as follows:



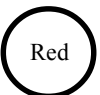
GOOD

On a healthy and properly charged battery, this indicator will flash while current is being drawn and flash rapidly after the load test stops, signifying that battery voltage is 12.0 (6.0) volts or greater. When this and the green “OK TO TEST” indicator are flashing, another Dynamic Load Test may be initiated by depressing the appropriate blue “A/H” select key.



MARGINAL

When testing a battery with an incomplete charge or reduced capacity, this indicator will flash while discharge current is being drawn and flash rapidly after the current draw stops, signifying that battery voltage is between 11.1 and 12.0 (5.55 and 6.0) volts. While this and the “OK TO TEST” are flashing, another Dynamic Load Test may be initiated by depressing the appropriate blue “A/H” select key.



BAD

On a poorly charged battery or one which has severely reduced capability, this indicator will flash while discharge current is being drawn, signifying that the battery voltage is less than 11.1 (5.55) volts. If the battery voltage remains in this region for five seconds, the discharge will stop and the indicator will begin to flash rapidly. The analyzer will not respond to a request for additional testing without first disconnecting the test leads to return to the Pre-Load Static Test.

The dynamic Load Test judges a battery’s ability to supply currents which may be required during backup conditions. This test removes approximately 2% of the battery’s rated capacity and may be repeated as needed to determine how the battery holds up at various percentages of discharge. For example, choosing to retest 3 times would discharge the battery by six percent of its rated capacity and give an indication of its performance after a high level discharge.

When testing high capacity batteries or performing high level discharges using the Model 612, remember that a great deal of heat is generated. The Model 612 is designed to withstand these high temperatures and has a high temperature shut down, but adequate ventilation of the area surrounding the analyzer should be maintained or the unit could heat sufficient to cause damage to heat sensitive surfaces. CARE SHOULD ALSO BE TAKEN WHEN HANDLING THE TESTER AFTER HIGH LEVEL TESTS TO AVOID BURNS.

charged, the charger may not be putting out sufficient voltage to fully charge the battery, or the battery may not be in a fully charged state, thereby loading the charger.

When a battery is removed from charge, the float voltage to which it had been charged will decrease to be within this range. If the voltage does not decrease, then the charger probably was not turned off or disconnected.

With the light loading imposed by the analyzer during the static portion of the test, the voltage of a properly charged battery should not fall below this region.

****”NO CHARGING/TOO LOW TO USE”

If this indicator is flashing while the battery is being charged, the charger is probably defective or the battery is shorted. The analyzer will not allow a Dynamic Load Test to be initiated if this indicator is flashing. There is no point in further testing a battery which has already tested bad with the static load. Replace the battery and test again.

DYNAMIC LOAD TEST

During the Dynamic Load Test, one of three indicators beneath the “TEST RESULT-DYNAMIC LOAD” label will flash to show battery condition. The following is an overview of the significance of these indicators:

****The green “GOOD” indicator will flash slowly during the discharge period while the battery voltage remains at 12.0 (6.0) volts or greater, indicating a good battery. If, after the discharge period, the voltage remains in this region, the indicator will flash rapidly. Another test may be performed at this time.

Batteries having high internal resistance or an open cell will not be able to maintain this level of voltage at the loads imposed by the analyzer. If a battery can withstand several cycles of the Dynamic Load Test with this being the only indicator flashing, the battery is performing well under what is considered to be a high load current test for a lead acid battery. The battery is indicated to be suitable for service.

****The yellow “MARGINAL” indicator will flash slowly during the discharge period if the battery voltage is between 11.1 and 12.0 volts (5.55 and 6.0). After the discharge period, this indicator will flash rapidly if the battery voltage remains within these limits.

During the load test, the red “BAD” indicator shows that a battery is definitely bad and must be replaced.

GENERAL COMMENTS

PRE-LOAD STATIC TEST

During Pre-Load Static Test, one of four indicators beneath the “PRE-LOAD STATIC TESTING” label will light to show battery condition. The following is an overview of the significance of these indicators:

****”CHARGE TOO HIGH/OPEN BATTERY”

Charge voltage in this range will overcharge the battery, thereby significantly reducing its useful life and ability to retain a charge at its rated capacity. Since most battery chargers for lead acid batteries are designed to operate in the constant voltage mode, this indication is generally a sign of a defective or improperly adjusted charging circuit. In some instances an open circuit battery will allow charger circuit voltage to rise above this level. If the battery tests good, then the problem lies in the charger. If the battery test bad, then the charger may have contributed to it’s failure. Replace the battery. After allowing the replacement battery to charge, repeat the test. If the yellow indication persists investigate the possibility of a malfunctioning charger before damage is done to the replacement battery.

Some alarm panels are known to overcharge the batteries on a routine basis and have no adjustments to correct this fault. When this is the case there is no choice but to periodically test the battery and replace it as necessary.

A normal battery is not capable of sustaining an output voltage at this level under any condition. If this indicator remains on, then the charger is still somehow supplying charge voltage to the battery.

****”NORMAL CHARGING VOLTAGE”

This voltage range is adequate to fully charge a lead acid battery. When this indicator is on, and the battery subsequently test good, then the charging system is performing satisfactorily.

If the charger is disconnected from the battery while this indicator is on, it may remain on for a brief period of time as the surface charge is removed before the indicator switches to “NORMAL CHARGED BATTERY”.

****”NORMAL CHARGED BATTERY”

This indicator should light within seconds of disconnecting the charger from the battery. Note that if this indicator is on while the battery is being

The specific meanings of each of these indications is further explained under General Comments in the “results and Interpretations” section.

TEST PROCEDURES:

The following is a recommended step by step procedure for checking a battery installed in an alarm panel. This method will test the battery and the charging system. **It is assumed that the battery has been connected to the panel and that the system has been operating for a period of time sufficient to fully charge the battery.**

Note that while the analyzer is connected to the battery at least one of the indicators on the analyzer should be on. Only two indicators will remain on solid at any time. If the indicators flash erratically or more than two indicators remains on solid there is insufficient voltage for analyzer operation. Do not proceed with test, the battery or the charging circuit is defective. See recommendations under the Significant Insights section.

- A. While the battery is connected to the charging circuit, connect the test leads of the Model 612 to the battery: red lead to the battery positive terminal and black lead to the battery negative terminal (The analyzer will not operate if polarity is reversed).
- B. **Pre-Load Static Test**
 1. Observe the indicators on the analyzer. One of the green “OK TO TEST” indicators should be on as well as one of the four indicators directly beneath the “PRE-LOAD STATIC TESTING” label, indicating status of the battery voltage. The green “NORMAL CHARGING VOLTAGE” indicator should be on, indicating that the analyzer is operating and that the battery voltage is within the range expected for a fully charged battery under normal charging conditions. If one of the other indicators is on refer to #2 in the Results and Interpretations section of this manual.
- C. Disconnect the battery from the panel charging circuit and reconnect the analyzer test leads to the battery, red to positive and black to negative. Observe the indicators on the analyzer. The green “OK TO TEST” indicator should be on and the green “NORMAL CHARGED BATTERY” indicator beneath the “PRE-LOAD STATIC TESTING” label should be on, indicating that the battery voltage is within the range expected for a fully charged battery operating under light load conditions. The green ”NORMAL CHARGING VOLTAGE” indicator may remain on for a brief period as the surface charge is drained from the battery.

If the indicators are as described, continue with the Dynamic Load Test in the next step. If one of the other indicators is on, refer to #4 in the results and Interpretations section of the manual.

D. Dynamic Load Test

1. Depress and release the blue key under the “BATTERY SIZE A/H” label nearest in value to the capacity of the battery being tested (always round up). The green “OK TO TEST” indicator will go out, the indicator beneath the “PRE-LOAD STATIC TESTING” label will turn off and one of the three indicators beneath the “TEST RESULT-DYNAMIC LOAD” label will begin to flash slowly indicating that the Dynamic Load Test is in progress. The green “GOOD” indicator should flash throughout the test interval.

2. After the test interval, the green “GOOD” indicator should start flashing rapidly and the green “OK TO TEST” indicator will come on, showing that another Dynamic Load Test can be performed on the battery. If the “GOOD” indicator has functioned as described throughout the test interval and flashes rapidly after the interval, then the battery has tested good and is able to supply at least the tested percentage of its rated capacity at a high rate of discharge, while holding an acceptable voltage level. If the yellow “MARGINAL” or the red “BAD” indicator is flashing rapidly, see #6 in the results and interpretation section of this manual.

3. If the battery has performed as described in the previous steps, the battery may now be reconnected to the panel and returned to service, or a more exhaustive test may be performed by again depressing the blue “A/H” select key appropriate to that battery. This will initiate another Dynamic Load Test, incrementally discharging the battery in 2% of capacity steps as desired. Fire alarm system batteries should be tested to at least 4% of their rated capacity, and 6 - 8% is recommended.

TEST COMPLETE

RESULTS AND INTERPRETATIONS

TEST SPECIFIC COMMENTS

When a good, fully charged battery is being properly float charged, the green “NORMAL CHARGING VOLTAGE” indicator will be on.

If the yellow “CHARGE TOO HIGH/OPEN BATTERY” indicator is on the battery is being overcharged. The battery will subsequently test “GOOD”, but may be damaged by continued overcharge. If possible, readjust the charger to 13.7 (6.85) volts at normal room temperature. This could also be an indication of an open cell.

If the green “NORMAL CHARGED BATTERY” indicator is on while the battery is being charged, the battery may not be fully charged or the charger may not be adjusted to provide sufficient charge voltage to the battery. If the battery has been on charge for 24 hours or longer AND if the battery test “GOOD” throughout the remainder of the test, readjust the charger to 13.7 (6.85) volts at normal room temperature if possible.

If the red “NO CHARGING/TOO LOW TO USE” indicator is flashing, the charger is not functioning properly or the battery has a shorted cell. Replace the battery with a good charged battery. If the “NORMAL CHARGING VOLTAGE” indicator comes on, then the battery was shorted and the charger circuit is probably OK. If the “NORMAL CHARGED BATTERY” indicator comes on and remains on, then the charger is not charging the battery properly and this problem should be investigated. If the red “NO CHARGING/TOO LOW TO USE” indicator remains on there may be an overload in the system draining more current than the battery and its charger can supply, or the panel charging circuit may require service.

If the red “NOT CHARGING/TOO LOW TO USE” indicator is flashing, the battery has not accepted a charge, or has a very high internal resistance, or an open cell: **replace the battery.**

During the load test, the yellow “MARGINAL” indicator shows that a battery probably has a high internal resistance and will not be suitable for use at high current load. It is also possible that the battery may not be capable of sustaining even light loads for a useful period of time. It is advisable to replace batteries with this characteristic. See the General Comments section for more information.

