Operating & Instruction Manual

TILT II & QUICK-CHECK
TRANSFORMER & CAPACITOR TESTERS
WITH AUTOMATIC SELF TEST

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IMPORTANT SAFETY INFORMATION

WARNING: The TILT II and Quick-Check Transformer and Capacitor Testers should be used only on equipment known to be deenergized and/or discharged.

CAUTION: Use on the secondary side of transformers may generate high voltages on the primary side. Stay clear of all primary connections while testing.

The Quick-Check Transformer and Capacitor Testers will not leave a significant charge on a capacitor.

OPERATIONAL IMPAIRMENT: If the Testers are used in a manner not described in this instruction manual, the protection and effective operation of this equipment may be impaired.
INTRODUCTION
The TILT II and Quick-Check Transformer and Capacitor Testers are versatile tools for quick and easy checks of transformers and the connections made to them. The Quick-Check Transformer and Capacitor Tester also tests power capacitors and capacitor banks. The transformer connections can include bundled secondaries or a cable run from the transformer to the meter.

In the field, the testers are used to test the primary and secondary sides of new or reworked, single or three phase transformer installations. The Quick-Check Transformer and Capacitor Tester also tests capacitor banks for short or open circuits prior to energizing.

In the shop the testers are used for quick screening of incoming and outgoing transformers (including their internal fuses and breakers). The Quick-Check Transformer and Capacitor Tester also tests capacitors for both shorts or opens. Both testers test 1Ø and 3Ø transformers including PT’s and other instrument transformers, and the Quick-Check Transformer and Capacitor Tester tests power capacitors in almost any size.

HOW THEY WORK
The Testers are used in the field for testing connected transformers, their connected primary and secondary leads and the Quick-Check Transformer and Capacitor Tester for power capacitors, individually or in banks, for both shorts or opens. Unlike a simple ohmmeter, the Testers use a high frequency, low voltage signal to measure transformer winding inductance (and power capacitor capacitance) and they can differentiate true shorts from other low resistance windings or connected equipment such as meters. NOTE: The TILT II and Quick-Check Transformer and Capacitor Testers will not detect a partially shorted transformer coil or an improper transformer ratio. They will not detect a capacitor with a partial short or open.

PRE-USE INSPECTION
The Testers will automatically perform a self-test of the battery, lights and beeper every time the TEST button is pushed. This self-test takes about one second to complete, after which the tester will begin testing whatever the leads are connected to. This self-test does not test the test leads and internal fuse. To test the leads and fuse, short the test leads together and press the TEST button. A rapidly blinking SHORT light after completion of the normal self-test indicates that the leads and fuse are good.

If the unit fails to operate, check or replace the battery. If this self-test is not completed, the unit will not perform any further testing and must be returned to the factory for service.
TESTING SINGLE PHASE TRANSFORMERS

For single phase transformers, use these figures as guidelines to get started. For 3Ø transformers, the test leads are connected from each phase to neutral and across each pair of phases. When all connections are proper and the transformer itself is good, the Tester will beep and show TRANSFORMER O.K. The OPEN indication designates a bad connection or an open transformer winding. A SHORT indication designates a short from phase to neutral or phase to phase in the transformer or the connections to it.

NOTE: Disconnect primaries or remove primary fuses before testing secondaries.

For the Quick-Check Transformer and Capacitor Tester and power capacitors, tests across the two bushings should show CAPACITOR O.K. On a single bushing capacitor tests from bushing to ground will also show CAPACITOR O.K. On a two bushing capacitor, tests from bushing to ground should show OPEN.

As a quick test in the shop, the Testers can be used to screen transformers by checking both primary and secondary windings and connections. Test for SHORTs on both primary and secondary windings and from primary to secondary. Test for OPENs on both primary and secondary windings to check for open windings or open breakers and fuses. Tests for power capacitors with the Quick-Check Transformer and Capacitor Tester are performed across each bushing and from bushing(s) to ground.
TESTING CAPACITORS

These instruments are intended for quick and simple testing of transformers or capacitors and the connections made to them. Do not energize visibly damaged equipment such as a transformer leaking oil or a bulged capacitor even if the Tester gives an O.K. reading.

The Testers are powered by an internal 9V lithium or alkaline battery. It is easily and quickly replaced by removing the battery cover on the back of the unit.

WARNING: The Testers should be used only on equipment known to be deenergized and/or discharged.

CAUTION: Using the Testers on the secondary side of transformers may generate high voltages on the primary side. Stay clear of all primary connections while testing.

The Quick-Check Transformer and Capacitor Tester will not leave a significant charge on a capacitor.

NOTE: For user safety there is a non-replaceable 600V internal fuse inside the instrument. If the instrument is connected to an energized transformer, the fuse will blow. The instrument must then be returned to the factory for repair.

TESTING THREE PHASE TRANSFORMERS

The TILT II and Quick-Check Transformer and Capacitor Testers should be used only on equipment known to be deenergized.

Using the Testers on the secondary side of transformers may generate high voltages on the primary side. Stay clear of all primary connections while testing.
For 3Ø transformers, the test leads are connected from each phase to neutral and across each pair of phases. When all connections are proper and the transformer itself is good, the Tester will beep and show O.K. The OPEN indication designates a bad connection or an open transformer winding. A SHORT indication designates a short from phase to neutral or phase to phase in the transformer or the connections to it.

For Y (wye) connections, test the primary and secondary sides of the transformer as follows:

- X1 - X2 Transformer O.K.
- X2 - X3 Transformer O.K.
- X1 - X3 Transformer O.K.
- X1 - X0 Transformer O.K.
- X2 - X0 Transformer O.K.
- X3 - X0 Transformer O.K.
- H1 - H2 Transformer O.K.
- H2 - H3 Transformer O.K.
- H1 - H3 Transformer O.K.
- H1 - H0 Transformer O.K.
- H2 - H0 Transformer O.K.
- H3 - H0 Transformer O.K.
- H1 - X1 Transformer O.K. if both H0 and X0 are grounded,
  otherwise OPEN
- H2 - X2 Transformer O.K.
- H3 - X3 Transformer O.K.
- H0 - X0 SHORT, if both sides are grounded, otherwise OPEN

For Δ (delta) connections, test the primary and secondary sides the same as the Y (wye) except omit the connections to X0 and H0.

The TILT II and Quick-Check Transformer and Capacitor Testers will not detect a partially shorted transformer coil or an improper transformer ratio. They are intended for quick and simple testing of transformers and the connections made to them.
TESTING DISTRIBUTION VOLTAGE REGULATORS

For typical distribution voltage regulators, test using these figures as guidelines. Both the line and load bushings tested to ground should indicate the reading shown in the figures. With the regulator in the neutral position, the line and load are internally connected with the resulting test indicating SHORT.

TESTING DISTRIBUTION TRANSFORMERS FROM METER SOCKETS

An overhead or underground distribution transformer can sometimes be more conveniently tested from a meter socket served by that transformer.

The TILT II and Quick-Check Transformer and Capacitor Testers should be used only on equipment known to be deenergized. Test both the load and source sides of the meter socket for the presence of voltage before using the Tester.

Using the Tester on the secondary side of transformers may generate high voltages on the primary side. Stay clear of all primary connections while testing. The Quick-Check Transformer and Capacitor Tester will test the secondary side of a transformer connected to the meter socket. Connect the Tester across the two source side receptacles and from each receptacle to ground and test.

NOTE: This procedure will not work if other loads are connected to the same transformer.

The wiring on the load side of the meter socket going into the main breaker can also be tested for shorts or crossed phases. Connect the Tester across the two load side receptacles and from each receptacle to ground. The absence of shorts or crossed phases will be indicated by an OPEN reading. If the main breaker is not open, connected loads within the building may cause a SHORT or TRANSFORMER O.K. indication.

The meter socket connections shown are typical. Local standards may specify different connections.
CARE AND MAINTENANCE

STORAGE - It is recommended for protection of the TILT II and Quick-Check Transformer and Capacitor Tester that it is stored in the carrying case.

CLEANING INSTRUCTIONS - To clean, wipe with a damp cloth with water. Do not use harsh chemicals or solvents.

DAMAGE - If you suspect any mechanical or electrical damage, do not use and arrange for repair by returning to the factory.

CALIBRATION & TESTING - Regular calibration is not required. There is no calibration adjustment.

WARNING: Use Only on Equipment Known to be Deenergized and/or Discharged
Automatic self test operates with each use. Check for lights and beeper when green light is on. To test leads and internal fuse, short leads together and verify blinking SHORT light. Connect the test leads to the device under test. Push the test button and observe the lights. An OK indication verifies no direct shorts or opens. OPEN indicates an open connection or high resistance leakage path. SHORT indicates a very low resistance. Using this tool on the secondary side of transformers may generate high voltages on the primary side. Stay clear of all primary connections while testing. Test transformers across all primary and secondary connections and from primary to secondary. Refer to instructions. Check the battery if unit fails to operate. Replace with 9V alkaline or lithium types. Contains a 600V fuse which is not replaceable. Return to factory for service. Maximum output voltage 6VDC.

DANGER: Failure to follow these directions or the instructions may expose the user to high voltage, severe injury or death.

HD Electric Company, Waukegan IL USA www.HDElectricCompany.com
TECHNICAL SPECIFICATIONS

MODELS
TL-AST-N, TL-AST-M, QC-AST-N, QC-AST-M

DIMENSIONS
3.6 in. W x 5.7 in. L x 1.2 in. H (9.1 cm x 14.5 cm x 3.0 cm)

WEIGHT
TL-AST-N / QC-AST-N - 1 lb., 1 oz. (0.47 kg)
TL-AST-M / QC-AST-M with magnet - 1 lb., 2 oz. (0.51 kg)

BATTERY
9V alkaline ANSI 1604A, IEC 6LR61 or 9V lithium ANSI-1604LC

OUTPUT VOLTAGE: 6VDC maximum pulsed at 50Hz nominal
SHORT: $\leq 10\Omega$, varies with battery voltage
OPEN: $\geq 10\Omega$, varies with battery voltage

TRANSFORMER O.K.: minimum inductance 800µH
CAPACITOR O.K.: (Quick-Check Transformer and Capacitor Tester only)
    - minimum capacitance 0.5µf
    - maximum capacitance 300µf

AUDIO OUTPUT: 85db at 30cm

ENVIRONMENTAL CONDITIONS
CONDITIONS: Indoor and outdoor use
ALTITUDE: Up to 6,566 ft. (2000M)
OPERATING TEMPERATURE: -20°F to +140°F (-29°C to +60°C)
HUMIDITY: 95% to +60°C (non-condensing)
POLLUTION DEGREE: PD2
ENCLOSURE MATERIAL: ABS UL 94-HB
OVERVOLTAGE CATEGORY: II Non-contact
PRINTED CIRCUIT BOARDS: FR-4 UL 94-V0

BATTERY REPLACEMENT INSTRUCTIONS
To replace the battery, open the compartment on the bottom of the housing. Remove and dispose of the old battery, replacing it with a fresh, new 9-volt lithium or alkaline battery.

MANUFACTURING LOCATION
HD Electric • Southaven, MS, 38672 USA
HD Electric Company is herein referred to either as “HDE” or “Seller” and the customer or person or entity purchasing goods or services (hereinafter collectively referred to as “Goods”) is referred to as the “Buyer”. These terms and conditions shall supersede all other communications, negotiations and prior oral or written statements regarding the subject matter hereof. No change, modification, rescission, discharge, abandonment, or waiver of these terms and conditions shall be binding unless made in writing and signed by HDE. These terms and conditions shall be the exclusive statement of the terms of the agreement governing the sale of Goods by HDE to Buyer. Buyer's acceptance of the Goods will manifest Buyer's assent to these terms and conditions without variation or addition. Any different or additional terms in Buyer's purchase order or other Buyer documents are hereby objected to. HDE reserves the right to refuse to perform under this order. Upon acceptance of this order, any terms or conditions submitted by Buyer, unless otherwise agreed to by HDE, are hereby rejected. Any current or future tax or governmental charge (or increase in same) affecting Seller's costs or production, or delivery of the Goods, or to which Seller is otherwise required to pay, shall cause the price of such Goods to be increased. Any increase or decrease in the price of such Goods shall be effective immediately upon the terms agreed to by HDE and shall be binding upon Buyer. Buyer shall be liable for all additional expenses, including attorneys' fees, relating to the collection of past due amounts. Should Buyer's financial responsibility become unsatisfactory to HDE, cash payments or security satisfactory to HDE may be required by HDE for future deliveries and for the goods therefore delivered. If such cash payment or security is not provided, HDE may discontinue deliveries.

2. TERMS OF PAYMENT: Terms are stated on HDE's invoice in U.S. currency. HDE shall have the right, at any time and from time to time, to suspend any further performance under this order and/or any other agreements with the Buyer in the event Buyer fails to make any payment when due, or to reduce or terminate any obligations of HDE to Buyer, and to engage in any other remedy, including legal action, for the collection of any amounts due to HDE.

3. SHIPMENT AND DELIVERY: Unless otherwise expressly provided, shipments are made F.O.B. HDE’s shipping point. Risk of loss or damage and responsibility shall pass from HDE to Buyer upon delivery, and receipt by Buyer. All claims for defective or damaged Goods must be submitted by the Buyer directly to the carrier. Claims or damages must be acknowledged and signed for at the time of delivery. While HDE will use reasonable commercial efforts to maintain the delivery date(s) acknowledged or quoted by HDE, all shipping dates are approximate and not guaranteed. HDE reserves the right to make partial shipments and HDE, at its option, shall be not bound to deliver the balance of any Goods not shipped. HDE shall not be liable for any failure to ship or deliver when such failure is caused by the act of God, civil commotion, strikes, labor disputes, transportation failures, or any other causes beyond HDE’s control.

4. HDE LIMITED WARRANTY: HDE covers its products with a manufacturer’s warranty against defects in material or workmanship for a period of ten years in the case of Capacitor Controls and in all other circumstances for a period of one year, unless otherwise stated by HDE in writing. To take advantage of this warranty, the complete product must be delivered prepaid to HDE or any HDE Authorized Service Center. This warranty shall not apply to any Goods but limited to products which: (a) Have been repaired or altered outside of HDE’s factory (or Authorized Service Center) or in any manner as to, in HDE’s judgment, to affect its serviceability or proper operation; (b) Have been used for purposes other than those intended by HDE; (c) Have been subjected to normal wear and tear, misuse, negligence, improper installation or operation. HDE’s obligation under this warranty, and the Buyer’s exclusive remedy for the breach thereof, shall be limited to, at HDE’s option, repair or replacement of any Goods and/or refund of purchase price. The Buyer shall not be entitled to any other claim against HDE, or any person acting on behalf of or at the direction of HDE, of any sort or nature whatsoever, whether arising from the breach of this warranty or any cause or cause of action, specifically including, without limitation, any claim for consequential, indirect, incidental, or punitive damages of any character in connection with the goods, which claim is hereby disclaimed and hereby released, whether in contract, negligence, strict liability or otherwise.

5. ASSIGNMENT: Buyer shall not assign its rights or delegate its duties hereunder or any interest herein without the prior written consent of HDE, and any such assignment, without such consent, shall be void.

6. INSPECTION/TESTING: Buyer, at its expense, agrees that it will promptly inspect the Goods upon receipt thereof, and in no event later than thirty (30) days from the date of receipt of the Goods. Buyer shall deliver to HDE within fifteen (15) days of receipt of any Goods, but in no event later than forty-five (45) days from the date of receipt of the Goods, written notice of any of and all deficiencies, defects, variations from specifications or complaints of any kind with respect to any Goods purchased from HDE. Such notice shall be in writing, and shall be accompanied by Buyer’s order number and a description of the Goods, if possible, and are deemed rejected by Buyer. HDE’s written approval for return of the Goods shall be made in accordance with and as outlined by HDE. In the event such Goods shall be deemed to be returned, HDE shall have the right to inspect and make necessary repairs. Buyer agrees to pay all expenses, including attorneys’ fees, relating to the collection of past due amounts. Should Buyer’s financial responsibility become unsatisfactory to HDE, cash payments or security satisfactory to HDE may be required by HDE for future deliveries and for the goods therefore delivered. If such cash payment or security is not provided, HDE may discontinue deliveries.

7. CHANGES: HDE reserves the right to change designs and specifications for standard Goods without prior notice to Buyer, but not with respect to custom Goods being made for Buyer. HDE shall have no obligation to install or make such change in any manufactured Goods after the date of change.

8. ASSIGNMENT: Buyer shall not assign its rights or delegate its duties hereunder or any interest herein without the prior written consent of HDE, and any such assignment, without such consent, shall be void.

9. INSTALLATION: Buyer shall be responsible for receiving, inspecting, testing, storing, installing, starting up and maintaining all Goods.

10. INSPECTION/TESTING: Buyer, at its expense, agrees that it will promptly inspect the Goods upon receipt thereof, and in no event later than thirty (30) days from the date of receipt of the Goods. Buyer shall deliver to HDE within fifteen (15) days of receipt of any Goods, but in no event later than forty-five (45) days from the date of receipt of the Goods, written notice of any of and all deficiencies, defects, variations from specifications or complaints of any kind with respect to any Goods purchased from HDE. Such notice shall be in writing, and shall be accompanied by Buyer’s order number and a description of the Goods, if possible, and are deemed rejected by Buyer. HDE’s written approval for return of the Goods shall be made in accordance with and as outlined by HDE. In the event such Goods shall be deemed to be returned, HDE shall have the right to inspect and make necessary repairs. Buyer agrees to pay all expenses, including attorneys’ fees, relating to the collection of past due amounts. Should Buyer’s financial responsibility become unsatisfactory to HDE, cash payments or security satisfactory to HDE may be required by HDE for future deliveries and for the goods therefore delivered. If such cash payment or security is not provided, HDE may discontinue deliveries.

11. COMPLIANCE: Seller/Contractor shall comply with all applicable federal, state or local laws, rules, regulations, or orders. Seller/Contractor shall comply with Executive Order 11224, as amended by Executive Order 11375, and the applicable provisions of the Office of Federal Contract Compliance Programs (OFCCP), 41 CFR Part 60, which are incorporated herein by this reference. Buyer shall comply with all applicable federal, state, or local laws, regulations or orders but not limited to the Federal Contract Compliance Programs (OFCCP), 41 CFR Part 60, which are incorporated herein by this reference. Buyer shall comply with all applicable federal, state, or local laws, regulations or orders but not limited to the Federal Contract Compliance Programs (OFCCP), 41 CFR Part 60, which are incorporated herein by this reference.

12. U.S. EXPORT CONTROL LAWS: All Goods sold to Buyer hereunder are subject to U.S. Export Control Laws. Buyer hereby agrees not to resell or divest any Goods contrary to such laws.

13. COMPLIANCE: Seller/Contractor shall comply with all applicable federal, state or local laws, rules, regulations, or orders. Seller/Contractor shall comply with Executive Order 11224, as amended by Executive Order 11375, and the applicable provisions of the Office of Federal Contract Compliance Programs (OFCCP), 41 CFR Part 60, which are incorporated herein by this reference. Buyer shall comply with all applicable federal, state, or local laws, regulations or orders but not limited to the Federal Contract Compliance Programs (OFCCP), 41 CFR Part 60, which are incorporated herein by this reference.

14. TERMS OF PAYMENT: Terms are stated on HDE’s invoice in U.S. currency. HDE shall have the right, at any time and from time to time, to suspend any further performance under this order and/or any other agreements with the Buyer in the event Buyer fails to make any payment when due, or to reduce or terminate any obligations of HDE to Buyer, and to engage in any other remedy, including legal action, for the collection of any amounts due to HDE.

15. ASSIGNMENT: Buyer shall not assign its rights or delegate its duties hereunder or any interest herein without the prior written consent of HDE, and any such assignment, without such consent, shall be void.

16. CLASS ACTION WAIVER: THIS MEANS THAT WHETHER BASED IN CONTRACT, TORT, OR OTHERWISE, EXCEPT AS OTHERWISE EXPRESSLY SET FORTH IN THIS AGREEMENT, THERE ARE NO OTHER WARRANTIES, EXPRESS OR IMPLIED. WHETHER OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR OTHERWISE. No employee, agent, dealer, or other person is authorized to give any warranty on behalf of HDE. This warranty extends only to persons or organizations who purchase the Goods from HDE for resale.

17. LIMITATION OF REMEDY AND LIABILITY: THE SOLE AND EXCLUSIVE REMEDY FOR BFREACH OF ANY WARRANTY HEREUNDER SHALL BE LIMITED TO REPAIR, CORRECTION, REPLACEMENT OR CREDIT, BUT HDE SHALL NOT BE LIABLE FOR DELAYS IN PERFORMANCE, AND IN NO EVENT, REGARDLESS OF THE FORM OF THE CLAIM OR CAUSE OF ACTION (WHETHER BASED IN CONTRACT, INFRINGEMENT, NEGLIGENCE, STRICT LIABILITY, LOSS OF PROFIT, OR OTHERWISE), SHALL HDE’S LIABILITY TO BUYER AND/OR ITS CUSTOMERS EXCEED THE PRICE PAID BY THE BUYER FOR THE GOODS (OR SERVICES) THAT ARE THE SUBJECT OF THE CLAIM OR CAUSE OF ACTION. IN NO EVENT SHALL HDE’S LIABILITY TO BUYER AND/OR ITS CUSTOMERS INCLUDE SPECIAL, INDIRECT, INCIDENTAL, CONSEQUENTIAL OR PURGATIVE DAMAGES OF ANY CHARACTER IN CONNECTION WITH THE SALE OF THE GOODS (OR SERVICES) THAT ARE THE SUBJECT OF THE CLAIM OR CAUSE OF ACTION. ANY AND ALL CLAIMS BY THE BUYER AGAINST OTHERS, OR LITIGATE IN COURT OR ARBITRATE ANY CLAIMS AS A REPRESENTATIVE OR MEMBER OF A CLASS OR IN A PRIVATE ATTORNEY GENERAL CAPACITY. ADMINISTRATION OF ARBITRATION WILL BE IN ACCORDANCE WITH THE RULES OF THE ARBITRATOR, THE BUYER, AND THE ARBITRATOR. ADMINISTRATION OF ARBITRATION IS LIMITED TO THE DISPUTES (INCLUDING PROCEEDING TO MITIGATE COSTS OF TRAVEL). This binding arbitration is governed by the Federal Arbitration Act ("FAA") (9 USC §1, et. seq.) and will govern the interpretation and enforcement. The binding arbitration will be administered by a neutral third-party arbitrator and the proceedings will be conducted in accordance with the rules of the American Arbitration Association ("AAA") in accordance with its Commercial Arbitration Rules and/or Supplementary Procedures for Consumer-Related Disputes (collectively, the "AAA Rules"). By agreeing to this Agreement ("FAA") You ("Buyer") are granting HDE the power (whether or not this Agreement is exercised or otherwise) to have the arbitrator confirm the decision of the arbitrator. The arbitrator shall be held at a location determined by AAA or at such other location as mutually agreed. In addition to the terms stated above, the following will apply to the binding arbitration: (1) the arbitrator, and not any federal, state, or local government or agency, will have exclusive authority to resolve any disputes relating to the interpretation, applicability, enforceability or formation of this Agreement including any claim that all or any part of this Agreement is void or voidable; (2) the arbitrator shall apply Illinois law consistent with the FAA.

HD Electric Company is committed to ongoing review and improvement of its product lines, and thus reserves the right to modify product design and specifications without notice.