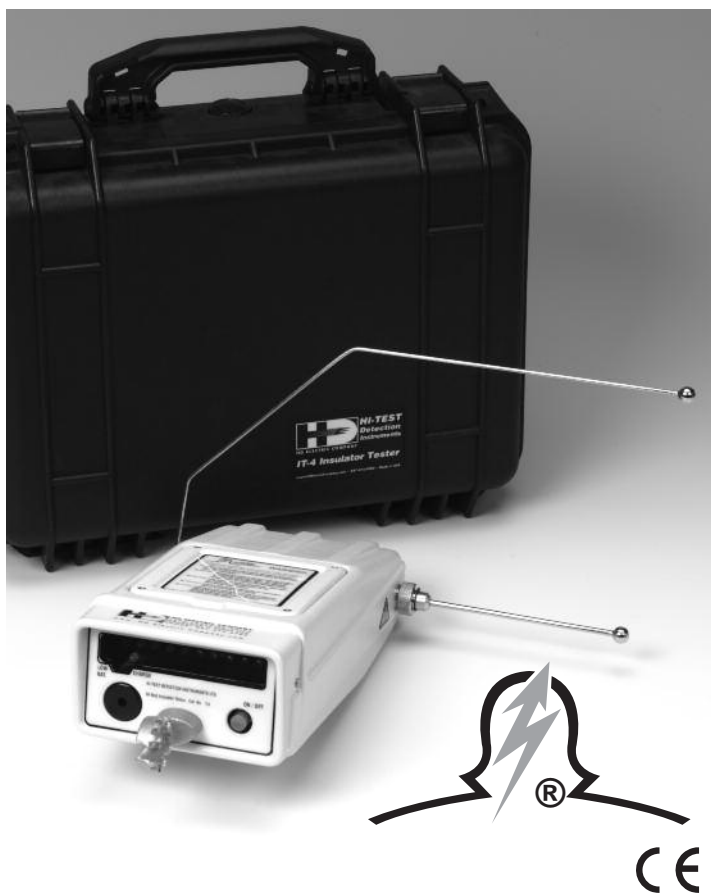


IT-4

HI-TEST® INSULATOR TESTER

Operating & Instruction Manual



HDE HD ELECTRIC
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IT-4

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Operating & Instruction Manual

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MANUFACTURING LOCATION

HD Electric • Southaven, MS. 38672, USA

SAFETY INFORMATION

Please take a few moments to read this manual in its entirety before using your new equipment. Pay special attention to the warnings and cautions both in this manual and on the equipment itself.

NOTICE - This product is designed for use by professionals trained in its use and application in and around high voltage electrical equipment. If you are not trained in the work methods required for safe operation, do not proceed until you obtain training.

CAUTION - This product was tested before leaving the factory but it must be tested prior to and after each use for proper working operation. Be aware that dirt, moisture, mechanical fatigue and other factors reduce the dielectric strength of this product. If any defect of condition is noted, do not use this product. Remove from service and arrange for repair.

WARNINGS - Rigorous hot stick work precautions and OSHA and company work practices must be followed. Always wear approved cover-up and safety equipment. Read and understand instructions prior to use. Misuse or abuse of this product can lead to severe injury or death.

OPERATIONAL IMPAIRMENT - If the IT-4 is used in a manner not described in this instruction manual, the protection and effective operation of this equipment may be impaired.

CLEANING INSTRUCTIONS - To clean the IT-4 wipe with a damp cloth with water. Do not use harsh chemicals or solvents.

REPAIRS

If any damage is found please contact us at 800-435-0786 to arrange for service.

LIMITATIONS TO THE USE OF THE HI-TEST® INSULATOR TESTER

Three factors limit the use of the Hi-Test Insulator Tester under energized conditions and they must be understood prior to its use:

- 1) On a 69 kVAC phase-to-phase nominal circuit the phase-to-ground voltage is approximately 40 kVAC. The tester has an operating frequency of 50/60Hz. The tester was designed and constructed to withstand 60 kVAC low impedance, phase-to-ground voltage across the probes of the tester. This gives an additional 50% safety margin above 40 kVAC before flashover will occur. **CAUTION:** The 60 kVAC flashover voltage was tested in clean, dry conditions. To further increase safety to the operator and to the tester, the tester is externally “shunted” on the back of the housing to limit the flashover voltage to 50 kVAC. This shunt ensures that should the tester be placed across a circuit in which the voltage exceeds 50 kVAC phase-to-ground, the tester will flash across its external surface first. The shunt is located behind the **DO NOT REMOVE** label (see Figure One below). The flashover voltage may be reduced by the moisture and/or contamination on the tester surface. **ALWAYS** be sure the tester is clean and dry before use. This means the tester is capable of withstanding the phase-to-ground voltage on any circuit up to and including 69 kVAC phase-to-phase nominal while testing insulators (i.e. the voltage on the line is directly across the probes of the tester with no other insulators in the string working).



Figure One

- 2) One side of any insulator under test must be isolated from the circuit in order to be able to test that insulator. If the user attempts to test an insulator going directly from phase-to-ground: the probe placed in contact with the conductor side of the insulator will be common with all insulators connected to that conductor; the probe placed in contact with the ground side of the insulator will be common with all insulators on that circuit sharing ground. The tester will then try to test the resistance of all parallel insulation paths it can reach simultaneously.

FURTHERMORE, placing the tester across a single insulator going directly from phase-to-ground at line voltages greater than 69 kVAC phase-to-phase nominal will result in externally flashing the tester and a line-to-ground fault!

NOTE: Users of the tester report some success testing pin and cap insulators on distribution circuits when the insulators are mounted on wooden cross-arms, which are not bonded to ground and when the cross-arms are dry. In these circumstances, the cross-arms provide isolation of the insulator under test to the common ground side.

- 3) **WHEN TESTING INSULATORS IN SUB STATIONS**, such testing must be done **DE-ENERGIZED** unless the user recognizes and understands the limitations set out above and uses the tester in accordance with those limitations.

READ ALL OPERATING INSTRUCTIONS PRIOR TO USING THE TESTER

SURFACE CONTAMINATION

Most contaminants that collect on the surface of insulators are only conductive in the presence of moisture. There are only a few wind blown contaminants that are conductive when dry and their occurrence in any area is generally well known to the utility company. As a result, these latter types of contaminants generally will not interfere with insulator testing activities.

For the more common wind blown contaminants, the visible amount of surface contamination on the insulator is a poor predictor of its surface conductivity for two reasons:

- 1) the actual visibility of contaminants varies greatly (e.g. concrete dust versus salt spray).
- 2) most wind blown contaminants are non-conductive until they are moistened - either by fog, heavy dew, light rainfall or extremely high humidity.

This means that line crews testing insulators for dielectric condition must pay attention to the moisture at the time they are testing. Since rainfall normally precludes the performance of live-line work, the surface conductivity of insulators in this circumstance is typically not a problem in the testing of insulators. It is recommended that the tester not be used in live-line conditions during rainfall or until after the insulators have fully dried following a rainfall.

However, early morning dew, fog and extremely high humidity are conditions which will interfere with insulator testing. To avoid the problem of early morning dew, it is advisable not to begin testing insulators until the sun has had time to dry the surface of the insulators to be tested. To avoid the problem of fog, it is advisable not to attempt to test insulators under foggy weather conditions. To avoid the problem of extremely high humidity, it is advisable to avoid testing insulators if the relative humidity exceeds 85%.

Finally, if any question arises about the surface conductivity of insulators being tested, the test crew can measure the surface conductivity of several of the subject insulators using the test procedures described in the Instructions for Testing Insulators section beginning on page 8.

OPERATIONAL IMPAIRMENT - If the IT-4 is used in a manner not described in this instruction manual, the protection and effective operation of this equipment may be impaired.

FITTING THE TEST PROBES

- 1) The probes can be fitted so that they project from either side of the tester.
- 2) The couplings on the tester to which the probes are fitted are notched in three locations on their outer edge to allow the longer probe to be fitted in three (3) configurations (see Figure Two). The longer probe can be fitted: i) to the top of the tester; ii) to project across the rear end of the tester; or iii) to project across the bottom of the tester (see Figures Three, Four, and Five).

The notches on the outside edge of the couplings on the tester are designed to receive a pin machined on the inside of the couplings on the end of the test probes. In order to fit the probes correctly to the tester, it may be necessary to rotate the probes slightly as they are being tightened onto the couplings on the tester. This will ensure that the pins fit into the notches.



Figure Two

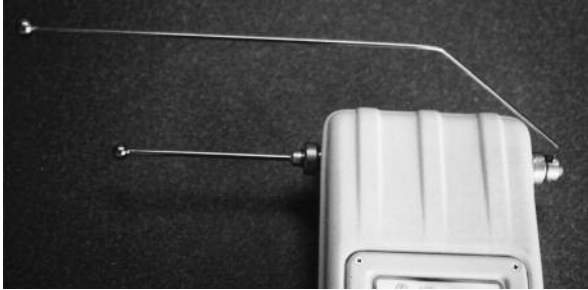


Figure Three

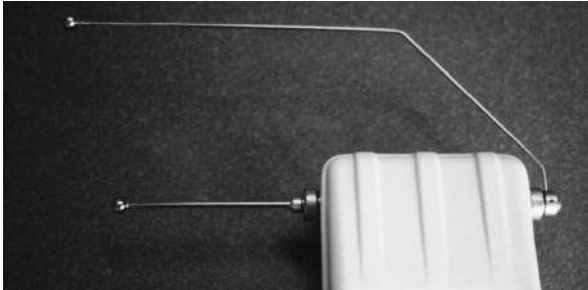


Figure Four



Figure Five



Indicates 10kVDC at probes

OPERATION OF THE TESTER

- 1) Push the ON button - the green LED at the far left of the LED display will light to indicate the instrument is ON. **NOTE:** When the tester is ON electrical potential between the test probes is 10 kVDC with an approximate current output of 85 micro amps.
DO NOT get in series with the test probes whether the tester is turned ON or turned OFF.
- 2) Bend the longer flexible probe to contact the rigid probe - all LED's should light and the warning buzzer should sound. If this does not happen, the tester is not functioning correctly and should be returned for service.
- 3) When testing insulators, one probe must make contact with the metal cap on the top side of the insulator and the other probe must make contact with the pin, metal cap or concrete bead (depending upon the configuration of the insulator - see INSTRUCTIONS FOR TESTING INSULATORS section, page 8).
- 4) When testing insulators installed on line, the probes should be shorted after completion of testing on each structure to ensure that the tester is functioning correctly. When testing insulators in a stores yard or warehouse, the probes should be shorted periodically to ensure that the tester is functioning correctly.



**Indicates
10kVDC at
probes**

RECHARGING AND CARE OF THE BATTERY

- 1) Make sure the tester is turned OFF.
- 2) Connect the recharging transformer to the power outlet and plug the recharging cable into the battery recharge receptacle on the bottom of the tester. The charge indicator LED on the front display should be lit green.
- 3) After the first hour of charging, a well-maintained battery will have enough charge for approximately 4 hours of tool use under typical conditions. The full charging cycle will complete in 6-8 hours. A fully charged tool with a well-maintained battery will operate for up to 12 hours of normal use under typical conditions.
- 4) If the instrument will not turn on, try charging it for fifteen minutes. The battery may be drained down too far to be able to power on. If it still will not turn on then the battery may need to be replaced. For battery replacement contact HD Electric to order a replacement battery. See page 11 for battery replacement instructions.

IT-4 Parts List for Tools with **Lithium-Ion Battery**

Note: The tester will have a 3-pin charger plug

IT4C-TOOL	Tester only - CE Approved
075-02020-8VLI	Lithium-Ion Replacement Battery
025-02220-120V	120VAC Charger
050-02050-12V	12VDC Charging Cord
050-00310-PRX	220V Adapter Kit

IT-4 Parts List for Tools with **Lead-Acid Battery**

Note: The tester will have a 2-pin charger plug

075-IT3-8VX4	Lead-Acid Replacement Battery
025-02070-120V	120VAC Charger
050-02000-12V	12VDC Charging Cord
050-02025-220V	220V Adapter Kit

INSTRUCTIONS FOR TESTING INSULATORS

Important Points of Information:

- 1) Insulators can be tested energized at any line voltage or de-energized using the Hi-Test Insulator Tester, subject to the limitations described in the LIMITATIONS TO THE USE OF THE HI-TEST INSULATOR TESTER section, page 4.
- 2) The types of physical damage usually seen during the visual examination of porcelain insulators (cracks, chips, broken skirts, flash burns, dried and flaking cement around the pins) are very poor predictors of the dielectric condition of these insulators. Such types of damage affect the flash over withstand capability and/or the gross mechanical strength of the insulators. However, they often do not affect the resistance value of the insulators. The type of damage that does affect resistance value is an internal crack, through the porcelain which is often non-visible (and, in the case of suspension insulators, always non-visible).
- 3) Insulators, by definition, should have infinite resistance. When they have less than infinite resistance there are only two paths for this loss of resistance: a) through the body of the insulator due to an internal crack which presents an opportunity for electric current to flow; and b) across the external surface of the insulator due to the presence of moisture on that surface. (NOTE: There are some insulators which are resistance graded and have conductive glazes making them surface conductive and the user should be aware of the possibility of their presence).
- 4) There are a wide variety of insulator shapes, sizes, and materials. They can all be tested with the Hi-Test Insulator Tester. However, the following points should be used as a guideline on where to focus testing efforts and attention:
 - A) **GLASS INSULATORS** - are all pre-stressed when manufactured so that any failure of the glass results in the entire skirt being shed. In this way, they are self identifying for failure of their resistance value and do not need to be tested for non-visible defects.
 - B) **COMPOSITE/POLYMER/NON CERAMIC INSULATORS** - failure of these types typically begins on the external surface and visible signs of potential failure include extensive evidence of surface tracking and/or color or consistency changes in the shed material. They can be tested using the procedure set out on page 9 for testing insulators; however, the visible signs described above rarely coincide with dielectric failure.
 - C) **PORCELAIN INSULATORS** - virtually every shape and style is capable of sustaining non-visible failure and they should all be routinely tested for such failures prior to being recycled.

NOTE: Several types of porcelain insulators appear to be single piece insulators but are, in fact, assemblies of two or more pieces of porcelain bonded together with cement. Such insulators can be readily identified by turning them upside down and looking for a cement bead between the skirts. If such a bead is located, each skirt must be tested separately (see test procedure on page 9).

- 5) When to test insulators for non-visible defects:
 - a) immediately prior to installation on the system, thereby ensuring they are not defective when installed;
 - b) when insulators are recycled they should all be tested for non-visible defects prior to being placed in inventory;
 - c) when troubleshooting RF/TVI and blinking light complaints as non-visible internal failures in insulators can be a source of such nuisance complaints;
 - d) as part of a routine maintenance and emergency repair work on transmission circuits - particularly on dead-end structures - to identify non-visible defective insulators before they become a safety hazard to line crews. Testing on dead-end structures is emphasized because evidence from the field indicates that the vast majority of non-visible insulator failures on transmission circuits occur on dead-ends.

Procedure for Testing Insulators

- 1) Follow all live line safety procedures when testing insulators energized.
- 2) When testing in close proximity to dead-end or cutout jumpers, take care to ensure that the tester probes do not shunt the jumper to the pole or cross arm.
- 3) When testing energized insulators DO NOT test strings of insulators which are buzzing abnormally - this is an indication of possible extensive insulator failure. When nominal voltage of the circuit is 69 kVAC and above, STOP TESTING any string of insulators if the number of insulators identified as defective reaches the following levels:

69kV	Do not test the last insulator if all previous insulators tested defective.
115kV	Do not test the last 2 insulators if all previous insulators tested defective.
230kV	Do not test the last 3 insulators if all previous insulators tested defective.
345kV	Do not test the last 5 insulators if all previous insulators tested defective.
765kV	Do not test the last 11 insulators if all previous insulators tested defective.

- 4) Keep the tester clean - particularly the area between the probes. This will prevent the possibility of erroneous tester readings due to surface creepage from one probe to the other across the dirty external surface of the tester. Clean unit with mild soap, rinse and dry thoroughly before using.
- 5) If insulators are to be tested energized, attach the tester to a hot stick appropriate for the line voltage and raise it to the lineman using a tie assist on the hot stick. When testing insulators that are energized, the tester should never be used hand held. If insulators are to be tested de-energized, the tester may be hand held.
- 6) Apply the tester probes briefly across the metal parts on either side of the insulator or from metal to concrete bead (depending upon insulator construction - see Section 4c of IMPORTANT POINTS OF INFORMATION on page 8).

INTERPRETATION

- 1) When the probes are first placed in contact with the insulator one or two yellow lights may come on briefly and then go off - this is normal and indicates that the tester is in contact with the insulator being tested.
- 2) The insulator is good when the probes are in contact with the insulator and the green LED and/or the first or second yellow LED are lit.
- 3) The insulator is surface conductive if some but not all red LED's are lit and the buzzer sounds - see Point 5 below.
- 4) The insulator is defective or has very high surface conductivity if the complete LED display is lit and the buzzer sounds - see Point 5 below.

NOTE: Refer to the Leakage Current Measurements Table on page 11 for the measured leakage current associated with each LED.

- 5) Readings produced by surface conductivity can be isolated from those produced by non-visible defects by applying both tester probes directly to the external porcelain surface of the insulator or one probe to the metal cap and one probe to the external porcelain surface of the insulator in question (it may be necessary to reposition the flexible probe 90 degrees from its original position on the tester - see section on FITTING THE TEST PROBES, page 5). With the probes in contact with the insulator as described in this step:
 - a) if the green LED and/or the first or second yellow LED are lit, the insulator is not surface conductive and the reading produced by Step 3 or 4 above is the result of a defective insulator. Move the contact point on the porcelain skirt to different places to rule out a dry banding on the insulator;
 - b) if the complete LED display is lit and the buzzer sounds, the insulator is surface conductive. It should be cleaned and dried prior to retesting or be tested at a time when the relative humidity is lower (see SURFACE CONTAMINATION section, page 5).

NOTE: Test results on strings of insulators will tend to fall into one of two cases.

In the first case, surface conductivity is generally present if EVERY one of the first several insulators tested indicates defective. If this pattern of defects occurs, the user should suspect surface conductivity and immediately test for this condition using the procedure in Point 5 above.

In case two however, if MOST of the insulators tested are found to be good, then the few which are found to be defective are probably defective. This is because surface conductivity is not likely to happen on only a few insulators on any particular string or structure. Therefore, those insulators which indicate they are defective under these circumstances are almost certain to be defective.

For more information, refer to the SURFACE CONTAMINATION section, page 5.

TECHNICAL SPECIFICATIONS

MODELS

IT-4 Tester

IT-4 Kit includes IT-4 Tester in case with 120VAC charger

IT-4/12V Kit includes IT-4 Tester in case with 12VDC charger

IT-4/220P Kit includes IT-4 Tester in case with 220VAC charger

DIMENSIONS 13 in. L x 5.5 in. W x 3.4 in. H
(33cm x 14cm x 8.6cm)

WEIGHT 3 lbs. (1.36kg)

BATTERY Rechargeable lithium-ion,
HD Electric p.n. 075-02020-8VLI, charging
current 875ma. maximum.

OUTPUT VOLTAGE AND CURRENT: 10kVDC
maximum and 65µA maximum, not simultaneously

BEEPER SOUND PRESSURE LEVEL: 100 db

ENVIRONMENTAL CONDITIONS

CONDITIONS: Indoor and outdoor use

ALTITUDE: Up to 6,566 ft. (2000M)

OPERATING TEMPERATURE:

-25°F (-32°C) to 125° F (52°C)

HUMIDITY: 65% to +52°C (non-condensing)

PRINTED CIRCUIT BOARDS: FR-4 UL 94-V0

ENCLOSURE MATERIAL: ABS UL 94-HB

POLLUTION DEGREE: PD4

MEASUREMENT CATEGORY IV

Classification Rating (CAT IV) –

Product is intended for use with test and measuring
circuits connected to the circuits/wiring outside of a
building installation, including transmission lines.

OVERVOLTAGE CATEGORY IV

BATTERY REPLACEMENT INSTRUCTIONS

To replace the battery, open the compartment on the
top of the housing. See page 7 for battery part numbers.

BATTERY USE AND DISPOSAL

- Charge the battery only with the HD Electric supplied charger.
- Do not disassemble, open, crush, bend, deform,
puncture or shred the internal battery.
- Contact your local recycling center or
HD Electric for proper battery disposal.
- Improper battery use may result in a fire,
explosion or other hazard.

LEAKAGE CURRENT
MEASUREMENTS:

LED	COLOR	LEAKAGE CURRENT
2	Amber	12µA
3	Amber	18µA
4	Amber	23µA
5	Amber	29µA
6	Red	35µA
7	Red	40µA
8	Red	46µA
9	Red	52µA
10	Red	57µA



WARNING

- 1) Read all operating instructions in the Operating Manual prior to first use.
- 2) When live insulators are tested, follow all live line procedures for your company.
- 3) **DO NOT** put your hands in series with the probes. Short the probes together to verify proper operation.
- 4) **DO NOT** use tester on damp insulators. See instruction manual note on Surface Contamination.
- 5) **DO NOT** test on any energized string of insulators that is buzzing abnormally.
- 6) **STOP** testing on any energized string of insulators above 69kV if the found number of defects reaches one half of the total insulators in the string.

OPERATING INSTRUCTIONS

- 1) Push ON button and verify one green light.
- 2) Short the two metal probes together and verify all lights on and beeper.
- 3) When testing suspension insulators, probes should contact metal cap on insulator top and metal pin on bottom.
- 4) **INTERPRETATION:**
 - a) When the probes first contact an insulator yellow lights may come on briefly indicating contact has been made.
 - b) The insulator is good when the probes are contacting the insulator and one to two yellow lights are on.
 - c) The insulator is surface conductive if some but not all red lights are on and the buzzer sounds (see instruction manual).
 - d) The insulator is defective or has very high surface conductivity if ALL lights and the beeper is on (see instruction manual).
- 5) After testing each group of insulators short the probes together again to verify proper operation.
- 6) Always insure the low battery light is not on. Charge battery as needed. Replace with HDE p.n. 075-02020-8VLI

SEE MANUAL FOR MORE INFORMATION
Maximum output at probes: 10kVDC, 65µA

HD Electric Company
www.HDElectricCompany.com



IT-4 SERIAL No.

TERMS AND CONDITIONS OF SALE

HD Electric Company is herein referred to 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, any price list or schedule, quotation, acknowledgment or invoice from HDE relevant to the sale of the Goods and all documents incorporated by specific reference therein, constitute the complete and 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 in its sole discretion to refuse orders.

1. PRICES AND TAXES: Unless a fixed price is quoted, the price at which the order is accepted is subject to adjustment to HDE's price in effect at the time of order. Any current or future tax or governmental charge (or increase in same) affecting Seller's costs or production, sale or delivery or which Seller is otherwise required to pay or collect in connection with the sale, purchase, delivery, storage, processing, use or consumption of Goods (but excluding any tax on Seller's net income or profit) shall be for Buyer's account and shall be added to the price.

2. TERMS OF PAYMENT: Terms are stated on HDE's invoice in U.S. currency. HDE shall have the right, among other remedies, either to terminate this agreement or to suspend further performance under this and/or other agreements with the Buyer in the event Buyer fails to make any payment when due, which other agreements Buyer and Seller hereby amend accordingly, or HDE otherwise deems itself insecure. Buyer shall be liable for all expenses, including attorney's 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 thereto delivered. If such cash payment or security is not provided, in addition to HDE's other rights and remedies, HDE may discontinue deliveries. HDE may apply a finance charge for payments made by credit card.

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 to and receipt by common carrier. Any claims for shortages or damages suffered in transit are the responsibility of Buyer and shall be submitted by the Buyer directly to the carrier. Shortages or damages must be acknowledged and signed for at the time of delivery. While HDE will use all 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. HDE, at its sole discretion, shall not be bound to tender delivery of any Goods for which Buyer has not provided shipping instructions. If the shipment of Goods is postponed or delayed by Buyer for any reason, Buyer agrees to reimburse HDE for any and all handling and storage costs and other additional expenses resulting therefrom. All claims for shipping errors, lost shipments or any other discrepancies must be made within ninety (90) days or they will be disallowed and deemed waived.

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 including but not limited to products which: (a) Have been repaired or altered outside HDE's factory (or Authorized Service Center) or in any manner so as, in HDE's judgment, to affect its serviceability or proper operation; (b) Have been subjected by persons other than HDE (or Authorized Service Center) to improper handling, operation, maintenance, repair or alteration; and, (c) Have been subjected to normal wear and tear, misuse, neglect, improper installation or, in addition to this warranty, the Buyer's exclusive remedy shall be limited to, at HDE's option, repair or replacement of any allegedly defective Goods or issuance of credit. HDE requires the return of any allegedly defective Goods, transportation prepaid, before honoring any claim. All returned Goods are subject to inspection, and if examination does not disclose any defect covered by this warranty, replacement of such Goods or issuance of credit for same will not be approved. THE FOREGOING CONSTITUTES HDE'S SOLE WARRANTY RESPONSIBILITY AND BUYER'S EXCLUSIVE REMEDY WHETHER SOUNDING IN TORT, CONTRACT, STRICT LIABILITY 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.

5. LIMITATION OF REMEDY AND LIABILITY: THE SOLE AND EXCLUSIVE REMEDY FOR BREACH OF ANY WARRANTY HEREUNDER SHALL BE LIMITED TO REPAIR, CORRECTION, REPLACEMENT OR CREDIT UNDER SECTION 4. HDE SHALL NOT BE LIABLE FOR DAMAGES CAUSED BY DELAY 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, OTHER TORT OR OTHERWISE), SHALL HDE'S LIABILITY TO BUYER AND/OR ITS CUSTOMERS EXCEED THE PRICE PAID BY BUYER FOR THE SPECIFIC GOODS GIVING RISE TO THE CLAIM OR CAUSE OF ACTION, AND BUYER SHALL INDEMNIFY HDE FOR ANY DAMAGES IN EXCESS THEREOF. BUYER AGREES THAT IN NO EVENT SHALL HDE'S LIABILITY TO BUYER AND/OR ITS CUSTOMERS INCLUDE SPECIAL, DIRECT, OR INCIDENTAL DAMAGES, OR PUNITIVE DAMAGES OF ANY CHARACTER IN CONNECTION WITH THE SALE, RESALE OR IMPLIED, WHETHER OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR OTHERWISE. HDE's term "consequential damages" shall include, but not be limited to, loss of anticipated profits, business interruption, loss of use of revenue, cost of capital or loss of or damage to property, equipment, or data, or loss of reputation. Further, Buyer shall indemnify and hold HDE harmless from any liability to Buyer, Buyer's employees, workers, contractors or any other persons arising out of Buyer's, and any other persons', use of the Goods. All instructions and warnings supplied to HDE shall be passed on to those persons who use the Goods. HDE's Goods are to be used in their recommended applications and all warning labels adhered to the Goods by HDE shall be left intact. It is impossible to eliminate all risks associated with the use of the Goods. Risks of serious injury or death, including risks associated with electrocution, arcing and thermal burn, are inherent in work in and around energized electrical systems. Such risks arise from the wide variety of electrical systems and equipment to which Goods may be applied, the manner of use or application, weather and environmental conditions or other unknown factors, all of which are beyond the control of HDE. HDE does not agree to be an insurer of these risks, and shall have no liability for all claims arising from such risks. WHEN YOU BUY OR USE THESE PRODUCTS, YOU AGREE TO ACCEPT THESE RISKS.

6. EXCUSE OF PERFORMANCE (FORCE MAJEURE): HDE shall not be liable for delays in performance or for non-performance due to acts of God; acts of Buyer; war; fire; flood; weather; sabotage; strikes, labor disputes, civil disturbances or riots; governmental restrictions, restrictions, allocations, laws, regulations, orders or actions; unavailability of or delays in transportation; default of suppliers; or unforeseen circumstances or events beyond HDE's reasonable control. Deliveries or other performance may be suspended for an appropriate period or cancelled by HDE upon notice to Buyer in the event of any of the foregoing, but the balance of this agreement shall otherwise remain unaffected. If HDE determines that its ability to supply the total demand for the Goods, or to obtain material used directly or indirectly in the manufacture of the Goods, is hindered, limited or made impracticable due to causes set forth herein, HDE may allocate its available supply of the Goods or such material (without obligation to acquire other supplies of any such Goods or materials) among itself and its purchasers on such basis as HDE determines to be equitable without liability for any failure of performance which may result therefrom.

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 Goods manufactured prior to the date of such 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 inspection, but in no event later than forty-five (45) days from the date of receipt of the Goods, written notice of any and all deficiencies, defects, variations from specifications or complaints of any kind with respect to the quantity, quality, condition, shipment, performance, price or appearance of the Goods so received by Buyer. If the amount no such written notice is received by HDE, Buyer shall be deemed conclusively to have inspected and accepted all such Goods unconditionally and to have waived any and all rights and claims, including without limitation any right to reject the Goods or to claim damages in respect thereof. Buyer may not return goods without first advising HDE of the reasons therefor, obtaining from HDE a material authorization number and observing such instructions as HDE may give in authorizing such return. In the event a return is authorized by HDE, a restocking for any Goods requiring repackaging or maintenance a twenty percent (20%) restocking fee shall be assessed to Buyer in the final credit amount.

11. SERVICES: If this agreement requires HDE to perform or provide any services, HDE (including without limitation its successors, assigns, agents or any person or entity acting at HDE's direction) shall not be responsible for any damages, claims, liabilities or expenses of any nature arising out of such services.

12. U.S. EXPORT CONTROL LAWS: All Goods sold to Buyer by HDE hereunder are subject to U.S. Export Control Laws. Buyer hereby agrees not to re-sell or divert 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 11246, 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, rules, regulations or orders including but not limited to the Foreign Corrupt Practices Act of 1977, as amended. HDE reserves the right to delay or refuse delivery if requests for reasonable assurances of Buyer's compliance are not tendered as requested.

14. MISCELLANEOUS: These terms and conditions 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 upon HDE unless made in writing and signed on its behalf by its duly authorized representative. No conditions, usage or trade, course of dealing or performance, understanding or agreement purporting to modify, vary, explain, or supplement these terms and conditions shall be binding unless hereafter made in writing and signed by Seller. No modification shall be effected by HDE's receipt or acceptance of Buyer's purchase orders, shipping instruction forms, or other documentation containing terms at variance with or in addition to those set forth herein, all of which are objected to by HDE. Any such modifications or additional terms are specifically rejected by HDE. No waiver by HDE with respect to any breach or default of any right or remedy and no course of dealing, shall be deemed to constitute a continuing waiver of any other breach or default of any other right or remedy, unless such waiver be expressed in writing and signed by HDE. All typographical or clerical errors made by HDE in any quotation, acknowledgment or publication are subject to correction. Validity and performance relating to the interpretation and effect of this statement of the state of Illinois without regard to its conflict of law principles.

15. DISPUTE RESOLUTION: In the event of any dispute INCLUDING, BUT NOT LIMITED TO, BREACH OF CONTRACT, BREACH OF WARRANTY, CLAIMS BASED IN TORT, NEGLIGENCE, PRODUCT LIABILITY, FRAUD, MARKETING, STATE OR FEDERAL REGULATIONS, ANY CLAIMS REGARDING THE ENFORCEABILITY OF THIS LIMITED WARRANTY, AND THE WAIVER OF CLASS ACTION TRIALS between Buyer and Seller, either may choose to resolve the dispute by binding arbitration, as described below, instead of in court. THIS MEANS IF EITHER BUYER OR SELLER CHOOSE BINDING ARBITRATION, NEITHER PARTY SHALL HAVE THE RIGHT TO LITIGATE SUCH CLAIM IN COURT OR HAVE A JURY TRIAL. DISCOVERY AND APPEAL RIGHTS ARE LIMITED IN BINDING ARBITRATION. Buyer and Seller agree that the proper venue for Arbitration is not to be chosen by Buyer or Seller of all actions arising in connection herewith shall be only in the state of Illinois and the parties agree to submit to jurisdiction. No action, regardless of form, arising out of transactions relating to the agreement, may be brought by either party more than two (2) years after the cause of action has accrued. The U.N. Convention on Contracts for the International Sales of Goods shall not apply to this agreement.

16. CLASS ACTION WAIVER: BINDING ARBITRATION MUST BE ON AN INDIVIDUAL BASIS. THIS MEANS NEITHER BUYER NOR SELLER MAY JOIN OR CONSOLIDATE CLAIMS IN ARBITRATION BY OR 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: The binding arbitration by HDE shall be administered by the American Arbitration Association ("AAA") in accordance with its Commercial Arbitration Rules and Supplementary Procedures for Consumer-Related Disputes (including proceedings 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 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 court or agency, will have exclusive authority to resolve any dispute 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.

HD Electric Company® products are available through HDE® sales representatives worldwide.

HD Electric products receive final assembly and shipment from HDE's production facility at

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